EXTRA-ECOWAS TRADE FLOWS AND TRANSMISSION OF INTERNATIONAL BUSINESS CYCLES

BY

SOLOMON ABAYOMI, OLAKOJO
B.Ed. Teacher Education (Economics/Geography); M.Sc. Economics (Ibadan)
Matric No. 116266

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ABSTRACT

The real gross domestic product (RGDP) of Economic Community of West African States (ECOWAS) is characterised by inconsistent growth rate, averaging -0.74%, 6.23%, 2.07% and 6.91% in 1978, 1988, 2002, and 2012, respectively. The business cycle (fluctuations of RGDP) is partly traced to trade flows and financial interdependence across countries. Previous empirical studies focused mostly on the effects of trade flows and financial interdependence on transmission of international business cycles among developed countries, with little attention paid to what obtains between developing and developed countries. This study, therefore, investigated the effects of extra-ECOWAS trade flows (trade between ECOWAS and her major trading partners - United States, European Union and China) and financial interdependence on the business cycles of ECOWAS between 1978 and 2012.

Stochastic technology shocks model, predicated on trade in intermediate inputs theory (that considered the peculiarity of sampled economies with varied levels of technology) was estimated. The model combined the effects of trade flows and financial interdependence on transmission of business cycles. Annual data used was obtained from the World Bank's *World Development Indicators* and World Trade Organisation's *World Integrated Trade Solution* covering 1978 - 2012. Trade flows was measured by total trade, intra-industry and inter-industry trade flows and financial interdependence by foreign direct investment (FDI). Pooled Mean Group (PMG) heterogeneous regression technique was employed for the estimations, while robustness of PMG was ascertained using log likelihood chi-square ratio-test. Fixed and Random Effects regression techniques were utilised for the analysis covering the period of slow (1978 - 1994) and rapid growth (1995 - 2012). An F-test was used to confirm country-specific effects, while the consistency of Fixed and Random Effects was ascertained using Hausman-test. All estimations were validated at 5% level of significance.

Total trade and FDI significantly affected the transmission of business cycles with elasticities of -0.5 and 0.2, respectively. This implied that a 1.0% increase in total trade reduced transmission of business cycles by 0.5%, while a 1.0% increase in FDI increased it by 0.2%. There were little variations across the major trading partners and other

measures of trade flows. Intra-industry and inter-industry trade with China as well as inter-industry trade with the United States had significant impacts of -0.7%, -5.7% and 1.4% on transmission of business cycles, respectively. The impact of FDI from European Union and the United States on transmission of business cycles was 0.2% each. Analysis by slow and rapid growth period indicated that inter-industry trade had significant impact of 0.8% on transmission of business cycles between 1978 and 1994, but no significant impact during 1995 - 2012. Over the same periods, FDI had significant positive effects (0.2% and 0.3%) on transmission of business cycles, respectively.

Foreign direct investment from all partners, except China, and inter-industry trade with the United States had the most significant influence on ECOWAS business cycles. Investment and inter-industry trade with the United States as well as investment attraction from the European Union should be sustained, while ECOWAS stand not to benefit from China's business cycles spillover.

Keywords: Extra-ECOWAS trade flows, International business cycles, Stochastic technology shocks, Foreign direct investment

Word count: 498

DEDICATION

To

The God Almighty
(The I am that I am)

Who made this goal to become a reality

And to

My love
Mojisola
The strength behind me

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Except the LORD build the house, they labour in vain that build it, except the LORD keep the city, the Watchman waketh but in vain. Psalms 127:1 KJV

All glory, honour and adoration belong to Almighty God, the Son and Holy Spirit for His goodness and mercy endureth forever. I thank God for His faithfulness in my life, for keeping me, for not allowing enemies to prevail over my soul and for making this vision a reality.

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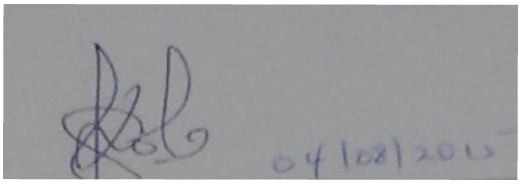
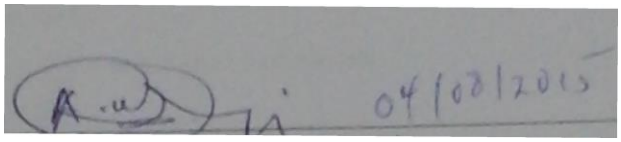
CERTIFICATION

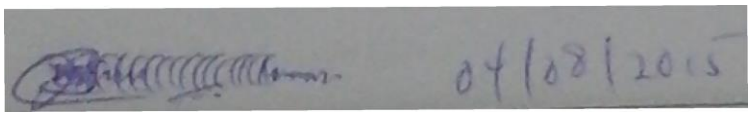
We certify that this work was carried out by Solomon Abayomi Olakojo under our supervision in the Department of Economics, University of Ibadan, Nigeria.



Professor E. Olawale Ogunkola
Chairman, Thesis Supervision Committee
B.Sc (Econs), M.Sc, PhD (Ibadan)
Department of Economics
University of Ibadan
Nigeria



Dr. Adeolu O. Adewuyi
Member, Thesis Supervision Committee
B.Sc (Econs), M.Sc, PhD (Ibadan)
Senior Lecturer, Department of Economics
University of Ibadan
Nigeria



Dr. Abiodun O. Folawewo
Member, Thesis Supervision Committee
B.Sc (Econs) (Ogun), M.Sc, PhD (Ibadan)
Senior Lecturer, Department of Economics
University of Ibadan
Nigeria

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CHAPTER ONE

INTRODUCTION

1.1. Background to the Study

In the recent time, relationship between cross-country business cycles and trade flows has engaged the attention of scholars and policymakers due to the need to address whether increased trade flows improve the level of business cycle synchronisation[1] or not; and whether countries should further promote trade integration to enhance business cycle co-movement or not. These issues are often justified on the basis of the conventional idea that more trade openness, particularly intra-industry[2] trade, leads to synchronisation of business cycles across countries, especially in this era of increasing internationalisation of production activities across countries. In this context, cross-country business cycles can be explained by two main factors. One, it is commonly believed that development in one country may be transmitted to other countries—depending on relative size, degree and pattern of openness. This suggests that vulnerable economies can be aided by less vulnerable ones to achieve desired growth trajectory through trade. Two, it is often accepted that common external disturbances, such as commodity and oil price shocks, can negatively affect simultaneously all primary goods dependent economies. This implies that positive and negative growths can be transmitted abroad though trade. Therefore, trade in the context of increasing global supply chains poses a new challenge for the interdependence across countries.

Against the above background, this study examines the sources of cross-country business cycles. Specifically, the interest is on whether trade between members of

[1] In the context of this thesis, business cycle synchronisation or co-movement refers to the existence of common elements in aggregate cyclical behaviour across trading countries.

[2] Trade within similar sector

ECOWAS and their major developed countries trading partners serves as a potential source of transmission of business cycles—though financial linkage has also received similar attention in the literature. Hence, an understanding of this relationship is relevant for the design of appropriate policies to ameliorate possible vulnerabilities associated with extra-ECOWAS trade flows, regional stabilisation and trade policy formulation, especially those that have to do with trade agreement with these major trading partners, given the overall aim of the ECOWAS to achieve regional economic stability.

1.2. Statement of the Problem and Research Questions

ECOWAS was formed in 1975 purposely to promote cooperation, integration and maintenance of enhanced regional economic stability (ECOWAS revised treaty, 1993). Regardless of this, the real gross domestic product (RGDP) of Economic Community of West African States (ECOWAS) is characterised by fluctuating growth rate, averaging -0.74%, 6.23%, 2.07% and 6.91% in 1978, 1988, 2002, and 2012, respectively—an indication of instability. One of the ways of achieving the broad objective of regional economic stability is through intra-regional trade flows; meanwhile, the objective of maintaining and enhancing regional economic stability would not be completely realised without considering extra-regional trade flows, especially where regional member states are more open to non-regional members. This is because business cycles in the global economy may dove-tailed into business cycles of ECOWAS through trade flows and financial interdependence—in the form of changes in volume of trade, government finances and foreign direct investment (FDI). For instance, accelerations in West African GDP growth rate has been found to be mostly triggered by increase in the terms of trade and economic liberalisation, while at the same time growth collapses are linked, among other things, to negative terms of trade shocks (Imam and Salinas, 2008). This indeed, reveals vulnerabilities associated with these economies to external shocks and raises the questions of appropriate policies to ameliorate such vulnerabilities.

Further, one of the aims of extra-regional trade relationship might be to benefit from growth spillover from the developed countries trading partners. An implication that can be drawn from such trade relationship, based on imported business cycles idea, is that

small domestic economy is subject to large economies shocks and the consequences of such reality on domestic economy may be too strong to ignore. A good example in this regard is the oil and commodity prices shocks of late 1970s and early 1980s and recent global financial crises with its attendant negative consequences on most Members of ECOWAS. Recession in most developing countries was prompted, among other things, by the recession in the industrial countries (Fole, 2003).

Moreover, Easterly and Levine (1997) note that the period between 1965 and 1990s was characterised with growth tragedy among many developing African countries—ECOWAS inclusive. Notably, there have been significant improvements in the last two decades. Coincidentally, the last two decades have also been characterised with more extra-regional trade openness among members of ECOWAS compared with the preceding decades. The question is; does trade liberalisation have anything to do with the current growth improvement episode (1995 to 2012)? Also, what are the implications of extra-ECOWAS trade flows for business cycles of selected Members of ECOWAS? Do these effects vary across trading partners and structure of trade flows (inter-industry and intra-industry trade flows)? Providing answers to these questions will shed light on potential vulnerability and benefit members of ECOWAS stand to gain from extra-ECOWAS trade relationship, thus providing guidance for trade and macroeconomic policies.

1.3. Objectives of the Thesis

The broad aim of this thesis is to examine the relationship between trade flows and cross-country business cycles among selected members of ECOWAS and their identified major trading partners. Specifically, this thesis seeks to;

1. estimate the effects of trade flows (total trade, inter-industry and intra-industry trade flows) and financial interdependence (FDI) on ECOWAS business cycles;
2. assess the effects of supply (export) and demand (import) channels on cross-country business cycles between members of ECOWAS and major trading partners; and

3. analyse the effects of trade flows and financial interdependence on cross-country business cycles between members of ECOWAS and main trading partners in the periods of slow and rapid growth.

1.4. Justification for the Study

The justification for this thesis arises from its probable contribution to knowledge in international economics and macroeconomics, specifically in the area of trade-international business cycles linkages.

In terms of theoretical contribution, a model of trade with stochastic technology shocks—predicated on the theory of trade in intermediate inputs—assumes that the level of technology shocks across trading countries are similar due to similarities in the structure of economies from which the model evolved. This is justifiable when trade is dominated by intra-industry trade flows and the technologies are significantly high among the trading economies. Notably, this model may not be appropriate where the levels of technology shocks and economic development vary across trading countries as in the case of members of ECOWAS and their major trading partners, the focus of this study. Thus, this thesis contributes to the theoretical literature by modifying the theory of trade in intermediate inputs to accommodate the identified gap in the literature.

In terms of methodology contribution, some of the existing empirical works in this regards use fixed effect or random effect or a combination of fixed or random effects instrumental variables estimators (to account for possible endogeniety problem between trade flows and cross country business cycles). There is no strong justification for using technique capturing endogeniety of trade flows between members of ECOWAS and their trading partners because policy coordination which often make trade and business cycles endogenous is not envisaged between them. Also, the recent literature on panel data warns against the use of standard pooled estimators such as fixed effect or random effect to estimate panel data models characterised with large number of cross-sectional observations (N) and time-series observations (T), as in this study. One of the central findings from recent panel econometrics literature is that the assumption of homogeneity of slope parameters is often inappropriate (Blackburne III and Frank, 2007). In other

words, the assumption of homogeneity, using intercepts parameter, is often empirically rejected and that of other slope parameters may not be an exception. Hence, this study employs heterogeneous panel models, underscoring its contribution to methodological literature in the context of assessing the relationship between trade flows and cross-country business cycles. In addition, this study also utilises fixed and random effects regression techniques for the analysis covering the periods of slow (1978 to 1994) and rapid growth (1995 to 2012). The justification for this is that the periods are fairly short and can be accommodated within the traditional fixed and random effect models.

In terms of empirical contribution, substantial existing empirical literature laid more emphasis on trade flows as a primary channel through which business cycle co-move and these are mostly carried out among regional economies. Studies in these categories include Frankel and Rose (1998), Calderón, Chong and Stein (2007), Rana (2007), Lee (2010) as well as Rana, Cheng and Chia (2012). These studies concluded that trade matters for cross-country business cycles. Specifically, most of them found trade in productive intermediate inputs and intra-industry trade influencing business cycle synchronization among sampled countries. On the contrary, studies such as Dellas (1986), Schmith-Grohe (1998) and Selover (1999) weakened the "locomotive" hypothesis[3] by showing that trade interdependent is insufficient to account for the observed output correlation across countries. Hence, the existing empirical evidences were characterised with mixed results regarding the potency of trade flows in explaining cross-country business cycles. Besides, previous empirical studies focused mostly on the effects of trade flows and financial interdependence on transmission of international business cycles among developed countries, with little attention paid to what obtains between developing and developed countries. This study, therefore, investigated the effects of extra-ECOWAS trade flows (trade between ECOWAS and her major trading partners—United States, European Union and China) and financial interdependence on the business cycles of ECOWAS, hoping to fill a gap in the empirical literature.

[3] This hypothesis states that business cycles can be transmitted abroad through trade flows.

1.5. Scope of the Study

This study is limited to between 1978 and 2012, while five members of ECOWAS (namely, Nigeria, Cote d'Ivoire, Ghana, Senegal and Togo) are selected as sample. The justification for the period covered and sample selection is not only based on data availability but also covers the period of most trade arrangements between members of ECOWAS and the identified trading partners. Besides, the selected members of ECOWAS account for over 70% of the community's gross output. Hence, business cycles of the selected members of ECOWAS are assumed to mirror the regional business cycles. Also, the major trading partners included in the sample are the United State of America (US), five European Union (EU) member states (France, Germany, United Kingdom-UK, Netherlands and Spain) and China. These trading partners account for significant extra-ECOWAS trade flows.

1.6. Organization of the Study

The thesis is organised into six chapters. Following this introductory chapter is chapter, which presents the characteristics of ECOWAS trade flows in terms of intra and extra-ECOWAS trade flows. Besides, the structure of selected economies, business cycles of ECOWAS, those of the identified trading partners as well as the nature of cross-country business cycles with the trading partners are examined. This chapter equally relates the nature of business cycles and cross-country business cycles to trade flows across different episodes.

Chapter three dwells on a review of literature. Among other things the theoretical review on evolution and theories of business cycles are examined. The emphasis is more on trade interdependent and international business cycles. Also, review of methodologies on business cycles and cross-country business cycles as well as previous empirical evidences on the relationship between cross-country business cycles and trade flows are examined. In chapter four, the theoretical framework and methodology are presented. The interest is to highlight the theoretical framework linking trade flows to cross-country business cycles between selected members of ECOWAS and the identified trading partners. This chapter also presents the methods for computing business cycles

synchronisation as well as methods for assessing the relationship between trade flows and cross-country business cycles. Finally, estimation procedures, estimation techniques and data sources are staged in this chapter.

Chapter five is on the results and discussion of various estimated models as well as assessment of the estimated results with the study objectives. This ranges from heterogeneous panel to homogenous panel estimates. Chapter six concludes with a summary, policy lessons as well as limitations of the study, suggestions for further research are also offered.

CHAPTER TWO

TRADE FLOWS, ECONOMIC STRUCTURE, BUSINESS CYCLES AND CROSS-COUNTRY BUSINESS CYCLES OF THE SELECTED COUNTRIES

2.1. Intra-ECOWAS and Extra-ECOWAS Trade Flows.

As indicated in chapter one, members of ECOWAS are more opened to non-regional members, and conduct the bulk of their trade with developed countries trading partners. The overview of this is presented subsequently.

2.1.1 Intra-ECOWAS Trade Flows: Characteristics and Components

In terms of intra-ECOWAS trade components, there were variations with trade flows skewed towards exports than imports suggesting that regional economies trade is dominated by export flows (Table 2.1). For instance, over the period 1976 to 2012, intra-ECOWAS export accounts for approximately 51.4% of total trade flows, dominated by Nigeria (21.8%), Cote d'Ivoire (15.8%) and Senegal (4.6%), while intra-regional imports accounted for approximately 48.6 percent dominated by Cote d'Ivoire (11.9%), Mali (6.8%), Nigeria (6.1%) and Ghana (5.8%). This means that only Nigeria and Cote d'Ivoire exports accounted for significant regional exports flows, while imports flows seem to be less concentrated. This analysis is in tune with Oyejide (2013) who reports that ECOWAS trade flows are less concentrated in imports flows with Nigeria and Cote d'Ivoire being the leader in terms of regional export and import flows, respectively.

In addition, intra-regional traded commodities are concentrated in a few products. The leading products according to Ogunkola (2011) include fuel and lubricants, raw

Table 2.1. Market shares of Member States in terms of regional export and import flows

	Panel A: Member States exports as percentage of total regional export flows										
Member States	1976	1986	1996	2006	2007	2008	2009	2010	2011	2012	1976-2012
Benin	0.27	0.11	0.88	2.77	3.31	0.88	0.32	3.89	1.75	1.55	1.36
Burkina Faso	0.40	0.03	0.07	0.30	0.44	0.12	0.24	0.75	0.20	0.71	0.48
Cape Verde	0.01	0.00	0.01	0.03	0.03	0.05	0.01	0.01	0.01	0.02	0.03
Cote d'Ivoire	N/A	21.05	16.97	6.21	9.06	6.78	6.80	8.73	5.46	5.57	15.78
Ghana	1.30	0.40	1.23	2.09	2.56	1.80	1.79	1.74	3.98	2.23	1.48
Guinea	N/A	0.01	0.11	0.44	0.30	0.24	0.30	0.25	0.13	0.13	0.18
The Gambia	0.05	0.02	0.05	0.01	0.01	0.01	0.01	0.03	0.15	0.09	0.07
Guinea Bissau	N/A	0.01	0.02	0.02	0.04	0.02	0.04	0.14	0.06	0.05	0.04
Liberia	0.16	0.04	0.01	0.14	0.09	0.19	0.34	0.11	0.20	0.08	0.24
Mali	1.97	0.07	0.13	0.18	0.04	0.09	0.29	0.20	0.30	0.89	0.50
Niger	0.38	0.00	0.04	0.15	0.05	0.06	0.11	0.11	0.09	0.87	0.20
Nigeria	12.91	34.41	24.73	21.10	22.30	21.77	20.23	21.15	11.86	9.50	21.76
Senegal	7.93	2.40	3.76	2.65	4.57	3.78	1.18	5.80	4.45	7.01	4.57
Sierra Leone	0.03	0.01	0.19	0.07	0.09	0.04	0.16	0.04	0.27	0.08	0.26
Togo	0.05	0.01	0.68	2.77	6.89	6.78	3.65	3.86	1.76	2.15	2.12
ECOWAS	**62.48**	**41.42**	**51.14**	**61.08**	**50.22**	**57.40**	**64.54**	**53.20**	**69.34**	**69.08**	**51.37**
	Panel B: Member States imports as percentage of total regional import flows										
Member States	1976	1986	1996	2006	2007	2008	2009	2010	2011	2012	1976-2012
Benin	2.04	2.53	5.40	1.17	1.90	1.25	3.46	2.57	1.94	1.52	2.82
Burkina Faso	11.27	4.93	1.35	7.10	4.93	3.37	6.51	4.81	5.38	5.23	5.13
Cape Verde	0.06	0.70	0.11	0.28	0.21	0.06	0.08	0.06	0.03	0.03	0.12
Cote d'Ivoire	3.26	12.06	21.15	20.13	11.25	10.83	15.62	10.91	13.23	21.43	11.90
Ghana	2.78	1.52	6.11	15.93	9.33	12.84	9.44	10.25	6.61	10.44	5.84
Guinea	0.03	3.11	1.83	0.91	1.15	0.88	1.51	1.22	1.17	1.10	1.49
The Gambia	0.03	1.40	0.60	0.87	1.16	0.86	1.12	0.91	0.59	0.71	0.95
Guinea Bissau	N/A	1.29	0.21	0.19	0.52	0.42	0.70	0.41	0.33	0.53	0.50
Liberia	2.54	0.07	0.37	0.92	0.59	6.73	0.73	0.66	3.07	4.38	1.11
Mali	12.14	8.44	1.64	3.41	6.21	4.78	6.77	7.11	3.69	4.39	6.77
Niger	4.72	1.16	0.79	0.65	1.59	1.26	1.36	1.27	0.83	0.88	1.76
Nigeria	13.22	2.06	3.42	6.58	6.86	5.72	10.77	8.17	4.76	3.14	6.05
Senegal	9.07	0.01	4.84	1.40	2.47	6.83	4.38	3.02	3.70	7.85	3.95
Sierra Leone	0.23	0.20	0.65	0.48	0.83	0.38	0.60	0.42	0.54	0.36	0.47
Togo	1.09	1.94	2.67	1.06	1.21	1.20	1.48	1.38	23.48	7.08	3.15
ECOWAS	**37.52**	**58.58**	**48.86**	**38.92**	**49.78**	**42.60**	**35.46**	**46.80**	**30.66**	**30.92**	**48.63**

Source: Author's computation based of World integrated Trade Solution (WITS).

Note: N/A-Observations not available.

agricultural products (such as oil seeds, live bovine animals, live sheep and goats, onions, garlic and leeks, wheat, maize, rice, plywood and fish) and mineral products (aluminium ores, petroleum products, etc). More details about these commodities are presented in Table A1 (in the Appendix). The intra-ECOWAS products traded reflect lack of diversification and absence of strong industrial base in the region (Ogunkola, 2011). Analysis of the main traded products is based on the members of ECOWAS' trade in 2012 which accounted for average of over 65% of total traded commodities in the year.

Finally, the major regional supplying markets of these major traded commodities are Nigeria and Cote d'Ivoire, accounting for shares of 21.8% and 15.8% of the total intra-regional exports between 1976 and 2012, respectively, while the major importing markets are Cote d'Ivoire, Mali, Nigeria and Ghana accounting for about 11.9%, 6.8%, 6.1% and 5.8%, respectively (Table 2.1).

Moreover, trade flows in ECOWAS is dominated by few members. Presented in Table 2.2 is the market share and regional traded values of member states between 1976 and 2012. It is important to note that five members; namely Nigeria, Cote d'Ivoire, Ghana, Senegal and Togo represent the major supplying and importing market in the region which accounted for approximately 78.5% of total regional traded value since ECOWAS inception in 1976. Besides, these Member States, except Togo, are categorised as relatively developed (Ogunkola, 2011). Henceforth, the attention will be more on the identified member states.

Further, among the major trading member states, Nigeria market share is the largest in the region with an average value of 26.0% of total regional trade value. One noticeable feature of the market share of Nigeria is inconsistency, and declining in the recent time, especially between 2010 and 2012. Its regional market share is more than double of some other Member States such as Ghana, Senegal and Togo. Next to Nigeria in terms of market share is Cote d'Ivoire and Ghana with 23.3% and 11.3% of total regional trade flows, respectively.

Table 2.2. Market shares of Member States in total regional trade flows[4]

	Percentage (%)										
Member States	1976	1986	1996	2006	2007	2008	2009	2010	2011	2012	1976-2012
Nigeria	26.1	36.5	28.2	27.7	29.2	27.5	31	29.3	16.6	12.6	26
Cote d'Ivoire	15.3	33.1	38.1	26.3	20.3	17.6	22.4	19.6	18.7	27	23.3
Ghana	4.1	1.9	7.3	18	11.9	14.6	11.2	12	10.6	12.7	11.3
Togo	1.1	2	3.3	3.8	8.1	8	5.1	5.2	25.2	9.2	9.3
Senegal	17	2.4	8.6	4	7	10.6	5.6	8.8	8.1	14.9	8.6
Sub-Group	**63.8**	**75.9**	**85.5**	**79.9**	**76.5**	**78.3**	**75.3**	**75.0**	**79.3**	**76.4**	**78.5**
Mali	14.1	8.5	1.8	3.6	6.2	4.9	7.1	7.3	4	5.3	5.6
Burkina Faso	11.7	5	1.4	7.4	5.4	3.5	6.8	5.6	5.6	5.9	5.3
Benin	2.3	2.6	6.3	3.9	5.2	2.1	3.8	6.5	3.7	3.1	4.3
Liberia	2.7	0.1	0.4	1.1	0.7	6.9	1.1	0.8	3.3	4.5	2.2
Guinea	N/A	3.1	1.9	1.3	1.5	1.1	1.8	1.5	1.3	1.2	1.6
Niger	5.1	1.2	0.8	0.8	1.6	1.3	1.5	1.4	0.9	1.7	1.5
Gambia	0.1	1.4	0.7	0.9	1.2	0.9	1.1	0.9	0.7	0.8	0.9
Sierra Leone	0.3	0.2	0.8	0.6	0.9	0.4	0.8	0.5	0.8	0.4	0.6
Guinea-Bissau		1.3	0.2	0.2	0.6	0.4	0.7	0.6	0.4	0.6	0.6
Cape Verde	0.1	0.7	0.1	0.3	0.2	0.1	0.1	0.1	0	0	0.2
Others	**36.2**	**24.1**	**14.5**	**20.1**	**23.5**	**21.7**	**24.7**	**25.0**	**20.7**	**23.6**	**21.5**
	Traded Value (Million US Dollars)										
Member States	1976	1986	1996	2006	2007	2008	2009	2010	2011	2012	1976-2012
Nigeria	79.3	75.7	1090.1	3054.7	3483.8	5124.8	3326.3	3851.7	3383.4	1708	1166.6
Cote d'Ivoire	46.5	68.7	1476.1	2906.1	2426.2	3283.7	2405.6	2580.1	3804	3648.2	1048.6
Ghana	12.4	4	284	1988.4	1420.3	2728.1	1205.2	1575	2154.9	1712	508.1
Togo	3.5	4.1	129.7	422.3	967.8	1486.8	550.9	689.3	5137.2	1248.4	417.9
Senegal	51.6	5	332.8	446.4	841.7	1977.8	596.7	1158.8	1658.7	2007.1	388.1
Sub-group Total	**193.3**	**157.4**	**3312.6**	**8817.9**	**9139.8**	**14601**	**8084.7**	**9854.9**	**16138.1**	**10323.7**	**3529.3**
Mali	42.8	17.7	68.4	395.8	746.4	907	756.5	961	812.3	714	250.6
Burkina Faso	35.4	10.3	54.9	816.3	641.6	649.6	724.5	730.3	1136.3	802.8	237.6
Benin	7	5.5	243.2	435	621.8	397.2	405	848.9	750.1	414.8	194.2
Liberia	8.2	0.2	14.5	117	81.7	1290.2	114.4	100.9	664.9	601.9	97
Guinea	N/A	6.5	75.1	148.5	173.3	208.1	195.1	193.4	264.4	166.4	70
Niger	15.5	2.4	32.1	87.8	194.9	244.9	158	181.4	187.4	235.6	67.5
Gambia	0.2	2.9	25.2	97.5	139.8	162.6	120.5	123.9	149.5	108.8	42.3
Sierra Leone	0.8	0.4	32.8	61.5	110.7	78.3	81.6	60	165.7	59.8	29
Guinea-Bissau	0	2.7	8.8	23.5	66.5	81.7	79.6	72.5	78.3	78.2	24.7
Cape Verde	0.2	1.5	4.6	34.1	28.3	20	9.7	10.3	8.6	6.7	7.7
Others Total	110.2	50.1	559.7	2217.1	2805.1	4039.5	2645	3282.5	4217.5	3189.2	1020.7
ECOWAS Total	**303.5**	**207.5**	**3872.3**	**11035**	**11945**	**18641**	**10730**	**13138**	**20355.7**	**13512.9**	**4494.5**

Source: Compiled from World Integrated Trade Solution (http://wits.worldbank.org).

Note: N/A- Observations not available.

[4] In some cases trade flows are based on mirror data. That is, reporters' import values are used as partners' export values. This is because most of the members of ECOWAS report of trade flows is inadequate.

In Africa, the problem of inadequate intra-regional economic trade flows is not only peculiar to ECOWAS. Across the African intra–regional economic communities in 2010, Oyejide (2013) reports that trade performance was low, led by SADC[5] (11.2%), followed by ECOWAS (9.2%) and COMESA[6] (8.0%). Also, looking at the share of intra-ECOWAS trade flows depicted in Table 2.3 (which shows the percentage of regional trade in total trade flows of selected member states), intra-regional trade flows is far from the desired. Comparatively, intra-regional trade in the North American FTA[7]; between the USA, Canada and Mexico (NAFTA[8]); among the south eastern Asian countries; and European Union (EU) stood at approximately average of 31.7%, 23.8% and 66.3% respectively in 2000 (Ogunkola, 2011). The corresponding figures for intra-regional trade integration among selected members of ECOWAS stood at 9.8% in the same year, while the overall level of trade integration in ECOWAS stood at 9.3% between 1976 and 2012 (Table 2.3)—there have been some improvement in the level of regional trade integration over time, nevertheless.

Further, it is quite surprising that member states like Nigeria (representing 26% of total regional traded market share) conducts lesser proportion of its trade within the region. It conducts only about an average of 2.6% (Table 2.3) of its total trade within ECOWAS between 1976 and 2012. It is important to mention that Cote d'Ivoire performs relatively well in terms of intra-ECOWAS market share and regional trade integration representing 23.3% (Table 2.2) and 11.9 (Table 2.3), respectively. Also, Togo is low in terms of ECOWAS market trade share but demonstrates a high level of intra-ECOWAS trade integration averaging 13.4%.

[5] South African Development Community (SADC)
[6] Common Market for Eastern and Southern Africa (COMESA)
[7] Free Trade Area (FTA)
[8] North America Free Trade Agreement (NAFTA)

Table 2.3. Intra-ECOWAS Trade Flows: share of regional trade in total trade flows

Countries	1976	1986	1996	2006	2007	2008	2009	2010	2011	2012	Average (1976-2012)
Togo	11.8	0.6	14.8	13.6	18.2	27.1	14.3	15.1	47.7	10.6	13.4
Cote d'Ivoire	14	1.6	19.2	25.8	19.3	21.2	18	16.9	22.3	21.3	11.9
Senegal	38.5	0.4	15.6	10.1	14	23.1	10.8	16.7	17.5	19.9	11.3
Ghana	4.7	0.3	7.1	21.5	12.5	17.9	10.7	10.8	9.4	7.2	6.6
Nigeria	4.9	0.6	4.7	3.7	3.5	3.9	3.9	3.3	2.2	1.2	2.6
Intra-ECOWAS	4.8	7.2	9.2	9.0	9.1	8.8	13.6	13.4	15.1	11.5	9.3

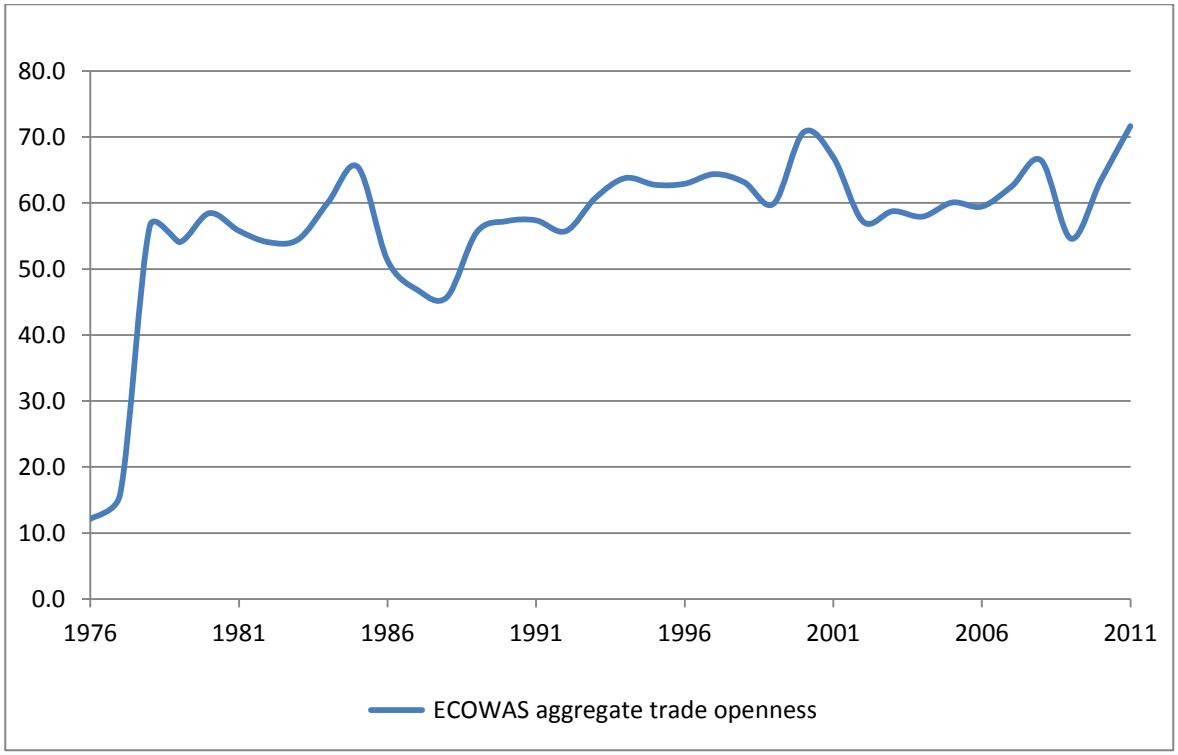
Source: Compiled from World Integrated Trade Solution, World Bank Data Base (http://wits.worldbank.org)

In addition, members of West African Economic and Monetary Union (WAEMU) (that is, Senegal, Cote d'Ivoire and Togo) demonstrate high level of intra-ECOWAS trade flows than the members of West African Monetary Zone (WAMZ)−Nigeria and Ghana. While WAEMU conduct average of 12.2% of their trade within ECOWAS region, WAMZ's stood at 4.6%. The reason for higher intra-ECOWAS trade among WAEMU might be rooted, among other things, in monetary union operating in the sub-region as well as higher degree of intra-ECOWAS trade liberalisation. Thus, it could be claimed that ECOWAS trade liberalisation appears to have been relatively more successfully implemented in WAEMU than in WAMZ. This observation is in line with earlier submissions of Oyejide and Njinkeu (2001) and Oyejide (2013).

Further, aggregate trade openness among members of ECOWAS remains significantly large (Figure 2.1). Over time, the share of aggregate trade in ECOWAS gross output is not only high but has been increasing marginally (with little fluctuations). Aggregate trade-GDP ratio for West Africa ranged from 12.1% in 1976 to 71.7% in 2011 (Figure 2.1). On the average, the share of trade in GDP was about 56.8% since ECOWAS inception. This indicates that the region has been generally open to trade over time, even more than some developed regions such as USA and Asian countries where trade represents only about 21.7% and 43.6% of GDP respectively between 1976 and 2012 (World Bank, 2014).

However, there are variations in the level of trade openness among the selected regional member states (Figure A1 to A5 in the Appendix). For instance, while other member states showed some increase in the level of trade openness, Nigeria and Togo experienced decrease in the level of trade openness in the recent time, especially between 2008 and 2012. Nevertheless, trade openness among the selected member states is relatively high. Surprisingly, Ghana, Cote d'Ivoire and Togo in 2000, 2012 and 1978 to 1980 had total trade higher than their level of gross output. This is an extreme form of openness which could have undesirable consequences on the domestic business cycles when there is an exogenous negative shock.

Figure 2.1. Aggregate trade openness (Trade to GDP ratios) in ECOWAS



Source: Author's computation based on WDI (2014) and World Integrated Trade Solution (http://wits.worldbank.org)

Apparently, the member states are less opened to regional trade as indicated in Table 2.3. The question is; where does the bulk of ECOWAS trade goes and what are the implications these extra-ECOWAS trade flows on regional member states' business cycles? Answer to this is presented subsequently.

2.1.2 Extra-ECOWAS Trade Flows: Characteristics and Components

The nature of ECOWAS production dominated by primary activities such as agriculture and mineral resources coupled with inadequate ability to convert the primary products into finished goods compel most regional members to conduct bulk of their trade with non-ECOWAS developed countries trading partners. One of the attributes of small open economies in the literature is the inability to influence the world prices. As a result, the prices of these primary products are set at international markets, and these are often very unstable, thus having a considerable effect on fiscal revenues and incomes (Imam and Salinas, 2008). Fluctuations in demand for these primary products arising from price and non-price factors (tariff and non-tariff) may have undesirable consequences on business cycles of the trading partners.

Presented in Table 2.4 are some of the identified trading partners among which are the USA, China as well as European Union (EU) member states such as France, Germany, Netherlands, United Kingdom and Spain. These countries altogether accounted for an average of approximately 50.6% of Nigeria, Cote d'Ivoire, Ghana and Togo's total trade flows (selected members of ECOWAS) and 51.0% of ECOWAS total trade flows. This indicates that the selected members of ECOWAS are a good reflection of the community in region. It is important to note that these proportions may vary across commodities being traded but this is not the focus of this thesis. Also, selected members of EU represent 73.1% of total ECOWAS trade flows with union (Table A2 in the Appendix). From Table 2.4 it is clear that the USA and France remain the only single major trading partner to Nigeria, Senegal and Cote d'Ivoire, they accounted for an average of 29.3%, 24.1% and 19.9% of total trade flows respectively between 1978 and 2012. In Ghana, China and UK are the leading trading partners; it traded 9.6% and 9.4%, respectively with them. Meanwhile, China seems to be the major trading partner of Togo, it accounted for about

Table 2.4. Direction of trade flows (percentage conducted with trading partners)

Nigeria	Trading Partners	1978-1985	1986-1994	1995-2004	2005-2012	1978-2012
	Germany	12.8	10.5	4.4	3.8	5.6
	Spain	2.2	7.4	6.6	5.7	5.4
	France	11.7	7.7	5.9	4.7	6.0
	UK	9.5	7.0	3.8	3.6	4.6
	Netherlands	7.2	4.9	2.8	5.3	4.8
	USA	29.9	33.5	31.9	29.6	29.3
	China	0.003	0.4	3.1	6.0	3.9
	All identified partners	73.4	71.4	58.6	58.7	59.5
Cote d'Ivoire						
	Germany	8.9	9.4	6.1	9.0	7.9
	Spain	3.8	5.0	4.1	2.9	3.6
	France	33.1	28.5	20.7	12.8	19.9
	UK	4.1	3.8	3.0	2.2	2.9
	Netherlands	6.5	8.3	7.3	7.2	7.1
	USA	12.2	8.5	7.3	8.7	8.6
	China	0.2	0.7	2.4	4.0	2.5
	All identified partners	68.8	64.4	51.1	46.8	52.6
Ghana						
	Germany	11.3	16.0	6.6	3.5	5.9
	Spain	2.1	1.9	3.0	1.9	2.0
	France	2.8	4.7	5.9	6.6	5.7
	UK	21.8	19.7	12.1	5.7	9.4
	Netherlands	4.9	5.2	6.6	7.4	6.4
	USA	21.1	14.6	9.2	6.9	8.8
	China	0.1	1.4	4.3	15.1	9.6
	All identified partners	64.1	63.4	48.1	47.0	48.1
	Total Trade					
Senegal						
	Germany	4.2	3.4	2.4	1.6	2.4
	Spain	4.2	5.5	4.8	3.5	4.1
	France	44.5	42.8	26.6	16.0	24.1
	UK	5.0	2.8	2.8	10.0	6.5
	Netherlands	4.2	2.8	2.4	4.8	3.7
	USA	4.2	4.8	3.6	2.6	3.1
	China	0.8	1.4	2.0	6.7	4.1
	All identified partners	67.2	64.1	45.6	45.3	48.3
Togo						
	Germany	8.2	5.6	3.0	2.8	3.4
	Spain	3.3	5.6	1.5	1.3	1.9
	France	29.5	22.2	10.4	5.0	9.1
	UK	6.6	2.8	3.0	2.7	2.9
	Netherlands	16.4	6.9	3.0	6.9	6.7
	USA	4.9	4.2	2.2	3.2	2.9
	China	0.5	6.9	11.2	25.0	17.8
	All identified partners	68.9	56.9	34.3	46.6	44.7
Selected Member States Average		68.5	64.0	47.5	48.9	50.6
ECOWAS Average		66.5	56.0	47.6	50.9	51.0

Source: Author's computation based on World Integrated Trade Solution (http://wits.worldbank.org)

17.8% of its trade flows. Trade flows between the selected members of ECOWAS and the identified partners, especially the traditional trading partners such as EU have relatively reduced, they recorded 66.5% between 1978 and 1985 and stood at 50.9% between 2005 and 2012 (Table 2.4). This is an indication that other trading partners around the world are equally ascending into greater prominence on the external trade profile of ECOWAS.

Of importance is China-ECOWAS trade flows which has been increasing consistently since 1984 (Table 2.4). This implies that trade relationship has substantially risen between ECOWAS and China, especially with Togo and Ghana, which conducted respectively 17.8% and 9.6% of their total trade with China between 1984 and 2012, respectively. The available data shows that ECOWAS trade with China has been mainly characterised with trade deficit, implying higher import than exports flows. Thus, in recent time the deficits have increased consistently, especially between 2009 and 2012 (See Figure A6). This has resulted into a lot of debate in the recent time on whether African countries, ECOWAS inclusive, have any significant benefit from such trade relationship. However, ECOWAS trade relationship with USA has been characterized with trade surplus—with consistent increase in surplus noticed between 2002 and 2008. Besides, ECOWAS trade balance with EU has been a mixture of trade deficits and surpluses (with higher trade surplus, notwithstanding). Between 1998 and 2004 represents the time when ECOWAS had the highest trade deficit with EU.

Further analysis at country level shows that the selected members of ECOWAS, except Nigeria and Cote d'Ivoire, had experienced trade deficits with almost all the identified trading partners (Figure A7 to A12). There are implications that can be drawn from this, especially relating to cross-country business cycles. First, increase in export of primary goods implies increased productive capacity in the domestic economy (a situation associated with increased oscillation of business cycles) thus, indicating availability of necessary inputs by the importing economies—the use of which increases the oscillation of importing countries business cycles—leading to synchronisation of domestic and foreign business cycles. Second, if trade flows is dominated by importation of finished goods, the level of cross-country business cycles will not only be weak but may even be negative. This is because the representative economy may be trading more with the

partners having unsynchronised business cycles with its own, to guide against consumption shocks.

Another noticeable feature of extra-ECOWAS trade flows with the identified trading partners is that of displacement of some of the traditional ones. For instance, while trade flows with USA and EU countries have relatively decreased, that of China has been consistently increasing. This implies that displacement of some of the traditional major trading partners' products by China in members of ECOWAS markets. In Nigeria, displaced traditional trading partners are USA and EU, specifically Germany and UK, while France and UK as well as UK and USA are the displaced markets in the case of Cote d'Ivoire and Ghana, respectively. Besides, Germany and France seem to be the displaced trading partners in Senegal and Togo markets (Table 2.4).

Moreover, it is important to note that the selected members of ECOWAS accounted for significant extra-ECOWAS trade flows (Table 2.4 and Table A3). They accounted for an average of 50.6% of total extra-ECOWAS trade flows between 1978 and 2012 (with Nigeria accounted for 59.5%, notwithstanding). This shows the relative importance of selected members of ECOWAS not only in the region (as indicated previously) but also in extra-ECOWAS trade flows.

The nature of commodities traded by selected members of ECOWAS clearly indicates the level of industrialisation among these economies and their ability to convert the endowed primary resources to finished goods. The weak industrial base makes most of the ECOWAS to export their endowment in crude and raw forms. This indicates low level of linkages in global value chain with the identified trading partners. Premised on this, it is presumed that there will be low level of business cycles synchronisation because of the low level of interconnectedness of production processes. In Nigeria, it is mainly the exchange of crude oil for refined oil products, automobiles and wheat (Table 2.5). For Ghana, it is exchange of crude oil and cocoa for refined oil products, automobiles and rice, while it is mainly raw agricultural products for more refined agricultural products in Cote d'Ivoire.

Table 2.5. Five leading traded goods of the selected members of ECOWAS (6-digit HS)

Member States	S/N	Exports	Imports
Nigeria	1	Petroleum oils and oils obtained from bituminous minerals, crude	Light petroleum oils and preparations
	2	Natural gas, liquefied	Other petroleum oils and preparations
	3	Light petroleum oils and preparations	Wheat and meslin (excl. seed for sowing, and durum wheat)
	4	Other petroleum oils and preparations	Automobiles w reciprocatg piston engine displacg > 1500 cc to 3000 cc
	5	Propane, liquefied	Commodities not elsewhere specified
Cote d'Ivoire	1	Cocoa beans, whole or broken, raw or roasted	Rice, semi-milled or wholly milled, whether or not polished or glazed
	2	Petroleum oils and oils obtained from bituminous minerals, crude	Medicaments nes, in dosage
	3	Cocoa paste not defatted	Wheat and meslin (excl. seed for sowing, and durum wheat)
	4	Technically specified natural rubber (TSNR)	Commodities not elsewhere specified
	5	Cocoa butter, fat and oil	Rice, broken
Ghana	1	Petroleum oils and oils obtained from bituminous minerals, crude	Other petroleum oils and preparations
	2	Cocoa beans, whole or broken, raw or roasted	Light petroleum oils and preparations
	3	Floating or submersible drilling or production platforms	Automobiles w reciprocatg piston engine displacg > 1500 cc to 3000 cc
	4	Commodities not elsewhere specified	Medicaments nes, in dosage
	5	Cocoa paste not defatted	Rice, semi-milled or wholly milled, whether or not polished or glazed
Senegal	1	Other petroleum oils and preparations	Petroleum oils and oils obtained from bituminous minerals, crude
	2	Gold in unwrought forms non-monetary	Other petroleum oils and preparations
	3	Phosphoric acid and polyphosphoric acids	Rice, broken
	4	Portland cement nes	Wheat nes and meslin
	5	Fish nes, frozen, excluding heading No 03.04, livers and roes	Medicaments nes, in dosage
Togo	1	Cement clinkers	Other petroleum oils and preparations
	2	Portland cement nes	Light petroleum oils and preparations
	3	Floating docks and vessels which perform special functions	Cement clinkers
	4	Cotton, not carded or combed	Medicaments nes, in dosage
	5	Casings,i/s,int/ext circ c sect,wld ext dia >406.4mm,oil/gas drill,nes	Petroleum bitumen

Sources: ITC calculations based on UN COMTRADE statistics.

In summary, unlike extra-ECOWAS trade flow, high and concentrated in a few markets outside the region, the intra-regional trade flow in West Africa has been very low. Besides, intra-ECOWAS trade flow is characterised with exchange of primary goods (mainly fuel and lubricants, raw agricultural products and mineral products), have been more concentrated in exports with few member states that accounted for bulk of regional exports. The extra-ECOWAS trade flow has involved significantly in exchange of primary goods for finished consumption commodities, while this trade balance vary with trading partners. There was evidence of displacement of some of the traditional trading partners, majorly ex-colonial administrators. This is an indication that other trading partners are gaining prominence in external trade profile of ECOWAS.

2.2. Structure of the Selected Economies

The structures of economy tell a lot about the nature of trade flows, business cycles and cross-country business cycles. On one hand, similarities in the structure of the economies make shocks to be similar and thus, enhance positive cross-country business cycles. On the other hand, dominancy of intra-industry trade flow—due to similarity in economic structures—enhances correlated similar shocks. Therefore, there is need to account for the degree of similarity in the structure of production across selected countries when studying the factors underlying trade flows, business cycles and cross-country business cycles.

Table 2.6 shows most selected members of ECOWAS still rely heavily on agricultural sector, although this trend is gradually reducing except in Cote d'Ivoire. The available information indicates that agricultural sector accounted for an average of 31.4% of the selected Members of ECOWAS GDP from 1978 to 2012. The situation is not the same with the selected trading partners where agricultural sector accounted for only an average of 4.8%, with China having the highest proportion averaging 20.4% between 1978 and 2012. The trend indicates that the proportion of agricultural sector in gross output is even reducing in some of these trading partners where it was marginal. This is a pointer to possibility of unsynchronised business

Table 2.6. Share of agricultural sector in GDP

Countries	1978-1987	1988-1997	1998-2007	2008	2009	2010	2011	2012	Average (1978-2012)
Nigeria	36.2	33.4	35.7	32.9	37.1	23.9	22.3	22.1	33.8
Cote d'Ivoire	25.9	29.1	23.9	25.0	25.1	25.3	28.4	26.9	26.3
Ghana	55.8	44.5	38.0	31.0	31.8	29.8	25.3	23.0	43.2
Senegal	22.0	20.3	17.0	15.9	17.3	17.7	15.7	16.7	19.2
Togo	30.2	36.7	36.6	40.7	32.9	31.0	30.8	N/A	34.4
ECOWAS Average	**34.0**	**32.8**	**30.2**	**29.1**	**28.8**	**25.5**	**24.5**	**22.2**	**31.4**
China	30.3	22.2	13.7	10.7	10.3	10.1	10.0	10.1	20.4
Germany	na	1.1	1.0	1.0	0.8	0.8	0.8	0.8	1.0
Spain	na	4.7	3.7	2.5	2.4	2.6	2.5	2.5	3.5
France	4.3	3.1	2.3	1.8	1.5	1.8	1.9	2.0	3.0
United Kingdom	na	1.5	0.8	0.7	0.6	0.7	0.7	0.7	1.0
Netherlands	4.0	3.7	2.3	1.7	1.5	1.8	1.6	1.7	3.1
United States	2.7	1.9	1.2	1.2	1.1	1.2	1.2	na	1.8
Partners' Average	**10.3**	**5.5**	**3.6**	**2.8**	**2.6**	**2.7**	**2.7**	**2.9**	**4.8**

Source: Author's computation based on World Bank, 2013.

na: not available data

cycles between business cycles of ECOWAS and those of the selected trading partners. That is, since agricultural sector is often driven largely by seasonality—especially in a situation of low level of agricultural technology—there are tendencies that ECOWAS business cycles will be more frequent than those of the selected developed trading partners.

Further, the level of industrial activities (especially manufacturing activities) is dictated by level of technology of a country. Since huge proportion of industrial activities of the selected members of ECOWAS is accounted for by extractive industries, the contribution of manufacturing sector to GDP is presented separately (Table 2.7). It is indicated in Table 2.7 that the contribution of manufacturing sector to GDP of the selected ECOWAS trading partners almost doubled that of the selected members of ECOWAS, an indication of higher level of technology of the selected developed countries trading partners when compared with selected members of ECOWAS. Therefore, if technologies are subject to shocks, the response of business cycles to these will vary across countries, depending on the relative importance of technology-dependent manufacturing activities in the aggregate economic activities across countries.

Table 2.7. Share of industrial sector in GDP

Countries		1978-1987	1988-1997	1998-2007	2008	2009	2010	2011	2012	1978-2012
Nigeria	Manufacturing	9.3	5.9	3.6	2.4	2.5	6.6	7.2	7.8	5.8
	Industry	32.4	43.4	40.0	41.5	34.2	22.0	24.8	23.7	37.7
Cote d'Ivoire	Manufacturing	7.9	16.0	14.6	11.8	12.1	12.0	12.0	11.8	14.0
	Industry	19.8	22.8	24.1	26.1	24.6	25.0	24.2	25.9	22.6
Ghana	Manufacturing	8.5	9.9	9.9	7.9	6.9	6.8	6.9	6.4	9.1
	Industry	13.0	22.2	26.5	20.4	19.0	19.1	25.6	28.6	21.1
Senegal	Manufacturing	13.8	15.8	15.7	14.0	13.9	13.8	14.8	14.2	15.0
	Industry	20.5	23.0	24.1	22.9	23.3	23.4	24.9	24.2	22.9
Togo	Manufacturing	7.1	9.5	8.4	8.5	7.9	7.8	8.1	na	8.3
	Industry	22.2	22.3	17.7	18.2	16.0	16.6	15.5	na	20.2
ECOWAS Average	Manufacturing	**9.3**	**11.4**	**10.4**	**8.9**	**8.7**	**9.4**	**9.8**	**8.0**	**10.4**
	Industry	**21.6**	**26.7**	**26.5**	**25.8**	**23.4**	**21.2**	**23.0**	**20.5**	**24.9**
China	Manufacturing	37.2	33.5	32.2	32.7	32.3	32.5	31.8		34.1
	Industry	45.2	44.9	46.3	47.4	46.2	46.7	46.6	45.3	45.6
Germany	Manufacturing		23.1	22.1	22.2	19.5	21.9	22.7	22.4	22.3
	Industry	39.9	34.6	29.9	30.1	27.8	30.2	30.7	30.5	34.1
Spain	Manufacturing			16.1	13.8	12.3	13.0	13.3	13.3	15.0
	Industry	35.5	31.9	31.3	30.5	28.5	27.2	26.6	25.9	32.2
France	Manufacturing	19.8	16.6	13.8	11.3	10.6	10.3	10.2	10.0	15.8
	Industry	30.0	25.6	21.8	20.2	19.4	18.9	18.9	18.8	24.9
United Kingdom	Manufacturing	na	18.8	13.9	10.9	10.3	10.4	10.3	10.1	14.8
	Industry	39.2	31.5	25.1	22.6	21.3	21.5	21.5	20.7	30.5
Netherlands	Manufacturing	17.3	16.8	13.8	12.8	11.7	12.2	12.7	12.6	15.5
	Industry	32.1	27.8	24.4	25.4	24.2	23.8	24.5	24.3	27.6
United States	Manufacturing	na	na	14.9	12.9	12.4	12.6	12.9	na	14.3
	Industry	32.1	26.8	22.6	21.1	19.6	19.8	20.2	na	26.3
Partners' Average	Manufacturing	**13.7**	**17.7**	**19.7**	**18.0**	**16.9**	**17.5**	**17.5**	**10.92**	**21.0**
	Industry	**36.3**	**31.9**	**28.8**	**28.2**	**26.7**	**26.9**	**27.0**	**23.6**	**31.6**

Source: Author's computation based on World Bank, 2013.

na: not available data

Services sector is becoming dominant contributor to GDP among the selected members of ECOWAS, this concentrates majorly in its information and communication sub-sector. Its increasing contribution to GDP among the selected members of ECOWAS and the selected trading partners indicates the potentials for services-related technology shocks to correlate across these countries. Table 2.8 shows that the average contributions of services sector to GDP, averages 43.8% and 64.9% among the selected members of ECOWAS and the identified trading partners between 1978 and 2012, respectively. The contribution of services sector to GDP is not only high but has also been consistently increasing. In this case, shocks in the services sector might be correlated across countries making cross-country business cycles to co-move.

Finally, similarities in the structure of economies across countries are important in determining the nature of business cycles and acts as a potential cause of correlated cross-country business cycles; the structure of the trading economies does not transmit business cycles internationally. It only does this indirectly through trade flows and financial interdependence.

Table 2.8. **Share of Services Sector in GDP**

Countries	1978-1987	1988-1997	1998-2007	2008	2009	2010	2011	2012	1978-2012
Nigeria	31.4	23.3	24.3	25.7	28.7	54.1	52.9	54.3	28.5
Cote d'Ivoire	54.3	49.0	52.0	48.9	50.3	49.6	47.4	47.2	51.3
Ghana	31.2	33.3	35.5	48.6	49.2	51.1	49.1	48.4	35.7
Senegal	57.5	56.7	58.9	61.1	59.4	58.9	59.5	59.0	58.0
Togo	47.6	41.0	45.7	41.1	51.1	52.3	53.7	na	45.3
ECOWAS Average	**44.4**	**40.6**	**43.3**	**45.1**	**47.8**	**53.2**	**52.5**	**52.2**	**43.8**
China	24.6	33.0	40.0	41.8	43.4	43.2	43.4	44.6	34.1
Germany		65.7	69.1	68.9	71.4	69.0	68.5	68.7	68.1
Spain		64.0	65.0	67.0	69.2	70.2	70.9	71.6	66.2
France	65.7	71.3	75.9	78.0	79.0	79.3	79.2	79.2	72.1
United Kingdom		68.1	74.1	76.7	78.2	77.8	77.9	78.7	72.8
Netherlands	64.0	68.5	73.4	73.0	74.3	74.4	73.9	74.0	69.4
United States	65.1	71.3	76.2	77.6	79.3	79.0	78.6	na	71.8
Partners' Average	**54.8**	**63.1**	**67.7**	**69.0**	**70.7**	**70.4**	**70.3**	**69.5**	**64.9**

Source: Author's computation based on World Bank, 2013.

na: not available data

2.3. Business Cycles and Cross-country Business Cycles of the Selected Countries

2.3.1. Business Cycles of the Selected Countries

There are clear indications given the structure of any economy, that some sectors and activities of the economy do not exhibit conformity or coherence with general business cycle, while some do. This categorisation is based on causes, duration, nature (scope in terms of whether international or domestic), sizes and patterns of cyclical behaviour across countries. Therefore, primary activities such as agriculture dominated by crop production which depends heavily on weather and season, especially among developing economies where agricultural mechanisation is low, may not be important in the discussion of business cycle. This is because unlike the cycles of the seasons and weather which run their course within a year, business cycles are longer (Moore and Zarnowitz, 1984).

Other activities[9] and variables such as manufacturing, wholesale and retail activities, private and inventory investments, prices of industrial commodities, income velocity of money[10], labour productivity and employment, stock prices and value of sold shares, business profit, short-term interest rate, narrow and broad money aggregate, capacity utilisation, consumers' expectations[11] and changes in business inventories exhibit conformity with business cycle (Zarnowitz, 1985). The reason is that these variables are assumed to be consistent with the various identified causes of business cycles among which are; new inventions (stimulating investment in capital goods industries), policies (such as fiscal and monetary), misperceptions about movement of wages and prices, significant changes in technology and productivity and exposure to external factors, often regarded as imported business cycles.

Also, there are other factors causing cycles in an economy such as civil wars, epidemics, and other social crises which do not reflect business cycles. These factors are regarded as "war cycles" or "crises cycles". Some of the member of ECOWAS such as

[9] This category is grouped into leading (e.g. stock prices and value of sold shares), coinciding (e.g. aggregate output movements together with related sectors) and lagging (e.g. inventories) variables in business cycles.

[10] That is, ratio of income to stock of currency and commercial bank deposits held by the public.

[11] This implies consumers' anticipations concerning their economic and financial fortunes.

Liberia and Sierra Leone especially between 1989 and 1996 and 1991 and 2001 respectively fall in this category. According to Zarnowitz (1985), these types of cycles do not fit into business cycle because they do not themselves produce the recurrent sequences of expansions and contractions. That is, business cycles are mainly generated by the internal economic mechanisms and exposure to related potential relevant external shocks.

Consequently, since the selected members of ECOWAS are largely characterised with primary activities (for instance, where agricultural value added forms the bulk of total output), one may be tempted to ask if business cycles exist in such economies. There are two main proofs of the potential for the existence of business cycles in ECOWAS. On one hand, the study of business cycles is related to macroeconomic dynamics which has a large interface with economics of growth, money, inflation and expectations which do exist in any economy. On the other hand, there is possibility of a sector representing only a small fraction of the economy (e.g. manufacturing sector in most member states) accounting for significant share of the amplitudes of the business cycles. Thus, it could be concluded that business cycles potential exist among the selected members of ECOWAS, even though the amplitudes and durations may vary from one member states to the other, depending on the dominant factors causing the cycles.

Moreover, one of the characteristics of business cycles is that they are not directly observable because they consist of recurrent (but not periodic) sequences of great number of diverse economic activities sufficiently diffused and synchronised to create major fluctuations in comprehensive aggregates of employment, production, real income, and real sales (Moore and Zarnowitz, 1984). Thus, business cycles are not just cyclical behaviour of a single economic variable such as real income, output, investment and employment. Nonetheless, some variables deserve more attention than others, because they are more comprehensive, significant economically and more reliable with respect to their cyclical timing and conformity characteristics with business cycles. For instance, some variables such as gross domestic product (GDP) do not only represent significant aggregate economic activities, but they are also a good example of coincident[12] variables in business cycles. Thus, claiming that growth cycles are entirely synonymous with

[12] These are variables that tend to rise in expansions and fall in contractions of business cycles.

business cycles is tantamount to lack of better words (Zarnowitz, 1985). Business cycles[13] of the selected countries were constructed using diffusion index. This could be defined as the barometer of an economy which measures the co-movement of many time series and how various economic components dispersed, spread out, or "diffused" over time. It is a summary measure of aggregate economic activity, this is further discussed in chapter three.

Presented in Table 2.9 are the selected characteristics of business cycles of selected members of ECOWAS and their selected major trading partners between 1976 and 2012. On the average, 12 business cycles have occurred among ECOWAS in the past 36 years, implying about one every three years. It is important to note that business cycles have tended to be longer and frequent in some of the countries than others. While members of ECOWAS such as Cote d'Ivoire had about 13 cycles, Togo is having about ten cycles. Among the trading partners, while Spain and United Kingdom recorded about nine cycles (about one every four years), United States and Netherlands experienced about 11 cycles. On the average, selected ECOWAS are characterised with more frequent cycles than the selected trading partners, which reflect the nature of their economies. Given that duration of business cycles varies from more than one year to 10 or 12 years as noted by Moore and Zarnowitz (1984), business cycles of selected countries could be categorised under three-year Kitchin cycle[14]. One of the explanations that can be offered for this is that inventory investment[15] plays a central role in the cycles of members of ECOWAS (Moore and Zarnowitz, 1984 and Gabisch and Lorenz, 1987).

[13] In the construction of the diffusion index for this study, agricultural activities are excluded to avoid mixing actual business cycles with season cycles.

[14] Other types of business cycles are 10-year Jugular cycles, 20-year Kuznets cycles and 50-year Kondratiev cycles.

[15] This refers to the difference between goods produced and sold in a given year. It is a component of ouput not sold in the year of production but may be sold in a latter year rather than in the year they were produced.

Table 2.9. **Business cycles of the selected countries with reference dates**

	1978-1985				1986-1994				1995-2004				2005-2012				1978-2012			
Selected Countries	Number of full Cycles	Expansions (yrs)	Contractions (Yrs)	Ratio(E/C)	Number of full Cycles	Expansions (yrs)	Contractions (Yrs)	Ratio, (E/C)	Number of full Cycles	Expansions (yrs)	Contractions (Yrs)	Ratio (E/C)	Number of full Cycles	Expansions (yrs)	Contractions (Yrs)	Ratio (E/C)	Number of full Cycles	Expansions (yrs)	Contractions (Yrs)	Ratio (E/C)
	Members of ECOWAS Business cycles																			
Cote d'Ivoire	3	3	7	0.4	3	6	4	1.5	4	6	4	1.5	2	2	4	0.5	13	16	20	0.8
Ghana	2	6	4	1.5	3	3	7	0.4	3	6	4	1.5	2	3	3	1	11	20	16	1.3
Nigeria	3	5	5	1	3	4	6	0.6	3	5	5	1	2	3	3	1	12	17	19	0.9
Senegal	3	5	5	1	4	6	4	1.5	3	4	6	0.6	2	4	2	2	11	20	16	1.3
Togo	3	7	3	2.5	3	3	7	0.4	3	6	4	1.5	1	5	1	5	10	19	17	0.9
Average	**2.8**	**5.2**	**4.8**	**1.28**	**3.2**	**4.4**	**5.6**	**0.88**	**3.2**	**5.4**	**4.6**	**1.22**	**1.8**	**3.4**	**2.6**	**1.9**	**11.4**	**18.4**	**17.6**	**1.04**
	Selected Trading Partners Business Cycles																			
China	3	5	5	1	3	3	7	0.4	3	3	7	0.4	1	1	5	0.2	10	15	21	0.7
France	3	5	5	1	4	4	6	0.6	3	6	4	1.5	1	4	2	2	12	19	17	0.9
Germany	3	3	7	0.4	3	2	8	1.5	3	6	4	1.5	1	1	5	0.2	10	13	23	0.6
Netherlands	2	4	6	0.6	3	4	6	0.7	3	5	5	1	1	3	3	1.0	11	15	21	0.7
Spain	2	6	4	0.3	3	4	6	0.7	4	7	3	2.5	1	2	4	0.5	9	22	14	1.6
United Kingdom	3	7	3	2.5	2	7	3	2.5	3	5	5	1	1	4	2	2.0	9	20	16	1.3
USA	3	4	6	0.6	2	6	4	1.5	4	6	4	1.5	1	2	4	0.5	11	19	17	0.9
Average	**2.7**	**5.0**	**5.0**	**1.0**	**3.0**	**4.0**	**6.0**	**1.1**	**3.3**	**5.4**	**4.6**	**1.3**	**1.0**	**2.3**	**3.7**	**0.9**	**10.3**	**17.6**	**18.4**	**1.0**

Source: Author's computation based on WDI (2013).

Note: Duration of business cycles expansions and contractions are expressed in years. Expansions are measured from troughs to peaks and contractions from peaks to troughs. A full cycle is measured from trough to trough or from peak to peak.

As a rule in business cycles, expansions must necessarily be on the average larger than contractions in duration. One explanation that can be offered for this is that the latter represents an unpleasant economic situation, which is often mitigated. Further, in terms of duration of contractions and expansions, the selected members of ECOWAS experienced most of their contraction phases between 1976 and 1995. Specifically, the highest contraction phase lasted three years which was between 1989 and 1991. This was followed by those of 1979 to 1980, 1982 to 1983, 1985 to 1986 and 1995 to 1996 which lasted two years each. These periods fall within oil and commodities price shocks of late 1970s and early 1980s, Structural Adjustment Programme (SAP) era and post-SAP era. It is observed that member states such as Cote d'Ivoire, Togo and Nigeria contributed significantly to contractions noticed in ECOWAS at these periods. Overall, each contraction phase lasted for average of about one and half years. Meanwhile, there have been improvements, especially from 1996 to 2011. For instance, since the contraction of 1995/1996, the contraction phase has been reduced by about a year, while the expansion duration has been extended by around two years. The highest expansion phases were mainly between 1987 and 1988, 2000 and 2002 and 2004 and 2005 which lasted for two years each. Nevertheless, there are wide variations regarding contraction and expansion phases among the selected members of ECOWAS.

Further, relating to the business cycles of the trading partners, Table 2.9 reveals that there were also periods of frequent economic crises among the selected major trading partners. For instance, among the EU trading partners one of the major economic downturn periods was during the stagflation of 1970s, when expansion and contraction of business cycles are equal (also see Figure A6). Although there was stability in the 1980s and 1990s in what came to be known as The Great Moderation, this, unfortunately, was followed by the global economic recession that started around 2008 which many countries, especially in the Western world, are yet to fully recover from. This period also featured EURO debt crises. For instance, during the 2005 to 2012, the number of contractions of business cycles exceeded those of expansions (Table 2.9). Notably, majority of EU economies are showing signs of recovery in their business cycles—especially between the year 2010 and 2012—with Netherlands, Germany and UK recovering faster than others (Table 2.9 and Figure A6).

2.3.2. Cross-country Business Cycle among the Selected Countries.

There are two main approaches to measuring[16] cross-country business cycles; the static and the dynamic. The static approach is presented in this chapter, while the methodology for dynamic correlation is presented subsequently in chapter three. Although both approaches yield similar results, dynamic approach is suitable for examining the nature of cross-country business cycles between any countries pair from historical perspectives. Table 2.10 presents static business cycles among the selected countries partitioning the study period into two: the periods of growth disaster and positive growth. Each of the two periods is further partitioned into two. This is necessary to appreciate changes in the level of cross-country business cycles.

Table 2.10 suggests less synchronised patterns of cross-country business cycles among selected members of ECOWAS. This is envisaged given the structure of trade flows and structures of the selected economies. However, they are becoming more synchronised. For instance, the level of synchronisation of business cycles have improved between 2005 and 2012, compared with what obtained between 1978 and 1994. Generally, there is inconsistency in the level of business cycles synchronization between selected members of ECOWAS and their trading partners, while there is no specific pattern of these cross-country business cycles over time except in few cases. Specifically, China demonstrated increasing unsynchronized business cycles, except for 1995 to 2004, when synchronisation marginally improved, with selected members of ECOWAS despite increasing level of trade flows. However, USA, on the average, is becoming more synchronised with the selected members of ECOWAS with Senegal driving the synchronisation especially between 2005 and 2012. Also, selected EU is becoming more synchronised with the selected members of ECOWAS except for 1995 to 2004, when synchronisation is lower than the preceding period. There are outliers; for instance, Nigeria was highly synchronised with most selected EU countries between 1978 and 1985, unlike what obtained between 2005 and 2012. Overall, as in the case of intra-ECOWAS synchronisation of business cycles, extra-ECOWAS business cycles co-movement has also improved.

[16] Several approaches at measuring the cross country business cycles are presented in the chapter three.

EU countries have demonstrated higher level of cross-country business cycles synchronisation among themselves and the level of synchronisation has also improved significantly. Also, while USA demonstrated high level of business cycle synchronisation with the EU countries, China showed low level of business cycles synchronization with all selected countries, except with Ghana, Senegal and Togo in few cases. The relationship between the trend in cross-country business cycles and trade flows, previously presented, is subsequently explained.

Table 2.10. Static Cross-country business cycles with reference dates

1978-1985											
	CIV	NIG	GHA	SEN	TGO	GMY	SPN	FRA	UK	NLD	CHN
CIV	1										
NIG	0.13	1.00									
GHA	-0.49	0.24	1.00								
SEN	-0.03	-0.32	-0.52	1.00							
TGO	-0.14	0.13	0.59	-0.26	1.00						
GMY	**-0.01**	**0.24**	**0.15**	**-0.20**	**-0.23**	1.00					
SPN	**-0.48**	**0.34**	**0.28**	**-0.26**	**0.06**	0.15	1.00				
FRA	**0.01**	**0.76**	**-0.01**	**0.08**	**-0.02**	0.10	0.58	1.00			
UK	**0.02**	**0.38**	**0.30**	**-0.27**	**-0.10**	0.44	-0.17	-0.18	1.00		
NLD	**-0.29**	**0.27**	**0.29**	**-0.46**	**-0.11**	0.80	0.56	0.10	0.43	1.00	
CHN	**-0.50**	**0.07**	**0.43**	**0.04**	**0.52**	-0.39	-0.12	0.01	-0.14	-0.41	1.00
USA	**0.14**	**-0.40**	**-0.04**	**0.31**	**-0.43**	0.47	-0.19	-0.27	0.18	0.16	-0.49

1995-2004											
	CIV	NIG	GHA	SEN	TGO	GMY	SPN	FRA	UK	NLD	CHN
CIV	1.00										
NIG	0.36	1.00									
GHA	0.35	0.07	1.00								
SEN	0.29	-0.12	-0.50	1.00							
TGO	-0.03	0.14	0.21	-0.10	1.00						
GMY	**0.34**	**0.04**	**-0.06**	**0.01**	**-0.77**	1.00					
SPN	**0.14**	**-0.28**	**0.12**	**-0.20**	**-0.36**	0.68	1.00				
FRA	**0.34**	**0.18**	**0.48**	**-0.11**	**-0.36**	0.65	0.50	1.00			
UK	**0.38**	**0.52**	**0.20**	**-0.39**	**0.45**	0.07	0.23	0.11	1.00		
NLD	**0.20**	**0.20**	**-0.23**	**0.07**	**-0.65**	0.84	0.66	0.61	0.15	1.00	
CHN	**-0.03**	**-0.43**	**-0.13**	**0.43**	**0.64**	-0.49	-0.11	-0.36	-0.07	-0.44	1.00
USA	**0.51**	**-0.01**	**0.20**	**-0.06**	**0.13**	0.29	0.68	0.25	0.64	0.43	0.18

1986-1994											
	CIV	NIG	GHA	SEN	TGO	GMY	SPN	FRA	UK	NLD	CHN
CIV	1.00										
NIG	0.42	1.00									
GHA	-0.63	0.33	1.00								
SEN	-0.47	-0.44	0.12	1.00							
TGO	0.00	0.09	0.34	-0.05	1.00						
GMY	**-0.25**	**0.11**	**0.49**	**-0.02**	**0.78**	1.00					
SPN	**0.11**	**-0.17**	**0.06**	**0.21**	**0.41**	0.43	1.00				
FRA	**0.01**	**0.02**	**0.02**	**-0.02**	**0.50**	0.75	0.46	1.00			
UK	**0.17**	**-0.34**	**-0.40**	**0.16**	**0.11**	-0.09	0.32	0.02	1.00		
NLD	**0.19**	**0.05**	**0.03**	**-0.39**	**0.77**	0.45	0.17	0.47	0.02	1.00	
CHN	**-0.64**	**-0.46**	**0.17**	**0.55**	**-0.41**	-0.12	-0.01	-0.17	0.00	-0.59	1.00
USA	**0.36**	**-0.09**	**-0.29**	**-0.11**	**0.19**	-0.23	0.26	-0.17	0.81	0.28	-0.42

2005-2012											
	CIV	NIG	GHA	SEN	TGO	GMY	SPN	FRA	UK	NLD	CHN
CIV	1.00										
NIG	0.71	1.00									
GHA	0.57	0.11	1.00								
SEN	0.24	0.26	0.74	1.00							
TGO	-0.37	-0.22	0.39	0.72	1.00						
GMY	**0.22**	**0.11**	**0.62**	**0.56**	**0.69**	1.00					
SPN	**-0.35**	**0.13**	**-0.06**	**0.38**	**0.77**	0.64	1.00				
FRA	**-0.02**	**0.14**	**0.26**	**0.37**	**0.69**	0.91	0.86	1.00			
UK	**-0.07**	**-0.03**	**0.51**	**0.64**	**0.89**	0.94	0.79	0.92	1.00		
NLD	**0.17**	**0.25**	**0.47**	**0.53**	**0.69**	0.97	0.78	0.97	0.94	1.00	
CHN	**-0.22**	**0.28**	**-0.51**	**0.00**	**-0.20**	-0.71	-0.09	-0.55	-0.53	-0.57	1.00
USA	**-0.01**	**0.11**	**0.40**	**0.54**	**0.80**	0.95	0.85	0.98	0.98	0.98	-0.53

Source: Computed based on constructed diffusion index.

Note: Figures in bold are extra-ECOWAS cross-country business cycles.

2.4. Synthesis of Extra-ECOWAS Trade Flows, Business Cycles and Cross-Country Business Cycles

ECOWAS is endowed with several agricultural products (cocoa, groundnut, palm produce, cotton, cassava, maize, fisheries, livestock, etc.) precious stones (gold, gemstones, etc.), crude oil and natural gas. These commodities can serve as inputs that would normally be relevant to business cycles of the trading partners. Likewise, the trading partners are endowed with capital and high level of technology which could enhance ECOWAS business cycles. Therefore, there are evidences of production interdependence, though limited, among selected members of ECOWAS and their trading partners.

Overall, aggregate trade flows of selected members of ECOWAS with the identified trading partners have improved from $25.9 billion between 1978 and 1985 to about $93.0 billion between 2005 and 2012, except between 1986 and 1994. In the same vein, total trade flows have also improved significantly, except between 1986 and 1994 (Table A3). Also, a good look at Table 2.9 reveals that the selected members of ECOWAS experienced most of their business cycles contraction periods between 1985 and 1994. This indicates that there is a sort of correlation between business cycles of selected Members of ECOWAS and trade flows. The extent to which trade may be responsible for the observed increased co-movement in business cycles needs to be investigated.

Also, there are established possible ways by which trade flows can influence cross-country business cycles. Such trade flows can either synchronise the business cycles (if the trade flows is dominated by exchange of productive intermediate goods) or leads to unsynchronisation of their business cycles (if trade is dominated by exchange of consumption goods). Synchronization or otherwise of international business cycles, among other reasons, depends on whether trade is intra-industry (associated with horizontal specialisation) or inter-industry (associated vertical specialisation). Hence, given the structure of members of ECOWAS compared with the selected developed countries trading partners and the nature of trade flows between them, the expectation is that of unsynchronised business cycles. A good look at Table 2.10 shows that some of the selected members of ECOWAS demonstrate high level of business cycles synchronisation

with these partners (this varies over time, notwithstanding). For instance, Nigeria was highly synchronised with EU members between 1978 and 1985, while Senegal and Togo were highly synchronised with all selected developed countries trading partners, except China especially between 2005 and 2012. The general picture emerging is that there have been improvements in the average synchronization of business cycles of selected ECOWAS with the identified trading partners recording approximately 0.03 between 1978 and 1985 which stood at approximately 0.28 between 2005 and 2012. This implies that these countries are becoming responsive to similar shocks but the extent to which trade is responsible for this, especially between selected members of ECOWAS and their trading partners needs to be understood.

Finally, it is realised that ECOWAS aggregate trade flows with the identified trading partners have increased, business cycles of selected members of ECOWAS have improved; and cross-country business cycles have become more positive over time. The question is, to what extent can cross-country business cycles be attributed to trade flows?

CHAPTER THREE

REVIEW OF LITERATURE ON BUSINESS CYCLES AND TRADE FLOWS

3.1. Review of Theoretical Issues

3.1.1. Theoretical Review on Evolution of Business Cycles

The concept of business cycle was developed in the era of great industrial growth and became an issue of interest after the great depression of 1929 to 1939. Chronologically, business cycles theories could be organized into four; the classical, self-correcting economy; the Keynesian revolution of no self-correction; the new classical, based on policy ineffectiveness; and the new Keynesian theory, which focuses on contract-based wage and price stickiness. The latest dimension to business cycles theory is based on trade interdependent, often referred to as imported business cycles.

i. The Classical Theory of Self-correcting Economy

This school of taught precedes Keynesian revolution, the main idea being propagated was that if every demand shift were followed by a simultaneous supply shift by equal amount in the same direction, then real output would never deviate from natural real output and there would be no business cycles. That is, if there is a change in aggregate demand and nominal wages change in proportion, the aggregate supply curve shifts vertically by equal amount as the demand shifts, with no change in real variables.

Further, classical economists such as Smith, Ricardo and Marshall assumed that the economy would not operate with real output far away from the level of natural real output for any length of time. As illustration, on one hand, if the real output is less than the natural real output, firms would be inefficient producing at below capacity, and would tend to cut nominal wages and prices, which would continue until natural real output is reached again. On the other hand, if the real output is greater than the natural real output,

above capacity production could support hikes in nominal wages and prices, until real output drops back to natural rate. The impact would be no business cycle in real output, although there would be in the price level and wages. This school views unemployment as a transitory and self-correcting condition of only minor social importance. This could be justified on the basis that the term *unemployment* was not a major issue until the late nineteenth century. Hence, the classicals saw remedies for unemployment in remedies for wage stickiness, not in fiscal or monetary policies.

ii. Keynesian Revolution of no Self-correction

There are two basic critiques of classical self-correcting theory from Keynesian perspectives. The first focuses on the failure of demand to adjust because of monetary impotence (that is, the failure of real GDP to respond to an increase in the real money supply or a fall in the real interest rate), while the second centres on the failure of supply to adjust as a result of rigid wages (that is, the failure of the nominal wage rate to adjust by the amount needed to maintain equilibrium in the labour market). Besides, the classical model assumes perfect flexible prices and relies on two basic channels by which deflation (fall in price level) leads to a stimulation of output to its natural level. First, deflation has to reduce interest rates through increasing real balances. Second, interest rates must be sufficiently reduced to stimulate the planned autonomous spending and aggregate demand necessary to bring the output level back to its natural rate.

Keynes' objection to the first channel is the possibility of a *liquidity trap*, in which an extremely low interest rate causes people to hold any additional money instead of purchasing interest-bearing assets. The liquidity trap corresponds to a perfectly flat money demand schedule and LM curve so that interest rates and therefore output will not respond to the increase in real money supply resulting from the deflation. The objection of Keynes to the second channel is the possibility that planned autonomous expenditures vary or totally unresponsive to changes in the interest rate. This implies a very steep or vertical investment-savings (IS) curve and aggregate demand (AD) curve, so that output will not respond to deflation. Keynes argues that demand-side problems are the result of the failure of flexible prices to influence real output through the real money supply, they are called the problem of monetary or deflation impotence.

Keynes' second critique of the classical school of taught is that nominal wage rigidity will imply a failure of the aggregate supply curve to adjust the economy to the long run equilibrium level. In this case, a fall in aggregate demand along a given aggregate-supply curve and the subsequent rise in the real wage rate in the labour market is perfectly analogous to the short run equilibrium point, resulting from an increase in aggregate demand. The essential difference in the Keynesian model is that nominal wage rigidity keeps workers off their labour-supply curve, preventing the adjustment of the actual wage to its equilibrium market-clearing value, thus preventing the shifts in the short run aggregate supply curve necessary to return the economy to its natural level of output. The result is *persistent unemployment*. One of the critiques of Keynesian model, though it is able to explain the persistence of unemployment from the excess supply of labour that arises from nominal wage rigidity, centres on failure to explain why or how the nominal wage remains rigid and the requirement that real wages move counter cyclically.

Further, in response to Keynes' criticisms, the classical school responded with the argument of the real balance effect where the increase in real money balances caused by deflation stimulates autonomous spending, and thus, the IS curve directly. The real balance effect assumes that the direct stimulus to aggregate demand caused by an increase in the real money supply does not require a fall in the interest rate. The force of the real balance effect is countered by the possibility of the destabilising expectations effect (that is, the decline in aggregate demand caused by the postponement of purchases when consumers expect prices to fall in the future) and redistribution effect (which implies the fall in aggregate demand caused by the effect of falling prices in redistributing income from high-spending debtors to low-spending savers) of falling prices.

The debate along the two opposing views has important policy consequences. The classical school largely argues for minimal government policy or regulation. That is, in the absence of external shocks the market functions. The proponents of exogenous causes of business cycles such as Keynesians largely argue for large government policy and regulation. That is, in the absence the regulations, the market will move from crisis to crisis. The critiques of the classical and the Keynesian theories have motivated both schools of taught to shift grounds. The new classical school attempts to revive previous

classical economics in a way consistent with observed business cycles and yet, allowing market clearing, while the new Keynesians develop non-market clearing models, in which exchange occurs without market clearing prices having been established.

iii. New Classical Theory

Some of the recent criticisms of Keynesian idea of business cycles are models of *rational expectations* (REs), which show that demand-oriented policy stimuli, discussed in Keynesian model, are ineffective if the individual knows the government's policy rules (discretionary policy rule) and if the expectations are formed based on those policy rules. The theory of REs could be traced to Lucas (1972a, 1975 and 1977). The theory uses the REs theory to challenge many orthodox economic assumptions, particularly Keynes' idea about the effectiveness of government intervention in the economy. Perhaps the interesting part of REs with respect to cyclical movements is that the policy ineffectiveness results when policy rules are assumed to be cyclical themselves. Suggesting that a government that attempts to manipulate the economy by means of stimulating demand policies will succeed only if it intentionally deviates from the fixed policy rule without announcing this deviation in advance. This implies that demand stimulating policies have to be unanticipated to be successful.

These models add one important element, the assumption of REs (which implies making the best use of available information and avoiding errors that could have been foreseen by knowledge of history). It is based on the idea that people make their best forecasts of the future based on all information currently available rather than having to learn and catch up to the current situation. Thus, REs can be distinguished from *adaptive expectations* (in which expectations for the next period's values are based on an average of actual values during the previous periods). In REs' models, individuals are forward-looking and adjust their expectations to their best forecasts of the future. With REs, errors in expectations occur only randomly and independently.

Further, in the explanation of REs to business cycles, each individual producer is assumed to know the price of its own product, but because of information barriers, they cannot directly observe the price of other products, thus, for any given price change, they

must infer whether it is a local or an aggregate price shock, if their guess is incorrect, the economy will be able to deviate from the natural level of output thus generating business cycles. In sum, REs approach to business cycles implies that if an individual believes that economic variables will be affected by some policies or events, the person's prophecies can be self-fulfilling through appropriate actions. Therefore, introduction of REs will dampens the potential oscillation-initiating influence of exogenous factors such as government policies. Hence, historical phenomena like the Dutch tulip mania in 17th century and the great depression may be explained by these self-fulfilling expectations (Gabisch and Lorenz, 1987).

Real business cycle (RBC) is one of the latest successors of the classical view of business cycle. This could be traced to Prescott (1986). In RBC model, it is assumed that the economy consists of a large number of identical price-taking firms and households that infinitely lived and maximise their expected utility, a function of income and work. The inputs in the production function are capital, labour and technology with the relationship presented in a Cobb-Douglas form. The economic output is divided among consumption, investment and government purchases. Also, it is assumed that technology is subject to random disturbances of which one of its components follows a first order autoregressive process. The assumption about technology is similar to that of government purchases except that the growth rate of per capita government purchases equals the growth rate of technology; otherwise government purchases will be arbitrarily large or small for the economy. Fraction of capital is assumed to depreciate in each period and government purchases are financed from lump-sum taxes which are equal to its purchases in each period, while labour and capital are assumed to be paid the values of their marginal productivities.

The implication of introducing leisure in the utility function and randomness in the technology and government purchases on household behaviour (assuming the representative household lives for two periods) is that a rise in interest rate and in the first period wages raises first-period labour supply relative to second-period. This is because the household reduces first period leisure relative to second period. Intuitively, a rise in interest rate increases the attractiveness of working today and saving relative to working tomorrow. Therefore, the effect of interest rate and relative wage on labour supply is

crucial to employment which is fundamental in business cycles. This effect is known as *intertemporal substitution* of labour supply (Lucas and Rapping, 1969 cited in Romer 2006). The conclusion of real business cycle model is that cyclical behaviour across countries is an optimal response to changes in the available production technology.

In the view of Markiw (1989), real business cycle theory does not provide an empirical plausible explanation of business cycle due to the assumption of technology disturbance (as the primary source of fluctuation) and inter-temporal substitution of leisure to explain changes in employment. Thus, macroeconomic policies are unnecessary. Connoting that in contrast to the Keynesian and the early new classical approaches to the business cycle, real business cycle theory embraces the classical dichotomy and accepts the complete irrelevance of government policies, thereby denying a generally accepted Keynesian tenet. The conclusion of RBC implies that nominal variables, such as the money supply and the price level are assumed to have no role in explaining fluctuations in real variables, such as output and employment.

iv. New Keynesian Theory

Friedman (1968) offers one of the alternatives to the Keynesian assumptions of nominal wage rigidity and nonmarket-clearing to explain the existence of business cycles, it contains some of the essential elements such as market clearing and imperfect information incorporated into the new classical theory. One of the features of Friedman's (1968) model is the specification of the labour supply curve to be dependent on the expected real wage, rather than the actual real wage. Hence, changes in the price level generally and correctly anticipated are matched by wage changes; these cannot cause deviations of unemployment from natural rate of unemployment, only unanticipated inflation can cause such deviations. This implies that the presence of imperfect price information on the part of workers will allow the economy to deviate from the long run natural level of output and generate business cycles. The main critique of Friedman was on the issue of embracing natural rate hypothesis without questioning the existence of an inverse relationship between inflation and unemployment in the short run. This is because expectations are

assumed to be "adaptive" backward-looking and involving only partial and lagging corrections of past errors (Zarnowitz, 1985).

Also, Markiw (1989) notes that much of the early studies in the new classical revolution of the 1970s attempted to nail the classical dichotomy without abandoning the fundamental axiom of continuous market clearing (Lucas, 1972). These models were based on the assumption that individuals have imperfect information regarding prices. These individuals confused movements in the overall price level (which under the classical dichotomy should not matter) with movements in relative prices (which should matter). An unanticipated decrease in the money supply leads individuals to infer that the relative prices of the goods they produce are temporarily low, which induce them to reduce the quantity supplied.

The basic criticism of the Friedman model is that it is often very hard to justify that workers can be “fooled” for any great length of time. This makes Friedman explanation of business cycles unsatisfactory. Friedman model helps to better understand and shed more light not only on the Keynesian model but also on the classical model, the major issues separating them as well as its importance to the development of modern business cycle theories.

Moreover, one of the latest incarnations of Keynesian explanation of business cycles is *political business cycles*. This is based on the potential influence of government activities on economic development and evaluated on the public sector’s performance given government legal commitment to reduce, for instance, unemployment and inflation rate necessary for reelection. Thus, incumbent political parties are believed to behave counter-cyclical to reduce business cycle fluctuations. This is because failure to manage the economy well will reduce its reelection chances. Thus, government behaviour may be viewed as providing the necessary exogenous shocks.

Government intervention goes beyond manipulating a single endogenous variable but rather a menu of connected and conflicting variables, depending on its objective function. Examples of some of these connected and conflicting variables are the trade-off between inflation and unemployment as well as trade-off between unemployment and

trade openness (subject to debate). This expresses the situations in which it becomes impossible to improve one without deteriorating the other in terms of social welfare. If the public is fully aware of the indefinably trade-offs between the variables involved and the public is indifferent between the possible variations, there is no room for political intervention. But suppose the economy is fluctuating due to endogenous forces, the government is aware of the development of the variables in the future and the public place more weight on some goals more than others, it may be appropriate for the government to influence the more preferred variables to be accorded good reputation by the public.

Basically, all political business cycle models establish the existence of a politically induced cycle. Implying that in the case of genuinely connected political and economic sectors, the political cycles may serve as an explanation of the persistence of business cycles. The effect of government behaviour on the business cycles is well-exploited in Nordhaus (1975). The basic objections to political business cycle from economists point view according to Gabisch and Lorenz (1987) is that the political business cycle models do not only assume the same kind of economic manipulation of the existing Keynesian model but also neglects endogenous dynamics in the economy and postulates that interventions have immediate economic consequences. Development in the REs approach strongly denies the ability of government intervention to have any significant impact when such intervention is subject to lagged error corrections on the part of the economic agents. Additional shortcoming, based on Nordhaus (1975) submission, is that political business cycle is more relevant in capitalist democratic economies.

Other Developments Related to Business Cycles

v. Linear Model of the Business Cycles

The *Samuelson business cycles model* combines multiplier concept of Keynesian income theory and the acceleration principle. It is assumed that current consumption is a function of past income and investment is of two components; autonomous and induced. Autonomous investment is assumed to be constant over time, while induced investment is assumed to behave according to the accelerator principle (change in capital stock does not only depend on current values of variables such as interest rates, capital prices and

demand but also on past changes in these variables). This may be explained by adaptive expectation of the economic agents. The essence of accelerator is that investors need to know the current period consumption demand in advance, implying that the consumption demand is effective before investment decision were made. In this model, the magnitude of marginal propensity to consume (MPC) and the accelerator determine the values of roots of the homogenous difference equation which could be real or complex. Depending on dominant root, the system will either be explosive (if the dominant root is greater than unity) or decreased (if the dominant root is less than unity).

In addition to the basic Samuelsson model is *Hick's Linear Accelerator*, a slight modification of the basic Samuelson model by assuming investment does not only depend on change in consumption but also by change in total demand. To explain the fluctuations in real output (or income), Hicks made effective use of the principles of the "multiplier" and the "accelerator". The "multiplier mechanism" shapes the movements of consumption in his model, while the 'accelerator' shapes the movements of investment except for a certain autonomous part. The major difference between the basic Samuelsson and Hicks model is that the margin between decreasing and increasing oscillations depends only on the accelerator in the latter and on the locus of the margin between MPC and accelerator in the former. This implies that basic Samuelsson model focuses on investment and consumption as the cause of business cycles, while Hicks attributes investment as the main cause of business cycles.

However, Metzler (1941) added inventory to the analysis of Samuelsson and Hicks by assuming that inventory serves as a safety buffer, because the firms cannot be sure that the sales expectations are correct. The conclusion is that inventories play an important role when an economy is fluctuating and changing inventory stocks may be considered as an indicator of economy activities. This is suggesting that fluctuations in inventories constitute the essential dynamic ingredient in the business cycle model.

vi. Nonlinear Multiplier-Accelerator Model of Business Cycles

The set of models in this category are characterised by separate linearly structured elements but the overall systems are nonlinear. A business cycles model is nonlinear in the

sense that the induced investment function is not valid over the full range of the cycle. A model in this category is; *ceiling and floor in the Hicks model*. Hicks (1950 cited in Gabisch and Lorenz, 1987) extended the linear model given further assumptions. The summary of Hicks assumptions that can induce cycles are: consumption is a lagged function of income, induced investment is a lagged function of the change in income and these functions are such that an upward displacement from the equilibrium path will tend to cause a movement away from equilibrium. Additional assumptions are that the system has an upward trend of output, geared to autonomous investment; output is not indefinitely extensible against an increase in effective demand. Therefore, falls in output cannot induce disinvestment in the same way as rises in output induce investment.

Further, the working of this model over a complete cycle requires autonomous investment and equilibrium output to exponentially grow at the exogenously given interest rate. There is an income above equilibrium income level (the maximum growth path called the ceiling), not attainable due to resources limitations. Also, there is another income below the equilibrium income level (minimum growth path called the floor). If the actual trajectory starts from equilibrium income level; as investment is rising, the income level will be rising too. Through the acceleration principle, the rise is explosively amplified by induced investment. The actual income therefore rises with a higher growth rate than autonomous investment. This will continue until the economy is limited by resource capacity since induced investment depends on the change in income, investment gradually falls to its equilibrium growth rate. Therefore, income gradually falls and excess capacity results. This is because growth in investment will not support output level above the equilibrium, but the equilibrium level. As the equilibrium growth path requires positive induced investment, now falling, the income path will be below (lower floor) the equilibrium growth path, which is characterised by zero induced investment. Moving along the lower floor for a while gives an inventive for positive induced investment, because the economy is characterised by positive growth rate of income, this begins a new cycle.

The major weaknesses of this model are that of the assumptions of no depreciation and an exogenously given growth rate of resources capacity, which grows at an equal rate

as autonomous investment, an impetus that keeps a series of cycles alive. First, depreciation implies negative change in capital stock and changes in capital stock inturn influences investment, a necessary parameter in business cycle. Second, according to Gabisch and Lorenz (1987) the disadvantage of Hicks model, given its assumption, is that it will only explain one and half cycles. This is because at the floor, there is no incentive for the system to swing up again if autonomous investment is assumed to be fixed at a constant level. Thus, a continuous series of exogenous shocks will be necessary to let the system oscillate permanently. Also, the introduction of upper and lower bounds to the motion of income in Hicks multiplier accelerator model is an ad hoc procedure because upper bound is exogenous to the model, given that its exact numerical value can hardly be determined (Gabisch and Lorenz, 1987).

Another example of nonlinear accelerator model of the business cycle is the *influence of Ratchet effects.* In the literature, several attempts have been made to modify Keynesian consumption function. One of those modifications is Duesenberry (1949) and Modigliani and Brumberg (1945) who introduced the popular ratchets effects, implying that consumption do not only depend on current income but also on the past income. One of the most prominent theoretical applications of this hypothesis can be found in a business cycle of Smithies (1957 cited in Gabisch and Lorenz, 1987) who introduced ratchet effect in the investment function, in addition to the assumption of Duesenberry (1949) and Modigliani and Brumberg (1945), in order to explain fluctuations and growth trend. Although the idea of Smithies seems attractive, some of the assumptions, such as assumption of different oscillation properties in two stages of the model, are problematic. This is because the motion of the income in such a two stage model is characterised by fluctuation around growth trend with increasing or decreasing amplitude, depending on whether construction allows for explosive or damped oscillations with unchanged parameters or not. Although the presence of ratchet effects can imply interesting consequences for other exogenously growth business cycle models, Smithies assumptions on ratchet effects in the investment function is not only unconvincing but also unable to endogenously explain growth cycles and hence, cannot be regarded as a standard business cycle model (Gabisch and Lorenz, 1987).

vii. Business Cycle Models with Stochastic Exogenous Effects

The justification for the introduction of the stochastic element in the business cycle theory is that some variables are purely random (with uncertain outcome), while some have deterministic causes which may be explained by other variables. Therefore, introduction of stochastic exogenous influences enriches the business cycle theory by taking into account irregularities observed in actual business cycles. These models are considered to be a knife-edge walk between overemphasis and insignificance. This is because superimposition of stochastic exogenous influences that do not change the outcome of the initial known results can be considered as superfluous and unnecessary.

The ideas of introducing stochastic exogenous influences to business cycles date back to Kalecki (1935, 1937) and Krelle (1959 cited in Gabisch and Lorenz, 1987). In these models, regular cyclical behaviour of a second order linear difference equation is augmented by stochastic terms with the assumption that the parameters of the model have values such that the oscillations of the system decreased (after an initial shock the amplitudes of the oscillation steadily decrease). The property of the stochastic term is that of normal distribution. Introducing the stochastic random term has some consequences for the dynamic behaviour of the model, one of which is that of an average increase of the amplitudes over time. That is, amplitude of the cycles will increase, dependent on the trend in stochastic series.

Krelle (1959) considered the consequences of stochastic influences in a growing economy where he equated business cycle to fluctuations in the economic growth rate. The model is constructed such that the overall development of growth rate depends on the endogenous dynamics of growth rate itself as well as on the stochastic influences. The model assumes the economy to initially be on equilibrium growth path with growth in all periods greater than zero. If no stochastic influence is involved there would be no tendency to move the economy away from that growth path. Meanwhile, the distribution of stochastic error term which could be negative or positive implies that the growth rate could decrease or increase. If the stochastic term takes negative value, the economy faces growth decrease in the next period. If it were positive, the increase in the next period growth is amplified. Once the growth path has started to increase, a negative next period

stochastic term which is absolutely larger than the original positive value is required to reverse the growth path. This model is very relevant especially in the context of rational expectation formation processes. The REs approach to business cycle made it evident that stochastic term cannot be superimposed on the existing structural relations and system, but they can constitute an essential ingredient in the determinants of individual behavour.

viii. Kaldor's Nonlinear Investment and Savings Models

This model is one of the earlier attempts to study effects of nonlinearity in a dynamic economy. Kaldor (1940) investigated the interaction between savings and investment functions (both are functions of income) and the fundamental structural requirements for the existence of self-sustaining cycles. In this model, the assumption of the long-term shifting of the investment and savings made it possible for it to display cyclical behaviour. Connoting a change in investment due to change in real income, exhibiting an S-shape form where there is a normal level of investment propensity somewhere in the mid-range of real income. The decreasing slope of the function for decreasing levels of income can be explained by missing profit opportunities in times of low economic activities relative to the normal midrange level. When income is relatively high, decreasing economies of scale as well as rising financial costs will also lead to small propensity to invest out of real income.

On the other hand, the savings function is like the mirror image of the S-shaped investment function except that it starts below origin given the fact that savings is negative when real income is zero. The explanation for this is that there is a normal level of propensity to save at high income relative to normal level; the marginal savings will rise too. If income falls below the normal level, a point will be reached where absolute savings will fall. This explanation is not well-convincing like the S-shape of the investment function, but what is interesting is that the nonlinear shapes are a requirement for oscillatory motion. Therefore, the essential dynamic feature that enables the model to display cyclical behaviour is introduced by the interaction between savings and investment. If ex-ante investment exceeds ex-ante savings, either ex-post investment will fall short of ex-ante investment or ex-post savings will exceed ex-ante savings; and both these discrepancies will induce an expansion in the level of activity. On the other hand, if

ex-ante investment falls short of ex-ante savings either ex-post investment will exceed ex-ante investment or ex-post savings will fall short of ex-ante saving, and both these discrepancies will induce a contraction. This must be so, because a reduction in ex-post saving as compared with ex-ante saving will make consumers spend less on consumers' goods, an excess of ex-post investment over ex-ante.

Kaldor (1940) defines investment ex-ante as the value of the designed increments of stocks of all kinds (the value of the net addition to stocks plus the value of the aggregate output of fixed equipment) which differ from investment ex-post by the value of the undesigned accretion (or decumulation) of stocks. Also, he defines savings ex-ante as the amount people intend to save. That is, the amount they actually would save if they correctly forecast their incomes. Ex-ante and ex-post savings can differ only when there is an unexpected change in the amount of income earned.

3.1.2. Imported Business Cycles

Business cycle theories reviewed in the preceding section, have been preoccupied with explanation of economic fluctuations from domestic factors, neglecting the explanation of the same in a trade dependent economy. Business cycles in a trading economy are not limited to only domestic forces but also to the numerous influences it receives from other countries, suggesting that business cycles may often be independent of external influences which may sometimes weaken or strengthen each other to determine the common effects. Therefore, the tendency for business cycles to be transmitted across trading countries becomes visible (Zarnowitz, 1985).

i. Trade Interdependence and Cross-country Business Cycles

In terms of sequencing, Kenen (1969 cited in Rana, Cheng and Chia, 2012) was one of the first arguments that a well-diversified economy having a large share of intra-industry trade will experience less asymmetric shocks, connoting that output shocks in such trading countries will tend to synchronise if trade is intra-industry. This amounts to stating that similarities in production structure should affect synchronisation positively, since two

economies producing the same types of goods will be subjected to similar shocks. Kalemli-Ozcan *et al* (2001) and Imbs (2004 and 2006) find that countries with similar production structure exhibit closer output correlation.

Krugman (1993) on the contrary, argues that the potential for asymmetric shocks increases with greater integration among countries engaging in intra-industry trade since it increases their specialisation. This implies that even if trade is intra-industry, there is a level of specialisation in differentiated goods across trading countries, creating potential asymmetry in business cycles. Krugman (1993) further argues that if trade is inter-industry, specialisation across countries and industry-specific shocks are important in driving business cycles. Therefore, imported business cycle may not be important in an economy engaging in inter-industry trade because the industrial structures are not the same. That is, a pair of countries that trade more may specialise more to reap the gains from trade; this will lead to more differences in each country's industrial structure, and in the situation of industrial specific shocks this can lead to more idiosyncratic business cycles.

It is important to note that there is potential for business cycle to co-move even when trade is inter-industry. This is a situation in which there is inter-dependent across sectors and trading countries. For instance, output of domestic manufacturing industry (eg., inorganic fertilisers and pesticides) may serve as major input in foreign agricultural sector. Therefore, a damped oscillation in manufacturing sector (reduces fertiliser and pesticides exports) in domestic economy is transmitted abroad due to inadequate imported fertiliser input, resulting in low foreign agricultural output. On the other hand, foreign economy's agricultural output may serve as major input in the domestic manufacturing sector. For instance, output of cotton may be an essential input in the manufacturing of textiles. Therefore, shocks to foreign agricultural sector are transmitted to domestic economy due to inadequate imported cotton input, resulting in low domestic textile output. These opposing views on what would be the effect of close integration on regional specialisation and business cycle synchronisation made Böwer and Guillemineau (2006) and Calderón, Chong and Stein (2007) conclude that the relationship between trade integration and business cycle synchronisation is fundamentally an empirical one.

Theoretical advances support the existence of different channels through which trade integration and business cycle co-movement interacts. First, positive surges in income in one country might lead to higher demand for foreign and domestic goods and the effect may be stronge if trade integration leads to more coordinated policy shocks (Frankel and Rose, 1998). Second, high trade integration might lead to a more rapid spread of productivity shocks through a more rapid diffusion of knowledge and technology. These links require a considerable level of trade integration (inter-industry and intra-industry trade inclusive) before the discussion of transmission of business cycles via trade could be appealing.

In sum, imported business cycles relating to trade explain that positive technology shock in the home country, leads to an increase in domestic productivity, as well as an increased oscillation of home business cycles. This effect could be transmitted to foreign countries in two ways; first, if home country depends on the foreign country for intermediate goods required to combine with new technology surge, there is an increase in demand for foreign goods as inputs. Second, this could work through supply channel in the case where foreign country depends on home for intermediate goods. Implying that with home country having increased production capacity following positive technology shocks implies that the range of goods it can export even at cheaper prices will increase. This leads to increase in foreign business cycles by importing intermediate goods from home country, other things being equal. Moreover, similar polarisation partitioned trade flows into intra-industry and inter-industry trade flows concluding that intra-industry trade flows, is the only feasible channel through which cross-country business cycles co-move, while there is potential asymmetric business cycles across trading partners engaging in inter-industry trade.

ii. Financial Interdependence and Cross-country Business Cycles

The cross-country business cycles among countries do not only come from international trade but also from international financial openness. In the recent decades, there has been increase in financial globalisation with the establishment of global supply chains and emergence of global financial institutions. Evidently, global financial crises of 2007 to

2009 reveal that countries business cycles are connected through the synchronised global downturn, the marginal impact of this on many developing countries cannot be ignored.

Further, Kalemli-Ozcan, Sorensen and Yosha (2001) note that with higher integration in international financial and goods markets, countries should be able to insure against asymmetric shocks by diversifying ownership and can afford to have a specialised production structure. Financially integrated economies tend to specialise in different sectors, to reap the gains from diversification and insure against investment risks. In this case, high level of financial integration will lead to unsynchronised business cycles. Financial integration between two economies could also increase the similarity of their production structures, as foreign investment could be concentrated on similar activities (Dees and Zorell, 2011). For instance, Foreign Direct Investment (FDI) flows could also be concentrated on sectors where the home country has a comparative advantage, thus replicating in the host country a similar productive structure (Garcia-Herrero and Ruiz, 2008 cited in Dees and Zorell, 2011). However, this became particularly important when asset markets are highly integrated across countries.

In the literature, three measures are often used to measure financial interdependent across countries; the level of integration in FDI, Foreign Portfolio Investment (FPI) and bilateral financial (banking) integration. Meanwhile, African economies are characterised mostly with uncertainty that arises from economic variables such as exchange rates risk as well as uncertainty from political and institutional environment (such as government inefficiency, policy reversals, and graft or weak enforcement of law), civil unrest, conflicts and wars, acknowledged by Reinhart and Rogoff (2003) and Asiedu (2002). The uncertainties, unpredictability and volatility of these economies increase the perceived risk by the multinational companies engaging in FDI and individual foreigners who which to buy stocks and bonds, thus leading to less FDI and FPI inflows into these economies.

iii. Policy Similarities and Cross-country Business Cycles

Close coordination of macroeconomic policies especially fiscal and a limitation of budget deficits may sustain an emergence of more symmetric business cycles (Aarle et al, 2008). High discrepancy in policy coordination should be linked to unsynchronised business

cycles. This standpoint is in line with Keynesian revolution and new classical business cycle theory within which political business cycle models are central. The impact of government manipulating some key macroeconomic variables germane to business cycles persistence cannot be overemphasised (Nordhaus, 1975). Fiscal and monetary policies coordination may have positive effects on cross-country business cycle: first, fiscal and monetary policies are potential sources of shock in an economy, their coordination should increase synchronisation. Second, coordination of fiscal and monetary policies may increase business cycle correlation between countries when the distribution of shocks is symmetric.

Conversely, information about the degree of business cycle synchronisation is also important because it provides information on the necessity of fiscal and monetary policies coordination. On one hand, if the business cycles are similar and shocks are common coordination of fiscal and monetary policies can be beneficial. On the other hand, if shocks are predominately country-specific the ability to conduct independent monetary and fiscal policies is generally seen as important in helping an economy adjust to a new equilibrium rather than policy coordination. This channel is not be relevant between members of ECOWAS and their trading partners because policy coordination is not feasible.

3.1.3. Cross-country Business Cycles and Trade Flows

The standard Heckscher-Ohlin trade model predicts that countries export and specialise in commodities that use abundant resources intensively. In order words, technology differences determine trade patterns. Trade in the context of H-O model does not generate similar pattern of specialisation in production and traded goods are non-intermediate goods. This implies that trading countries may be characterised with unsynchronised business cycles because different industries are assumed to respond to shocks technology differently across countries.

New trade theories among which is theory of trade in intermediate inputs directly modelled the presence of trade in intermediate inputs, caused by firms splitting their production process across several countries. This is sometimes called “production sharing”

by the companies involved or simply “outsourcing” (Feenstra, 2004). Some of the activities done within an industry in a country can be imported from abroad, hence, trade in intermediate inputs can impact on production with the assumption that the final output bundles together the domestically and foreign sourced intermediate inputs. There is an extension of the theory of trade in intermediate inputs. This extension is referred to as model of international trade with stochastic technology shocks. This model assumes that a positive foreign productivity shocks imply sourcing for intermediate inputs from more efficient and cheaper foreign suppliers that has also experienced similar positive technology shocks. Hence, there is a business cycles spillover through demand and supply of traded intermediate goods.

According to Juvenal and Monteiro (2010), it is assumed that the technology level in each country can be represented as the product of a deterministic component and a stochastic component. While the deterministic component governs the average technological or productivity advantage of one country over the other, the stochastic component in each country follows a serially correlated discrete Markov process, independent across countries. Hence, countries have differential access to technology making efficiency to vary across commodities and countries. In this case, a positive foreign technology shock implies that foreign intermediate goods cost less and foreign output has also risen, raising the import penetration ratio. The imported intermediate inputs could then be combined with home country mobile factors leading to increase in efficiency and labour productivity and consequently to increase in home country business cycles.

In summary, the previous review of imported business indicated that there are three main channels through which business cycles can be transmitted abroad; first, through trade interdependence partitioned into inter-industry and intra-industry trade flows; second, through financial interdependence; and finally through policy coordination. While the first two channels are potential sources of cross-country business cycles between members of ECOWAS and trading partners, the third channel is not feasible since policy coordination is not envisaged between members of ECOWAS and trading partners.

3.2. Review of Methodological Issues

3.2.1. Measurement of Business Cycles

Given that economic fluctuations are not evenly distributed across economic activities, the problem of measuring aggregate state of the economy with respect to business cycles may not be straightforward. Hence, presented next are some of the measurements of business cycles.

i. Economic indicators

This indicator has to do with constructing different time series of data such that the overall movement of economic activities can be made transparent by the series. Some of in the category of economic indicators are:

1. **Harvard Barometer**: This according to Gabisch and Lorenz (1987) was developed by Persons; originally it consisted of five groups of time series, later reduced to three groups (A, B and C) with focus on 13 time series. This was necessary to exclude series fluctuating erratically than others. The approach is that time series belonging to the same group were characterised by roughly similar and simultaneous cycles. In the approach of Persons as reported by Gabisch and Lorenz (1987), group A was made up of four series, capturing speculation index, group B consisted of five series, capturing physical productivity and commodity prices; and group C was an index of financial situation in the New York City. These indicators were constructed to measure past, present and hope to serve as an instrument of predicting business cycles. Overtime, it became unreliable and abandoned after failing to predict the great depression.

2. **NBER Indicator:** In line with Harvard indicators, National Bureau of Economic Research (NBER) in 1938 constructed another indicator based on ordering 71 time series as statistical indexes of cyclical revival according to the average lead or lag with regard to the reference revival. The leading series, on the average, were from one to ten months ahead of the reference revival, while the lagging series were from one to twelve months behind. From these series were chosen economic indicators which passed tests of conformity and timing: conformity meaning the

consistency, with which a time series turning point has led, lagged or roughly coincide with the reference data. Using this classification, only 21 series were accepted as economic indicators of business cycle and among the leading variables are the number and value of shares sold in New York stock exchange as well as average hours worked per week in manufacturing. The coinciding variable is physical value of business activities and laggers are total factory pay rolls and ninety-day time money rate. This indicator can serve as past and present economic activities but using them for forecasting will yield the same outcome as in the case of Harvard Barometer (Gabisch and Lorenz, 1987).

3. **Diffusion Index:** This was an improved version of former NBER index. It has to do with; that at any point in time, some series out of a specified set may move upward while the rest move downward. If the relative number of upward moving time series is greater (less) than half, the economy is expanding (contracting). This is closely related to leading, coinciding and lagging approach. The index was termed diffusion index for the proportion of expanding series by Moore (1961) who used the approaches for a set of 700 time series (which served as index of general economic activities). The steps involved in diffusion index are: collecting and plotting a number of time series which reflect general economic activities, for each time series the upper and lower turning points must be determined and asterisked, the turning points are then connected by a straight line given an ordinal picture of how a business cycle wonders through the individual series; diffusion index can then be calculated by counting the number of upward sloping lines at each point in time and expressing these numbers as a proportion of total number of series.

   Further, an alternative way of calculating diffusion index according Getz and Ulmer (1990) is to find changes in the series of interest to see if a component increased, decreased, or had no change. Each component is assigned a value 0, 50 and 100%, depending on whether it decreased, no change, or increased over a given time span. The next thing is to sum the values of the components and divide by the number of components. This average (mean) is the diffusion index. In this

case, assigning a value of 50% to the unchanging series effectively counts one-half of them as rising and one-half of them as falling (Getz and Ulmer, 1990). There is a fundamental problem in the manner values are assigned. For instance, assigning the same value to a variable that increases (decreases) at an increasing rate and the one increasing (decreasing) at a decreasing rate with the one that increases (decreases) generates missing oscillations in a particular series. Another problem associated with this approach is that a variable having a positive change all through the time span will have the same assigned values. In this case, there will be no oscillations at all. A variable may be oscillating within positive changes, therefore, the approach used in this study is that each component is assigned a value 0, 25, 50, 75 and 100% depending on whether a component is falling at an increasing rate (negative and decreasing), falling at a decreasing rate (negative and increasing), no change, rising at a decreasing rate (positive and decreasing) or rising at an increasing rate (positive and increasing) over a given time span[17].

Diffusion index takes the value of 100% when all the series are upward moving (economy is expanding) and 0%, when they are moving down (economy is contracting). Diffusion index ranges from 0% to 100%. If the diffusion index is between 100% and 50% (0% and 50%) the economy is on its way to expansion (contraction). Undoubtedly, diffusion index is useful in analysing historical business cycle capturing time variability, notably; using it to construct current economic state of affairs may be difficult. This is because the turning points of each time series are precisely known. The identification of current turning points involves the forecasting of the coming events. Given that a peak or trough comes to existence following a decline or rise and the diffusion index leads the turning points, it seems logical to use this index to forecast the tuning points. Hence, construction and identification of current turning point implies forecasting.

[17]. It is important to note that values are assigned to business cycle components such as inflation rates and changes in inventories in an inverted manner. This is because such variables rise in contractions and fall in expansions. Also, computation of diffusion index starts from the year beyond 1976 to correct for any starting values bias.

Of concern is whether diffusion index and rate of change in the respective variables give similar information. Obviously, the diffusion index attaches equal importance to all individual series and neglects changes in individual series. One logical thing is that a rising diffusion index implies that rate of change is rising. Therefore, when a group of series is rising the average should rise also. However, this may not be the case, if the increasing number of rising series rises by decreasing amount, whereas the decreasing series decreases by increasing rate. In this case, the two indexes may diverge but the choice between diffusion index and the first difference of the aggregate is almost purely one of convenience (Gabisch and Lorenz, 1987). This study relies on first difference approach to deal with possibility of non-stationarity in the series used in diffusion index computation.

ii. Capacity Utilisation

This measure is based on the idea that if capacity is underutilised, a growing or decreasing Gross National Product (GNP) must be accompanied by growing or decreasing employment. A rise in GNP will be associated with a rise in employment because some resources are previously unemployed. Therefore, capacity utilization, the ratio of actual output to potential may serve as a measure for the business cycle. The concept of potential GNP is theoretical; with different approaches of evaluating it (such as approach based on single factor of production, production functions with labour and capital and Wharton School Index and Survey) give different results.

iii. Nonparametric and Parametric Approaches

The most common approach for computing business cycles is to use a particular series such as GDP, decompose the trend and the cycle components from the observed trend. Meanwhile, using a single series such as GDP as a measure of business cycles is a narrow way of computation (Moore and Zarnowitz, 1984; Zarnowitz, 1985; and Gabisch and Lorenz, 1987). Some of these approaches are parametric in nature, while others are non-parametric. These are well-explored in Aarle et al (2008). The nonparametric procedure provides an alternative in the presence of outliers posed by the nature of the data.

1. **Non-parametric Methods**

Baxter-King filter: This is also referred to as "band-pass filters" a commonly used approach among the nonparametric methods. This approach eliminates the trend and irregular components of a series while preserving business cycle components. It also requires a specification of a finite-order moving average for extracting the high-frequency component. Besides, this procedure is based on variations of two-sided moving averages to the series and requires a specification of a typical cycle length. Also, in the class of non-parametric approach is *Christiano-Fitzgerald* filter. This is similar to *Baxter-King* filter, except that the weights given to the lead and lag components of the time series differ.

Hodrick-Prescott Filter: This method uses a smoothing parameter λ, used to input the assumptions about the typical duration of the reference cycle. Thus, if λ is close to zero, the smoothed component is equal to the original time series. Very large values of λ will produce a smoothed component that corresponds with a linear time trend and all actual output movements around this time trend are assigned to the cyclical component. This method corresponds to the assumption of the standard real business cycle theory which presumes all output movements to be equal to fluctuations in the potential value. In practice, λ values of 1600 for quarterly data and 100 for annual data have been established, this represents the degree of smoothness for the trend.

2. **Parametric Methods**

Moving Average (MA): This approach is used for estimating a smooth trend component of the series of interest. The estimate of the cycle is the difference between the observations and the MA. Some of the advantages of this method is that it is simple to compute and highly transparent.

First Order Difference (D1): This requires year-on-year difference of a time series. This is very easy to calculate and does not rely on a sophisticated statistical framework to decompose trend and cycle. This is one of the methods of dealing with nonstationarity in a series which rely on the basic assumption that the secular component of the series is a random walk without drift and the wandering in a series is due to the addition of stochastic

error components at each time t, making the series to trend in an unpredictable manner. If a series is subject to a sequence of positive shocks, the stochastic error components take a positive value; it takes a negative value when subjected to a series of negative shocks. In this case, the condition for stationarity does not hold because variance increases over time, meaning that the series may not return to its mean and so sample means taken for different periods are not the same. Trend in the level of a series questions the suitability of a random walk model with no drift because such trend may be characterised with stochastic and deterministic components.

Linear Regression Model : This approach, unlike first order difference (D1), assumes that output fluctuates around a deterministic and a stochastic trend, that deviation from the trend are stationary and may be interpreted as a business cycle. It assumes that the value of a series is made up of negligible initial value, the stochastic trend component and deterministic trend component. It is deterministic trend because a fixed intercept value is added for each time "t" and hence a series is assumed to warder up (when the drift component is positive) and down (when the component drift is negative) as well as increase by the fixed amount at each time "t". Thus, constant mean and constant variance conditions of stationarity are violated. Note that de-trending an integrated economic time series neglects the changes in the growth component of the series, this leads to an overestimation of the variance and persistence of the cyclical component. Since the series used in the construction of diffusion index in this study are not trend-stationary but difference-stationary, the study relies on first difference approach.

Unobserved Components Model (UC): The assumption of this approach is that output can be decomposed into three; a trend, a cycle and an irregular component. In this model, the trend component is a second order random walk, while the cycle is specified as trigonometric function. The cycle is calculated as the difference between the estimated trend and the actual output series. Model parameters are estimated via the Kalman filter recursion and numerical optimisation of the likelihood function. The unobservable trend component is obtained with the aid of the fixed interval Kalman smoother (Aarle *et al*, 2008).

***Production Function Approach (PFA)*:** This approach belongs to the class of multivariate methods for estimating the trend component of output and the gap. The concept of potential output is central to this method. One of the assumptions of this approach is that there is an actual aggregate production function, which combines various input factors at any current level of available technology, and a potential output conceived of as the output of an economy subject to a given quantity of non-variable input factors and sustainable quantities of variable input factors. Therefore, the PFA combines data, typically of Cobb-Douglas type, on the potential labour input, the trend of total factor productivity and the capital stock with production technology. This approach offers a broad view on the cyclical movements of aggregate output in the sense that it combines information from a broad set of key macroeconomic variables and suited for decomposing real output. The problem with this approach, as previously mentioned, is the issue of calculating potential output. This is because different approaches of evaluating potential output often give different results.

3.2.2. Methods of Computing Business Cycle Correlation.

Given the fact that business cycles' correlation is not directly observable and measurable, several methods to describe them have been developed in the literature. For instance, Frankel and Rose (1998) specified the cross-country covariance of output as;

$$Cov(\Delta y_t, \Delta y_t^*) = Cov(\sum_i \alpha_i U_{i,t}, \sum_i \alpha_i^* U_{i,t}) + Cov(V_t V_t^*) \quad (3.1)$$

$$Cov(\Delta y_t, \Delta y_t^*) = \sum_i \alpha_i \alpha_i^* \delta_i^2 + \delta v, v^* \quad (3.2)$$

Where δ_i^2 is sectoral variance and $\delta v, v^*$ is the covariance between the country-specific aggregate shocks. Frankel and Rose (1998) worked with the covariance adjusted for the country-specific volatility of aggregate income. The degree to which business cycles are correlated depends on how this covariance changes with increased integrations. Related to Frankel and Rose approach, Calderón, Chong and Stein (2007) computed the correlation between the cyclical components of output for countries i and j as

$$Corr(y_i^c, y_j^c) = \frac{Cov(y_i^c, y_j^c)}{\sqrt{Var(y_i^c) Var(y_j^c)}} \quad (3.3)$$

Where y^c is the cyclical component of output obtained using different de-trending techniques. In this case, high correlation implies high level of business cycle synchronisation, while negative correlation value is an indication of unsynchronised business cycle. This approach is common among significant number of empirical works investigating the relationship between trade flows and business cycles synchronisation.

Bayoumi and Eichengreen (1997) developed an alternative measure of business cycle coherence by computing an indicator of business cycle asymmetries for countries i and j as

$$asymm(y_i y_j) = SD(Iny_i - Iny_j) \quad (3.4)$$

The right hand side of equation (3.4) is the standard deviation of the difference in the logarithm of real output between i and j computed over τ periods. The lower the value of asymm(yi, yj), the higher the degree of business cycle synchronisation and vice versa.

Further, few studies propose a correlation index that allows measuring the cross-country synchronisation period per period, rather than using time windows as done in most studies and methodologies previously reviewed. For instance, Nikolaos (2012) employed the Dynamic Conditional (time varying) Correlation (DCC) model of Engle (2002). The estimation of the DCC model involves two steps: first, each conditional (time varying) variance is specified as a univariate Generalised Autoregressive Conditional Heteroskedasticity (GARCH) process and second, the standardised residuals from the first step are used to construct the conditional correlation matrix. Lee (2010) applied DCC model developed by Engle (2002) to resolve the problems associated with convectional correlation measure. It is important to note that the DCC model is a family of GARCH model which does not only require larger sample size but also requires that the variances of the series are time varying. If the series are characterised with constant variances the appropriateness of Engel's DCC will be undermined.

Recently, Cerqueira and Martins (2009) proposed another year-by-year index that—when averaged over the entire sample—would produce the linear correlation index. This index has advantage of capturing dynamics in cross-country business cycles over the correlation index computed over the entire period (Cerqueira, 2010). Therefore, Cerqueira and Martins (2009) proposed:

$$R(y_i, y_j)_{,t} = 1 - \frac{1}{2}\left(\frac{y_{j,t} - \bar{y}_j}{\sqrt{\frac{1}{T}\sum_{t=1}^{T} (y_{j,t} - \bar{y}_j)^2}} - \frac{y_{i,t} - \bar{y}_i}{\sqrt{\frac{1}{T}\sum_{t=1}^{T} (y_{i,t} - \bar{y}_i)^2}} \right)^2$$

(3.5)

$R(y_i, y_j)_{,t}$ is year-by year correlation between any pair of countries and T is the total number of observations. $R(y_i, y_j)_{,t}$ is not bounded between -1 and 1, but between 3-2T and 1[18] (Cerqueira, 2010). In order to have an index bounded between -1 and 1, a sort of Fisher transformation is applied to $R(y_i, y_j)_{,t}$. This index is given by:

$$R^*(y_i, y_j)_{,t} = 1 - \frac{1}{2} In\left(\frac{1 + \frac{R(y_i, y_j)_{,t}}{2T - 3}}{1 - R(y_i, y_j)_{,t}} \right) \quad (3.6)$$

Then for a bounded version between -1 and 1:

$$R^{**}(y_i, y_j)_{,t} = \tanh(R^*(y_i, y_j)_{,t}) \quad (3.7)$$

Equation (3.7) implies that the bounded year-by-year index is the hyperbolic tangent of original unbounded year-by-year correlation index.

3.2.3 Review of Methods of Assessing Relationship between Trade Flows and Cross-country Business Cycles

A number of studies have investigated the relationship between trade flows and cross-country business cycles. These studies include Frankel and Rose (1998); Canova and Dellas (1993); Calderón, Chong and Stein (2007); Rana (2007); Lee (2010) and Rana, Cheng and Chia (2012). Besides, these studies followed a number of different approaches. For instance, Canova and Dellas (1993) tested some of the implications of stochastic general equilibrium model of the world economy, developed to analyse the contribution of trade interdependence to international business cycles, using data from ten major industrial countries and a variety of de-trending techniques to calculate the cyclical

[18] For detail, see Cerqueira and Martins (2009) and Cerqueira (2010).

component of output. Such de-trending techniques include a log random walk with no drift uncorrelated with the cyclical component (random walk de-trending), a deterministic linear process uncorrelated with the cyclical component (linear de-trending), a smooth stochastic process uncorrelated with the cyclical component [Hodrick-Prescott (HP) de-trending], and a log random walk perfectly correlated with the cyclical component [Beveridge-Nelson (BN) de-trending).

Frankel and Rose (1998) employed ordinary least squares (OLS) and instrumental variables (IVs) within the framework of panel data to capture the effect of trade intensity on the correlation of economic activity among the European countries. The essence of estimating IVs is to capture the possibility of endogeniety of trade flows. In addition, to carry out some robustness checks, the study performed sensitivity analysis, augmented with a dummy variable, taking the value of unity if the two countries shared a bilateral fixed exchange rate throughout the sample. This is based on the idea that the high correlation among European incomes may not be as a result of trade links, but of Europeans' decision to relinquish monetary independence vis-a-vis their neighbours. In addition, sensitivity analysis was also carried out to address the impact of global oil price shocks, often thought to be a major source of positively correlated business cycles, regardless of the exchange rate regime. Therefore, they took the real price of oil (the price of oil in dollars per barrel, divided by the CPI for industrial countries), and multiply it by net exports of fuel, expressed as a percentage of nominal GDP. This variable, to measure the degree of dependency on imported oil, is added to their other control variables, including linear and quadratic time trends, as well as quarterly dummies. Prasad (1999) used structural vector autoregressive models within the framework of stochastic version of Mundell–Fleming model to assess the dynamic relationship between trade flows and business cycles co-movement.

Similarly, Calderón, et al (2002) is within the framework of gravity model, estimated using OLS and IV (to account for endogeneity of bilateral trade). In order to estimate the IV, the study instrumented bilateral trade intensity with variables such as distance between two countries, remoteness of countries, output and population, while dummy variables for common border, common geographical region, common language,

colony, common main trading partner and dummy for regional free trade agreement also featured in their estimated gravity equations.

Likewise, Rana (2007) investigated the relationship between trade intensity and business cycle synchronisation in East Asia using OLS and the IVs approach in line with Frankel and Rose (1998). Rana, Cheng and Chia (2012) investigated the relationship between trade intensity and business cycle synchronisation comparing East Asia and Europe. The models were estimated within panel framework using panel data with emphasis on fixed effects and random effects. Notably, the chi-square value of the Hausman test cannot reject the random effects model in favour of the fixed effects model. Also, the measure of trade intensity follows that of Frankel and Rose 1998 approach.

Lee (2010) investigated the relationship between trade integration and business cycle co-movement across the United States. For comparison purposes, the study first applies OLS to regressions that include each of the four alternative trade measures as the sole explanatory variable. This dwells on aggregate trade intensity, intra-industry trade, intra-industry trade intensity and inter-industry trade intensity between any state pair. To attenuate the endogeniety problem between trade flows and business cycles co-movement, the study used IVs in a regression estimated with the generalised method of moments becomes necessary. The set of instruments used include the log geographical distance between two states, a dummy variable representing geographic adjacency, and the total output levels of the two states.

3.3. Review of Empirical Issues

Most studies that have investigated the relationship between trade flows and cross-country business cycle found that countries or regions with stronger trade linkages have more correlated business cycles. For instance, Canova and Dellas (1993) examined the relationship between trade interdependent and international business cycle among the following 10 industrial countries; Austria, Canada, France, Germany, Italy, Japan, South Africa, Sweden, the United Kingdom and the United States using quarterly data from 1960 to 1986. The study finds that the significance of trade in the transmission of economic disturbances across countries is not robust to the choice of the de-trending method. In

general, the role of trade interdependence is moderate and seems to have been stronger before 1973.

Further, Frankel and Rose (1998) considered the relationship between two of the criteria used to determine whether a country is a member of an optimum currency area. Using a panel of 30 years (1959 to 1993) of data from 21 industrialised countries, the study finds a strong positive relationship between the degree of bilateral trade intensity and the cross-country bilateral correlation of business cycle activity. Suggesting that greater integration historically has resulted in more highly synchronised cycles.

Similarly, Calderón, *et al* (2007) investigated whether the same result from Frankel and Rose (1998) holds true for the case of developing countries, as their different patterns of international trade and specialisation may lead to cyclical asymmetries among them. The sampled countries contained annual information for 147 countries between 1960 and 1999 (33, 676 country pairs). The study finds, among other things, that countries with higher bilateral trade exhibit higher business cycle synchronisation. Also, countries with more asymmetric structures of production exhibit a smaller business cycle correlation and the impact of trade integration on business cycles is higher for industrial countries than developing and the industrial-developing country pairs.

Rana (2007) examined whether increasing trade intensity among East Asian countries has led to a synchronisation of business cycles. The study finds that intra-industry trade, rather than inter-industry trade, is the major factor explaining business cycle co-ovements in East Asia, with important implications for the prospects for a single currency in the region. The results suggest that intra-industry trade (together with macroeconomic coordination variables when the crisis dummy is not included) is a major factor explaining business cycle co-movements in East Asia. This implies that increasing trade itself does not lead to synchronisation of business cycles. In particular, if increasing trade occurs mainly across different industries, it does not foster co-movements of production with trading partners. In a similar manner, Rana, *et al* (2012) provides a comparative analysis of the relationship between trade intensities and synchronisation of business cycles in 10 East Asia and 15 European countries between 1986 and 2007. The study finds that intra-industry trade, rather than inter-industry trade, is the major factor in

explaining business cycle co-movements in both regions. The paper also supports the hypothesis that the relationship between trade intensity and output co-movement is stronger in East Asia than in Europe.

Also, Lee (2010) evaluated the impact of bilateral trade integration on business cycle comovements of the 50 states in the US for the year 2002. The study distinguishes intra-industry from inter-industry trade flows and finds that business cycles are more synchronised between economies with deeper trade linkages. Also, the study uses a measure of trade integration and inter-industry and intra-industry trade flows following Frankel and Rose (1998) and Grubel and Lloyd (1971) respectively. Disaggregated trade data further suggest that much of the observed effects from trade arise from intra-industry trade flows.

Prasad (1999) constructed and implemented structural vector autoregressive model to characterise trade dynamics in response to different macroeconomic shocks and obtain relative importance of these fluctuations on trade balance. An interesting finding is that in the post-Bretton Woods periods, nominal shocks appear to have an important role in determining trade fluctuations among the G-7 countries (Japan, France, Italy, Canada, United Kingdom, United States and Germany). These tend to generate positive correlation between output and trade balance.

In summary, the previous empirical and methodological review represents only some of the existing empirical literature on the relationship between trade flows and business cycles across trading countries. A comprehensive summary of these and other empirical studies are presented in Tables 3.1a to 3.1g.

Table 3.1a. **Summary of existing empirical studies**

Author (s)	Objective (s)	Scope	Reference cycles periods	Data used to construct business cycles	Methodologies for de-trending BC and estimation	Significant Determinants	Conclusion
Canova and Dellas (1991)	To investigate impact of trade interdependence on business cycle synchronisation	10 major industrial countries between quarterly data from 1960 to 1986	Full Sample	Series of gross national products	Random walk, Linear, Hodrick-Prescott (HP) and Beveridge-Nelson (BN) de-trending/ correlation, spectral and VAR methods.	No any other variable was identified but trade is not important.	The study finds that the significance of trade in the transmission of economic disturbances across countries is not robust.
Frankel and Rose (1998)	To examine relationship between two (trade integration and business cycles correlation) of the criteria of optimum currency area.	21 industrial countries between 1959 and 1993	Four equally-sized sub-samples	Quarterly data on real GDP, industrial production (IP), total employment, unemployment rate	Fourth differences, Linear and quadratic time trends, Hodrick-Prescott Filter / OLS estimation with instrumental variables	Bilateral trade intensity	Greater integration resulted in more highly synchronised business cycles.
Otto and Willard (2001)	To investigate OECD output correlations	17 OECD countries between 1960-2001	Full sample and two sub-samples: 1960-1979 and 1980-2000	Real and nominal GDP growth rates, Bilateral trade flows, Foreign direct investment, Short-term interest rates, Stock market indices	OLS estimation with instrumental variables	Trade intensity, equity return spreads, exchange rate volatility, FDI intensity, interest rate spreads, industry structure, and language	Trade and exchange rate volatility are important are important in driving output correlation

Source: Author's compilation

Table 3.1b. summary of existing empirical studies

Author (s)	Objective (s)	Scope	Reference cycles periods	Data used to construct business cycles	Methodologies for de-trending BC and estimation	Significant Determinants	Conclusion
Otto and Willard (2003)	To carry out a cross section study of the international transmission of business cycles	22 OECD countries between 1960 and 2000	Different sub-periods based on data availability	Annual real GDP data	Annual GDP growth rates, Hodrick-Prescott filter, Baxter-King filter / OLS estimation with instrumental variables	Trade intensity, Financial Linkages (FDI, equity flows, bond market), Monetary and exchange rate policies	Trade, integration of equity markets, Exchange rate stability, Similar economic structure, Speed of technology adoption, Bond market integration and FDI intensity are important, they have positive effects on synchronisation of business cycles
Calderón *et al.* (2007)	To investigate the causes of business cycles synchronization among developing countries.	147 countries between 1960 and 1999	Four equally sized samples: 1960-1969, 1970-1979, 1980-1989, 1990-1999	Real GDP data	First-differences, HP filter, Baxter-King filter / OLS estimation and instrumental variables	Bilateral trade, Specialisation / sectoral Structure, Several gravity variables	Trade has a positive impact on synchronisation, while Asymmetric production structure lowers correlation.
De Haan *et al.* (2002)	To investigate whether business cycles have become more synchronised and their determinants	USA (all states excluding Alaska and Hawaii); Germany (9 states); 18 OECD countries between 1929 and 1993 as well as between 1950 and 1996	Different sub-samples due to time horizons	Yearly deflated personal income, Yearly real GDP, Monthly Industrial production	Hodrick-Prescott filter / OLS estimation	Trade and monetary integration	Trade intensity and exchange rate volatility are determinants of higher co-movement.

Source: Author's compilation

Table 3.1c. Summary of existing empirical studies

Author (s)	Objective (s)	Scope	Reference cycles periods	Data used to construct business cycles	Methodologies for de-trending BC and estimation	Significant Determinants	Conclusion
Gruben, Koo and Millis (2002)	To investigate the impact of international trade on business cycle synchronisation	21 OECD countries between 1965 and 1998	Four sub-samples: 1965-1972, 1973-1981, 1982-1990, 1991-1999	Quarterly real GDP, Industrial production index, Total employment, Unemployment rate	Fourth differences, Quadratic time trend, Hodrick-Prescott filter Baxter-King filter / OLS estimations with instrumental variables, Panel estimation with fixed effects	Intra-and inter-industrial trade, Specialisation	No support for negative impact of specialisation on business cycles, thus high share of intra-industry trade may contribute to more synchronisation.
Bordo and Helbling (2003)	To investigate whether business cycles have become more synchronised and their determinants	16 countries between 1880 and 2001	Four eras: 1880-1913 1920-1938 1948-1972 1973-2001	Annual GDP data and annual industrial production data	First differences, Baxter-King filter, Concordance correlations and Standard output correlations /Static factor model and VAR model	Global and idiosyncratic shocks, Supply and demand shocks, Trade integration, Asset market integration and Exchange rate policy	Modest role of bilateral trade and no evidence for positive effect of joining a fixed exchange rate regime.
Bergman (2004)	To examine similarities in European business cycles	14 EU countries and five non-EU-countries between 1961 and 2001.	Four sub-samples : 1961:1-1973:1, 1973:2-1978:4, 1979:1-1987:2, 1993:1-2001:4	Quarterly industrial production data	Baxter-King filter / OLS estimation and IVs	Trade, Monetary policy, Fiscal policy, Gravity variables (border, size, distance, EU membership)	Synchronisation is higher with flexible exchange rates, Economic and monetary integration have positive effect in the last 10 years and trade has positive effect.

Source: Author's compilation

Table 3.1d. **Summary of existing empirical studies**

Author (s)	Objective (s)	Scope	Reference cycles periods	Data used to construct business cycles	Methodologies for de-trending BC and estimation	Significant Determinants	Conclusion
Imbs (2004)	To investigate relationship among trade, finance, specialisation and synchronization.	24 countries between 1980 and 2000, 1960 and 2000, and 1977 and 2001	As indicated in the covered periods	Quarterly and annual GDP	Baxter-King filter / Simple OLS and 3SLS estimation with instrumental variables	Trade integration, financial integration, specialisation exogenous: geographical distance, linguistic similarity, common border	Strong positive effect of intra-industry trade, Negative effect of specialization, Positive effect of financial integration.
Baxter and Kouparitsas (2005)	To investigate the determinants of business cycle co-movement.	100 countries (developed and developing) between 1970 and 1995	Full sample	Annual RGDP	Baxter-King filter/ Extreme-bounds analysis	Bilateral trade, total trade, sectoral structure, export/import similarities, factor endowment, gravity variables	Bilateral trade and distance are important, Industrial structure and currency union are not important.
Inklaar, Jong-A-Pin and De Haan (2005)	To examine the relationship between trade and business cycle synchronisation in OECD countries	21 OECD countries between 1970 and 2003	Three sub-samples: 1970-1981, 1981-1992, 1992-2003, Correlations over 8 years rolling windows	Quarterly GDP, Monthly index of industrial production	Baxter-King filter / OLS estimation with instrumental variables, Least trimmed squares estimation, Extreme-bounds analysis	Trade, Specialisation, Monetary policy, Fiscal policy, Financial Integration	Positive impact of trade integration as well as of similar fiscal and monetary policies on business cycle synchronisation.

Source: Author's compilation

Table 3.1e. Summary of existing empirical studies

Author (s)	Objective (s)	Scope	Reference cycles periods	Data used to construct business cycles	Methodologies for de-trending BC and estimation	Significant Determinants	Conclusion
Böwer and Guillemineau (2006)	To analyse the determinants of business cycle synchronisation across euro area countries	EU12 countries between 1980 and 2004	Three sub-periods: 1980-1988, 1989-1996, 1997-2004	Annual real GDP data	Baxter-King filter /Extreme-bounds analysis	Bilateral trade, economic specialisation, flow of bank assets, interest rate difference, exchange rate volatility, fiscal deficit, price competitiveness, stock market difference, geographical distance and labour market flexibility.	Trade has robust positive effect, monetary unions that foster intra-industry trade can become endogenously optimal, Stock market integration has robust positive impact on co-movement
Imbs (2006)	To investigate real effects of financial integration	41 countries (large sample), 12 core and 31 periphery countries between 1960 and 2000.	Full sample	Annual GDP and bilateral portfolio investment	Hodrick-Prescott filter / Simple OLS and 3SLS estimation with instrumental variables	Trade integration, financial integration, specialization.	Financially integrated economies tend to have more synchronised cycles, while the effect of financial integration on sectoral specialisation remains unclear
Akin (2007)	To investigate the determinants of Business cycle synchronisation	47 countries (including 27 emerging countries) between 1970 and 2003	3 sub-periods: 1970-1979, 1980-1989, 1990-2003	Real annual GDP data	Baxter-King filter / OLS, GMM and 3SLS estimations with IVs (simultaneous equations)	Trade, financial openness, partner similarity, free trade area membership, exchange rate volatility, oil-import dependency	Trade integration is the most important determinant of synchronisation, Financial integration has a weak positive effect, while trade partner similarity has no effect.

Source: Author's compilation

Table 3.1f. Summary of existing empirical studies

Author (s)	Objective (s)	Scope	Reference cycles periods	Data used to construct business cycles	Methodologies for de-trending BC and estimation	Significant Determinants	Conclusion
García-Herrero and Ruiz (2007)	To analyse the effect of trade and financial links on business cycle synchronisation	109 countries between 1990 and 2003	Full Sample	Annual GDP data	Baxter-King filter / Simple OLS as well as 3SLS estimation with instrumental variables	Trade, financial linkages, similar production structures, distance, language, member of euro area and EU, inflation differentials, exchange rate volatility, land area, population and oil dependency	Similar production structures , Trade integration, Sectoral shocks, Common policies, except financial integration all have positive impact on business cycles co-movement.
Rana (2007)	To investigate the relationship between trade intensity and business cycle synchronisation	East Asia between January 1989 and December 2004	Full Sample	Monthly industrial production index (IPI)	Hodrick-Prescott filter/ OLS and the IVs approach	Intra-industry trade leads to synchronisation of business cycles	The study finds that intra-industry trade, rather than inter-industry trade, is the major factor explaining business cycle co-movements
Lee (2010)	To evaluate the impact of bilateral trade integration on business cycle co-movements	50 states in the US for the year 2002	Full Sample	gross state product (GSP)	Hodrick-Prescott (HP) filter/ OLS and IV with GMM.	Trade integration, intra-industry trade flows	Most of the observed effect from trade arise from intra-industry trade flows.

Source: Author's compilation

Table 3.1g. Summary of existing empirical studies

Author (s)	Objective (s)	Scope	Reference cycles periods	Data used to construct business cycles	Methodologies for de-trending BC and estimation	Significant Determinants	Conclusion
Dees and Zorell (2011)	To examine whether economic ties between countries foster business cycle synchronisation	Central and Eastern Europe between 1993 and 2007	Full sample	GDP	HP-filtered GDP/3SLS	Trade integration and similarity in production structure are significant with the expected signs, while financial integration influences indirectly, through similarities in production structure	Business cycle synchronisation is mostly explained by the similarity in production structure and by trade linkages. Financial linkages contribute to closer output correlations rather indirectly, by making countries more similar.
Rana, *et al* (2012)	To carry out a comparative analysis of the relationship between trade intensities and synchronisation of business cycles	10 East Asia and 15 European countries between 1986 and 2007	Two periods, 1987–1996 and 1997–2007	Annual real GDP data at constant price	The output data are first-differenced in logarithm / OLS and the IV approach	Intra-industry trade and macroeconomic coordination variables	The study finds that intra-industry trade, rather than inter-industry trade, is the major factor explaining business cycle co-movements

Source: Author's compilation

A cursory look at these Tables shows none of the existing studies focused on assessing the transmission of business cycles between ECOWAS and trading partners. Most of the studies that investigated relationship between trade flows and cross-country business cycles focused developed countries. Besides, none of these studies computed business cycles but used growth cycles (a narrow measure of business cycles). This study computed the actual business cycles, using diffusion index. This study also computed dynamic cross-country business cycles, unlike previous studies that used static cross-country business cycles, which does not capture dynamics in cross-country business cycles.

Common previous techniques are instrumental variables fixed effect and random effect as well as two stage least squares and three stage least squares, which do not control for possibility of non-stationarity. This study employed pooled mean group technique, which deals with potential non-stationarity in the time series and heterogeneity across cross-sectional observations. Notably, this study did not account for endogeniety between trade flows and cross-country because policy coordination which often create endogeniety problem is not envisaged between ECOWAS and selected trading partners.

CHAPTER FOUR

THEORETICAL FRAMEWORK AND METHODOLOGY

4.1. Theoretical Framework

The review of related theories suggests that trade interdependence explains cross-country business cycles. For instance, Heckscher-Ohlin (H-O) model concludes that changes in the available technology of production does not generate similar pattern of specialisation in production making cross-country business cycles unsynchronised. H-O model assumes vertical specialisation between trading countries, leading to inter-industry trade flows; thus trading in this regards is a pointer to unsynchronised cross-country business cycles. Meanwhile, new trade theories such as theory of trade in intermediate inputs and model of international trade with stochastic technology shocks conclude that business cycles can be transmitted abroad through trade flows. The emphasis is on trade in intermediate productive inputs and intra-industry trade flows.

From all the trade theories reviewed, stochastic technology shocks model, predicated on trade in intermediate inputs theory (that considered the peculiarity of sampled economies with varied levels of technology) was estimated. This is based on the assumption that trade in intermediate inputs directly affects production since final output bundles domestically and foreign sourced intermediate inputs. Further assumption is that all firms in a country can either source inputs domestically or import them from abroad, depending on the relative cost of the inputs, so that the total output of good *i* in the two economies in period t is:

$$Y_t^i = f_i(y_{t-1}^d - x_1, y_{t-1}^f - x_2, \mu_t) \qquad \forall i = 1,2 \qquad (4.1)$$

$x_1 > 0$ if the domestic economy exports input 1 and $x_2 < 0$ if it imports inputs from the trading partners. The implication of this is that importing these intermediate inputs will increase production of final output of trading economies, while exporting them do the converse because it makes such input less available for domestic use in the production process. Also, μ_t is a productivity shock which follows a stationary stochastic process and whose value is known when production is completed at period t but unknown when the investment decision is made at period t-1. Equation (4.1) implies that production of final output (Y) in period t is a function of accumulated inputs at period t-1, either sourced domestically or imported. In addition, the production functions of these intermediate inputs exhibit decreasing returns to scale in labour and capital. The labour can be domestically sourced or sourced from foreign countries in the form of expatriate workers. Also, the capital can also be sourced domestically (domestic investment) or from foreign countries in the form of foreign direct investment (FDI). For simplicity, any labour and capital inputs used in the two goods are assumed given.

The optimal output for all the firms in a particular country, which includes the two activities (final output, and the two forms of intermediate inputs), can be solved by minimising the short run cost function subject to the value of output from the final good which includes net trade. Thus, rewriting equation (4.1) and linearising it gives:

$$InY_{t+1}^{i} = \sum_{i=1}^{2} \beta_i Iny_t^i + In(\mu_{t+1}^i) \qquad \sum_j \beta_i = 1 \qquad (4.2)$$

Where: β_i is the share of domestically sourced inputs and foreign inputs in the production of final good Y. This also captures the extent of bilateral intra-industry trade among the countries with the assumption that summation of all firms' demand for inputs represents a country's demand for inputs. Hence, summation of the shares of the two inputs used in the production of final good is assumed to be unity. If the short run cost function for the representative firm is given as:

$$C(p) = Min \sum_{i=1}^{2} py_i \qquad \forall i = 1,2 \qquad (4.3)$$

Where: p is inputs prices. Hence, if $c_i(p_1, p_2)$ denotes the unit cost function that is dual[19] to $f_i(y_1, y_2)$, whereby the final good is assembled from two intermediate inputs, the price of final good satisfies $p_i = c_i(p_1, p_2)$ such that $\hat{p}_i = \theta_{i1}\hat{p}_1 + \theta_{i2}\hat{p}_2$. Also, θ_{ij} is the cost share of input i in the final output. The change in the price of the final good could be seen as a weighted average of the change in the input prices. The implication of equation (4.2) is that final output exhibits constant return to scale in intermediate inputs. Connoting that scaling up or down the intermediates goods by a constant increases or decreases the production of final output by that constant. Hence, minimising (4.3) subject to (4.2) can be solved as:

$$L = p_i y_i - \lambda\left[\sum_{i=1}^{3} \beta_i In y_t^i + In(\mu_{t+1}^i)\right] \qquad \forall i = 1,2,3 \qquad (4.4)$$

$$\frac{\partial L}{\partial y_i} = p_i - \lambda\frac{\beta_i}{y_i} = 0 \qquad (4.5)$$

Thus,

$$p_i = \lambda\frac{\beta_i}{y_i} \qquad (4.6)$$

Making β_i the subject of equation (4.6) and recalling that $\sum_i \beta_i = 1$, gives:

$$\sum_i \frac{p_i y_i}{\lambda} = 1 \qquad (4.7)$$

Multiplying equation (4.7) through by λ and noting that $\sum_i p_i y_i = C$, yields:

$$C = \lambda \qquad (4.8)$$

Substituting equation (4.8) in (4.5) and rearranging yields;

$$y_i = C_t^i\frac{\beta_i}{p} \qquad (4.9)$$

[19] That is, an optimum combination of inputs that minimises costs, necessarily maximises output.

Where: C_t^i embed the prices of the three inputs prices.

Therefore, using duality principle—combination of inputs that minimises expenditure (C) also maximises output (Y)—equation (4.9) yields;

$$y_i = Y_t^i \frac{\beta_i}{p} \tag{4.10}$$

Equation (4.10) implies that demand for tradable intermediate inputs is directly related to output of final goods and inversely related to their prices.

Substituting (4.10) in (4.2) gives:

$$Y_{t+1}^i = f_i(m_{ij}(Y_t^i), m_{ij}(Y_t^i), \mu_{it+1}) \tag{4.11}$$

$m_{ij}(i \neq j)$ is the bilateral trade flows among countries. The correlation between any countries pair of final output can be realised, by writing equation (4.11) explicitly as follows:

$$\begin{pmatrix} Y_{t+1}^d \\ Y_{t+1}^f \end{pmatrix} = \begin{pmatrix} m^{dd} & m^{df} \\ m^{f\ d} & m^{f\ f} \end{pmatrix} \begin{pmatrix} Y_t^d \\ Y_t^f \end{pmatrix} + \begin{pmatrix} \mu_{t+1}^d \\ \mu_{t+1}^f \end{pmatrix} \tag{4.12}$$

Equation (4.12) is a form of autoregressive model which can be expressed as;

$$Y_t^d = m^{dd} Y_{t-1}^d + m^{df} Y_{t-1}^f + \mu_t^d \tag{4.13}$$

$$Y_t^f = m^{fd} Y_{t-1}^d + m^{ff} Y_{t-1}^f + \mu_t^f \tag{4.14}$$

The interest is to obtain the variances and auto-covariance (a measure of business cycles co-movement) of domestic and foreign business cycles.

Introducing the lag operator in (4.13) and (4.14) gives:

$$Y_t^d = m^{dd} LY_t^d + m^{df} LY_t^f + \mu_t^d \tag{4.15}$$

$$Y_t^f = m^{df} LY_t^d + m^{ff} LY_t^f + \mu_t^f \tag{4.16}$$

Hence,

$$Y_t^d = \frac{m^{df} L Y_t^f}{1 - m^{dd} L} + \frac{\mu_t^d}{1 - m^{dd} L} \quad (4.17)$$

Therefore, the expected value of Y^d in equation (4.17) becomes;

$$E(Y_t^d) = \frac{m^{df} L Y_t^f}{1 - m^{dd} L} \quad (4.18)$$

Note that the expected value of random variable (μ_t^d) is zero.

$$Var(Y_t^d) = \delta_{yd}^2 = E\left\{\left[m^{df} L Y_t^f (1 + m^{dd} L)\right]^2 + \left[\mu_t^d (1 + m^{dd} L)\right]^2\right\} \quad (4.19)$$

$$Var(Y_t^d) = \delta_{yd}^2 = E\left\{\left[(m^{df})^2 L^2 Y_t^f + (m^{df} m^{dd})^2 L^3 Y_t^f\right] + \left[(\mu_t^d)^2 + (m^{dd})^2 L^2 (\mu_t^d)^2\right]\right\} \quad (4.20)$$

$$Var(Y_t^d) = \delta_{yd}^2 = m^{df\,2} \delta_{yf}^2 + m^{dd} m^{df} \delta_{yf}^2 + \delta_{\mu d}^2 + (m^{dd})^2 \delta_{\mu d}^2 \quad (4.21)$$

$$Var(Y_t^d) = \delta_{yd}^2 = \frac{\delta_{yf}^2}{1 - m^{df\,2} - m^{dd} m^{df}} + \frac{\delta_{\mu d}^2}{1 - (m^{dd})^2} \quad (4.22)$$

Equation (4.22) implies that variation in domestic business cycles is a direct function of variation in foreign business cycles (δ_{yf}^2) and shocks to domestic technology ($\delta_{\mu d}^2$). Similar expression can be defined for foreign business cycles.

The covariance (a measure of business cycles co-movement) between two countries business cycles can be derived as;

$$Cov(Y_t^d, Y_t^f) = E(Y_t^d, Y_t^f) = E\left[(m^{dd} Y_{t-1}^d + m^{df} Y_{t-1}^f + \mu_t^d)(m^{fd} Y_{t-1}^d + m^{ff} Y_{t-1}^f + \mu_t^f)\right] \quad (4.23)$$

$$Cov(Y_t^d, Y_t^f) = E\begin{bmatrix} (m^{dd} m^{fd} (Y_{t-1}^d)^2 + m^{dd} m^{ff} Y_{t-1}^d Y_{t-1}^f + m^{dd} Y_{t-1}^d \mu_t^f + m^{df} m^{fd} Y_{t-1}^f Y_{t-1}^d \\ + m^{df} m^{ff} (Y_{t-1}^f)^2 + m^{df} Y_{t-1}^f \mu_t^f + m^{fd} Y_{t-1}^d \mu_t^d + m^{ff} Y_{t-1}^f \mu_t^d + \mu_t^d \mu_t^f \end{bmatrix} \quad (4.24)$$

Equations (4.23) and (4.24) are expressions for covariance between foreign and domestic business cycles. What is necessary is to plug in the equation (4.13) and (4.14) into equation (4.23) to arrive at equation (4.24).

Recall that the expected value of random variable (μ_t^d, μ_t^f) is zero and assuming that $Cov(Y_t^d, Y_t^f) = Cov(Y_{t-1}^d, Y_{t-1}^f) = Cov(Y_{t-n}^d, Y_{t-n}^f) = \rho$;

ρ will be expressed as:

$$\rho = m^{dd} m^{fd} \delta_{yd}^2 + m^{dd} m^{ff} \rho + m^{df} m^{fd} \rho + m^{df} m^{ff} \delta_{yf}^2 \quad (4.25)$$

It is assumed here that domestic and foreign technologies are not correlated. That is, E ($\mu_t^d \mu_t^f$) is zero. Otherwise, it would have been equal to δ_{ui}^2.

Equation (4.25) can be solved as;

$$\rho = \frac{m^{dd} m^{fd} \delta_{yd}^2 + m^{df} m^{ff} \delta_{yf}^2}{1 - m^{dd} m^{ff} - m^{df} m^{fd}} \quad (4.26)$$

Rearranging 4.26 yields;

$$\rho = m^{dd} m^{fd} \delta_{yd}^2 + m^{df} m^{ff} \delta_{yf}^2 \left(1 - m^{dd} m^{ff} - m^{df} m^{fd}\right)^{-1} \quad (4.27)$$

Share of domestically sourced intermediate input is indicated by m^{dd}; m^{fd} is the share of imported intermediate inputs by foreign trading partner; m^{df} is the share of imported intermediate inputs by domestic economy; and m^{ff} is the share of foreign sourced intermediate inputs in foreign production of final output. Hence, equation (4.27) shows that business cycles correlation is a direct function of exchange of productive intermediate inputs between domestic and foreign economy. Thus, a variant of equation (4.27) becomes the estimable equation.

4.2. Methodology

4.2.1. Model specifications

Given the expression in equation (4.27), the panel regression model is expressed as:

$$\rho_{ijt} = \alpha_0 + \alpha_1 TRADE_{ijt} + \alpha_2 FDI_{ijt} + \varepsilon_{ij} \quad (4.28)$$

Where: ρ_{ijt} denotes the business cycle correlation between country *i* and j, $TRADE_{ij}$ is trade flows between country i and j and FDI_{ijt} is bilateral FDI inflows between any country pair. The approach is to find the total outward FDI flows of the selected major trading partners as a ratio of the selected members of ECOWAS total inward FDI flows. If

the ratio is decreasing, there are two possibilities; the outward FDI of the partner could have fallen or that the FDI inflows to the selected members of ECOWAS are increasing but not from the identified trading partner pair. Hence, bilateral FDI inflows from the trading partners are low. On the other hand, if the ratio is increasing there are tendencies that the FDI inflows from the identified partners to the selected members of ECOWAS are increasing more proportionately. Hence, bilateral FDI inflows from the paired partner are high, showing the relative importance of the partner in terms of FDI inflows.

Further, $TRADE_{ij}$ represents total trade flows, further partitioned into intra and inter-industry trade flows as well as import and export flows. The intra-industry and inter-industry trade flows, following Grubel and Lloyd (1971), is computed as:

$$IIT_{ijt} = 1 - \frac{\sum_{k=1}^{48} \left| X^{k}{}_{ijt} - M^{k}{}_{jit} \right|}{\sum_{k=1}^{48} \left(X^{k}{}_{ijt} + M^{k}{}_{jit} \right)} X100 \qquad 0 \le IIT \le 100 \qquad (4.29)$$

Where: X_{ij}^{k} and M_{ij}^{k} denote the export of commodity k from country i and import of commodity k from j to i respectively. A value of zero implies a complete specialisation (if industries are exporters or importers of selected products, never both), while a value of 100 indicates total intra-industry trade (if trade is balance within each industry, implying countries export and import roughly equal quantities of the selected products). The value at the upper part of the right hand side is the absolute value of trade balance. It is important to note that in computing the intra-industry trade flows, this study relies on data of trade structure broken down into 48 two-digit codes of the United Nation's Standard International Trade Classification (SITC), revision 2. The list of these commodities is presented in the Table A4 (in the Appendix). In addition, the corresponding index for inter-industry trade share in total trade flows is; $INTER_{ij} = (100 - IIT_{ij})$.

The expected signs trade and FDI are as follows:

$\alpha_1 \prec 0,$ the effect is ambiguous. Trade is generally expected to improve the level of business cycles synchronisation provided that the commodities traded are vital in the

production of further goods in foreign country and vice versa. However, while trade flows dominated by intra-industry trade flows or trade in intermediate inputs are expected to enhance synchronisation of business cycles, trade dominated by inter-industry trade is expected to lead to unsynchronised business cycles because of differences in the structure of production and specialisation differences.

$\alpha_2 \gtrless 0,$ also, the impact of financial integration (FDI) on synchronisation of business cycles is ambiguous depending on whether the financially integrated economies specialises in different sectors to reap the gains from diversification and insure against investment risks or foreign investment concentrated on similar investment activities.

4.2.2 Estimation Procedures and Techniques

i. Technique for Computing Business Cycles and Cross-country Business Cycles

Obtaining business cycles variable for the study involved the constructing diffusion index using seven series categorised into leading (e.g., value of shares traded on the stock exchange), coinciding (e.g., sectoral value-added other than agriculture and changes in price level), and lagging (e.g., changes in inventory) in business cycles. The index reflects mainly physical productivities, prices, financial situation and investment situation in each of the selected countries. These variables were subsequently divided into three major groups; A, B and C. Group A is made up of four series, capturing physical productivity across sectors (manufacturing sector, industrial sector other than manufacturing and services sector's real value-added[20]) and commodity prices (consumer price index; inflation rates[21]), group B is an index of financial situation (this is the total value of shares[22] traded during the period), except for Togo and Senegal, and group C is an index

[20] These variables were adjusted for price level as measured by the GDP deflator using 2000 as the base year. The respective countries GDP deflators were calculated from the nominal and real GDP of each country. For countries like Nigeria where the sectoral value-added data were not available in the WDI (2012 and 2013), the sectoral value-added was sourced from CBN statistical Bulletin (2012) and the yearly official exchange rates with the US dollars were used for conversion to dollars equivalent.

[21] Inflation pressure may be associated with less productivity. Hence, inflation pressure is associated with business cycles (Adams and Junz, 1970).

[22] Most data on stocks traded started in 1981.

of real interest rates and changes in inventories[23] which reflect investment situation. It is important to note that agricultural value-added (majorly forestry, hunting, and fishing, as well as cultivation of crops and livestock production) is excluded from business cycle computation because the sector is dominated by cash and food crops majorly driven by seasonality, a factor that is not important in business cycle theory.

Each of the seven series used was differenced to correct for possible nonstationarity in the series. Consequently, each series is assigned a value of 0, 25, 50, 75 and 100% depending on whether it is falling at an increasing rate (narrowing output gap), falling at a decreasing rate (widening output gap), no change, rising at a decreasing rate (narrowing output gap) and rising at an increasing rate (widening output gap). Finally, all the series were averaged to arrive at diffusion index for each country. This index takes the value of 100% when all the series are upward moving (economy is expanding) and 0% when they are moving down (economy is contracting). Hence, the index ranges from 0% to 100% (Figure A6 for the computed business cycles of the selected countries in the Appendix).

Dynamic cross-country business cycle is computed using year-by-year correlation approach utilising equations (3.5) and (3.7). The convincing part of the measure of year-by-year correlation is that when averaged, it gives the same value as the correlation computed over the entire sample period. Thus, it gives similar result with that of Dynamic Conditional Correlation (DCC) model of Engel (2002). The DCC model was not found appropriate for this study because one of the assumptions of the model is that the series residuals must possess time varying variance property. The computed business cycles (diffusion indexes) residuals are characterised with constant variance properties when nested in univariate GARCH DCC model (Figures A13 to A15 for the computed dynamic cross-country business cycles in the Appendix)

[23] Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales and work in progress.

ii. Pre-estimation Diagnoses

1. Panel Unit Root Test

The study's cross-sectional data is characterised with fairly long time series; hence, there are possibilities of nonstationarity of the time series data across the cross-sectional observations. The panel unit root test was conducted utilising Im, Pesaran and Shin test. This is because Levin, Lin and Chu test, Hadri Lagrange multiplier stationarity test and Harris-Tzavalis test require a strong strongly balanced data, which is not the case in this study. Also, some of the other tests, particularly Levin, Lin and Chu (LLC) test are too restrictive in terms of their null (all cross-sections have unit root) and alternative hypothesis (all cross-chapters do not have unit root) and thus, not applicable in the presence of cross-sectional correlation (Baltagi, 2005). In addition, O'Connell (1998) finds that the LLC test suffered from significant size distortion in the presence of correlation among contemporaneous cross-sectional error terms. The essence of the unit root test is to have the knowledge of the order of integration of variables and to guide against mis-specification of the panel models.

2. Multicollinearity Test

Panel data give more informative data, more variability, less collinearity among the variables, more degrees of freedom and more efficiency since the cross-section dimension adds a lot of variability; these are testable assumptions. Testing for multicollinearity (a situation of a very high positive correlation between any two explanatory variables) becomes necessary because of consequences of ignoring it. In addition, multicollinearity the strength of positive relationship between explanatory variables, does not affect the biasness of the estimators and does not pose problems for prediction. However, multicollinearity causes some difficulties of parameters estimates. This is because estimates in the presence of multicollinearity become very sensitive to changes in specification of the model. Besides, multicollinearity leads to inflated variances of estimates of the parameters of the model. Given that the standard error is the square root of the variance, it implies that the standard errors will also be large in which case the t-ratios will be small implying insignificant coefficients leading to wrong conclusion.

iii. Post-estimation Diagnoses

1. Cross-sectional Dependency Test

There is a growing concern that panel data models are likely to exhibit substantial cross-sectional dependence in the errors, which may arise because of the presence of common shocks and unobserved components that ultimately become part of the error term. The impact of cross-sectional dependence in estimation depends on a variety of factors, such as the magnitude of the correlations across cross sections and the nature of cross-sectional dependence itself. Although the major estimates implemented in this study is nonstationary panel time series which emphasises variable nonstationarity, cross-section dependence as well as time-variant parameter heterogeneity; this study equally estimated fixed and random effects models, prone to cross-sectional dependency problem.

Four main tests of cross-sectional dependence are Breusch–Pagan LM, Pesaran's cross-sectional dependency, Friedman's and Frees'. Hence, the new stata command xtcsd which tests for the presence of cross-sectional dependence in FE and RE panel data models was used. This command was developed by Pesaran's (2004) it is suitable for cases where T is small as $N \rightarrow \infty$. This was used to complement the Breusch–Pagan LM test with command xttest2 developed by Baum (2001)—valid for small N as $T \rightarrow \infty$. Under the null hypothesis, residual is assumed to be independent and identically distributed (i.i.d.) over periods and across cross-sectional units. Under the alternative, the residual may be correlated across cross sections, but the assumption of no serial correlation remains.

2. Log Likelihood Ratio Test

Log likelihood ratio test which compares the fits of two models—model at iteration zero and model at final interaction—was used to test for the overall model adequacy. This is peculiar with maximum likelihood techniques. This test compares the null model, the model at iteration zero and also the starting log likelihood with the alternative model—model at last log likelihood and last iteration. The test is expressed as minus two times the difference between the starting (restricted) and the ending (unrestricted) log likelihood. It is important to note that the model at first iteration (iteration zero) corresponds to the log

likelihood of the null or empty model, model with no predictors. The unrestricted model, on the other hand, corresponds to the maximum likelihood of observed outcome with varying parameters over the whole sample space often presented at the last iteration when the difference between successive iterations are very small. At this point, the model is considered to have converged.

iv. Estimating Panel Time Series Models with Heterogeneous Slopes

Initially, panel estimators are designed for "moderate-T (length of the time series), large-N (number of firms)" micro panels and "moderate-T, moderate-N (number of countries)" macro panels. Over time, the panel data econometrics has shifted towards studying the asymptotics of macro panels with large N and large T rather than the usual asymptotics of micro panels with large N and small T. This is because with increase in time observations inherent in large N, large T macro panels and issues such as nonstationarity, spurious regression, cointegration, parameters heterogeneity across countries and serially correlation of the regressors are often of concern. Thus, literature warns against the use of standard pooled estimators such as FE to estimate large N and large T and dynamic panel data models, claiming they are subject to large potential bias when the parameters are heterogeneous across countries and the regressors are serially correlated. Also, the literature argues that with *T* being large, each country's regression can be estimated separately. Such studies include Pesaran and Smith (1995), Pesaran, Shin and Smith (1997, 1999), Im, Pesaran and Shin (2003), as well as Blackburne III and Frank (2007).

One of the approaches in study is the Pooled Mean Group (PMG) estimator of Pesaran, Shin, and Smith (1997, 1999), an improvement over Mean Group (MG) estimator of Pesaran and Smith (1995). These techniques are suitable when parameters are heterogeneous across cross-sectional observations. The PMG relies on a combination of pooling and averaging of coefficients, characterised with a structure implying an error correction model in which the short run dynamics of the variables in the system are influenced by the deviation from long run equilibrium. This accounts for the error-correcting speed of adjustment making it suitable in estimating nonstationary panels. Also, PMG is an intermediate estimator that allows the intercept, short run coefficients, and error

variances to differ across the groups (as would the MG estimator) but constrains the long run coefficients to be equal across groups (as would the fixed effect estimator).

The suitability of PMG lies in of nonstationary dynamic heterogeneous panel data, implemented using a maximum likelihood technique and achieved through iteration method. In addition, traditional FE and RE methods require pooling individual groups and allowing only the intercepts to differ across the groups; however, one of the central findings from the large N and large T literature is that the assumption of homogeneity of slope parameters is often inappropriate (Blackburne III and Frank, 2007). This is because the assumption of homogeneity, using intercepts parameter, is often empirically rejected and that of other slope parameters may not be an exception.

Pooled Mean Group (PMG) Estimator

Assume a simple heterogeneous dynamic model: for i=1,...,N (where i is "group", typically countries or regions) and t=1,...,T (where t is time, typically years which must be large enough such that the model can be fitted for each group separately) in the form;

$$y_{it} = \sum_{j=1}^{k} \alpha_{ij} y_{i,t-j} + \sum_{j=0}^{l} \beta_{ij} x_{i,t-j} + \mu_i + \varepsilon_{it} \qquad (4.30)$$

Where: X_{it} is a k x 1 vector of explanatory variables; β_{it} are the k x1 coefficient vectors; α_{ij} are scalars; μ_i is the group-specific effect; and the white noise error terms, ε_{it}. If the variables in equation (4.30) are, for instance, I(1) and cointegrated, then the error term is an I(0) process for all i. Thus, equation (4.30) can be re-parameterised into an error correction equation in the form:

$$\Delta y_{it} = \lambda_i (y_{i,t-1} - \omega_i x_{it}) + \sum_{j=1}^{k} \alpha_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{l} \beta_{ij} \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \qquad (4.31)$$

Where: $\lambda_i = -(1 - \sum_{j=1}^{p} \lambda_{ij})$ and $\omega_i = \sum_{j=0}^{q} \beta_{ij} / (1 - \sum_k \alpha_{ik})$. The parameter λ_i is the error-correcting speed of adjustment term. If λ_i = 0, there would be no evidence for a long-run relationship. Hence, λ_i is expected to be significantly negative under the prior assumption

that the variables show a return to a long run equilibrium. Of particular importance is the vector, ω_i, a measure of long-run relationships between the variables.

Moreover, PMG is suitable in the case of large N-large T panel data, moderate N-large T panel data and where nonstationarity, spurious regression, cointegration, parameters heterogeneity across countries and serially correlation of the regressors are of concern; it also lacks in some fundamental aspects. For instance, these estimators do not account for the time-invariant variables. In addition, endogeniety problem is not envisaged because policy coordination which often generates a spurious correlation between trade and business cycle synchronisation is not an issue between members of ECOWAS and their trading partners. This makes the study's estimation using PMG to be valid against Frankel and Rose (1998) and Kose, Prasad, and Terrones (2003) that the previous estimations are invalid because output correlations and trade patterns may be jointly endogenous due to policy coordination effect.

v. Techniques for Estimating Panel Time Series Models with Homogenous Slopes

The previous panel methodology is suitable in the case of large time series (T) and large cross-sectional observation panel when nonstationarity is an issue but not suitable in the case of small T, because the problem of nonstationarity is not envisaged in small T panels. Since one of the aims of this study is to partition the period covered in two, before and after 1995; marking growth tragedy among members of ECOWAS and positive growth periods, respectively. Therefore, the study utilises the panel data with homogenous slopes parameters but accounts for possible heterogeneity using fixed and random effect models.

Hence, the general panel specification can be given as:

$$y_{it} = \beta_i + \sum_{j=2}^{k} X_{ijt}\beta_j + \sum_{p=1}^{s}\gamma_p Z_{pi} + e_{i_t}\ , \quad t = 1....T\ ,\ i = 1....N\ ,\ j = 1...k\ , p = 1...s \tag{4.32}$$

$$e_{i_t} = \delta_t + \varepsilon_{it} \tag{4.33}$$

Therefore,

$$y_{it} = \beta_i + \sum_{j=2}^{k} X_{ijt}\beta_j + \sum_{p=1}^{s}\gamma_p Z_{pi} + \delta_t + \varepsilon_{i_t} \tag{4.34}$$

Where: y_{it} is a vector dependent variables in country *i* at time *t*, *X* is a vector of exogenous (observed) variables, including the constant, and β_j is a vector of coefficients, Z_i are unobserved characteristics of the dependent variables. ε_t is a vector of random error terms. Equation (4.34) decomposes the error process into a summation of two components; time variant and remainder error process.

Fixed Effect Panel Model: The fixed effect model captures individual heterogeneity unlike the between effect or pooled model previously presented. The equation representing this relationship is given as:

$$y_{it} = \beta_i + \sum_{j=2}^{k} X_{ijt}\beta_j + \sum_{p=1}^{s} \gamma_p Z_{pi} + \delta_t + \varepsilon_{it} \qquad (4.35)$$

In fixed effect model, the individual effect is captured within the constant term (assuming that the individual characteristic is fixed).

Random Effect Panel Model: The random effect model also captures individual heterogeneity like the fixed effect model. The equation representing this relationship is given as:

$$y_{it} = \sum_{j=2}^{k} X_{ijt}\beta_j + \sum_{p=1}^{s} \gamma_p Z_{pi} + \delta_t + (\beta_i + \varepsilon_{it}) \qquad (4.36)$$

Random effect model unlike fixed effect model treats the individual characteristics as part of the error term (assuming that individual characteristic is random), the individual effect is capture within as part of the error term.

Testing for heterogeneity: Given that the general specification of pooled model does not account for the heterogeneity across individuals as previously indicated, there is the motivation to test for individual heterogeneity, utilising fixed and random effect models given by:

$$rho = \frac{(sigma\_u)^2}{(sigma\_u)^2 + (sigma\_e)^2} \qquad (4.37)$$

Where:

$sigma\_u = sd$ of residuals within groups u_i

$sigma\_e = sd$ of residuals (overall error term) e_i

F-statistics test can also be used to check for heterogeneity (in the case of fixed effect mode), given by:

$$(F_{N-1,NT-N-K} = \frac{R^2_{Fixed} - R^2_{polled} / N - 1}{(1 - R^2_{Fixed}) / NT - N - K}) \qquad (4.38)$$

If rho is greater than 50 % and/or F-statistics is significant, it implies that the significant percentages of the variance across cross-sectional observations are due to differences across panels and that the coefficient of determination of pooled least squares is significantly different from that of the fixed or random effect model. The implication of the test result is that model parameters are heterogeneous across the paired countries.

Choosing between Fixed Effect Model and Random Effect Model: To decide between fixed or random effects, the study performs a Hausman test as follows:

$$H = (\hat{b}_{FE} - \hat{\beta}_{RE})'(V_{FE} - V_{RE})^{-1}(\hat{b}_{FE} - \hat{\beta}_{RE}) \qquad (4.38)$$

Where: $\hat{b}_{FE}$ and $\hat{\beta}_{RE}$ are estimates of fixed and random effects estimate respectively and V_{FE} and V_{RE} are coefficient vector and estimated asymptotic covariance matrix of fixed and random effect models, respectively. The hypothesis to be tested in Hausman is given as:

Hypothesis H_0: u_i is uncorrelated with x_i

Hypothesis H_1: u_i is correlated with x_i.

It is important to note that fixed effect is consistent under H_0 and H_1, while random effect is efficient, and consistent under H_0 (but inconsistent under H_1). Hence, Hausman test basically tests whether the unique error (u_{it}) are correlated with the regressors, the

null hypothesis is that they are not. This implies that the test picks a model with no endogeniety problem.

4.2.3 Data Sources and Variables Measurement

Trade data were sourced from World Integrated Trade Solution, World Bank based on UN COMTRADE and World Trade Organisation (WTO) utilising two-digit codes of the United Nation's Standard International Trade Classification (SITC), revision 2, and are measured in thousand US dollars. Also, variables measuring physical productivity (RGDP) are measured at year 2000 constant prices, in US dollars, as well as Consumer Price Index are sourced from World Development Indicators (WDI, 2013). Also, variables on bilateral FDI were extracted from Organisation of Economic Corporation and Development (OECD) statistical database, measured in million US dollars, while other FDI data were sourced from WDI (2013), measured in million US dollars.

CHAPTER FIVE

EMPIRICAL ANALYSIS

This chapter is devoted to empirical analysis and detailed discussion of the estimated results. In terms of sequencing, the descriptive analysis of variables used in the estimation is presented, followed by multicollinearity test as pre-estimation diagnoses. Finally, the estimated results are presented in line with the study objectives.

5.1. Descriptive Analysis of Variables.

The descriptive analysis presented in Table 5.1 revealed basic characteristics of variables used. For instance, cross-country business cycle between ECOWAS and trading partners averages approximately 0.21 (on the scale of -1 to +1) and there is no much variation across the trading partners. Also, trade flows have been dominated by inter-industry rather intra-industry trade flows, averaging about 70.3% and 29.7 %, respectively. However, there are variations with China having about 95.5% and 4.5% of inter-industry and intra-industry trade shares, respectively. This indicates that the production structure and specialization of selected members of ECOWAS differ from those of their trading partners which could explain the low level of business cycles synchronisation among them.

Total trade flows between selected members of ECOWAS and their trading partners' averages about $1.04 billion, dominated by trade surplus, with variations across trading partners. While selected members of ECOWAS are having trade surplus with USA and EU, trade with China has been deficit, with import flows overwhelming exports. Moreover, using the ratio of partners FDI outflows to ECOWAS FDI inflows, it is realised that the net FDI inflows have been positive with China having the least FDI with the selected members of ECOWAS.

Table 5.1. Descriptive analysis between 1978 and 2012

ECOWAS and all Trading Partners							
STATS	CCBC	INTRA	INTER	IMP	EXP	TTRADE	FDI
mean	0.21	29.7	70.3	368576.5	673304.0	1041880.0	359.0
min	-1.0	0.0	0.0	1923.2	23.9	6584.9	-96231.0
max	0.76	99.9	100	9296313.0	39200000.0	43200000.0	9679.1
sd	0.63	30.3	34.7	767986.5	2720080.0	3122238.0	3663.6
cv	3.03	1	0.6	2.1	4.0	3.0	10.2
ECOWAS and EU Partners							
mean	0.21	33.1	69.9	316860.6	409260.9	726121.4	354.9
min	-1.0	0.0	0.0	1923.2	333.5	7028.5	-31168.6
max	0.76	99.9	100	5300431.0	9074047.0	9513880.0	7440.4
sd	0.63	30.2	32.5	530391.1	892845.0	1249693.0	2093.1
cv	2.99	0.9	0.5	1.7	2.2	1.7	5.9
ECOWAS and China							
mean	0.17	4.5	95.5	655860.9	82554.6	738415.6	194.0
min	-1.0	0.0	0.0	3157.3	23.9	6584.9	-284.4
max	0.76	67.9	100	9296313.0	1583680.0	10800000.0	2297.3
sd	0.64	11.0	44.9	1531031.0	223099.5	1741156.0	368.5
cv	3.78	2.4	0.7	2.3	2.7	2.4	1.9
ECOWAS and USA							
mean	0.23	38	62.0	389120.5	2482998.0	2872118	544.3
min	-1.0	0.0	0.0	10480.1	1293.3	16121.4	-96231
max	0.76	99.0	99.8	4976621.0	39200000.0	43200000.0	9679.1
sd	0.62	31.6	33.0	782094.9	6541461.0	7252128.0	8503.0
cv	2.66	0.8	0.6	2	2.6	2.5	15.6

Source: Author's computation

Note: sd is standard deviation and cv is coefficient of variation.

Further, partitioning the study period into two; between 1978 and 1994 as well as between 1995 and 2012, gives further insight into changes in the nature of cross country business cycles and trade flows over time. For example, before 1995 the aggregate trade flows between selected members of ECOWAS and their trading partners averaged just about $0.59 billion which has improved significantly to about $1.44 billion between 1995 and 2012 (Table 5.2 and Table 5.3). This indicates that trade flows between ECOWAS and their selected partners have been more than double between the two periods. However, that of China improved more significantly with its associated wider trade deficit. While trade flows of the selected Members of ECOWAS with China recorded about $33.8 million between 1978 and1994, it stood at $1.17 billion between 1995 and 2012. Besides, trade flows of ECOWAS with these partners recorded deficits before 1995; but over time it has been surplus except China which has been consistently deficit.

Table 5.2. Descriptive analysis between 1978 and 1994

ECOWAS and all Partners							
STATS	CCBC	INTRA (%)	INTER (%)	IMP	EXP	TTRADE	FDI
mean	0.17	29.2	70.8	201772.3	393135.0	594907.3	-137.8
min	-1.0	0.0	0.0	1923.2	23.9	6584.9	-96231
max	0.76	98.1	100.0	2879109.0	11300000.0	12500000.0	7440.4
sd	0.66	31.1	37.2	355061.6	1086265.0	1300498.0	5936.6
cv	3.82	1.1	0.7	1.8	2.8	2.2	-43.1
ECOWAS and EU Partners							
mean	0.19	32.7	67.3	223070.4	277708.1	500778.6	33.3
min	-1.0	0.0	0.0	1923.2	333.5	7028.5	-31168.6
max	0.76	98.1	100	2879109.0	3029876.0	4801667.0	7440.4
sd	0.65	30.9	34.7	378812.0	475281.1	765737.1	3298.6
cv	3.45	0.9	0.6	1.7	1.7	1.5	99.2
ECOWAS and China							
mean	0.08	1.7	98.3	28677.1	5159	33836.1	-4.8
min	-1.0	0.0	0.0	3157.3	23.9	6584.9	-284.4
max	0.76	37.8	100.0	120759.7	36892.7	121289.6	25.9
sd	0.69	5.4	48.1	27293.8	6681.1	27019.9	40.6
cv	8.22	3.2	1.2	1.0	1.3	0.8	-8.5
ECOWAS and USA partners							
mean	0.18	39.4	60.6	207284.4	1221312	1428597	-1126.5
min	-1.0	0.0	0.0	12422.3	1293.3	16458.5	-96231.0
max	0.76	97.2	99.8	1503947.0	11300000.0	12500000.0	6165.3
sd	0.66	32.7	34.4	315773.2	2433599.0	2727895.0	13948.3
cv	3.69	0.8	0.7	1.5	2	1.9	-12.4

*Source***:** Author's computation

Note: sd is standard deviation and cv is coefficient of variation.

Moreover, in terms of FDI inflows, there were significant improvements between and after 1994. While net FDI inflows stood at (-) $137.8 million between 1978 and 1994, it recorded $635.00 million between 1995 and 2012. For instance, the net FDI inflows from China and USA recorded negative values between 1978 and 1994 and recorded positive inflows between 1995 and 2012, although FDI inflows from China was still the lowest among all selected partners during the period. The period of improved growth episode may be responsible for the investment attraction and other political economy issues may also be responsible.

Further, it is noticed that the measure of cross country business cycles improved marginally between 1987 and 1994 as well as 1995 and 2012. While the average cross-country business cycle was 0.17 between 1978 and 1994, it improved to approximately 0.25 between 1995 and 2012. Meanwhile there were significant improvements in the case of China, it recorded cross-country business cycles of about 0.08 before 1995, which now reached 0.27 between 1995 and 2012. In essence, nearly all the countries show some improvements in their cross-country business cycles, trade flows and financial interdependent in the recent time (1995-2012).

Table 5.3. Descriptive analysis between 1995 and 2012

ECOWAS and All Partners							
STATS	CCBC	INTRA	INTER	IMP	EXP	TTRADE	FDI
mean	0.25	30.3	69.7	518170.8	924566.7	1442737.0	635.0
min	-1.0	0.0	0.0	6290.7	62.1	14355.4	-43.5
max	0.76	99.9	100.0	9296313.0	39200000.0	43200000.0	9679.1
sd	0.6	29.4	29.9	979360.6	3585118.0	4080189.0	1059.2
cv	2.4	1.0	0.4	1.9	3.9	2.8	1.7
ECOWAS and EU partners							
mean	0.24	33.6	66.4	405440.1	533505.1	938945.2	533.6
min	-1.0	0.1	0.1	6290.7	454.5	14355.4	-43.5
max	0.76	99.9	99.9	5300431.0	9074047.0	9513880.0	5825.2
sd	0.61	29.4	29.4	629200.8	1143052.0	1546875.0	834.7
cv	2.57	0.9	0.4	1.6	2.1	1.6	1.6
ECOWAS and China							
mean	0.27	7.5	92.5	1039140.0	129852.0	1168992	304.5
min	-1.0	0.0	0.0	33700.1	62.1	34127.8	7.3
max	0.76	67.9	100.0	9296313.0	1583680.0	10800000.0	2297.3
sd	0.57	14.2	25.4	1844054.0	273022.4	2100093.0	420.3
cv	2.15	1.9	0.3	1.8	2.1	1.8	1.4
ECOWAS and USA							
mean	0.29	36.5	63.5	560854.7	3674589.0	4235444.0	1472.5
min	-1.0	0.3	1.0	10480.1	1778.0	16121.4	3.1
max	0.76	99.0	99.7	4976621.0	39200000.0	43200000.0	9679.1
sd	0.57	30.4	30.4	1019971.0	8666742.0	9588012.0	1834.4
cv	1.95	0.8	0.5	1.8	2.4	2.3	1.2

Source: Author's Computation

Note: sd is standard deviation and cv is coefficient of variation

The nature of the variables in the tables above calls for some transformations. First, cross-country business cycles is measured in 100, a value of 100 implies perfect synchronisation of business cycles, while -100 indicates perfect unsynchronised business cycles between any country pair. Second, FDI flows are measured on a net basis, making some countries observations to have negative values and cross-country business cycles could take either positive (synchronisation) or negative values (unsynchronised business cycles). To preserve the observations with negative values with logged models, this study employed Busse and Hefeker (2007) transformation approach, given by $In\left(X_{jt}+\sqrt{(X^2+1)}\right)$. In order to confirm the adequacy of the transformed FDI and the original FDI measurement and transformed cross-country business cycles and original cross-country business cycles, correlation between the two was performed, it was discovered that they are highly significantly correlated (Table A5 in the Appendix).

5.2. Pre-estimations Diagnoses

5.2.1. Panel Unit Root Test.

Presented in Table 5.4 is the panel unit root tests conducted utilising Im, Pesaran and Shin (IPS) unit root test as previously indicated. The IPS's t-bar, t-tilde-bar, and Z-t-tilde-bar statistics assume that the number of time periods, T, is fixed. When there are no gaps in the data, IPS reports exact critical values for the t-bar statistic, predicated on the number of panels, N, also being fixed. The other two statistics (t-tilde-bar and Z-t-tilde-bar statistics) assume N tends to infinity. For the asymptotic normal distribution of Z-t-tilde-bar to hold, T must be at least 5, if the data set is strongly balanced and the deterministic part of the model includes only panel-specific means, or at least 6, if time trends are also included. If the data are not strongly balanced, then T must be at least 9 for the asymptotic distribution to hold. If these limits on T are not met, the p-value for Z-t-tilde-bar is not reported.

The essence of the unit root test is not only because the cross sectional data is characterised with relatively long time series, creating potential for nonstationarity of the time series data across the cross-sectional observations, but also because of having

Table 5.4. Im, Pesaran and Shin's panel unit root tests

	IPS Test at Level					IPS Test at First Difference				
Variables	t-bar	t-tilde-bar	z-t-tilde-bar	P-Values	Remark	t-bar	t-tilde-bar	z-t-tilde-bar	P-Values	Remark
Log (CCBC_T)	-2.74	-2.21	-3.18	0.045	I(0)	-2.29	-2.10	-4.82	0.000	I(0)
Log (INTRA)	-2.82	-2.27	-3.40	0.035	I(0)	-3.18	-2.69	-9.27	0.000	I(0)
Log (INTER)	-4.00	-2.83	-5.67	0.023	I(0)	-3.98	-3.06	-12.02	0.000	I(0)
Log (IMP)	-2.56	-2.05	-2.54	0.014	I(0)	-3.03	-2.59	-8.51	0.000	I(0)
Log (EXP)	-2.35	-2.02	-2.42	0.031	I(0)	-2.57	-2.28	-6.21	0.000	I(0)
Log (TTRADE)	-6.19	-4.27	-11.19	0.047	I(0)	-6.65	-4.40	-21.89	0.000	I(0)
Log (FDT_T)	-7.10	-4.52	-12.21	0.049	I(0)	-4.90	-3.71	-16.82	0.000	I(0)

Source: Author's computation using STATA

Note: Null Hypotheses: All panels contain unit root. Alternative Hypotheses: Some panels are stationary.

knowledge of the order of integration of the panel data, which guides against missspecification of the panel models. The variables to be used across models to be estimated are tested for the unit roots. Given the null and the alternative hypotheses in Table 5.4 and the associated probability values, it could be concluded that some panels are stationary at level. Therefore, the null hypothesis that all panels contain unit root is rejected at 0.05 level. Notably, some panels are integrated of order zero, while some are integrated of order one. A cursory look at Table 5.4 shows that the level of stationarity (the p-values associated with IPS test at level test and those at first difference) of the variables improved at first difference indicating that more panels are stationary when differenced.

5.2.2. Multicollinearity Test

The multicollinearity test is considered in Table 5.5. The Table shows the strength of relationship between any pair of variables used in the study. The first column presents results which measure the correlation relationship between dependent variable and each of the explanatory variables. Analysis of these results does not indicate multicollinearity problem. However, a closer look at the table shows that total trade flows (addition of import and export between any country pair) is highly correlated with import (0.91) and export flows (0.89), these are expected. Also, import is correlated with export (0.68), which indicates that increase in import is likely to be associated with increase in export flows. Therefore, the approach employed is to estimate a separate model for export and import flows. This allows for the analysis of separate effect of supply and demand channel on cross-country business cycles.

Table 5.5. Correlation between pairs of variables

	LOG CCBC_TT	LOG INTRA	LOG INTER	LOG IMP	LOG EXP	LOG TTRADE	LOG FDI_T
LOGCCBC_TT	1.00						
LOGINTRA	-0.04 (0.22)	1.00					
LOGINTER	0.06 (0.04)**	-0.56 (0.00)***	1.00				
LOGIMP	-0.06 (0.05)**	0.15 (0.00)***	-0.12 (0.00)**	1.00			
LOGEXP	-0.04 (0.13)	0.55 (0.00)***	-0.36 (0.00)***	0.68 (0.00)***	1.00		
LOGTTRADE	-0.05 (0.08)	0.31 (0.00)***	-0.22 (0.00)***	0.91*** (0.00)	0.89 (0.00)***	1.00	
LOGFDI_T	0.15 (0.00)**	0.01 (0.84)	-0.03 (0.39)	0.10 (0.00)**	-0.01 (0.69)	0.06 (0.04)**	1.00

Source: Author's computation

5.3. Effect of Trade Flows and Financial Interdependence on Cross-country Business Cycles, 1978-2012

The estimated PMG model allows for heterogeneous short run dynamics and common long-run estimates of cross-country business cycles. Often, only the long run parameters are of primary interest because of the assumption that the variables must have shown a return to a long run equilibrium from their possible short run disequilibrium. Results presented in Table 5.6 show the effect of trade flows on cross-country business cycles between ECOWAS and their trading partners.

In terms of model adequacy, the study compares the log likelihood of restricted and unrestricted model using log likelihood ratio (LLR) chi-square test as previously indicated. Given the results presented in Table 5.6, the log likelihood chi-square test statistic for all the partners model can be calculated manually as -2 [-3051.00-(-3057.16)] = 12.32. In this model, there are four predictors, so there are four degrees of freedom. Log likelihood chi-square statistic value of 12.32 is significant at 5% level, leading to rejection of the null model (the restricted model). This suggests that unrestricted model with more parameters, as estimated, fit well. Hence, the joint hypothesis of non-exogeneity of the regressors and non-stability of the regression parameters over time is rejected.

Generally, the outcome reveals that trade flows have significant negative impact on the synchronisation of cross-country business cycles in the long run. This connotes that trade flows between members of ECOWAS (irrespective of whether trade flows is inter or intra-industry and whether it is export or import flows) and their trading partners reduce co-movement of cross-country business cycles in the long run, except in the case of USA. For instance, the results indicate that 1% increase in aggregate trade flows between ECOWAS and their major trading partners will reduce synchronisation of business cycles by approximately 0.5% (Table 5.6). Intra and inter industry trade flows shows no significant effect of trade flows, except in China. The results show that 1% increase in intra and inter-industry trade flows between ECOWAS and China reduces synchronisation of business cycles by approximately 0.7% and 5.7%, respectively.

Table 5.6. Pooled Mean Group (PMG) estimates of the impact of trade flows on cross-country business cycles

D(LOGCCBC)	ECOWAS and All partners	ECOWAS and EU Partners	ECOWAS and China	ECOWAS and USA
LONG RUN				
LOGINTRA	-0.044 (-0.37)	0.252 (1.48)	-0.662 (-2.92)**	0.327 (0.85)
LOGINTER	0.241 (1.08)	0.265 (1.07)	-5.740 (-1.97)**	1.392 (2.22)**
LOGTTRADE	-0.499 (-3.34)***	-0.202 (-0.99)	-0.198 (-0.54)	-0.853 (-1.53)
LOGFDI_T	0.197 (5.52)***	0.178 (4.38)***	-0.109 (-0.55)	0.238 (3.04)**
SHORT RUN				
EC	-0.928 (-27.9)***	-0.957 (-31.21)***	-0.967 (-5.31)***	-0.924 (-24.42)***
D(LOGINTRA)	0.039 (0.09)	-0.137 (-0.25)	0.300 (2.93)**	-0.090 (-0.09)
D(LOGINTER)	-20.605 (-0.78)	3.228 (1.29)	-112.750 (-0.8)	-2.572 (-0.58)
D(LOGTTRADE)	1.805 (2.48)**	1.813 (2.06)**	2.350 (0.93)	0.425 (0.26)
D(LOGFDI_T)	0.118 (0.89)	0.199 (1.78)*	-0.253 (-0.26)	0.085 (1.18)
_cons	6.424 (20.88)***	1.861 (15.52)***	29.003 (4.68)***	5.505 (5.77)***
Statistics				
Number of Iterations	3	3	4	4
Starting Log likelihood	-3057.16	-2341.17	-243.337	-468.552
Log likelihood	-3051.00	-2339.52	-239.102	-464.428
LLR Chi2	12.32***	3.3***	8.47***	8.25***
Observations	1117	850	97	170

Source: Author's computation

It is noticed that response of cross-country business cycles to inter-industry trade flows is elastic unlike the intra-industry trade flows with China. This is expected given the arguments in the literature on the relationship between trade flows and cross country business cycles when trade flows are dominated by inter-industry trade flows. For instance, it can be inferred from Kenen (1969 cited in Rana, Cheng and Chia, 2012) argument that an economy having a large share of inter-industry trade flows will experience more asymmetric shocks and thus, have their business cycles unsynchronised and vise versa. Kenen (2000) and Kose and Yi (2001) noted that trade integration alone does not ensure business cycle synchronisation, if economies are not sufficiently similar.

It is noticed that even intra-industry trade flows between ECOWAS and China does not synchronise cross-country business cycles. This is line with one of the Krugman's (1993) arguments that the potential for asymmetric shocks increases with greater integration among countries engaging in intra-industry trade since more intra-industry trade increases their specialisation which gives room for products differentiation. Overall, this is related to stating that dissimilarities in production structure should influence synchronisation negatively because the trading economies producing different types of goods will be subject to dissimilar shocks.

On the contrary, it is noticed that inter-industry trade flows between selected members of ECOWAS and USA influence synchronisation of business cycles positively. The results show that business cycles synchronisation responds more proportionately to 1% increase in inter-industry trade flows. This result is against the Krugman's position that only intra-industry trade synchronises cross-country business cycles.

Moreover, it is noticed that financial interdependent is an important factor influencing synchronisation of cross-country business cycles significantly. Overall, the results show that 1% increase in FDI inflows will generate about 0.2% synchronisation of cross-country business cycles. Similar outcome is noticed in EU trading partners and the USA. Observably, FDI inflows from China do not significantly influence cross-country business cycles. This is expected because the level of FDI inflows from China has been

low. The implication of this outcome is that most FDI inflows to the selected members of ECOWAS from their trading partners have been within the same sector. Therefore, there is likelihood for shocks from the mother companies to spread to the investment in the host countries creating synchronisation of business cycles. This in line with Garcia-Herrero and Ruiz (2008 cited in Dees and Zorell, 2011) that FDI flows concentrating on sectors where the home country has a comparative advantage is a replication of the host country similar productive structure, making cross-country business cycles to synchronise.

Possible explanation why trade between ECOWAS and the identified trading partners not found synchronising cross-country business cycles is that trade flows between them is less of trade in intermediate productive inputs but more of trade in finished consumer goods, which theoretically have potential of not transmitting business cycles. However, transmission of business cycles from inter-industry trade with the USA is an indication of high level of inter-sectoral linkages between ECOWAS and the USA. On other hand, financial interdependence (FDI) was found transmitting business cycles, an indication of high level of financial and investment interdependence between ECOWAS and the identified trading partners. Hence, financial integration and investment across the sampled economies is concentrated in similar production structure.

Further, the short run estimations show that trade flow has some significant positive effect on cross-country business cycles, especially with EU trading partners. However, FDI does not show significant impact in the short run. The error correction mechanism in the short run of PMG estimation is negative and significant. The error correction coefficient is of the appropriate sign under the prior assumption that the variables show a return to a long run equilibrium making D(CCBC) to be negative to restore the equilibrium. The error correction coefficients in Table 5.6 indicate CCBC is likely to fully adjust within a year. Also, the estimated models show that there are about three iterations before convergence is achieved. The main virtue of the iteration method is that the last iteration provides the correct estimate of the asymptotic covariance matrix for the parameter estimator. Hence, the three iterations imply that it will take about three years, given the annual data used, before the estimated long run equilibrium can be achieved.

5.3.1. Effects of Supply and Demand Trade Channels on Cross-country Business Cycles, 1978-2012

This study disentangled the different effects of supply and demand channel on cross country business cycles. Depicted in Table 5.7 are the results of the different impacts of exports and imports on cross-country business cycles. It is noticed that some of the models did not perform well given the LLR chi-square test. The implication is that none of either supply (exports) or demand (imports) channel of trade is enough to transmit business cycles. The outcome in Table 5.7 reveals that only import penetration ratio does not synchronise business cycles significantly in the long run. Overall, 1% increase in import flows between selected members of ECOWAS and their trading partners generated about 0.3% reduction in the synchronisation of cross-country business cycles. This comes majorly from China. This implies two things; first, there is less production complementarities between Members of ECOWAS and their trading partners. Second, specialisation differs and trade is dominated by inter-industry trade.

The above phenomenon is widely documented in the existing literature, it is related to the fact that greater trade intensity between two countries can lead to either positive or negative spillover impact from one country's economic activity to another (Otto and Willard, 2001). A related argument is raised by Calderon *et al* (2007) to explain how the trade and business cycles synchronisation relationship may differ among country groups of various level of development. This argument cannot be divorced from comparative advantage and differences in specialization, suggesting that countries at different levels of development are likely to have dissimilar production structures, making business cycles more asynchronous through trade flows.

Table 5.7. Pooled Mean Group (PMG) estimates of trade supply and demand channels on cross-country business cycles

D(LOGCCBC)	ECOWAS and All Partners		ECOWAS and EU Partners		ECOWAS and China		ECOWAS and USA	
LONG RUN	Export	Import	Export	Import	Export	Import	Export	Import
LOGEXP	-4.140 (-1.13)	-	0.132 (0.71)	-	-0.321 (-1.83)*	-	-0.311 (-0.64)	-
LOGIMP	-	-0.283 (-2.26)**	-	-0.09 (-0.51)	-	-0.510 (-2.61)**	-	-0.307 (-0.64)
SHORT RUN								
EC	-0.944 (-34.19)***	-0.941 (-33.36)***	-0.964 (-34.25)***	-.9068 (-32.4)***	-0.934 (-6.71)***	-0.904 (-7.38)***	-0.968 (-15.51)***	-0956 (-16.88)***
D(LOGEXP)	1.069 (2.53)**	-	1.244 (2.22)**	-	0.122 (0.82)	-	0.478 (0.6)	-
D(LOGIMP)	-	1.410 (2.2)**	-	1.384 (1.74)*	-	1.807 (0.87)	-	0.605 (0.55)
_cons	3.558 (26.35)***	5.319 (27.58)***	0.321 (2.12)**	2.994 (19.09)***	4.597 (6.94)***	6.965 (6.56)***	6.06 (8.38)***	5.934 (12.51)***
Statistics								
Iterations Num.	3	3	2	3	4	5	3	3
Starting LL	3275.31	-3258.56	-2409.06	-2398.09	-386.65	-381.03	480.14	479.53
Log likelihood	3272.85	-3253.01	-2409.05	- 2397.20	-382.65	-375.54	479.69	479.05
LLR Chi2	4.92***	11.1***	0.02	1.78*	8.00***	10.98***	0.9	0.96
Observations	1160	1160	850	850	140	140	170	170

Source: Author's Computation

In the short run, positive relationship is noticed between members of ECOWAS and their trading partners with huge effects coming from the EU trading partners, this does not continue in the long run. The implication of this is clear, the more countries trade with one another the more they are likely to specialize and the more the business cycles are likely to be asynchronous (Krugman 1993).

5.4 Effects of Trade on Cross-country Country Business Cycles in the Periods of Slow and Rapid Growth

Partitioning growth episodes into two; period of growth disaster (1978-1994) and period of positive growth (1995-2012), regressions reported in Table 5.8 reveal further insight into trade and cross-country business cycles relationship. First, the adequacy of estimated models is evaluated.

The F-tests and rho values show that some significant percentage of the variance is due to differences across panels. Meaning that heterogeneity effects are important and there are unobserved effects making the pooled panel regression to be rejected. However, it is noticed that the heterogeneity effects are rather weak (given the rho values) indicating likelihood of homogeneity in trade and business cycles across the selected sampled countries. The choice of either fixed or random model was made using Hausman test. In cases where the Hausman chi-square is statistically insignificant, random effect is rejected in favour of fixed effect model. In addition, as indicated in Table 5.8, the cross test do not reject the null hypothesis of no cross-sectional dependence (CD) at 5% level, but does at 10% level in most cases. Included in the CD test was the *abs* option in the *xtcsd* command to obtain the average *absolute* correlations of the residuals which were very low and insignificant in most cases. There is no sufficient evidence suggesting the presence of cross-sectional dependence in under the fixed and random effect estimations in Table 5.8.

Further, Table 5.8 indicates that inter-industry trade influences synchronisation of business cycles positively across the entire trading partner between 1978 and 1994, this could not be traced to any particular partner. Between 1995 and 2012, it was found that inter-industry trade flows with EU only synchronises cross-country

Table 5.8. Effects of trade on cross-country business cycles in the 1978-1994 and 1995-2012 periods

	1978-1994				1995-2012			
	ECOWAS and All partners	**ECOWAS and EU Partners**	**ECOWAS and China**	**ECOWAS and USA**	**ECOWAS and All partners**	**ECOWAS and EU**	**ECOWAS and China**	**ECOWAS and USA**
LOG (CCBC)	FE	RE	FE	FE	RE	FE	FE	FE
LOG (INTRA)	0.183 (0.97)	0.051 (0.3)	-0.030 (-0.07)	0.243 (0.43)	0.011 (0.12)	-0.009 (-0.03)	-0.421 (-1.92)*	0.434 (0.75)
LOG (INTER)	0.826 (2.32)**	0.343 (0.97)	21.616 (1.89)*	1.557 (1.94)*	0.271 (1.22)	0.686 (2.2)**	-2.499 (-0.84)	0.249 (0.37)
LOG (TTRADE)	0.605 (1.25)	-0.018 (-0.12)	-4.455 (-2.24)**	-1.155 (-0.81)	-0.071 (-0.52)	0.050 (0.13)	-0.806 (-1.88)*	-0.110 (-0.15)
LOG (FDI_T)	0.154 (3.42)**	0.176 (3.62)***	-0.679 (-1.53)	0.211 (2.17)**	0.255 (2.35)**	0.528 (3.06)**	-0.102 (-0.15)	0.504 (1.01)
_CONS	-9.729 (-1.57)	-0.010 (0.00)	-49.663 (-0.97)	8.883 (0.51)	0.225 (0.09)	-4.535 (-0.8)	23.903 (1.72)*	-2.063 (-0.17)
STATISTICS								
Rho	0.51	0.40	0.38	0.47	0.43	0.44	0.50	0.41
F-test that all u_i=0	8.71**	-	6.40**	7.96**	-	5.52**	6.63**	5.89**
F/wald-statistics	4.72**	13.55***	2.67*	2.33*	14.57***	4.03**	3.72**	0.54
R2	0.01	0.03	0.23	0.02	0.02	0.02	0.17	0.03
Hausman test Chi2 (FE, RE)	8.74*	12.75**	2.78	3.66	12.83***	4.38	0.77	0.04
Pesaran's CD test	1.834*	1.793*	1.002	1.760*	1.294	1.767*	1.833*	1.756*
Friedman's CD test	1.889*	1.824*	1.657*	1.895*	1.756*	1.866*	1.879*	1.942*
Observations	539	425	29	85	622	450	82	90

Source: Author's computation

business cycles, with synchronisation of business cycles responding to inter-industry trade flows in an inelastic manner. Meanwhile, total trade flows with China continued to asynchronise the cross-country business cycles with ECOWAS, especially between 1978 and 1994. Nevertheless, this effect reduced between 1995 and 2012.

A measure of FDI inflows maintained similar positive pattern, synchronising cross-country business cycles between members of ECOWAS and the selected trading partners in the two periods, except with China. This has been previously acknowledged. Notably, it is noticed that USA FDI inflows was no longer significantly influencing synchronisation of cross-country business cycles between 1995 and 2012.

5.4.1. Effect of Supply and Demand Trade Channels on Cross-Country Business Cycles in the period of Slow and Rapid Growth

Similar to analysis in the heterogeneous panel estimations, Table 5.9 shows that only exports flows from ECOWAS depict significant negative effect on cross-country business cycles between 1978 and 1994, this is noticed particularly with China. Between 1995 and 2012, import and export flows from China generated unsynchronised business cycles. This is suggesting that exchanges of traded commodities between ECOWAS and China are inter-industry and hence does not spillover either to China's or ECOWAS business cycles. Overall, it is realised that increased import penetration from all trading partners generates asynchronous cross country business cycles. This is noticed especially between 1995 and 2012.

It is realised that most estimated models in this regards are not significant, suggesting that neither export nor import flows are sufficient to explain the observed cross-country business cycles among the selected countries. This is indicated by extremely low R-squared and insignificant F-statistics in most cases.

Table 5.9. Effects of supply and demand trade channels on cross-country business cycles in the 1978-1994 and 1995-2012 periods

	1978-1994							
LOGCCBC	**All Partners**		**EU Partners**		**China**		**USA**	
	1 (FE)	2 (FE)	1 (FE)	2 (FE)	1 (FE)	2(FE)	1(FE)	2(FE)
LOGIMP	0.065 (0.16)	-	0.837 (1.68)*	-	-1.417 (-1.9)*	-	-1.227 (-0.86)	-
LOGEXP	-	0.213 (0.76)	-	0.486 (1.35)	-	-0.123 (-2.23)**	-	-0.344 (-0.43)
_cons	0.948 (0.21)	-0.657 (-0.21)	-7.82 (-1.39)	-3.812 (-0.94)	16.024 (2.17)**	2.940 (0.7)	5.633 (0.6)	5.633 (0.6)
Statistics								
Rho	0.52	0.65	0.37	0.45	0.50	0.39	0.48	0.41
F-test that all u_i=0	6.65**	8.96**	4.34**	5.01**	5.48**	3.75**	7.21**	5.31**
F/wald-statistics	0.03	0.58	2.84*	1.81	3.63*	0.05	0.73	0.18
R2	0.001	0.00	0.00	0.00	0.06	0.01	0.00	0.00
Hausman test Chi2 (FE, RE)	0.18	0.83	3.37*	2.30	0.49	0.12	0.70	0.31
Pesaran's CD test	1.734*	1.693*	1.702*	1.690*	1.557	1.867*	1.683*	1.856*
Observations	565	565	425	425	55	55	85	85
	1995-2012							
LOGCCBC	**All Partners**		**EU Partners**		**China**		**USA**	
	1 (RE)	2 (FE)	1 (RE)	2 (FE)	1 (RE)	2 (FE)	1 (FE)	2(FE)
LOGIMP	-0.366 (-2.96)**	-	-0.534 (-1.71)*	-	-1.133 (-3.38)**	-	-0.529 (-0.9)	-
LOGEXP	-	-0.224 (-1.26)	-	0.073 (0.26)	-	-0.497 (2.1)**	-	0.026 (0.04)
_cons	6.430 (4.24)***	4.515 (2.21)**	8.351 (2.2)**	1.025 (0.31)	16.474 (3.82)**	6.988 (2.9)**	8.779 (1.22)	2.016 (0.28)
Statistics								
Rho	0.58	0.61	0.39	0.45	0.50	0.41	0.49	0.41
F-test that all u_i=0	6.62**	7.76**	4.33**	5.00**	5.47**	4.25**	5.21**	4.38**
F/wald-statistics	8.79**	1.58	2.93*	1.72	11.39**	4.42*	0.81	0.00
R2	0.01	0.01	0.00	0.00	0.13	0.08	0.02	0.01
Pesaran's CD test	1.889*	1.824*	1.657*	1.895*	1.756*	1.866*	1.879*	1.942*
Hausman test Chi2 (FE, RE)	4.55**	0.26	1.5	0.29	0.58	0.00	0.04	0.08
Observations	630	630	450	450	90	90	90	90

Source: Author's computation.

5.5. Assessment of Results with the Study's Objectives

The broad aim of this thesis is to examine the relationship between trade flows and cross-country business cycles between selected members of ECOWAS and the identified major trading partners between 1978 and 2012. Corresponding the broad aim are the specific objectives; these are to: estimate the effects of trade flows (total trade, inter-industry and intra-industry trade flows) and financial interdependence on ECOWAS business cycles; assess the effects of supply (export) and demand (import) channels on cross-country business cycles between members of ECOWAS and major trading partners; and analyse the effects of trade flows and financial interdependence on cross-country business cycles between members of ECOWAS and main trading partners in the periods of slow and rapid growth.

These objectives have been achieved given the results presented previously. It was found that total trade and FDI significantly affected the transmission of business cycles with elasticities of -0.5 and 0.2, respectively. This implied that a 1.0% increase in total trade reduced transmission of business cycles by 0.5%, while a 1.0% increase in FDI increased it by 0.2%. There were little variations across the major trading partners and other measures of trade flows. Intra-industry and inter-industry trade with China as well as inter-industry trade with the US had significant impacts of -0.7%, -5.7% and 1.4% on transmission of business cycles, respectively. The impact of FDI from EU and the US on transmission of business cycles was 0.2% each. Analysis by slow and rapid growth periods indicates that inter-industry trade had significant impact of 0.8% on transmission of business cycles between 1978 and 1994, but no significant impact during 1995 to 2012. Over the same periods, FDI had significant positive effects of 0.2% and 0.3% on transmission of business cycles, respectively.

CHAPTER SIX

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1. Summary of the Study

This thesis attempts to investigate the relationship between trade flows and cross-country business cycles between ECOWAS and their major trading partners. Hence, business cycles among the selected economies were based on constructed diffusion index, using seven series representing leading, coinciding, and lagging variables in business cycles, while a dynamic measure of cross-country business cycles was utilised.

This study was motivated by several factors; first, the objective of maintaining and enhancing regional economic stability will be partial without considering extra-regional trade flows, especially when regional economies are more open to non-regional countries. Also, it is commonly believed that development in one country may, depending on relative size and the degree of openness, can be transmitted to other countries suggesting the same way growth or development can be transmitted abroad; vulnerability can also be transmitted through trade flows. In addition to investigating the effects of trade flows on cross-country business cycles, the study looks at different effects of inter-industry and intra-industry trade flows, supply and demand of traded goods and financial interdependence on cross-country business cycles. Also, different estimations were done for the periods of slow (1978-1994) and rapid (1995 and 2012) growth.

In terms of sampling, five members of ECOWAS, namely Nigeria, Cote d'Ivoire, Ghana, Senegal and Togo were selected. These are relatively developed member state, they also accounted for significant proportion of total extra-ECOWAS trade flows. The major trading partners covered in the sample are Germany, Spain, France, UK, Netherlands, China and USA. These trading partners also accounted for significant

proportion of total extra-ECOWAS trade flows. The study covered between 1978 and 2012.

6.2. Conclusion

The impact of trade flows on cross-country business cycles was examined among the selected members of ECOWAS and the identified major trading partners utilising pooled mean group (PMG) estimator, which uses maximum likelihood framework. This approach follows the recent advances offered by Pesaran and Smith (1995) and Pesaran, Shin, and Smith (1997; 1999) in the estimation of heterogeneous panels with large N and large T. Thus, the study used new stata command, xtpmg, which estimated PMG estimator that relies on a combination of pooling and averaging of coefficients across cross sectional units.

The study finds that trade flows are insufficient to account for the observed correlated cross-country business cycles, except in the short run, financial interdependence does, but not in the short run. In line with studies such as Dellas (1986), Schmith-Grohe (1998) and Selover (1999), this study largely weakens the existence locomotive hypothesis through trade by showing that trade interdependence was insufficient to account for the observed increase in positive correlation of cross-country business cycles of selected members of ECOWAS with their trading partners. Nonetheless, it upholds the possibility of locomotive hypothesis through financial interdependence (FDI inflows). Regarding the FDI effect, the study's findings deviated from that of García and Ruiz (2007) that financial integration does not have positive impact on business cycles co-movement. Meanwhile, it is in line with Imbs (2006) that financially integrated economies have more synchronised cycles.

Trade flows is not completely irrelevant in explaining the observed business cycles correlation across trade flows' types and trading partners. For instance, the study found that inter-industry trade flows with the USA had potential of synchronising the cross-country business cycles. This supports the possibility of global value chains between selected members of ECOWAS and the USA in their specific areas of specialisation. In this case, there were scant evidence to support Krugman's (1993) argument and other

assertions and findings in the literature that higher inter-industry trade flows, which cause greater specialisation, asynchronise the business cycle correlation. Further, the study could not establish a positive relationship between intra-industry trade flows and synchronisation of business cycles (unlike studies such as Imbs, 2004; Rana, 2007; and Lee, 2010) except in the short run, with specific reference to China-ECOWAS intra-industry trade relationship.

Disaggregating trade flows into supply and demand channels indicate that none has sufficient impact on synchronising of business cycles. Finally, partitioning the study periods into pre-1995 and post-1995 show no significant different results from the estimation covering the entire sampled period results, except that trade flows elasticity of business cycles synchronisation reduce and become insignificant after 1994, while that of financial interdependence increases and become significant with all trading partners between 1995 and 2012.

6.3. Recommendations

In terms of policy, the estimated results show that members of ECOWAS are not vulnerable to the selected major trading partners through trade flows, except in some cases in the short run and the case of inter-industry trade flows with the USA. On one hand, this implies that business cycles crises of these trading partners are unlikely to have negative influence on ECOWAS' business cycles in the long run; although some effect may be felt in the short run through merchandise trade flows. On the other hand, it also becomes apparent that ECOWAS are unlikely to benefit from possible positive business cycles or technology spillover through merchandise trade flows with these partners. This is partly because merchandise trade flows (especially import flows) from these partners are dominated with trade in finished consumer goods which theoretically do not synchronise business cycles. Hence, depending on the objective of regional trade policymakers; if the objective is to enhance regional stability using trade as a tool with expectation of benefiting from technology spillover; trading with these partners (except in the case of inter-industry trade flows with the USA) may not help. At the same time, there is no enough evidence to support that ECOWAS will be vulnerable to these partners through merchandise trade flows since vital intermediate inputs do not dominate such trade flows.

This does not imply that they may not be vulnerable through other channels. For instance, the study found evidence to support financial interdependence potentially effects on synchronisation of cross-country business cycles. On one hand, ECOWAS may be vulnerable to the identified trading partners through financial interdependence. Th is suggesting that financial or business cycles crises of the identified trading partners may have unpleasant impact on the business cycles of ECOWAS. Therefore, if the objective of regional policy makers is to minimize regional instability, FDI inflows should be embraced with caution. On the other hand, if ECOWAS desire to benefit from technology spillover through FDI from the selected trading partners, FDI inflows with these partners will go a long way in helping to achieve it.

Further, given the objective of ECOWAS to enhance regional growth and stability, there is a need to have a mixture of policies that will encourage trade flows and FDI. Increase in inter-industry trade flows with the USA and FDI inflows may benefit ECOWAS region in terms of gaining from the technology spillover from these developed countries trading partners which may help the region to achieve its growth and developmental potentials. The region should also invest in critical sectors of the economy to compliment the FDI because relying solely on foreign direct investment in critical sector of the economy may have adverse effect on the stability of the region in a situation of financial or business cycles crises in the developed countries trading partners.

Finally, investment and inter-industry trade with the US as well as investment attraction from the EU should be sustained, while ECOWAS stand not to benefit from China's business cycles spillover.

6.4. Limitations of the Study

This study has raised a lot of vital and important issues that could not be addressed in a single study. Therefore, it may be useful to note some limitations and possible extensions associated with the current study. One of the important empirical findings of this study is that extra-ECOWAS trade flows do not synchronise cross-country business cycles with the major trading partners. The main feature of this study is that it is a macroeconomic

analysis of the impact of trade on cross-country business cycles. By implication, it means that aggregate economic data were utilised. Meanwhile, there are several subsectors making up this aggregate. Therefore, by not utilising subsectors analysis, some vital information might have been lost. Apparently, it would be useful to investigate this issue from sectoral angle. This may yield further interesting insights and results. Also, modelling with a larger sample size would be an improvement on the current study. This can be done using quarterly data since this study only concentrated on the yearly data from 1978 to 2012, due to the inadequate data for most of the variables for 2013 and beyond. Hence, further studies may extend to more recent years.

6.5. Suggestions for Further Research

Future studies are required to explore the relationship between trade flows and transmission of international business cycles. The future studies may expand or reduce the number of explanatory variables used in this study, while some variables could be substituted with others. In addition, other methodologies apart from those used in this study can be adopted. It is worth noting that the measure of financial linkages is rather narrow, that is, bilateral FDI. This measure may not fully capture the financial transmission of global shocks. Therefore, other studies may include other measures of financial linkages such as portfolio investment and international banking linkages. These suggestions are expected to provide a more detailed examination of the impact of trade and financial interdependence on cross-country cycles than what has been achieved in this study.

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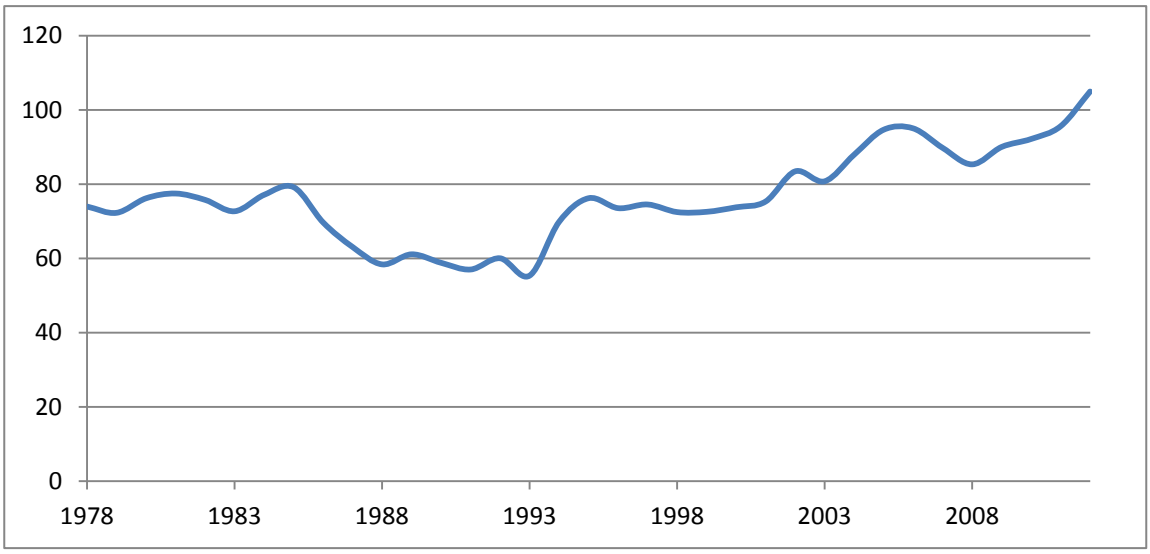
APPENDICES

Table A1. Major traded commodities among selected ECOWAS Member States (6-digit HS)

	S/N	Export	Import
Cote d'Ivoire	1	Other petroleum oils and preparations	Petroleum oils and oils obtained from bituminous minerals, crude
	2	Palm oil and its fractions refined but not chemically modified	Fish nes, frozen, excluding heading No 03.04, livers and roes
	3	Light petroleum oils and preparations	Butanes, liquefied
	4	Petroleum oils and oils obtained from bituminous minerals, crude	Light petroleum oils and preparations
	5	Petroleum bitumen	Cigarettes containing tobacco
Ghana	1	Butanes, liquefied	Petroleum oils and oils obtained from bituminous minerals, crude
	2	Beauty or make-up preparations nes; sunscreen or sun tan preparations	Cement clinkers
	3	Veneer, non-coniferous nes, less than 6 mm thick	Fish nes, frozen, excluding heading No 03.04, livers and roes
	4	Coffee husks and skins, coffee substitutes	Petroleum bitumen
	5	Panels, 1 outer ply coniferous wood nes	Onions and shallots, fresh or chilled
Nigeria	1	Petroleum oils and oils obtained from bituminous minerals, crude	Palm oil, crude
	2	Light petroleum oils and preparations	Palm oil and its fractions refined but not chemically modified
	3	Cigarettes containing tobacco	Cod dried, whether or not salted but not smoked
	4	Footwear, outer soles/uppers of rubber or plastics, nes	Plywood consisting solely of sheets of wood <= 6 mm thick, with at lea
	5	Float glass etc in sheets, non-wired coloured throughout the mass etc	Margarine, excluding liquid margarine
Senegal	1	Portland cement nes	Petroleum oils and oils obtained from bituminous minerals, crude
	2	Soups and broths and preparations thereof	Palm oil and its fractions refined but not chemically modified
	3	Other petroleum oils and preparations	Other petroleum oils and preparations
	4	Fish nes, frozen, excluding heading No 03.04, livers and roes	Lumber, tropical hardwood nes, sawn lengthwise >6mm
	5	Rice, broken	Soap&orgn surf prep,shapd,nes;papers&nonwovens impreg w soap/prep,nes
Togo	1	Cement clinkers	Other petroleum oils and preparations
	2	Portland cement nes	Butanes, liquefied
	3	Petroleum bitumen	Fish nes, frozen, excluding heading No 03.04, livers and roes
	4	Sacks and bags (including cones) of polymers of ethylene	Cigarettes containing tobacco
	5	Beauty or make-up preparations nes; sunscreen or sun tan preparations	Light petroleum oils and preparations

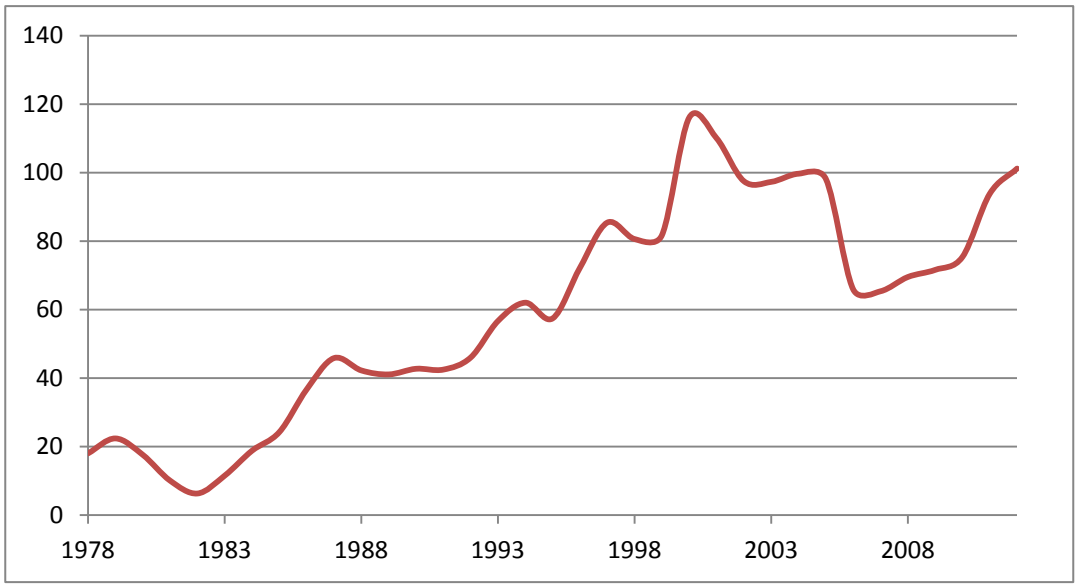
Source: Author's Compilation from ITC Trade map Statistics.

Figure A1. Cote d'Ivoire's level of trade openness



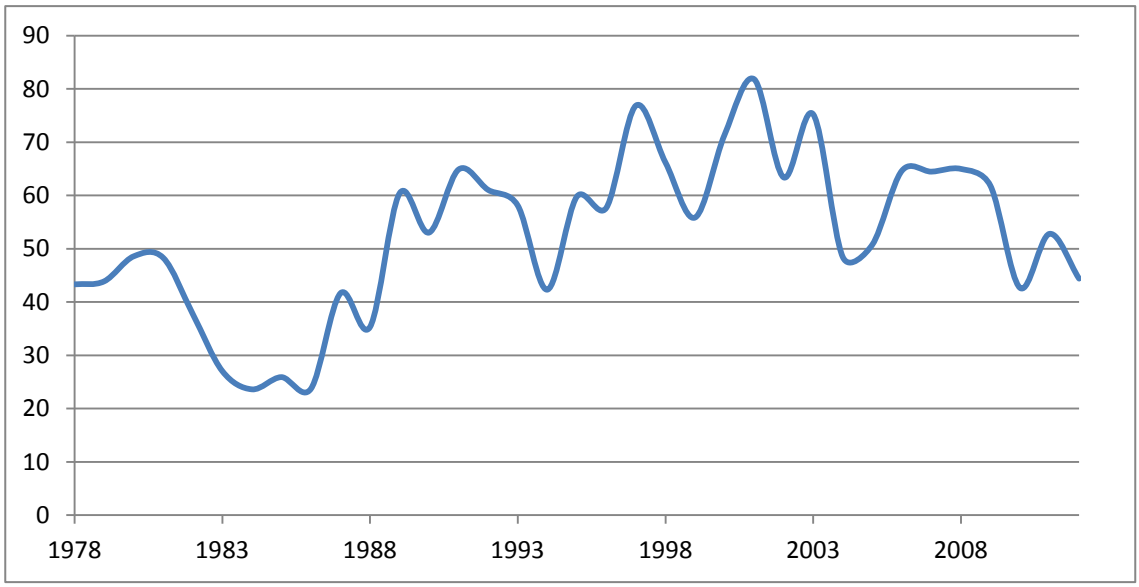
Source: Author's Computation based on WDI (2013)

Figure A2. Ghana's level of trade openness



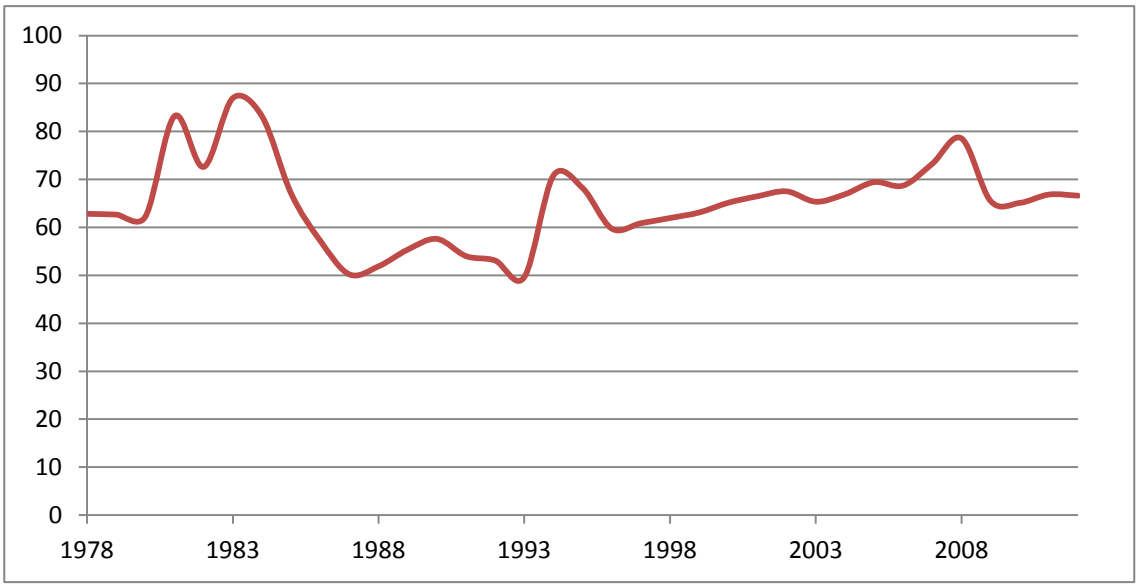
Source: Author's Computation based on WDI (2013)

Figure A3. Nigeria's level of trade openness



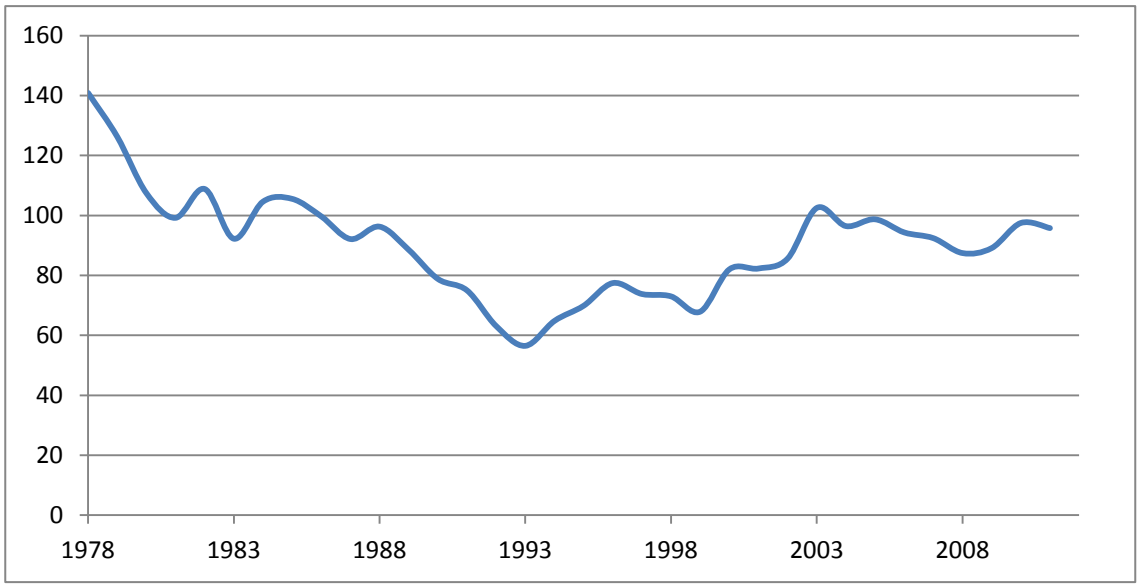
Source: Author's Computation based on WDI (2013)

Figure A4. Senegal's level of trade openness



Source: Author's Computation based on WDI (2013)

Figure A5. Togo's level of trade openness



Source: Author's Computation based on WDI (2013)

Table A2: **Market share of selected EU partners in total ECOWAS trade flows to EU**

Countries	**1978**	**1986**	**1996**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**1978-2012**
France (%)	25.4	27.0	26.7	21.7	19.7	20.8	21.9	21.4	21.1	17.3	24.9
Germany (%)	20.5	19.2	11.3	13.8	12.1	12.4	13.7	12.4	13.0	13.1	15.2
United Kingdom (%)	19.1	13.2	10.6	9.0	9.5	10.6	10.4	11.0	12.2	15.3	11.5
Netherlands (%)	12.7	8.1	9.1	11.8	14.9	15.0	18.4	20.1	19.2	19.7	10.8
Spain (%)	3.2	5.8	12.6	16.0	14.7	14.2	12.1	14.3	13.7	14.3	10.7
Sub-Group Total (%)	81.0	73.2	70.3	72.4	71.0	73.0	76.6	79.3	79.1	79.6	73.1
Sub-group Total (Billion US Dollars)	16.0	11.9	15.5	29.1	32.4	46.3	35.3	43.1	63.0	64.9	21.3
EU total (Billion US Dollars)	19.70	16.3	22.1	40.2	45.6	63.4	46.1	54.3	79.7	81.5	28.8

Source: Author's computation based of World integrated Trade Solution (WITS)

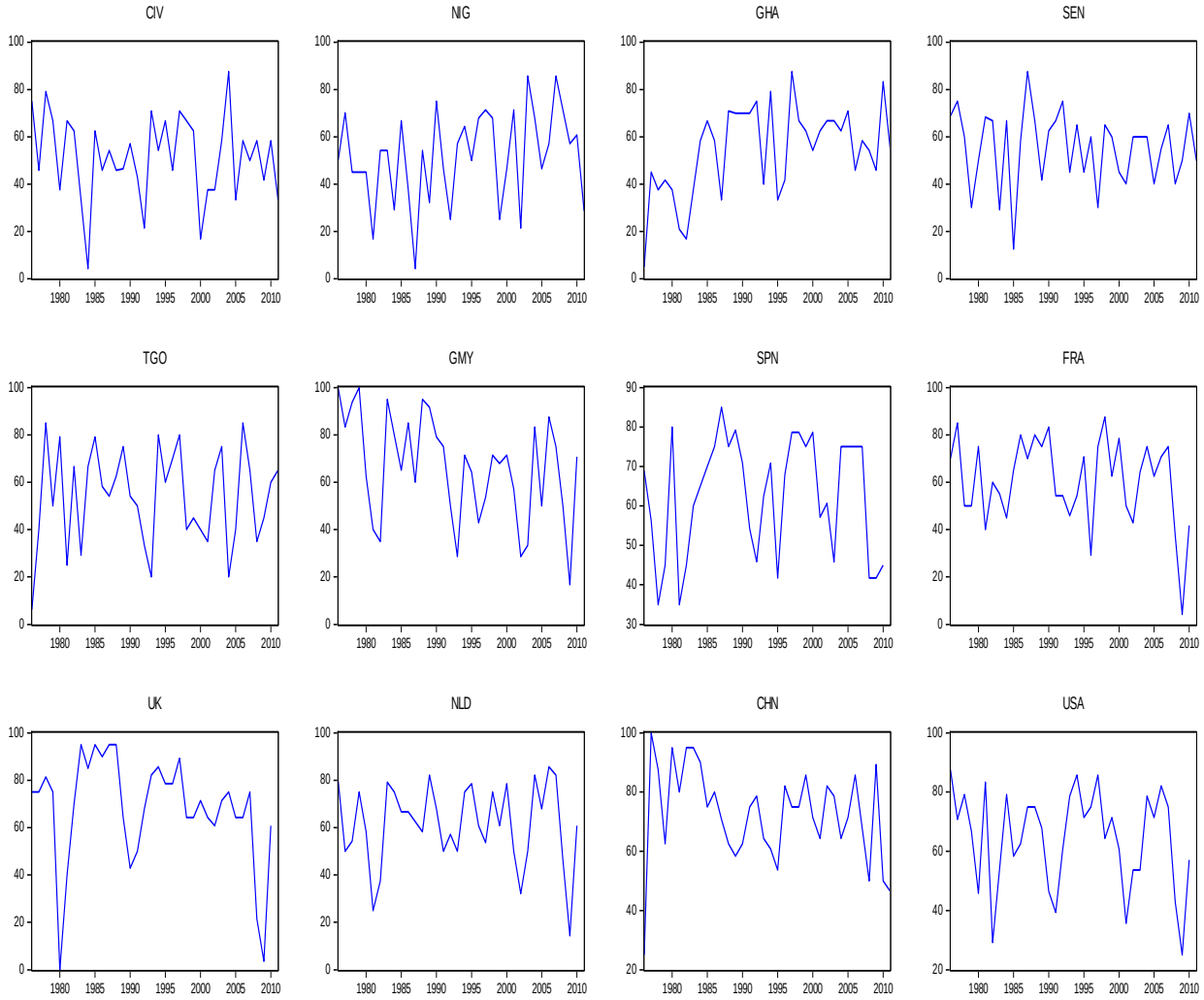
Table A3. Trade Flows (Billion US Dollars) with the identified major trading partners

Nigeria	Trading Partners	1978-1985	1986-1994	1995-2004	2005-2012	1978-2012
	Germany	3.16	1.68	1.25	4.14	2.42
	Spain	0.54	1.19	1.88	6.30	2.31
	France	2.87	1.23	1.68	5.18	2.58
	UK	2.35	1.12	1.09	3.91	1.99
	Netherlands	1.77	0.78	0.79	5.76	2.07
	USA	7.37	5.37	9.05	32.46	12.61
	China	0.003	0.06	0.89	6.63	1.67
	Trade with identified partners	18.06 (73.4%)	11.43 (71.4%)	16.63 (58.6%)	64.38 (58.7%)	25.65 (59.5%)
	Total Trade	24.61	16.01	28.38	109.71	43.10
Cote d'Ivoire						
	Germany	0.37	0.40	0.45	1.24	0.58
	Spain	0.16	0.21	0.30	0.40	0.26
	France	1.38	1.21	1.52	1.77	1.46
	UK	0.17	0.16	0.22	0.30	0.21
	Netherlands	0.27	0.35	0.54	1.00	0.52
	USA	0.51	0.36	0.54	1.20	0.63
	China	0.01	0.03	0.18	0.56	0.18
	Trade with identified partners	2.87 (68.8%)	2.73 (64.4%)	3.76 (51.1%)	6.47 (46.8%)	3.85 (52.6%)
	Total Trade	4.17	4.24	7.36	13.83	7.32
Ghana						
	Germany	0.16	0.34	0.29	0.50	0.32
	Spain	0.03	0.04	0.13	0.28	0.11
	France	0.04	0.10	0.26	0.95	0.31
	UK	0.31	0.42	0.53	0.82	0.51
	Netherlands	0.07	0.11	0.29	1.06	0.35
	USA	0.30	0.31	0.40	1.00	0.48
	China	0.002	0.03	0.19	2.17	0.52
	Trade with identified partners	0.91 (64.1%)	1.35 (63.4%)	2.10 (48.1%)	6.77 (47.0%)	2.61 (48.1%)
	Total Trade	1.42	2.13	4.37	14.40	5.43
Senegal						
	Germany	0.05	0.05	0.06	0.11	0.07
	Spain	0.05	0.08	0.12	0.24	0.12
	France	0.53	0.62	0.66	1.10	0.71
	UK	0.06	0.04	0.07	0.69	0.19
	Netherlands	0.05	0.04	0.06	0.33	0.11
	USA	0.05	0.07	0.09	0.18	0.09
	China	0.01	0.02	0.05	0.46	0.12
	Trade with identified partners	0.80 (67.2%)	0.93 (64.1%)	1.13 (45.6%)	3.12 (45.3%)	1.42 (48.3%)
	Total Trade	1.19	1.45	2.48	6.88	2.94
Togo						
	Germany	0.05	0.04	0.04	0.17	0.07
	Spain	0.02	0.04	0.02	0.08	0.04
	France	0.18	0.16	0.14	0.30	0.19
	UK	0.04	0.02	0.04	0.16	0.06
	Netherlands	0.10	0.05	0.04	0.41	0.14
	USA	0.03	0.03	0.03	0.19	0.06
	China	0.003	0.05	0.15	1.49	0.37
	Trade with identified partners	0.42 (68.9%)	0.41 (56.9%)	0.46 (34.3%)	2.78 (46.6%)	0.93 (44.7%)
	Total Trade	0.61	0.72	1.34	5.97	2.08

Source: Author's computation based on World Integrated Trade Solution (http://wits.worldbank.org)

Note: Shares of each selected ECOWAS Member States in total ECOWAS trade with the identified partners are in parentheses.

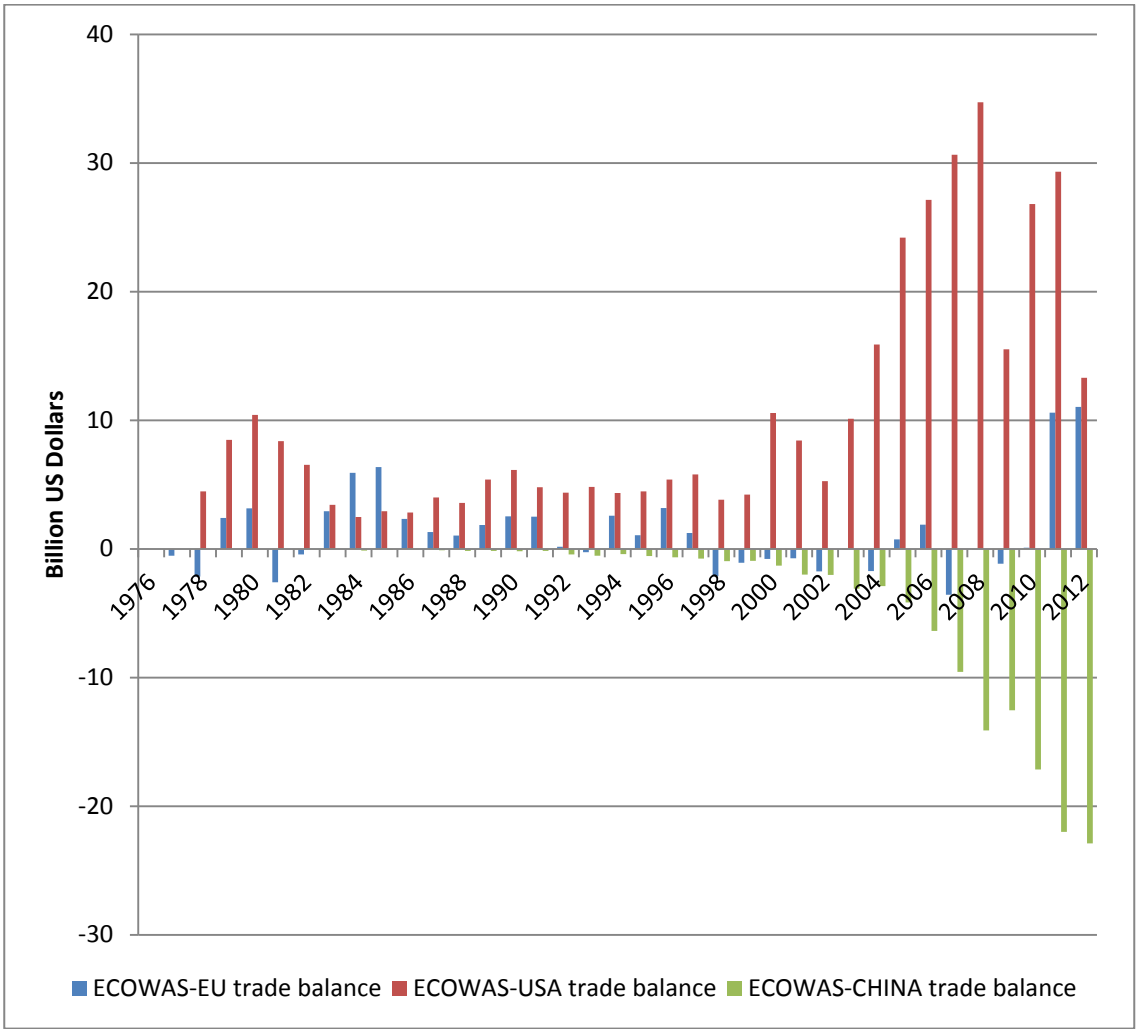
Figure A6. Business cycles (diffusion indexes) of the selected countries



Source: Author's Computation Based on WDI, 2013.

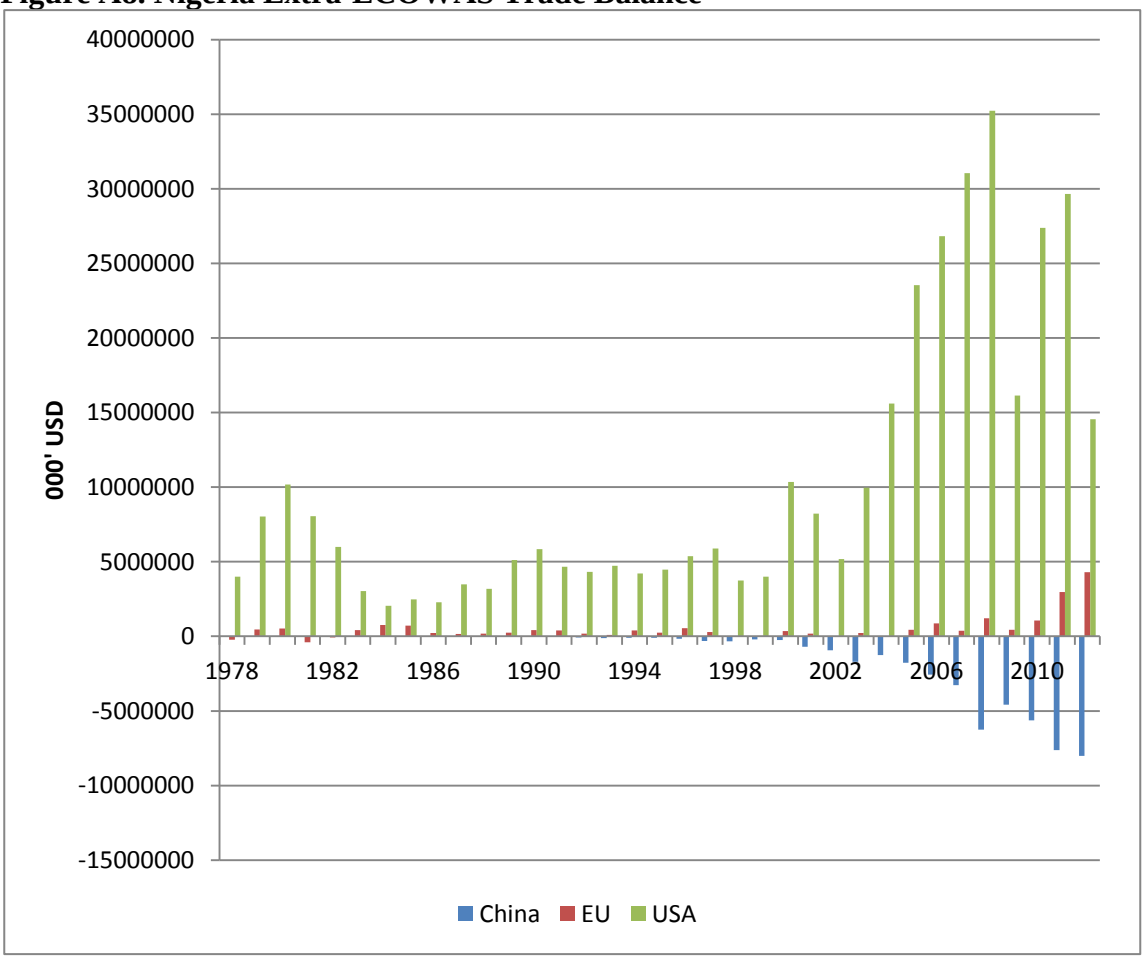
Note: CIV, NIG, GHA, SEN, TOG, GMY,SPN, FRA, UK, NLD, CHN, USA represents respectively, Cote d'Ivoire, Nigeria, Ghana, Senegal, Togo, Germany, Spain, France, United Kingdom, Netherlands, China and United States of America.

Figure A7. Aggregate extra-ECOWAS trade balance



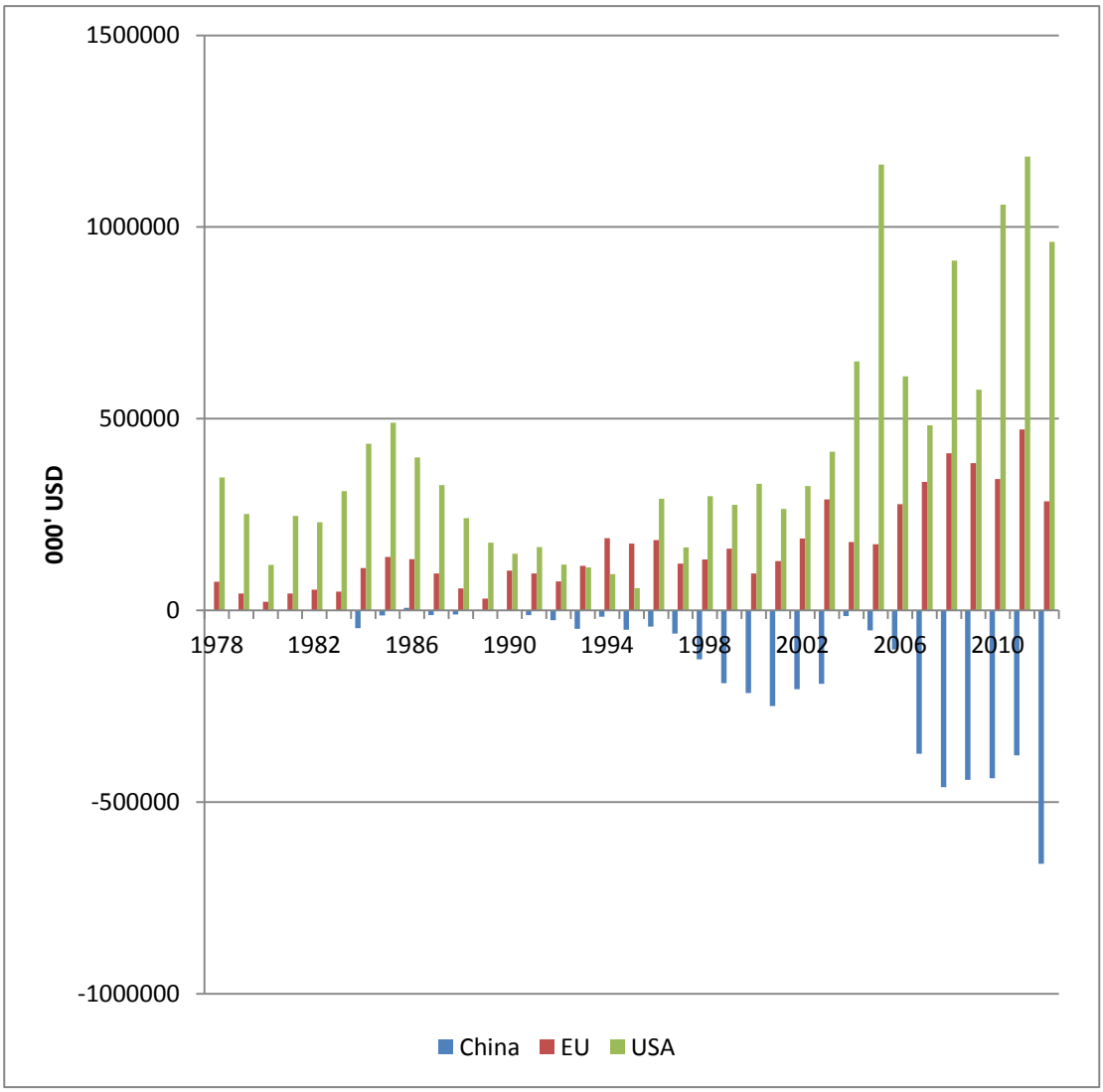
Source: Author's Computation from World Integrated Trade Solution (http://wits.worldbank.org)

Figure A8. Nigeria Extra-ECOWAS Trade Balance



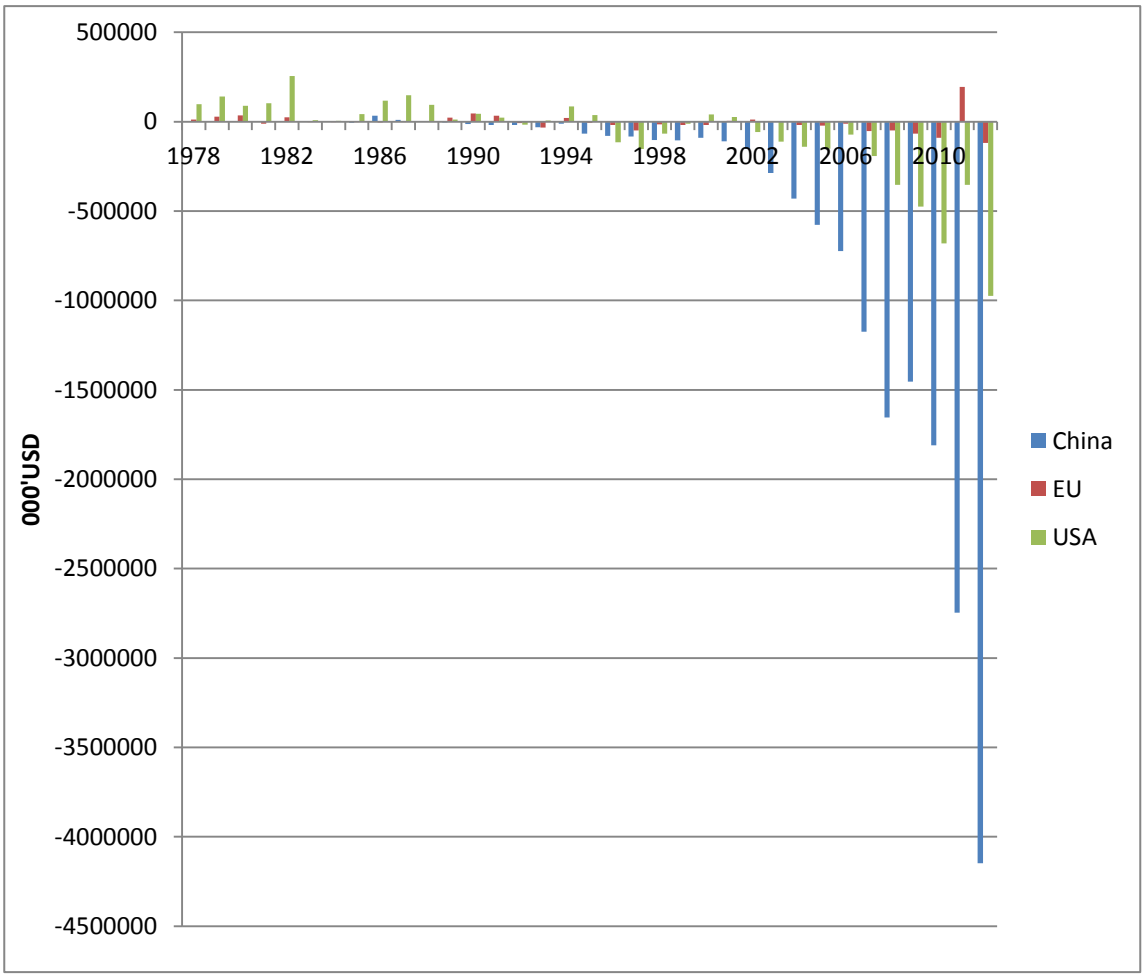
Source: Author's Computation from World Integrated Trade Solution (http://wits.worldbank.org)

Figure A9. Cote d'Ivoire extra-ECOWAS trade balance



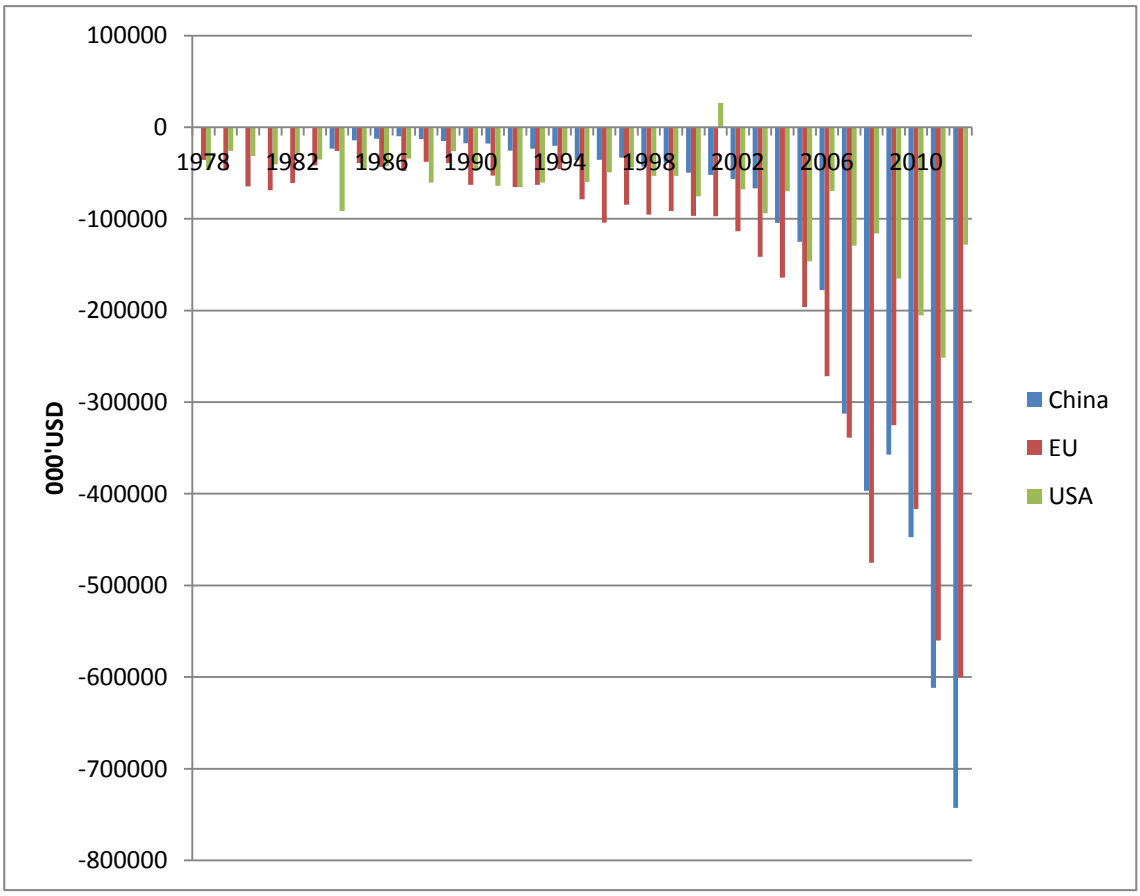
Source: Author's Computation from World Integrated Trade Solution (http://wits.worldbank.org)

Figure A10. Ghana extra-ECOWAS trade balance



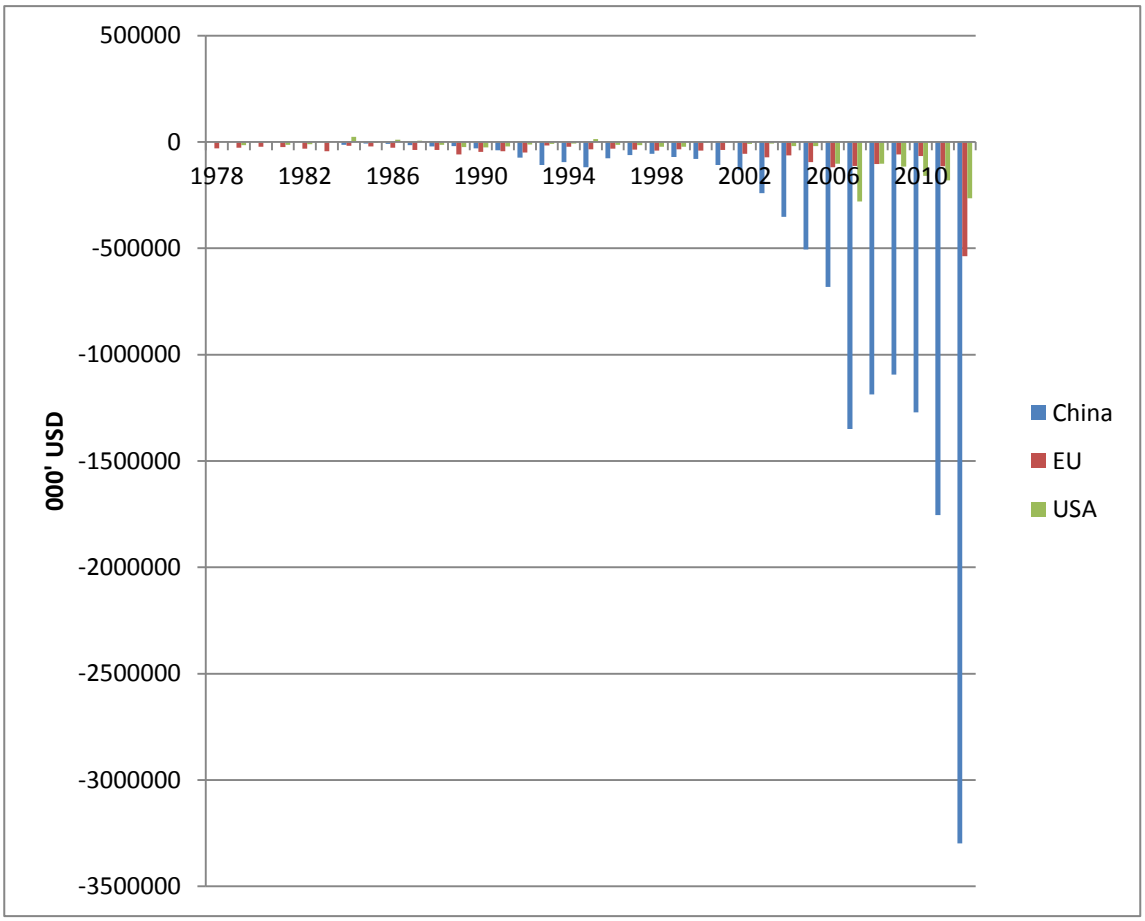
Source: Author's Computation from World Integrated Trade Solution (http://wits.worldbank.org)

Figure A11. Senegal extra-ECOWAS trade balance



Source: Author's Computation from World Integrated Trade Solution (http://wits.worldbank.org)

Figure A12. Togo extra-ECOWAS trade balance



Source: Author's Computation from World Integrated Trade Solution (http://wits.worldbank.org)

Table A4i. List of commodities flow surveyed, data by 2-digit SITC, revision 2

S/N	SITC 2-Digit	Product Description
1	2	Dairy products
2	4	Cereal preparations
3	6	Sugar,sugar preparations
4	7	Coffee,tea,cocoa,spices,manufactures thereof
5	9	Miscel.edible products and preparations
6	11	Beverages
7	12	Tobacco and tobacco manufactures
8	33	Petroleum,petroleum products and related materials
9	34	Gas,natural and manufactured
10	35	Electric current
11	41	Animal oils and fats
12	42	Fixed vegetable oils and fats
13	43	Animal-vegetable oils-fats, processed and waxes
14	51	Organic chemicals
15	52	Inorganic chemicals
16	53	Dyeing,tanning and colouring materials
17	54	Medicinal and pharmaceutical products
18	55	Essential oils & perfume mat.;toilet-cleansing mat
19	56	Fertilizers,manufactured
20	57	Explosives and pyrotechnic products
21	58	Artif.resins,plastic mat.,cellulose esters/ethers
22	59	Chemical materials and products,n.e.s.
23	61	Leather,leather manuf.,n.e.s.and dressed furskisg
24	62	Rubber manufactures,n.e.s.
25	63	Cork and wood manufactures (excl.furniture)
26	64	Paper,paperboard,artic.of paper,paper-pulp/board
27	65	Textile yarn,fabrics,made-upart.,related products
28	66	Non-metallic mineral manufactures,n.e.s.
29	67	Iron and steel
30	68	Non-ferrous metals
31	69	Manufactures of metal,n.e.s.

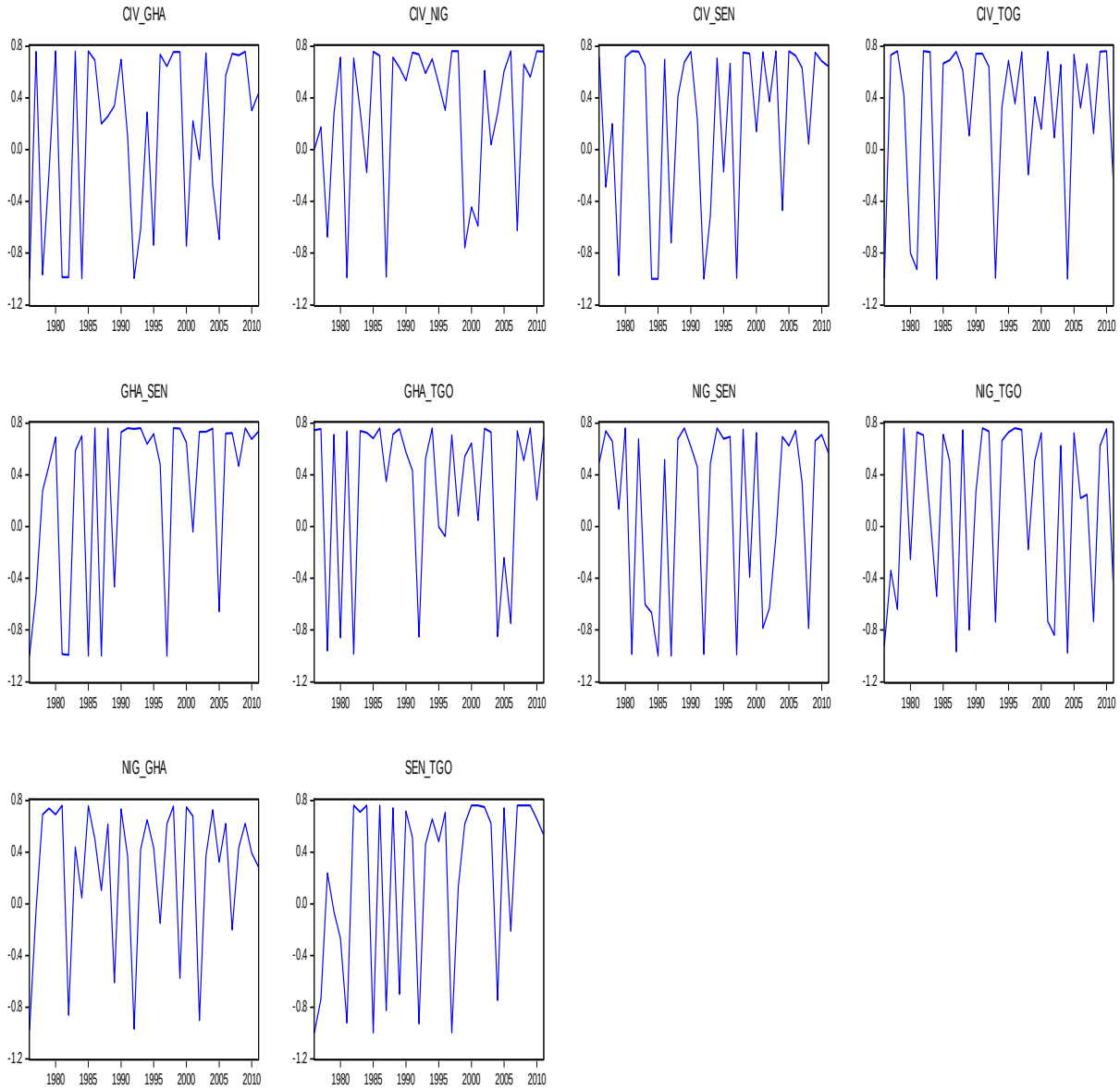
Source: Author's Survey Based on Word Integrated Trade Solution Data Base

Table A4ii. List of commodities flow surveyed, data by 2-digit SITC, revision 2

S/N	SITC 2-Digit	Product Description
32	71	Power generating machinery and equipment
33	72	Machinery specialized for particular industries
34	73	Metalworking machinery
35	74	General industrial machinery & equipment,and parts
36	75	Office machines & automatic data processing equip.
37	76	Telecommunications & sound recording apparatus
38	77	Electrical machinery,apparatus & appliances n.e.s.
39	78	Road vehicles (incl. air cushion vehicles
40	79	Other transport equipment
41	81	Sanitary,plumbing,heating and lighting fixtures
42	82	Furniture and parts thereof
43	83	Travel goods,handbags and similair containers
44	84	Articles of apparel and clothing accessories
45	85	Footwear
46	87	Professional,scientific & controling instruments
47	88	Photographic apparatus,optical goods,watches
48	89	Miscellaneous manufactured articles,n.e.s.

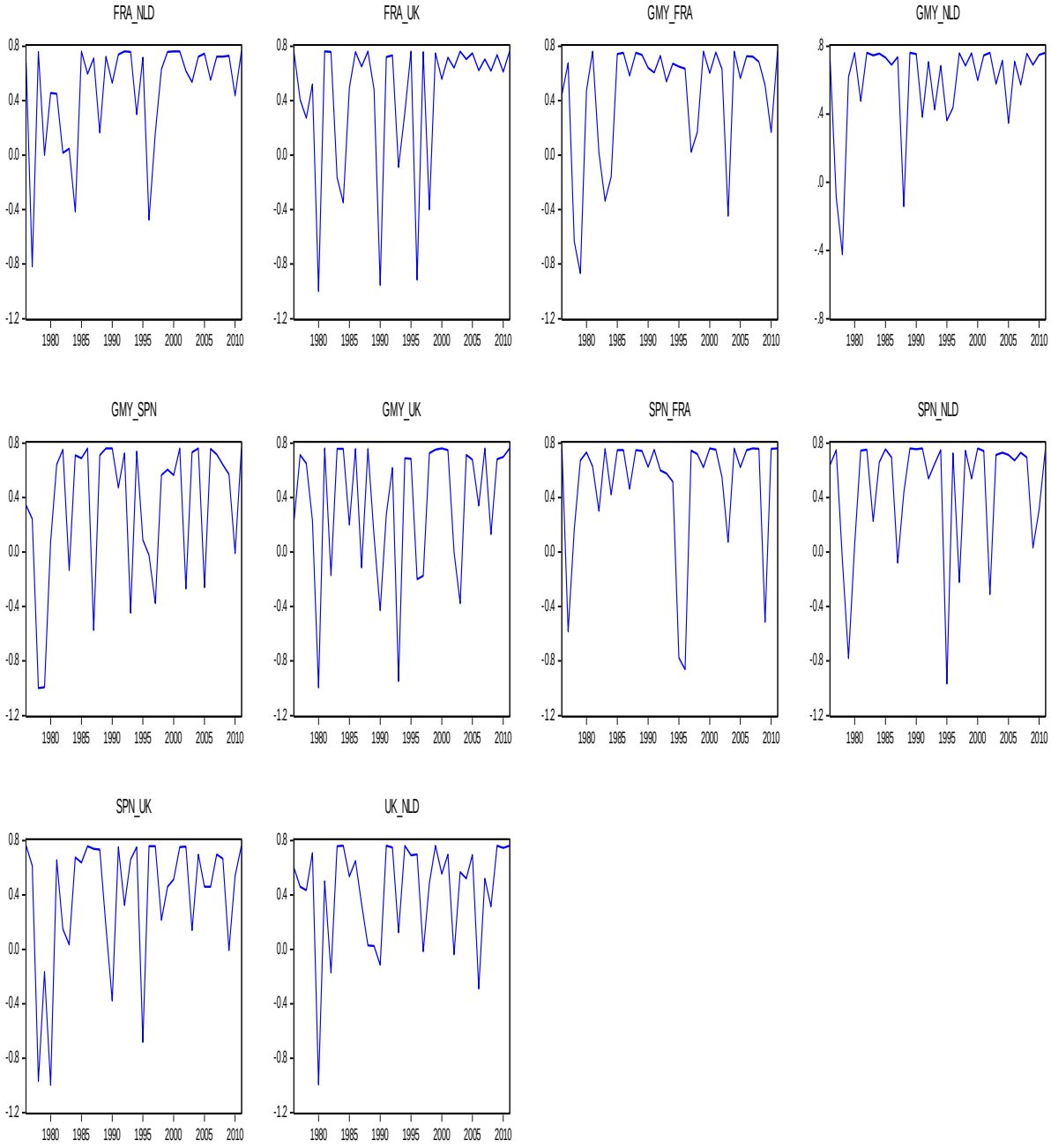
Source: Author's Survey Based on Word Integrated Trade Solution Data Base

Figure A13. Year-by-Year cross-country business cycles among ECOWAS Member States



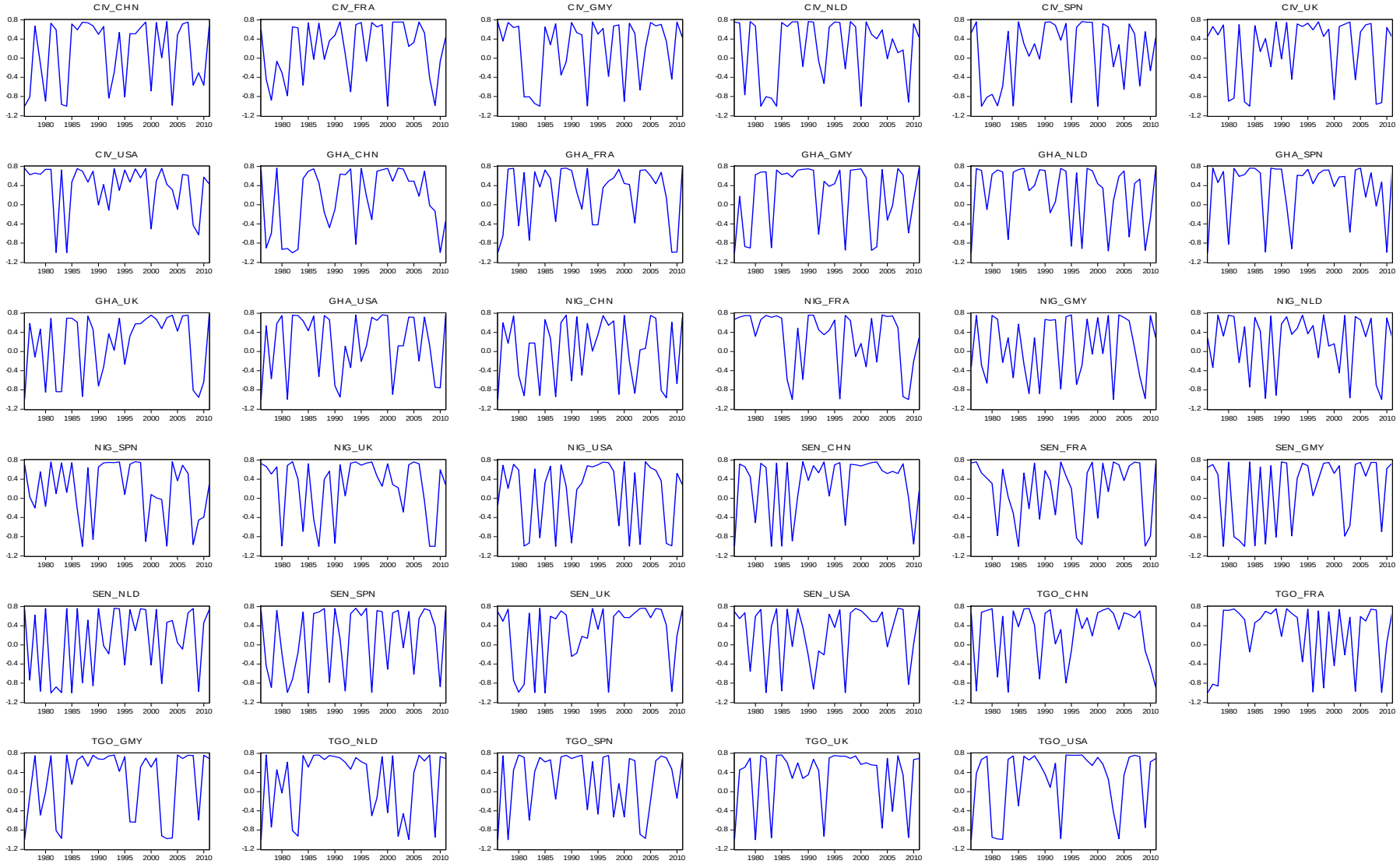
Source: Author's Computation.

Figure A14. Cross-country business cycles among selected EU Member States



Source: Computed.

Figure A15. Dynamic cross-country business cycles among ECOWAS Member States and major trading partners



Source: Computed

Table A5. **Correlation between pairs of Transformed Variables**

	CCBC	LOGCC_T	FDI	LOGFDI_T
CCBC	1.00			
LOGCCBC_T	0.97	1.00		
P-value	0.00			
FDI	0.05	0.06	1.00	
P-value	0.15	0.08		
LOGFDI_T	0.17	0.15	0.65	1.00
P-value	0.00	0.00	0.00	

Source: Computed