ECONOMIC CONVERGENCE AMONGST ECOWAS MEMBER COUNTRIES: THE ROLE OF FOREIGN DIRECT INVESTMENT

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ABSTRACT

The phenoma of per capita income convergence has a lot of welfare implications. FDI is identified as a principal candidate for technology transfer to developing countries. However, the distribution of FDI is observed to be highly skewed in favour of limited number of countries. Africa in general, and ECOWAS in particular, perfromed poorly in FDI attraction compared to other countries. ECOWAS is also characterized by huge within group gap both in terms of FDI and real GDP per capita. Using data spanning from 1970 – 2014, this study investigates the relationship between real GDP per capita and FDI for a sample of 15 ECOWAS countries. The study employs SURADF procedure to investigate on absolute convergence within each income group as well as convergence within ECOWAS at large. It is observed that seven economies tend to converge to the group average real GDP per capita, of which only one is a low-income. On the speed of convergence, the study reveals that relatively poor economies tend to catch up with relatively richer economies in the group at 1.10 percent, a rate considered very slow. The study further reveals that FDI plays a significant role in facilitating per capita income convergence amongst ECOWAS member states. Investigation of the role of FDI in attaining across group convergence for ECOWAS and each income group also yields results showing a sharp difference between the two income groups. Low income countries have positive and significant relationship between FDI and convergence as opposed to the case of lower middle income. The policy implications of these findings is that ECOWAS countries need to implement policies that would aid FDI attraction as well as ensure adequate absorptive capacity, which is an important condition to reap the benefits of FDI.

Keywords: GDP per capita, convergence, FDI, ECOWAS, SURADF

ABSTRAK

Fenomena penumpuan pendapatan per kapita mempunyai banyak implikasi dari aspek kebajikan. FDI dikenal pasti sebagai penyumbang utama pemindahan teknologi kepada negara-negara sedang membangun. Walau bagaimanapun, pengagihan FDI didapati sangat condong ke arah beberapa buah negara tertentu sahaja. Afrika secara umumnya, dan negara-negara ECOWAS secara khususnya didapati agak lemah dalam aspek tarikan FDI berbanding negara-negara lain. ECOWAS juga dicirikan mempunyai jurang yang besar dalam kumpulan dari segi FDI dan KDNK per kapita. Dengan menggunakan data yang terangkum sejak tahun 1970 hingga tahun 2014, kajian ini menyelidik hubungan antara KDNK per kapita dan FDI bagi sampel 15 negara ECOWAS. Kajian ini menggunakan prosedur SURADF untuk menyelidik penumpuan mutlak dalam setiap kumpulan pendapatan serta penumpuan dalam ECOWAS secara amnya. Dapatan kajian mendapati terdapat tujuh ekonomi tertumpu kepada purata pendapatan KDNK per kapita sebenar, dan hanya satu didapati berpendapatan rendah. Dari segi kelajuan penumpuan, kajian ini mendapati bahawa negara berekonomi lemah cenderung untuk mengejar negara berekonomi lebih kukuh dalam kumpulannya pada kadar 1.10 peratus, yang mana dianggap sebagai sangat perlahan. Kajian ini seterusnya mendedahkan bahawa FDI memainkan peranan penting dalam memudahkan penumpuan terhadap pendapatan kapita dalam kalangan negara anggota ECOWAS. Penyelidikan terhadap peranan FDI terhadap penumpuan kepada keseluruhaan kumpulan ECOWAS dan pendapatan setiap kumpulan juga menghasilkan keputusan yang menunjukkan perbezaan yang jelas. Negara yang berpendapatan rendah mempunyai hubungan yang positif dan signifikan antara FDI dan penumpuan yang mana bertentangan dengan negara yang berpendapatan sederhana rendah. Implikasi dasar penemuan ini adalah negara ECOWAS perlu melaksanakan dasar-dasar yang dapat membantu tarikan FDI serta memastikan keupayaan penyerapan yang mencukupi memandangkan hal ini merupakan keadaan yang penting untuk meraih faedah daripada FDI.

Kata kunci: KDNK per kapita, penumpuan, FDI, ECOWAS, SURADF

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LIST OF ABBREVIATIONS

Abbreviation	Full Meaning
ADF	Augmented Dickey-Fuller
DCs	Developed Countries
ECOWAS	Economic Community of West African States
EEC	European Economic Community
EU	European Union
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
IPS	Im, Pesaran and Shin
LDCs	Less Developed Countries
LI	Low Income
LM	Lagrange Multiplier
LMI	Lower Middle Income
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Squares
RFDI	Real Foreign Direct Investment
RGDP	Real Gross Domestic Product
SSA	Sub-Saharan Africa
SURADF	Seemingly Unrelated Regression Augmented Dickey-Fuller
UNCTAD	United Nations Conference on Trade and Development
UNECE	United Nations Economic Comparison for Europe
USA	United States of America
USD	United States Dollars
WAC	West African Countries
WDI	World Development Indicators

CHAPTER ONE

INTRODUCTION

1.1 Introduction

This chapter consists of ten sections. It serves the purpose of introducing the entire research. Section 1.2 provides background and motivation for conducting the study. While Section 1.3 consists of problem statement, Section 1.4 presents a number of research questions which are translated into objectives of the study as contained in Section 1.5. Significance of the study is provided in Section 1.6. Study area is highlighted in Section 1.7. Scope of the study is highlighted in Section 1.8. Finally, while Section 1.9 explains organization of chapters for the entire research, Section 1.0 concludes the chapter.

1.2 Background and Motivation of Study

Issues surrounding economic growth, its determinants and convergence[1] among countries of the world and regions have received remarkable attention of researchers (Crespo-Cuaresma, Foster & Stehrer, 2011). Beside its human welfare effects, the phenomenon of income/growth convergence is considered as an avenue to testing the validity of alternative economic growth theories (Islam, 2003). Despite the re-emergence of interest in the debate on growth convergence and its determinants, consensus among economists appears to be impossible. In the view of United Nations

[1]The term convergence refers to an economic phenomenon where poor countries tend to grow faster than the richer ones over the long run. Convergence is said to be absolute or unconditional when the gap in the output growth between richer and poor countries vanishes over time regardless of the differences in observable characteristics of the countries. On the contrast, convergence is regarded as conditional if the reduction in the gap depends on certain observable characteristics of the countries.

Economic Comparison for Europe (UNECE) (2000), despite the fact that the discipline of economics revolves around the subject of growth, there is seemingly a failure from the side of economist in providing clear policy guidelines for achieving long-term growth. According to UNECE, researchers in the field have not yet provided clear answers to obviously simple 'practical questions' relating to output growth.

Neoclassical growth theory by Solow (1956) maintains a proposition that poor countries would grow faster than the richer ones to a point where convergence in growth would take place. In view of this proposition, a lot of literature directed towards testing this hypothesis evolved. Such studies include Maddison (1983), Barro (1991) and more recently Kumar (2011), Fakthong (2012) and Miron and Alexe (2014).

Contrary to the position of Neoclassical growth model that presumes convergence among countries irrespective of the structural characteristics of countries; new growth models are pessimistic about absolute convergence, rather the theories consider human capital and technological progress as endogenous and necessary ingredients for growth (Silvestriadou & Balasubramanyam, 2000). In the view of Romer (1986) and Lucas (1988), inclusion of human capital and technological progress as endogenous variables to the system of new growth models handles the issue of diminishing return on capital investments in capital-abundant nations and hence maintains that convergence is conditional.

Regardless of what the source of poor countries is in achieving convergence, it appears there is no evidence that low-income countries in the Western region of Africa are catching up with lower middle-income countries in the same region. For instance, as

contained in Table 1.1, for the period 1971 – 2014, the ratio of real Gross Domestic Product (GDP) per capita of lower middle-income countries to that of low-income ones has been increasing, indicating a paradox or a kind of deviation from the theory.

Table 1.1
5-*Year Average of Annual Real GDP per Capita for WAC, 1970 – 2014*

Period	Income Level		Ratio of Lower Middle-Income to Low-Income
	Low Income	Lower Middle-income	
1971 – 1975	405.85	934.37	2.30
1976 – 1980	412.99	943.86	2.29
1981 – 1985	391.17	861.37	2.20
1986 – 1990	380.81	883.05	2.32
1991 – 1995	345.43	896.65	2.60
1996 – 2000	341.99	1,004.02	2.94
2001 – 2005	365.22	1,154.18	3.16
2006 – 2010	387.03	1,378.19	3.56
2011 – 2014	416.68	1,512.24	3.63

Source: Author's computations using WDI, 2014

Another commonly used indicator to gauge the existence or otherwise of convergence among a cross section of countries is computing the standard deviation (an indicator of dispersion) of real GDP per capita growth for each year. Using this indicator also reveals a similar result of absence of convergence among West African Countries (hereafter, WAC).

Figure 1.1 depicts graphical representation of standard deviations of real GDP per capita for 15 WAC for the period of 1970 – 2014. As can be observed from Figure 1.1, the standard deviation has been growing throughout the period under review. From statistics point of view, this trend has the implication that dispersion or variation in the series grows over time. Such situations are worrisome as they indicate absence of convergence across countries.

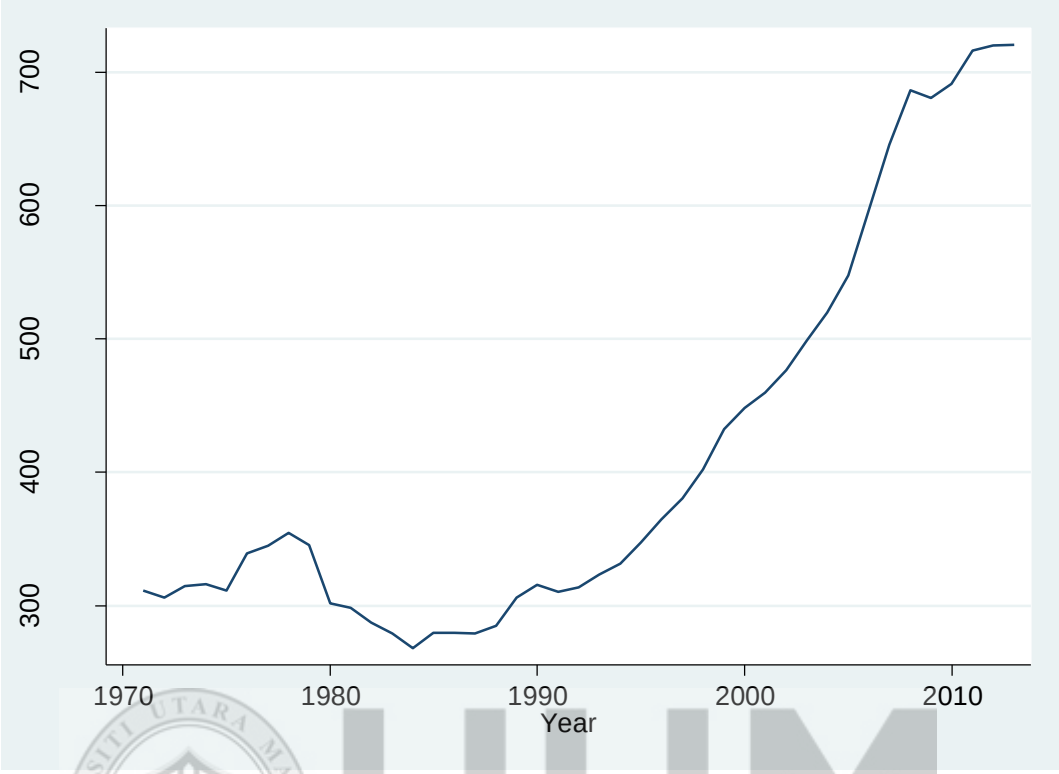


Figure 1.1
Standard Deviation of Real GDP per Capita among WAC, 1970 – 2014

Amazingly, absence of convergence between the group of low-income of WAC and that of lower middle-income ones is not the only situation; rather there is apparent lack of convergence even within the group of low-income countries. For clarity purposes, Table 1.2 is generated and presented to portray the degree of per capita divergence among low-income of WAC. The table displays the ratio of real GDP per capita for country with highest per capita to that of one with lowest real GDP per capita for each year. Looking at the sixth column of Table 1.2, one would come up with the understanding that the lowest ratio for the period under review is by a factor of 1.69 in 1988 with highest being 8.89 in 1995.

Table 1.2
Real GDP Per Capita Ratio (Richest to Poorest Country among Low-Income WAC, 1971–2013

Year	Low-Income (LI)		Lower Middle-Income (LMI)		Ratio - Highest to Lowest	
	Lowest	Highest	Lowest	Highest	LI	LMI
1971	224.75	600.42	732.28	1,372.05	2.67	1.22
1972	234.19	604.18	749.17	1,365.45	2.58	1.24
1973	227.05	564.98	691.48	1,380.77	2.49	1.22
1974	219.92	575.69	699.46	1,375.09	2.62	1.21
1975	241.46	559.34	683.58	1,421.32	2.32	1.22
1976	255.91	544.50	646.81	1,533.00	2.13	1.19
1977	262.86	562.42	650.71	1,572.24	2.14	1.16
1978	273.73	605.18	673.29	1,667.29	2.21	1.11
1979	273.73	625.32	664.58	1,633.21	2.28	1.06
1980	277.45	579.87	652.12	1,392.03	2.09	1.12
1981	274.40	526.33	611.46	1,379.88	1.92	1.16
1982	273.33	488.90	550.78	1,325.15	1.79	1.13
1983	267.80	473.78	507.65	1,221.70	1.77	1.07
1984	255.49	482.57	532.91	1,141.83	1.89	1.10
1985	270.19	484.87	542.14	1,147.82	1.79	1.12
1986	272.59	481.02	553.53	1,141.88	1.76	1.15
1987	273.64	478.89	563.87	1,155.35	1.75	1.18
1988	281.82	477.20	579.61	1,213.28	1.69	1.21
1989	282.15	483.60	592.83	1,267.41	1.71	1.23
1990	198.64	494.39	595.99	1,255.28	2.49	1.21
1991	173.42	491.85	610.19	1,245.75	2.84	1.24
1992	114.65	485.83	616.30	1,251.54	4.24	1.27
1993	77.70	484.62	619.81	1,306.84	6.24	1.28
1994	60.40	488.68	619.45	1,360.05	8.09	1.27
1995	56.14	498.88	631.17	1,425.49	8.89	1.27
1996	59.56	510.26	647.13	1,486.23	8.57	1.27
1997	114.17	531.49	651.05	1,566.14	4.66	1.22
1998	136.92	492.95	673.02	1,664.55	3.60	1.37
1999	157.00	504.33	696.10	1,826.67	3.21	1.38
2000	187.10	512.95	703.14	1,922.82	2.74	1.37
2001	220.30	527.87	716.64	2,002.86	2.40	1.36
2002	258.80	533.38	702.53	2,070.42	2.06	1.32
2003	187.33	535.95	729.49	2,131.18	2.86	1.36
2004	174.38	534.74	751.70	2,191.24	3.07	1.41
2005	185.94	532.61	772.60	2,309.39	2.86	1.45
2006	203.88	535.50	770.29	2,526.24	2.63	1.44
2007	216.44	543.29	786.46	2,734.68	2.51	1.45
2008	240.47	553.66	793.18	2,910.91	2.30	1.43
2009	259.53	551.92	789.94	2,867.64	2.13	1.43
2010	272.70	549.99	799.84	2,898.44	2.02	1.45
2011	268.48	552.59	789.90	2,995.32	2.06	1.43
2012	286.99	566.69	792.93	3,008.77	1.97	1.40
2013	287.48	582.86	788.58	2,997.28	2.03	1.35

Source: World Development Indicators (Author's computation)

More so, looking at same Table 1.2, the trend of ratio for the low-income countries can be divided into two trends: The first trend covering 1992 – 1998 is evident by extremely high ratios. Investigation on this abnormality reveals that the trend emanated from the very awful real GDP per capita recorded by Liberia. The country suffered two civil wars fought during the periods 1989 – 1996 and 1999 – 2003. The second trend for the low income group can be observed from the periods 1971 – 1991 and 1999 – 2013. These periods are characterised by relatively less volatile ratios, with the highest being 2.84 (1991) and 3.21 (1999).

On the contrast, similar ratios for the group of lower middle-income countries show upward trend throughout the period under review (see Figure 1.2 for the plot of ratios and seventh column of Table 1.2 for of lower middle-income countries).

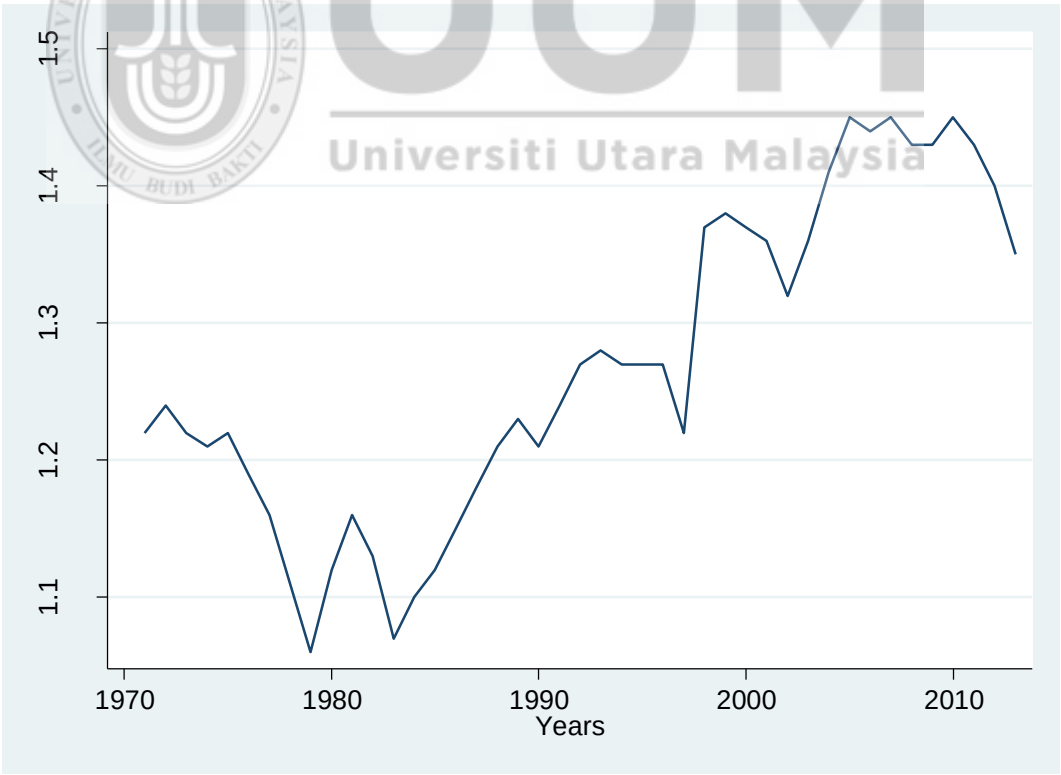


Figure 1.2
Ratio of Real GDP per Capita of Richest Country to the Poorest among Lower Middle-Income of WAC, 1970 – 2014

Endogenous growth theories developed by Romer (1986) and Lucas (1988) emanated as a critical response to the preceding Neoclassical theory. The theories emphasise on the role of idea gap bridging between poor and rich countries as one of the key factor towards achieving growth convergence among countries. In line with this, a lot of researches were conducted on the means through which 'idea gap bridging' between poor and richer nations can be achieved. Although trade and foreign investment are regarded as the possible ways via which idea gap bridging between poor and richer countries can be achieved, absorptive capacity of poor countries is regarded as a necessary condition for such countries to grab the benefits attached to the foreign investment and trade (Crespo & Fontoura, 2007).

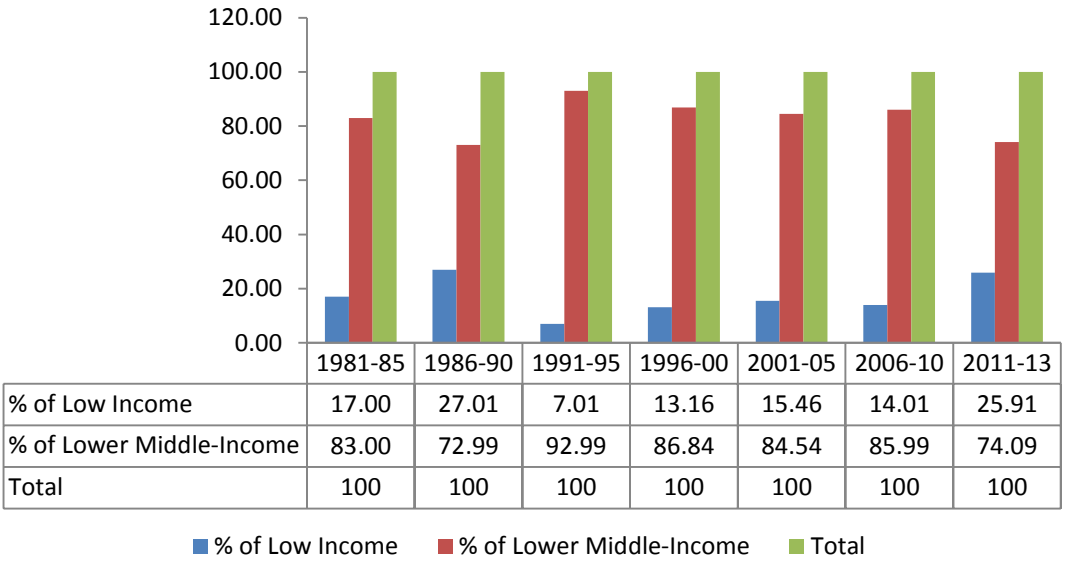
Foreign capital attraction capacity of developing countries is another issue that has been largely scrutinized. According to Noorbakhsh, Polaniand and Youssef (2001), although there is 'dramatic increase' in the level of FDI flows into developing countries, the distribution of such capital is highly skewed in favour of a limited number of such countries. With the view to investigate on the determinants of capital attraction capacity of countries, Moosa and Cardak (2006) utilized data on eight determinants of FDI inflow for a sample of 138 countries. Results emanating from the work of Moosa and Cardak (2006) turnout to provide a justification for what Noorbakhsh *et al.* (2001) observed.

According to Moosa and Cardak (2006), level of inward FDI inflow into a particular country depends positively on the level of development, trade openness as well as low risk. The researchers therefore prescribed for developing economies putting in place

policies that would focus on enhancing physical, legal and political environment alongside trade openness. In a similar research carried out on 29 Chinese regions, Cheng and Kwan (2000) reported regions with relatively larger size of market tend to attract more FDI inflows than ones with relatively smaller size of market. Moreover, regional infrastructural development was identified to have direct link with the FDI inflows attraction capacity of a region. However, the researchers identified wage cost of labour as having negative link with the inward FDI of the regions. In a more recent study by Arbatli (2011), on emerging market economics, political instability, high corporate income tax rates and trade tariffs are negatively related to inward FDI.

The trend and distribution of FDI inflows among WAC provides a support to the proposition proffered by Noorbakhsh *et al.* (2001) that FDI distribution is highly skewed in favour of a limited number of developing economies. Figure 1.3 gives a highlight of the distribution of FDI inflows among 15 WAC (comprising of 10 low-income and five lower middle-income) countries over the period 1981 – 2014.

Figure 1.3 shows the percentages of the total net FDI inflows into each group – low-income and lower middle-income – over the course of 32 years. Reading from the figure, it is observable that the category of low income countries recorded its highest FDI inflow percentage during the period 1986 – 1990, with 27 percent. This compares with the highest record of 92.99 percent for the lower middle-income group over the next five years.



	1981-85	1986-90	1991-95	1996-00	2001-05	2006-10	2011-13
% of Low Income	17.00	27.01	7.01	13.16	15.46	14.01	25.91
% of Lower Middle-Income	83.00	72.99	92.99	86.84	84.54	85.99	74.09
Total	100	100	100	100	100	100	100

Figure 1.3
Distribution of FDI Net Inflows among Low and Lower Middle Incomes of WACs, 1981 – 2013

Having discussed on the key issues of growth performance, convergence and FDI inflows allocation/distribution, which are the main focus of this research, the section dwells on the importance attached to realising growth convergence across world countries.

According to Sala-i-Martin (1996a), other reasons than testing growth theories exist as to why empirical researches are being conducted on growth and issues related to it. Both from theoretical and practical points of view, it is undisputable fact that convergence in per capita output across countries is of enormous importance. For instance, in the view of Sala-i-Martin (1996a), a significant contribution resulting from re-emergence of researches on growth is using the idea of convergence to distinguish between neoclassical growth theory from endogenous growth theories developed. In the words of Durlauf (2003) "… convergence tests have been used to evaluate the presence or absence of increasing returns to scale in the growth process. As such, the convergence hypothesis has important implications for modern macroeconomic

theory". These developments can be regarded as theoretical development that emanated from conducting investigations on economic growth convergence. "…from an economic point of view, the issue of convergence or divergence is very important (UNECE, 2000). Achieving per capita output growth convergence across world nations over the long run translates into poverty level reduction and income inequality reduction among world populace. Therefore, outcome of studies on growth convergence across world nations has enormous contribution towards providing policy recommendations on poverty reduction and welfare enhancement.

1.3 Problem Statement

According to United Nations (2001), Africa in general achieved moderate economic growth from the mid-1960s till the end of the 1970s. The report further highlighted that during 1970s the region recorded remarkable positive change in its output growth, a development identified to have direct link to boom in commodity prices and increased official development assistance flows into the continent.

However, for the last periods of 1970s, African continent has performed poorly compared to other regions of the world (Collier & Gunning, 1999). As evident by the macroeconomic data of the region, significant fraction the economies in the region are generally characterised by low growth rate (negative in some cases), high rate of unemployment and wide trade deficits for a long period of time. For instance, according to ADIs (World Bank, 2014), the region recorded an average annual growth rate of GDP per capita of 2.39 percent during the period 1961 – 1970. This compares with a sharp decline in average per capita growth to 0.90 percent for the subsequent decade, 1971 – 1980. Moreover, the continent's average growth in GDP per capita for

the periods 1981 – 1990 and 1991 – 2000 are -0.96 percent and -0.32 percent, respectively.

The beginning of 21st century was the golden moment for most of the African countries. The region achieved unprecedented growth in its output since the beginning of 2000s until mid-2008 (Devarajan & Kasekende, 2011). However, the researchers regarded this outstanding performance of the region to be mainly a function of improvement in macroeconomic policies, better political atmosphere and favourable external environment in the form of commodity prices boom and search for new markets from the part of foreign investors. For example, for the period 2001 – 2008, World Bank (2014) reported an average annual growth rate in the real GDP for African region to be five percent. This growth rate, however, remains the highest achievement of the region for the past 30 years. In addition, Devarajan and Kasekende (2011) caution that the accelerated growth for the period 2001 through 2008 does not translate to improvement in the living standard of individuals when considered from the view point of per capita income.

Considering the performance of the regions in comparison to that of other regions of the world, the picture is still poor. In other words, the region is characterised by very poor performance in terms of output growth convergence to the other world regions. For instance, according to a simple comparative analysis provided in the work of Collier and Gunning (1999), during 1980s the region suffered a 1.3 percentage points fall in its GDP per capita per annum, a poor performance that put the continent five percentage points below the average for all low-income developing economies. The situation worsened during the period 1990 – 1994 when the reduction in GDP per capita for the

region escalated to 1.8 percent per annum, thereby putting the regional performance well below that of all low-income developing nations by 6.2 percentage points.

Beside such poor macroeconomic performance that characterises Sub-Saharan Africa (hereafter SSA) for several years in comparison to other world regions, intra-regional divergence in terms of per capita growth is another trait of the region. For example, Devarajan and Kasekende (2011) observe a significant divergence in terms GDP growth rate among sub-regions and individual countries located in SSA.

Referring to Table 1.2, the existence of divergence in the average annual economic growth for two groups of countries in the Western sub-region of Africa – lower middle-income and lower income – is apparent. As shown by column four, the ratio of average annual real GDP per capita of lower middle-income group to that of low-income countries has been on the increase throughout the period under review, there by revealing the existence of persistent divergence in the region. Moreover, it is noteworthy that except for the period 1986 – 1990, the low-income countries recorded increase in their GDP per capita growth but not sufficient enough to generate any catch-up with lower middle-income countries.

Contrary to what is highlighted above of poor convergence performance among SSA countries and between SSA and other regions of the world, Neoclassical growth models hold that poor countries tend to perform faster in terms of per capita output than the rich ones. To put differently, per capita growth rate is inversely related to the initial per capita output, thereby making poor countries to grow faster than the rich ones to the extent that a point of convergence in terms of per capital output growth would be

reached over the long run (Barro & Sala-i-Martin, 1992). The simple explanation to this proposition is that capital investment in capital-abundant economies would reach its peak and diminishing return would automatically set in, while capital investment in the poor countries would continuously grow until a particular threshold of capital accumulation is reached. This clear contradiction between theory and actual situation calls for an empirical investigation.

With the widespread belief that foreign capital inflows is an effective catalyst for growth and development, attention of policymakers in the region was directed towards putting in place polices that would enhance the capacity of their economies to gain sizable access to foreign capital in the form of FDI inflows and other forms of foreign capital. On their part, researchers have shed a lot of ink linking access to foreign capital in the form of FDI inflows and other forms of foreign capital on one hand, and various macroeconomic performance measures on the other.

One of the underlying assumptions associated with support for foreign capital is that it has the capacity to facilitate bridging 'idea gap' between rich and poor countries (Romer, 1993). Moreover, Easterly, King and Rebelo (1994) emphasized on the role of technology adoption via human capital accumulation and international trade as an important determinant of output growth in developing nations. Considering the role of FDI in bridging technology diffusion, employment generation and skills acquisition, poor countries are more in need of FDI than the richer ones. According to Noorbakhsh *et al.* (2001), less developed countries place higher hope on FDI inflows to pave their ways in alleviating skills and resource constraints. Moreover, the authors observed that

the trend of FDI flows across the world is highly skewed in favour of very few countries that provide certain combination of locational advantages.

Looking at the trend of FDI inflows across the globe, it is apparent that while each developing continent enjoys upsurge in its share of FDI inflows, the gap among regions, sub regions and individual countries remains wide. For example, development indicators database of World Bank (2014) reveals that during 1986 – 1990 net FDI inflows to East Asia and Pacific and SSA stood at $71.72 billion and $5.65 billion, respectively. As for the global FDI inflows, the database reveals that for the period 2006 – 2010, low-income economies' share of the allocation accounts for a meager value 0.54 percent, this compares with 5.56 percent for lower middle-income category. While the share of upper-middle-income countries stood at 21.34 percent, that of high-income economies is 72.56 percent.

Studies linking FDI inflows and economic growth are quite numerous, such as Carkovic and Levine (2002), Alfaro, Chanda, Kalemli Ozcan and Sayek (2010) and Doytch and Uctum (2011). There are also several studies conducted on the determinants of FDI inflows. Such studies include Chem and Kwan (2000), Noorbakhsh *et al.* (2001) and Moosa and Cardak (2006). While some of these studies utilized time series data some used panel data. However, there are too few studies conducted to access the extent to which divergence in FDI allocation and distribution among countries of a particular region affect economic growth and convergence (Choi, 2004).

However, few studies conducted on the link between FDI and economic convergences suffers a number of weaknesses. For instance, the work of Choi (2004) employs

traditional panel date tools that have inherent weakness of inability to handle the endogeneity problem. As a remedy, the existing study employs dynamic panel data method in the form of system GMM. In addition, the study pooled data from both developed and developing economies. By pooling data from both developed and developing economies, the study does not show clearly the impact of FDI inflow on the per capita income convergence of developing economies to the real GDP per capita of developed economies. The current study therefore addresses the problem identified with the work of Choi (2004).

In summary, it has been clearly highlighted that the performance of African economy is not generally encouraging. Moreover, it was also gathered that the continent does not only perform poorly, but it also lags behind when compared to other regions. Significant difference in terms of growth among countries of the region is also a feature identified with the region. On the part of foreign capital attraction, although there is improvement in the region's capital attraction capacity, when compared to other regions the performance is low. More so, wide gap is in terms of FDI inflows to countries within the region is apparent.

The study would answer questions on the implication of such wide gap in FDI inflows on macroeconomic performance of the region and the extent to which it affects convergence among countries in the Western sub-region of the continent. The study would also provide additional empirical evidence on the nature and degree of relationship between FDI and output growth at individual country levels.

1.4 Research Questions

In view of the problem statement above, the research would answer the following questions:

i. to what extent do WAC diverge/converge in terms of real GDP per capita income?

ii. do low-income countries differ from lower middle-income countries in terms of the role that FDI plays in facilitating within-group catch-up?

iii. what role FDI plays in determining the capacity of low-income countries to catch up with lower middle-income countries in ECOWAS?

iv. For ECOWAS as a whole, at what speed, if any, do relatively poor economies converge to the real GDP per capita of relatively richer economies?

1.5 Objectives of the Study

The general objective is to investigate the role of FDI inflows on the economic growth convergence/divergence of WAC. The specific objectives are:

i. to investigate on the phenomena of per capita income convergence amongst ECOWAS member countries.

ii. to investigate on the difference between low-income and lower middle-income ECOWAS member countries in terms of the role of FDI in facilitating 'within-group' per capita income convergence.

iii. to probe on the role of FDI in aiding per capita income convergence of low income countries to the lower middle income ECOWAS economies.

iv. to calculate the speed of convergence of relatively poor economies to the relatively richer ECOWAS economies.

1.6 Significance of the Study

Studies conducted on the phenomena of economic convergence are quite numerous. However, a teeming majority of such studies were conducted either on developing economies alone or on regions comprising mainly of developed nations. A couple of studies were also conducted using data exclusively on regions within a given developed economy, especially United States of America (USA). On the other hand, the other strand of studies that have not treated developed countries in isolation have pulled data from both developed and developing economies to study the phenomena of economic convergence. Therefore, on the whole, there is lack of studies on the phenomena of economic convergence on the developing economies in general and very acute shortage of such studies on African economies in particular. The implication of such situation is that, whereas the findings of studies that have utilized data from developed economies only cannot be applied to the developing economies, findings from studies that pulled data from both developed and developing economies may not be reliably applicable to developing nations in a bid to achieve economic convergence. In an attempt to contribute toward filling this lacuna, this study utilized data mainly from developing Africa to examine the phenomena of income convergence amongst and across the economies.

Central to the objectives of establishing Economic Community of West African States (ECOWAS) is promoting cooperation and integration amongst member countries. Promoting cooperation and integration amongst member states is in turn expected to raise the living standards of citizens of member economies. Consequently, achieving economic convergence within and across a sample of economies has direct impact on raising the standard of living of citizens of such economies. In line with this reality,

testing the phenomena of economic convergence for the sample of ECOWAS member countries serves as an effort to gauge the extent to which the regional group achieved this set objective of promoting cooperation and integration amongst member states.

One of the commonly mentioned benefits associated with FDI form the developed countries to the developing nations is its technology diffusion impact. This therefore implies that the higher the volume of FDI a poor economy attracts the higher the access it has to superior technology and by extension convergence to the per capita income of the richer economies. One of the implications of this proposition is that FDI is capable of facilitating economic convergence. However, in spite of such clear relationship between FDI and economic convergence, there is apparent dearth of studies linking FDI and economic convergence in general. Therefore, giving such palpable shortage of studies on convergence effect of FDI, this study has contributed to both economic convergence and FDI literature.

Moreover, studies investigating the phenomena of economic convergence have generally used single equation time series based unit root testing procedures on group mean-deviation series. Others have used traditional panel data unit root testing methods to explore the phenomena of convergence. However, in studying convergence across as small sample of closely located economies that are open to each other, treating the countries in isolation using single equation time series based methods can be erroneous. On their part, traditional panel data unit root testing procedures also suffer a couple of drawbacks. For instance, such methods cannot discern clearly panel members converging to the group average from those that are not. As one of its main contributions, this study employs Seemingly Unrelated Regression Augmented Dickey-

Fuller (SURADF) method to study convergence amongst ECOWAS member economies. The method is based on simulations using the underlying dataset and is believed to adequately address the problems associated with the other methods.

1.7 Study Area

1.7.1 ECOWAS – Establishment and Objectives

Created by the Treaty of Lagos, Nigeria, Economic Community of West African States (ECOWAS) is a regional group established on 28 May, 1975. The Community is made up of countries located in the Western sub region of Africa covering a landmass of 5,112,903km^2. Available data at the World Bank reveals the estimated total population of the Community member states to be 339,825,169 persons as at 2014, with an average population growth rate of 2.70 percent.

As contained in the Treaty of Lago, the main aim of establishing the community is to: "to promote co-operation and development in the fields of economic activity particularly in the fields of industry, transport, telecommunications, energy, agriculture, natural resources, commerce, monetary and financial questions and in social and cultural matters of the purpose of raising the standard of living of its peoples, of increasing and maintaining economic stability, of fostering closer relations among its members and of contributing to the progress and development of the African continents". Furthermore, the Treaty contains an undertaking that all member states shall ensure that their policies are formulated in such a way that they can achieve the set objective of the Community.

Aimed at stimulating economic growth and development of West Africa, in 1993 the Treaty of Lagos was revisited leading to the establishment of economic and monetary union. Although ECOWAS has undergone several changes, membership of countries in the Community can be said to have remained very stable, with Cape Verde joining in 1976 and Mauritania withdrawing in the year 2000. With headquarter located in Abuja, Nigeria, the current membership of ECOWAS is 15 countries. The member are: Benin, Burkina Faso, Cape Verde, Cote d'Ivoire and The Gambia. Other members include: Ghana, Guinea, Guinea Bissau, Liberia, Mali, Niger, Nigeria, Sierra Leone, Senegal and Togo.

1.7.2 Macroeconomic Background of ECOWAS

ECOWAS member countries have generally performed poorly for most parts of 1960 until late 1970s. For such periods, majority of the member states of ECOWAS are characterized by very slow growth rate of GDP and negative in some cases. World Bank income level categorization of world economies considers 10 ECOWAS member countries as low income with the remaining five falling under the category of lower middle income economies. However, except for the downturn caused by 2008 global financial crisis, on the whole, the Community member countries have shown signs persistent improvement in terms of GDP growth. For instance, according to WDI, for the period 1981 – 1990, the average real GDP for ECOWAS member states was 1.62 percent compares to 3.78 percent for the period 1991 – 2000. The average real GDP per capita further escalated to 4.58 percent during 2001 – 2014.

1.8 Scope of the Study

The study covers a panel of 15 WAC. According to the World Bank development indicators (World Bank, 2014), the region consists of two categories of countries by income level – 10 low-income and five lower middle-income. The choice of the WAC is justified by the existence ECOWAS, a regional group established on 28 May, 1975 with the view to promote economic integration in the region. The research would therefore utilize data for the entire panel of 15 WAC for the period 1970 – 2014. The selection of the time span is mainly influenced by the availability of data on entire observations of each of the variables. The study would use data on real GDP per capita, FDI stock, trade openness, population growth and government size.

1.9 Organization of Chapters

The research is made up of five chapters. Chapter 1 serves the purpose of introducing the entire research. It contains background and motivation for the study, problem statement, research questions and objectives and significance of the study. Other components of this chapter are scope of the study as well as organization of chapters. Chapter 2 provides a critical review of the existing literature on issues relating to the study. Chap accommodates methodological issues ranging from research framework to aspects such as variables measurement, justification for variable, data type and sources. More importantly, techniques adopted in analysing the data are clearly explained in the last section of the chapter. Chapter 4 is designed to host data presentations and analysis. Lastly, summary of findings, conclusions, policy implications of the findings as well as the recommendations would be provided in the in the fifth chapter.

1.10 Conclusion

As an introductory chapter, this chapter provides an insight into the entire research. It covers aspects such as background and motivations for conducting the study. Under this sub-section on background and motivation for the study, a background regarding growth performance and per capita income convergence among WAC is provided. In addition, the sub-section highlights on the importance attached to achieving convergence among world nations. Next to the sub-section on background and motivation of the study, the chapter provides a problem statement where the problem at stake was explained. After providing a concise problem statement, a number of research questions were drawn in another sub-section and later translated into objectives in the next sub-section. Significance attached to this study is provided in a separate sub-section. Concise background regarding the study area is also provided in the chapter. Finally the last two sub-sections of the chapter explains the scope of the study and organization of chapters, respectively.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter is devoted to the review of literature related to the research. The chapter has ten sections inclusive of the introductory section. In Section 2.2, literature relating to the theories and concepts of convergence is systematically reviewed. The section hosts a review of growth theories within the context of economic convergence phenomena. Absolute convergence, conditional convergence and club convergence are also discussed in the section. Section 2.3 is meant to provide an insight into the literature on the beta and sigma convergence. In Section 2.4, empirical studies on economic convergence are reviewed. Of the important contribution of this study is examining the link between FDI and per capita income convergence. As a result, Section 2.5 is allocated to the empirical researches on the link between FDI and economic convergence. In Section 2.6, a review is provided on the relationship between trade and economic convergence. Section 2.7 and Section 2.8 respectively review literature on the relationship between government size and population growth on one hand, and economic growth on the other. Before concluding the chapter in Section 2.10, Section 2.9 identifies the existing gap in the extant literature.

2.2 Theory and Concepts of Economic Convergence

This section deals with the theoretical and conceptual aspects relating to economic convergence. Specifically, the section reviews prominent economic theories – neoclassical and endogenous growth theories – within the context of economic

convergence. Moreover, the concepts of absolute, conditional and club convergence are extensively discussed.

2.2.1 Neoclassical Growth Theory versus Endogenous Growth Theories

Also commonly referred to as neoclassical growth theory, Solow or Solow-Swan growth theory is an exogenous growth model independently developed by neoclassical economists Robert Solow and Trevor Swan in 1956. In the view of Barro and Sala-i-Martin (2004), the neoclassical growth theory is the next most important contribution to the literature of economic growth since the works of Harrod (1939) and Domar (1946). One of the major intricacies of the theory is its emphasis on the role of capital accumulation, population growth (labour), and technological progress (which is exogenously determined) as the major determinants of long-run productivity growth among countries (Mankiw, 2002). The theory incorporates a production function developed by Cobb-Douglas. The novelty of the theory rests on the issue of economic growth convergence among countries. Empirical studies that document the validity of economic convergence hypothesis are generally regarded as supportive of the neoclassical growth theory.

The main thesis of the theory is that owing to the diminishing marginal return on capital relatively poor countries would grow faster than the richer ones to the point where convergence would take place. In addition to the assumption of diminishing marginal return on capital, other assumptions the theory maintains are: constant return to scale, substitutability between labour and capital and an exogenously determined technological progress.

By constant return to scale, the neoclassical growth theory assumes a production function in which if the two private factors of production – land and labour – are scaled up by a constant factor the output would as well increase from former level to a new level that is exactly a multiple of the scalar by which the two private factors are increased.

Endogenous growth theories (also known as the new growth theories) on the other hand emanated as a critical response to the preceding neoclassical theory. The theories, developed by Romer (1986) and Lucas (1988), marked the beginning of boom in empirical research on the determinants of economic growth. In contrasts to the neoclassical growth theory, new growth theories consider technological progress to be endogenous.

The assumption of diminishing marginal return to capital, which is central to the neoclassical growth theory, is eliminated in the new growth theories. The scholars argue that as a particular economy develops, it may grow indefinitely as return on investment does not necessarily exhibit diminishing return, an assumption that is central to the neoclassical growth theory. This is the main point of divergence between the neoclassical growth theory and new growth theories. By eliminating a very central assumption of diminishing return on capital of the neoclassical growth theory, the economic convergence hypothesis of neoclassical growth theory is simply invalidated. As a result, empirical studies that found no evidence of convergence across economies are generally regarded as supportive of new growth (endogenous) theories.

2.2.2 Absolute versus Conditional Convergence

An economic phenomenon where poor countries grow faster than the richer ones in terms of per capita income is termed as absolute convergence (Barro & Sala-i-Martin, 2004:461). As highlighted by Barro and Sala-i-Martin, conditional convergence differs from absolute convergence. Conditional convergence refers to an economic scenario where the rate of growth of per capita income of an economy depends positively on the distance of the economy from its own steady state[2]. Two economies can be converging in the conditional sense if each is growing in terms of per capita income depending on its distance from its own steady state output. On the other hand, same economies may not be converging in absolute terms if the richer economy is growing faster than the poor one as a result of the former being further below its own steady state compared to the latter. However, the two concepts are identical if the two economies are similar in terms of their steady state. Empirically, investigating absolute convergence differs from that of conditional convergence in the sense that when estimating the conditional convergence a set of explanatory variables such as savings and population growth rates are included in the standard cross-section regression.

2.2.3 Club Convergence

Another concept directly related to that of conditional convergence is 'club convergence'. Baumol (1986) has the credit of introducing the concept into economic convergence literature for the first time. However, Islam (2003) contends that exact and clear formulation of the concept is a credit due to Durlauf and Johnson (1995) and Galor

[2] Refers to a point in the growth evolution of a given country where capital stock, per capita output and consumption tend to grow at the same rate that equals a given exogenous technological progress. Such process is made possible by the assumption of diminishing marginal returns on capital maintained in the Solow growth model.

(1996). In the case of absolute convergence predicted by the Solow's growth model, there is a single 'unique equilibrium' to which all economies approach. In contrast, the conditional convergence hypothesis considers each economy as having its own equilibrium towards which it approaches. In other words, countries grow in per capita towards same steady state provided they are similar in terms certain characteristics, such as technology, government policies and population growth, irrespective of their initial levels of income.

At the other end, the idea of club convergence assumes multiple equilibriums and each economy approaches a particular equilibrium depending on its initial position in relation to the equilibrium and certain characteristics it possess. Therefore if a group of economies share same initial location and are common in terms of certain attributes, they tend to approach the same equilibrium and are hence considered as forming a convergence club.

In his prominent study, Baumol (1986) utilised data on GDP per worker covering the period of 110 years, 1870 – 1979, for 16 industrialised market countries. Using both descriptive statistics in the form of ratios and standard deviation and a bivariate cross country regression equation, Baumol established a sort of convergence in per worker GDP across the 16 industrialised countries. Moreover, using data on output per capita for a larger sample of 72 countries, similar analysis was carried out over the course of 30 years, 1950 – 1980. In contrast to the finding for the group of industrialised economies, countries in the larger sample do not only display absence of convergence, but they rather reveal evidence of divergence among them. The author therefore

concludes that economies that are similar in terms of initial level of income and certain attributes, like level of industrialization in this case, tend to converge.

As aforementioned, precise formulation of the concept of club convergence is the credit of Durlauf and Johnson (1995) and Galor (1996). Results emanating from Durlauf and Johnson led the authors into drawing an important conclusions regarding convergence across economies. First, the authors observe that the linear model specification used by majority of the empirical studies on convergence is misspecified. Second, by segregating the data into various groups using varying initial condition, such as initial capital and initial level of adult literacy rates, the authors observed that different countries obey different production functions. This finding by extension implies that countries growth rate patterns are compatible with multiple steady states perspective.

Although the intuition of club convergence hypothesis was conceived for close to three decades by Baumol (1986) and later formulated more rigorously by Durlauf and Johnson (1995) and Galor (1996), Alexiadis and Tomkins (2004) contend that club convergence hypothesis received relatively less attention in economic convergence literature. However, among the popular exceptions to this postulation of Alexiadis and Tomkins are: Oxley and Greasley (1999) and Su (2003). In addition, more recent studies on club convergence hypothesis include Fischer and Stirbock (2006) and Siano and D'Uva (2006).

Su (2003) investigated club convergence across a sample of 15 Organization for Economic Cooperation and Development (OECD) countries using two different sources of data. The first data source is from Bernard and Durlauf (1995), covering the

period 1900 – 1987. The second source of data is from Maddison (1995) ranging 1885 – 1994. For both datasets, there is no evidence that the entire countries are converging. However, there appears to be five clubs with number of members ranging from two to four. As for the comparative analysis of club convergence hypothesis on the basis of two data sources, it was discovered that results are sensitive to data choice and econometric tools. In view of this, conclusion can therefore be drawn that findings of evidence of club convergence or lack of thereof is partly dependent upon the data source and method of data analysis employed.

Alexiadis and Tomkins (2004) used data spanning 1970‑2000 to test club convergence hypothesis on 13 Greek regions. Forming a total of 78 pairs, the author applied bivariate Augmented Dickey-Fuller (ADF) technique to test for stochastic convergence. Results from bivariate ADF test divulge little evidence in favour of stochastic convergence among the regions. In specific terms, of the 78 possible pairs formed, bivariate ADF test favours stochastic convergence in only 18 out of 78 cases. On the other hand, it was observed that while not all regions follow a particular pattern of convergence, some regions appear to follow common convergence path. The authors therefore conclude that there is evidence of club convergence across some regions of Greece.

In a similar study, Siano and D'Uva (2006) employed similar time-series approach Alexiadis and Tomkins (2004) adopted to study club convergence among a panel of 123 European regions from a total of nine countries. Using data covering the period 1981 to 2000 on GDP per capita in terms of purchasing power parity and employment, the authors reported some evidence in support of club convergence hypothesis. On the basis of initial level of income, average GDP growth rate over the sample period and

sectoral of specialisation of the regions, four groups were formed. Studying convergence pattern among the groups, it was observed that there is strong evidence of convergence among wealthiest members of European Union. The study therefore affirms evidence of club convergence.

Similarly, Fischer and Stirbock (2006) have undertaken a study aimed at testing the validity of club convergence hypothesis using spatial econometric framework on data covering 1995-2000 for 256 NUTS-2 regions located across 25 European economies. Relating the concept of club convergence to the notion of spatial heterogeneity is the focal point and central contribution of the paper to economic convergence literature. Result from the study indicates heterogeneous pattern of convergence process across the regions. This implies that regions in the sampled economies formed different convergence clubs. In addition, the authors found that there is evidence of spatial dependence of the error term and failure to account for this has the potentials to bias results. The study therefore while stablishing the existence of different convergence clubs across the sample regions, rejects the traditional Barro-type regression approach to studying economic convergence.

In a related research, Oxley and Greasley (1999), using a sample of four Nordic countries – Denmark, Finland, Norway and Sweden – found evidence in support of club convergence. Employing time-series technique on data for GDP per capita (sourced from Bernard and Durlauf, 1995) covering 1900– 1987, Oxley and Greasley established three economies – Denmark, Finland and Norway – forming club convergence.

2.3 Measurement of Economic Convergence

2.3.1 Beta Convergence versus Sigma Convergence

There are two strand views on what constitutes income convergence in the economic growth literature (Barro & Sala-i-Martin, 2004:462). In one view, as contend by scholars such as Baumol (1986) and DeLong (1988), convergence is said to be taking place when poor countries grow faster than the richer ones in terms of per capita income or output. The basic premise for the argument is the assumption of positive diminishing marginal return on capital maintained by the neoclassical growth theory. This concept of income convergence is also referred to as 'regression toward the mean' or β-convergence. The second view of what measures income convergence has to do with the decline in the dispersion of per capita output. The commonest way of measuring this type of convergence is by computing the annual standard deviation of logarithms of per capita income across a sample of countries. Each of the two concepts is discussed below in a more detailed way.

The debut of the twin concepts of β-convergence and σ-convergence in the economic growth and convergence literature is a credit of the PhD dissertation of Sala-i-Martin (1990). However, the work of Barro and Sala-i-Martin (1992) triggered a lot of debate on the nature of the relationship between the two concepts as well as the direction of causality. As Furceri (2005) points, there appears to be a general inclination among researchers to the view that presence of β-convergence in given dataset is a necessary condition for σ-convergence to occur. Leading researches holding such view include Barro (1991) and Sala-i-Martin (1996a).

At the other end, some scholars such as Friedman (1992) and Quah (1993) argue vehemently that the popular approach adopted in studying β-convergence is plagued by Galton's fallacy and as a result conclusions from such studies can be misleading. In their view, the question of whether a panel of economies exhibits β-convergence or not is of less interest. To their view, what matters and requires policy attention is achieving continuous decline in the dispersion of per capita income across countries. However, Sala-i-Martin (1996a) maintains differing view regarding the relevance of the two concepts – β-convergence and σ-convergence. The author stresses that while its undisputable fact that achieving reduction in income dispersion across countries is of paramount importance with lot of welfare implications, studying the phenomenon of β-convergence is equally relevant. The author further argues that studying σ-convergence shows only the distribution of income across countries over a given period of time. On the other end, β-convergence reveals the mobility of income within the same distribution which is an issue he considers very relevant for policy making. Sala-i-Martin therefore concludes that both concepts are important and empirical investigation on them is worth doing. Similarly, Barro, Sala-i-Martin, Blanchard and Hall (1991) argue that the work of Quah (1993) only achieved the goal of showing that β-convergence is a different concept from σ-convergence, but not providing that the former concept is uninteresting.

Of the studies conducted on the relationship between the two concepts of convergence is the work of Furceri (2005). The study establishes a functional relation between the two concepts with the goal to determine the direction of causality between σ and β-convergence. In contradiction to the opinions of Barro (1991) and Sala-i-Martin (1996a) that β-convergence is the necessary condition for σ-convergence to occur,

Furceri finds that reverse is the case. In other words, the author observes that its reduction in dispersion of per capita income across countries that leads to the attainment of β-convergence.

In another dimension, Dalgaard and Vastrup (2001) carried out a study to investigate the consistency of results relating to the two popular measures of σ-convergence – coefficient of variation and standard deviation. Amazingly, using data from Penn World Table, Dalgaard and Vastrup reported that establishing convergence or lack of thereof depends on the measure adopted in testing the hypothesis. The explanation advanced by the author to buttress his finding is that the two different measures assign varying weights to individual countries' output growth performance.

2.4 Empirical studies on Economic convergence

Empirical studies on economic convergence can be categorized into three –cross-section regressions based, panel data based and time-series based. In the following sections, a review of literature on each of these three methods is made. Studies on convergence are dominated by debates on the appropriateness of methods of data analysis. On the basis of this, the following review of literature is structured on the basis of method of data analysis.

2.4.1 Cross-Section Approach

Most of the pioneer studies on income and growth convergence have used cross-section regressions in estimating their models. Such studies include Kormendi and Meguire (1985), Baumol (1986) and Grier and Tullock (1989). Cross-section regression approach to investigating the convergence entails regressing current income levels

against the initial level of income. A negative coefficient of initial level of income shows evidence of convergence.

As pointed out by Islam (2003), initial studies that used such approach are deficient for the regression they estimate has not been formally derived from the theoretical models of growth. As a response to such deficiency, studies by Mankiw, Romer and Weil (1992) and Barro and Sala-i-Martin (1992) have provided a formal derivation of initial-income regression equation within the framework of neoclassical growth theories. The equation was derived from Solow's growth model that incorporates Cobb-Douglas production function. The regression equation is single cross-country equation. The underlying assumption that warrants using single cross-country regression equation to study convergence is the assumption that countries have identical production function (Islam, 1995; Durlauf & Johnson, 1995).

Islam (1995) argues that it can be unmistakably believed that countries do not possess identical production functions. As a result, he opines that studies based on familiar single cross-country regression equation may not be reliable and can be misleading. As a consequence, Caselli, Esquivel and Lefort (1996) assert that almost all the studies conducted using cross-section regression suffer from two major problems – inappropriate treatment or complete neglect of country-specific effects, and endogeneity. As noted by Caselli *et al.*, nearly all of the cross-section regression-based studies suffer from both problems, thereby making the results emanating from such studies inconsistent. Moreover, Bernard and Durlauf (1995) cautions that negative sign of the β coefficient in the cross-country should not reliably taken as an indication that the economies are converging. As he postulated, data from countries converging to

varying steady states can exhibit negative sign for β in single cross-country regression commonly used. Concluding evidence of absolute or unconditional performance can therefore be misguiding. Evans and Karras (1996) also argues that the traditional method of using cross country regression in studying convergence across economies is not valid unless if: a) permanent features that differentiate a given sample of economies understudy are adequately controlled for, and 2) the countries share identical first-order autoregressive dynamic structures.

Moreover, Lichtenberg (1994) shares similar view with Bernard and Durlauf (1995) that evidence of mean reversion does not necessarily means convergence. Providing empirical example, Lichtenberg shows the relationship between mean-reversion and convergence hypotheses. The author establishes an argument that whereas mean-reversion is a necessary condition for convergence, it is by no means a sufficient one. To provide solid ground for his argument, the author provides some empirical example where the null hypothesis of no mean-reversion is rejected with a failure to reject the null hypothesis of no convergence using the same dataset. However, despite the criticisms the single cross-country regression equation approach for measuring convergence receives, it is still useful to explore in a more detailed way findings from such studies.

In his study, Sala-i-Martin (1994) provides a summarised picture of the entire major studies that investigated the convergence hypothesis using cross-country regressions. As shown by Sala-i-Martin, there is clear evidence of the presence of conditional β-convergence using varying datasets. As for the case of σ-convergence or absolute

convergence, the author noted that there is no evidence of their presence over the long-run and for a large sample of countries.

In their famous work, Barro, Sala-I-Martin, Blanchard and Hall (1991) studied traditional Ordinary Least Squares (OLS) on a sample of nine sub-periods on data personal income for the period 1880-1988 to examine the convergence process across USA states and regions. The authors use traditional single equation regression to examine the speed of convergence of relatively poor states and regions to the personal incomes in relatively richer states and regions. Findings from the study are generally supportive of convergence hypothesis. However, the authors observed that the speed of convergence of states and regions depends to a large extent on variables such as savings rate and labour mobility.

One of the most notable and apt-cited studies in the area of economic growth is the work of Kormendi and Meguire (1985). The multidimensional study employed single cross-country regression equation to test the validity of six different economic growth hypotheses across a sample of 47 countries. One of the hypotheses tested by Kormendi and Meguire is that of convergence. Findings relating to the convergence hypothesis are the interest of this study, and as such reviewed.

Acquiring data from IMF International Financial Statistics covering the period 1950 – 1977, the authors computed averages for the annual series to generate a single data point of each variable for each country. This approach is quite faulty as it distorts trend associated with a particular series. As predicted by neoclassical growth theory, results from the study showed that population growth is positively correlated with the average

annual growth rate for the cross-section of 47 economies. Similarly, the relationship between annual real GDP growth rate and initial level of income measured in 1975 USD prices follows the prediction of Solow growth theory. In other words, a negative relationship was found to exist between average annual economic growth and initial level of income across the countries. However, as noted earlier, these findings cannot be taken on trust since for each country a single data point was used to represent the entire sample period for the variables under study. This action has the implication of destroying information in the sample (Grier & Tullock, 1989).

Of the pioneer studies that have utilised single cross-country regression equation is the work of Grier and Tullock (1989). The study was conducted with the sole goal of examining various determinants of economic growth. Covering a large sample of 133 economies, the authors investigated the relationship between economic growth and a set of seven variables believed to have some impact on economic growth of a country. Of the seven explanatory variables included in the regression, the only variable of interest to this review is initial level of income per capita. As highlighted previously, the relationship between initial level of income and economic growth is the most popular way of testing the convergence hypothesis, an issue that is central to this study.

Dividing the sample of 113 countries into two – 24 OECD countries (with 30 years annual data) and 89 rest-of-the-world economies (20 years annual data) – the authors used five-year-average data points to produce a total of 500 observations for the analysis. Using five-year-averaging by this study can be seen as an improvement over the previous study by Kormendi and Meguire (1985). As a consequence, results from this study can be seen as more reliable for it covers more data points. Results emanating

from the study in respect of the relationship between initial level of per capita income and economic growth are mixed. As for the sample of OECD countries, there is evidence that the economies are converging. Dividing the sample of rest of the world into three on the basis of continents – Africa, Americas and Asia – the authors found no evidence that economies in each of the three sub-samples are converging. In more clear terms, while for Americas it can be deduced that there is non-convergence, for Asia and Africa it is palpable that the economies are diverging with relatively richer economies growing at a faster rate than the relatively poor ones.

Another famous study was carried out by Barro and Sala-i-Martin (1992). The work is has made tremendous contribution to the convergence study methodology wise. For instance, Baumol (1986), Kormendi and Meguire (1985) and Grier and Tullock (1989) have all utilized cross-country single regression equation to study convergence using a model not formally developed within the framework of any standing theory. However, in their work, Barro and Sala-i-Martin have developed a formal derivation of cross-country regression equation for studying economic convergence within the framework of Solow growth model that incorporates Cobb-Douglas production function. Using data spanning 1840 – 1988 to estimate what is popularly known as Barro's regression, Barro and Sala-i-Martin documented evidence in support of convergence hypothesis across a sample of 48 USA states. The authors observed presence of convergence even if no variable is held constant except initial level of per capita income.

Utilizing data spanning 1961 – 1991 for 10 Canadian provinces, Coulombe and Lee (1995) have investigated the phenomena of economic convergence using cross-section based regression. Using six different measures of income, the authors established

evidence of income convergence across Canadian provinces for the period 1961 – 1991. The authors further observed that the speed of convergence across the provinces is largely attributable to government transfers, taxes and favourable trade terms of trade. Comparing their findings to those obtained from similar studies, the researchers observed that their speed of convergence is of similar magnitude to other regional-based studies carried out on other European economies and America.

In a more recent study, Rodríguez-Pose, Psycharis and Tselios (2012) explored the link between public investment and economic growth and convergence across Greece regions. Using data covering the period 1978–2007 on public expenditure per region, the researchers reported evidence that public expenditure impact positively on economic growth of regions. On the contrast the authors documented that there is no evidence supporting positive impact of public expenditure on converge.

2.4.2 Panel Data Approach

Panel data approach to estimating convergence across countries is one of the three alternative approaches to convergence studies. However, the fact that many of the cross-section regression-based studies, such as Kormendi and Meguire (1985), Baumol (1986) and Grier and Tullock (1989) are plagued with the problem of omitted variable bias, as noted by Caselli *et al.*, an inclination towards using panel data methodologies in studying convergence began to surface.

As maintained by Islam (2003), panel data approach in studying convergence has an edge over cross-section approach for it handles variations in technological progress across countries. According to Islam, even Mankiw *et al.* (1992) have acknowledged

the fact that technological progress of countries vary although they regard it as part of the error term. In the view of Islam, part of the necessities that led researchers to neglect country-specific differences in technological attainment for the error term to handle could be identification problem associated with such variable. However, even though such country-specific variations might be quantified, the unobservable part of it can have some correlation with some of the explanatory variables, hence making estimates using cross-country regressions inconsistent. Proponents of panel data approach to studying convergence include Knight, Loayza and Villanueva (1993) and Islam (1995).

Apart from the benefit of providing solution to the problem of omitted variable bias that panel data approach to testing convergence hypothesis offers, there are numerous other advantages that can be derived from panel data, compared to cross-section and time series data. Panel data avails researchers with a larger number of observations or data points and as a consequence improvement in econometric estimations efficiency. In addition, panel data help to lessen the problem of data multicollinearity (Hsiao, 1985).

Using the work of Mankiw *et al.* (1992) as a benchmark, Knight *et al.,* (1993) utilised data extending the period 1960 – 1985 to explore whether the results differ when employing panel data analysis to study the determinants of economic growth and convergence. Converting the data into five-year non-overlapping averages for each country, the authors observed significant change in terms of the speed of convergence compared to the estimates provided by Mankiw *et al*. In nearly all of the cross-section based researches, technology is assumed to be exogenously determined. As an improvement to the previous works, Knight *et al*. assume technology to depend on openness to international trade and infrastructure.

Knight *et al*. reported that there is country specific-effect neglected by the study of Mankiw *et al*. (1992). As observed by the Knight *et al*. there is significant increase in the speed of conditional convergence compared what Mankiw *et al*. reported. As predicted by the neoclassical growth theory, a significant positive relationship was observed between saving ratios and economic growth. To this end, the authors conclude that, due to country specific-effects, studying economic growth and convergence using panel data analysis tools yields more efficient results as a result of larger volume of information associated with panel data and the advantage associated with its analytical tools in handling individual effects.

Islam (1995) carried out a study utilising panel data approach. The study estimated the familiar cross-section regression using panel data framework for a sample of 192 economies. Similar to the work of Knight *et al.* (1993), Islam used Mankiw *et al*. (1992) as a benchmark to study the phenomenon of convergence using dynamic panel data methodology. Although both Islam and Knight *et al*. employed varying panel data estimators, findings from Islam tend to affirm those documented by Knight *et al*. (1993). The author also reported increase in the speed of convergence across the sample of 112 countries covered by the research.

A closer look at the existing literature on economic convergence would lead one to the conclusion that Africa as a whole suffers a serious neglect. Researchers commonly pooled data from both developed and developing countries to investigate the convergence hypothesis. There are also studies that examined convergence phenomenon across developed economies and across regions of a particular developed

country. However, McCoskey (2002) is one of the very few studies conducted on Africa in isolation. In contrast to the findings of Knight *et al.* (1993) and Islam (1995) who found evidence of convergence using panel data approach, McCoskey reported no evidence of convergence across the sample of SSA countries.

On the same token, Weeks and Yao (2003) employed GMM to investigate the scenario of income convergence across China's 15 main provinces. Data spanning 1953 – 1997 was used. Forming two sub-samples on the basis of pre-reform and post-reform periods, convergence hypothesis was tested for each of the two periods. For the pre-reform period, 1953 – 1977, the authors established that the provinces were converging. In the contrast, the reform period, 1978 – 1997, was characterised by income divergence among the provinces. This finding led the authors to the conclusion that China's post reform increased economic growth was achieved at a price of increased divergence. More recently, a study related to that of Weeks and Yao (2003) was carried out by Lei and Tam (2010). The authors employed panel unit root test on data covering the period 1982 – 2006 to explore whether Mainland China, Hong Kong and Macao are converging in terms of per capita income. As opposed to the work of Weeks and Yao, Lei and Tam observed that the three regions are converging during post reform period.

Beside the issues of omitted variable bias and that of endogeneity raised as a criticism against cross-country studies on economic convergence, regional economists are also concerned about spatial dependence of regions and countries, an important issue that has been for long ignored in the debate on economic convergence (Rey & Montouri, 1999). Countries and regions that are closely located tend to have some level of dependence in terms of economic growth due to factors such as technology spill over,

related labour markets and factor mobility. In consideration of this, regions cannot be treated in isolation as done in cross-section regression (Badinger, Muller & Tondl, 2004).

In an attempt to mitigate the problem of spatial dependence problem associated with cross-country studies on income and economic growth convergence, a number of studies were carried out. Such studies include Rey and Montouri (1999) and Badinger *et al.* (2004). Rey and Montouri (1999) carried out a research aimed to exploring the phenomena of convergence from spatial econometric point of perspective. As claimed by the authors, empirical evidences on regional convergence need to be re-examined within the context of spatial econometric in order to observe how robust they are to the geographical dynamics of the economies and regions. Using data on USA regional income growth covering the period 1929 – 1994, the authors observed a strong global as well as local spatial autocorrelation for the entire sample period. This finding led the author to the conclusion that the initial income regression approach adopted by Baumol (1986) suffers a serious problem of model misspecification. On the basis of this observation, the authors further conclude that while a set of countries can be seen as converging in relative terms, the economies are not converging independently, but rather they are moving in a similar direction of their neighbours owing to spatial dependence.

In a related study, Badinger *et al.* (2004) examined a panel of 196 European regions over the course of 1985 – 1999 with the view to estimate the speed of convergence among the regions. Before estimating the relationship, the authors performed a spatial autocorrelation test on the data. As revealed by the Moran's *I* test results, the data

exhibited a strong spatial dependence. Removing the spatial correlation component from the data and estimating the speed of economic convergence of the regions using GMM, the authors observed significant decrease in the estimates for the speed of convergence. Therefore a conclusion can be drawn that high rates of convergence recorded by studies such as Islam (1995) and Knight *et al*. (1993) could be as a result of spatial dependence.

2.4.3 Time Series Approach

Time series approach to studying economic convergence is the most recent development in the area of economic convergence. Introduction of time series approach to investigating economic convergence led to the emergence of the concept of stochastic convergence. Stochastic convergence in per capita income or economic growth is said to exist when shocks to relative per capita income or economic growth are temporary (Carlino & Mills, 1993). This sub-section is devoted to the review of famous studies that adopt time series approach to investigating convergence across countries and regions.

Carlino and Mills (1993) explored per capita income convergence across USA regions over the course of 1929 – 1990. The study investigated both the phenomena of β convergence as well as stochastic convergence across USA regions. The authors reported evidence in support of neoclassical growth theory that predicts income convergence. However, while USA regions were observed to have exhibited β convergence over the course of 60 years, stochastic convergence was found to exist only after allowing for a structural break in 1946.

Similarly, Loewy and Papell (1996) obtained regional level data on USA to investigate the hypothesis of per capita income convergence amongst the regions. Their study serves as an improvement over the work of Carlino and Mills (1993). In the work of Carlino and Mills, the researchers incorporated one exogenous structural break in examining the stochastic convergence process of the USA regions. However, Loewy and Papell employs unit root test that allows for two endogenous structural breaks. Findings from the study show some degree of improvement over the findings in the previous work of Carlino and Mills. Whereas in the previous study finds evidence of stochastic convergence only in three out of seven regions examined, Loewy and Papell have found evidence of convergence in seven out of the eight regions examined.

In their famous work, Bernard and Durlauf (1995) proposed a new definition of convergence across countries. To the view of Bernard and Durlauf, two economies are said to be converging if the long-run forecast of their outputs is equal at a fixed time. As for the case of more than two countries, economies are said to be converging if the long-run forecast for all economies are equal at a fixed time. Testing for these types of convergence can be carried out using a popular time series literature of cointegration. Making use of data on real GDP per capita adjusted to 1980 prices covering the period 1900 – 1987 for a total of 15 industrialized economies, the authors reported absence of convergence. Using ADF test the researchers observed that for the entire set of countries, the null hypothesis of no convergence cannot be rejected. In other words, there is no evidence that per capita income of each pair of economies does not contain a unit root. Related study was also conducted by Carlino and Mill (1996). The study investigates the phenomena of convergence across USA states. Unlike Carlino and Mills (1993), Carlino and Mills investigated on the convergence across USA states

rather than the regions. Findings of Carlino and Mills support those of Bernard and Durlauf (1995) of no convergence across the states.

Aubyn (1999) found results conflicting Bernard and Durlauf (1995). His study covers a sample of 16 industrialised economies over the course of 1890 – 1998. The study's sole objective was to examine the convergence of the rest of 15 economies in his sample towards USA per capita GDP. The analysis was carried out using three different sample periods – period prior to Second World War (1890 – 1939), period after Second World War (1947 – 1989) and entire sample period (1890 – 1998). Results from ADF test on the entire sample period rejected the null hypothesis of no convergence for most of the countries. Specifically, the null hypothesis cannot be rejected in only five out of 15 cases. However, for the periods prior to Second World War, using same ADF test, rejects convergence in only four cases. Finally, the test rejects no convergence hypothesis in only three out of 15 cases.

Dawson and Sen (2007) carried out an investigation on the both stochastic convergence and β convergence on a sample of 29 OECD and Non-OECD economies. Using data converging the period 1900 – 2001, the study employs traditional ADF approach to test for stochastic convergence. Findings emanating from the study indicate that there is more evidence of stochastic convergence amongst the economies as compared to the evidence of β convergence. In specific terms, the authors reported that of the 29 countries the study covers, there is evidence of β convergence in 16 countries as opposed to stochastic convergence that is found to exist in 21 economies.

In a related study, Dawson and Strazicich (2010) investigates the phenomena of real per capita income for a sample of 29 economies. As opposed to using traditional ADF test to examine the convergence phenomena, the researchers resorted to using Lagrange Multiplier (LM) test for unit root with two structural breaks to examine the location of breaks in the data. Utilizing LM test which endogenously determine the location of structural breaks in a given dataset is one of the major contributions of the study to the ongoing debate on convergence in per capita income of world economies. Using large timeframe data spanning 1900 – 2001, the authors reported a number of findings.

In a similar research, Strazicich, Lee and Day, (2004) delve on the stochastic convergence process amongst a sample of 15 OECD economies for the sample period covering 1870 – 1994. The major difference between the work Strazicich, Lee and Day and that of Dawson and Strazicich (2010) is that data on smaller sample of OECD economies was used for a relatively longer period of time. Employing LM test that determines two structural breaks endogenously, on the whole, the researchers found evidence of stochastic convergence amongst the sampled economies.

Regarding the time period for structural break, World War II was identified as the most occurring structural break in the dataset. On the aspect of convergence, it was observed that there is supportive evidence to believe that income are converging amongst 23 economies. Compared to what is reported in Dawson and Sen (2007) who utilize traditional ADF test to study convergence in the same sample 29 countries, the study by Dawson and Strazicich provides some improvements. In Dawson and Sen, evidence of stochastic convergence was found in a sample of 21 countries, as opposed to 23 countries reported in Dawson and Strazicich. This improvement in detecting

convergence in a 23 economies as opposed to 21 may be related to the employed methodology of LM test. King and Ramlogan-Dobson (2014) investigate the hypothesis of income convergence using data for a sample of 24 OECD economies. Employing frontier LM test which accounts for unknown number of structural breaks in a given dataset, the researchers reported a number of interesting findings. Using USA per capita income as a benchmark, the researchers observe that half of the sampled economies showed some evidence of convergence to the USA per capita income.

Using time series approach, Cellini and Scorcu (2000) also explored on whether the convergence hypothesis holds for a sample of G-7 economies. The study covers a sample period of 90 years, 1900 – 1989. Keeping with the popular norm, the study used data on real GDP per head adjusted to 1985 prices. The researchers formed 21 possible pairs of economies in order to test for pairwise stochastic convergence for each pair. Contrary to the findings of the teeming number of studies that have employed time series approach to investigate the convergence hypothesis, Cellini and Scorcu reported findings that affirm convergence as holding for the group of G-7 economies. Justifying their findings, the authors believe that failure to find convergence by many previous studies that have used time series approach may not be unrelated to the problem of misspecification of models with time fixed parameters.

To the view of Cellini and Scorcu (2000), once structural break is allowed for, the possibilities of finding convergence among OECD countries are very high. After allowing for structural breaks in the data, the hypothesis of no convergence was rejected for only four out of 21 pairs. However, dividing the sample into two sub-periods reveals

that in no case the convergence hypothesis was not rejected. This by implication implies that increased integration of G-7 has led to the end of convergence among the countries.

In a related study, Greasley and Oxley (1997) investigated on whether convergence hypothesis holds for a sample of eight OECD economies – Australia, Belgium, Denmark, France, Italy, Sweden, The Netherlands and United Kingdom. In contrast to the findings of Carlino and Mills (1996) and Bernard and Durlauf (1995), results from the study affirm convergence hypothesis. Employing bivariate time series approach, the authors formed four pairs of countries. The study utilised data on real GDP per capita covering the period 1900 – 1987. To perform a unit root test on the series of the annual differences in real GDP per capita for each pair of economies, traditional ADF test was used. Rejecting the null hypothesis that says the series contains a unit root is considered as evidence in support of convergence. However, except for pair of Sweden and Denmark, the ADF test rejects null hypothesis, thereby revealing an outcome in support of convergence. The three pairs are: Australia and the UK; Belgium and The Netherlands; and France and Italy. Investigating on whether structural break could be the possible explanation for non-convergence outcome for the pair of Sweden and Denmark and alternative unit root test advocated by Perron (1989) was employed. Taking care of 1939 break of Second World War, null hypothesis is strongly rejected for the pair of Sweden and Denmark. Similarly, Oxley and Greasley (1995) employing time series analysis for a sample of three countries – Australia, UK and USA – concludes the there is evidence of convergence among the countries.

Habibullah, Dayang-Affizzah and Puah (2012) conducted a research with the view to access the extent to which various Regional Development Plans of Malaysian

Government have achieved the goal of reducing the degree of income disparities across the regions. To put differently, the study explored the phenomenon of convergence across six Malaysian regions. The study covers a sample period of four decades, 1965 – 2003. The study utilised data on regional per capita GDP at constant 2000 prices. Using Central Region's per capita GDP as a benchmark, the authors explored on the presence or lack of thereof of stochastic convergence across the regions. Results from univariate time series appear to generally support stochastic convergence hypothesis in all of the six regions. Findings from Habibullah *et al.* (2012) are not in line with Bernard and Durlauf (1995) who found absence of stochastic convergence across a panel of 15 industrialised economies.

Employing LM test with two structural breaks, Jayanthakumaran and Lee (2013) undertake a study to compare both *β* and stochastic convergence of pioneer member countries of association of South East Asian Nations (ASEAN-5) and that of South Asian Association of Regional Cooperation (SAARC). Results from the research show that there is evidence of both β and stochastic convergence for the sample of ASEAN-5 economies. However, there is no evidence of presence of both stochastic and β convergence was found amongst the sample of SAARC economies. As for the ASEAN-*5* economies, the convergence process was observed to be heavily affected by the shocks in world oil prices as well as Asian crisis of 1990s.

In a recent study, Heckelman (2013) investigated convergence in per capita income amongst USA states using both cross-sectional and time series based methods. Data spanning 1930 – 2009 was used to achieve the set objective of the research. Of the contributions of the research is its being comparative in nature as it utilizes both cross-

section and time series methods. Results from cross-section based approach which employs probit regression model are generally found as supportive of both σ and β convergence across USA states. However, it was observed that σ and β convergence amongst the states do not hold for the last three decades of the sampled period. On the other hand, time series approach reveals evidence of stochastic convergence in only about half of the USA states.

Cook (2008) also performed investigation on stochastic convergence process using data from United States. Using minimum LM test on state level data for USA that spans 1929 – 1990, the author found no evidence that the states are converging. The author attributed such deviation of his study to the previous findings to the issue of variable measurement. Whereas in teeming majority of the studies carried out on stochastic convergence performed their analysis on the series generated as the ratios of a give state's real GDP per capita relative to that of USA as a whole. In his study, Cook performs the minimum LM test on the per capita GDP series of individual states rather than the ratios. The author therefore calls for exercising caution in drawing conclusions on the evidence of convergence amongst economies using GDP ratio series.

Caggiano and Leonida (2009) make an important contribution to the literature of time series based approach to investigating convergence. Rather than using the stationarity approach to test the hypothesis of convergence, the authors explores the hypothesis of convergence by employing autocorrelation function (ACF). The authors argue that by exploring the autocorrelation properties of detrended real GDP per capita series of a given economy, one can observe the transitional dynamics of the economy towards its steady state path. Using data for a sample of 15 OECD economies, the authors report

finding that contrasts many other works on OECD. The authors report no evidence that OECD member countries experienced conditional convergence over the period of study.

2.5 Foreign Direct Investment and Economic Convergence

Studies carried out on the determinants of economic growth and convergence among countries consider technological progress of a given economy relative to the rest of the world as crucial to achieving long term economic growth and catch-up. In the words of Mokyr (2005), "Economists have become accustomed to associate long-term economic growth with technological progress". In fact, one of the major areas of divergence between the neoclassical growth theory of Solow (1956) and new growth theories, Romer (1986) and Lucas (1988) has to do with the role of technology in long-run economic growth.

FDI is widely regarded as the most important way through which transfer of technology from advanced to developing economies can be attained (Bijsterbosch & Kolasa, 2010). In essence, the entire argument that FDI is critical to achieving output growth rests, to a large extent, upon the basis that it aids innovation, adoption and accumulation of new technology. Consequently, existing literature on the determinants of economic growth places a lot of emphasis on the role of FDI in achieving growth in developing countries. While there is enormous body of literature on the studies linking FDI to output growth, on the contrast, as noted by Choi (2004), research on the relationship between FDI and income convergence among countries is still scanty. However, it is worth noting that there are a lot of studies on the link between FDI and variables such human capital development, technology diffusion and employment generation. In the rest of this

section, both studies directly linking FDI to income convergence and those linking FDI to various determinants of income convergence are reviewed.

Zhang (2001) utilized data covering the period 1960 – 1996 investigated on the impact of regional integration among 10 East Asian countries on income convergence. Using trade openness, liberalization and FDI flows as proxies for regional integration the author employed nonlinear least squares to estimate the relationship. Results emanating from the research provide further support for a positive link between trade openness and FDI on one hand and regional convergence among countries in the East Asian region on the other.

On the same vein, Choi (2004) investigated on the link between FDI and income convergence among a panel of countries. Making use of bilateral FDI data from OECD for the period spanning 1982 – 1977, both OLS and panel regressions were employed to estimate the relationship. The data covers a panel of 16 source countries and 57 host economies. Measuring convergence as the absolute difference in per capita GDP between source and host country, the researcher reported evidence that increase in the ratio of bilateral FDI between two countries, is associated with a shrink in the difference in per capita GDP between the source and host country. Using both measures of per capita income and the growth rates of per capita income the results are similar.

In addition to the relationship between bilateral FDI and income convergence between source and host countries, the impact of bilateral distance and common language on per capita income convergence was also investigated. Interestingly, it was discovered that the shorter the distance between source and host country the higher the reduction in

GDP growth gap between the economies. Similarly, common language was identified to have a positive impact of income convergence. In conclusion, the author opines that shorter distance and common language between two countries contribute in increasing human capital spillover resulting from bilateral FDI.

Lee (2009) has recently undertaken research aimed at comparing the impact of FDI to that of trade on the long run productivity convergence. Using sector level data on productivity spanning 1975 – 2004, the author employed a dynamic panel framework to achieve the objective of the research. Following Ben-David (1996), 25 trade based groups and 24 FDI based groups were formed, with each group comprising of six countries, including the source country. Results based on panel unit root tests revealed additional support on the impact of FDI and trade on the productivity convergence.

The estimated parameter for the convergence variable is negative – indicating evidence of convergence – in all of the 25 import based and export based groups. However, the parameter estimates for the convergence variables are all significant, although at different levels (1, 5 and 10 percents). Similarly, results from FDI based panels also support presence of convergence; in all the cases negative parameters were obtained. However, in contrast to the trade based groups, some of the parameter estimates are not statistically different from zero in the case of FDI. Hence, leading the author to conclude that convergence is more trade related than FDI. Furthermore, comparing convergence process of manufacturing sector productivity to that of the service sector reveals that there is no evidence that the service sector is converging due to trade or FDI. However, such results cannot be taken on trust as evidence of convergence. This

is so because observing convergence based on trade and FDI grouping does not necessarily translate into causation from trade or FDI to productivity convergence.

Moreover, Bijsterbosch and Kolasa (2010) have observed that EU member states among Central and Eastern European countries have achieved significant improvement in their productivity levels over the last 15 years. As noted by the authors, such period coincided with the increased flow of foreign capital to the countries in the form of FDI. However, to investigate whether such improvement in productivity growth resulted from increased FDI inflows, Bijsterbosch and Kolasa undertook a study. The research covers a sample of eight countries – The Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia. Making use of industry-level data converging 19 sectors, over the course of 10 years for the panel of eight countries, a number of findings surface from the work of Bijsterbosch and Kolasa (2010). One, further evidence stressing the impact of FDI on productivity convergence among the countries and across the sectors was found. Two, productivity growth among the countries was found to depend upon FDI inflows. Third, absorptive capacity of the receiving country plays a critical role on the impact of FDI on productivity growth. Finally, the authors observed a significant heterogeneity across industries, countries and time with regards to the findings of the research. For instance, convergence of the productivity in manufacturing sector was found to be stronger as opposed by the service sector. As for the heterogeneity across the countries, Estonia, Latvia and Lithuania were found to have more of FDI effect on convergence than the rest of the countries.

Does income growth and convergence effect of FDI across host countries depend on the FDI source? Mayer-Foulkes and Nunnenkamp (2009) seek to provide an answer to

this question by using data on various related FDI activities of the USA. Mayer-Foulkes and Nunnenkamp use data on various FDI related activities of USA, in addition to the conventional approach of using stocks and flows to measures of the FDI. The authors argue that the measure of FDI matters a lot for the outcome of a study, and the commonly used measure of using FDI flows and stocks does not sufficiently measure FDI.

Another important finding of Mayer-Foulkes and Nunnenkamp (2009) has to do with income convergence effect of USA FDI. It was discovered that the positive effect USA FDI depends to a large degree on the level of development of the host economy. While fairly advanced economies enjoy income convergence relative to the USA income, there is no evidence of similar effect for less advanced economies. Moreover, for many USA FDI host economies that are low-income or middle-income in the light of World Bank income classification, USA FDI has income divergence effect, or at least non-convergence effect.

Technological progress attainment has been recognised as an important determinant of income/growth convergence among countries. In the view of Keller (2004), technology diffusion from foreign sources is so much important that it accounts for not less than 90 percent of increase in the levels of domestic productivity of many world economies. FDI and international trade have been identified as the major channels via which technology transfer takes place across countries. However, whereas there are a lot of empirical studies on the role of international trade in technology diffusion, researchers seem to pay relatively less attention to the link between FDI and technology diffusion (Xu & Wang, 2000). The probable reason for such little attention to studies on

technology diffusion role of FDI is that data on FDI is relatively poor in quality compared to the data on international trade (Xu & Wang 2000). As a means to linking FDI to income/growth convergence, subsequent paragraphs give a review of empirical works linking FDI to technology diffusion.

Xu (2000) explored the ability of USA manufacturing multinational enterprises to facilitate technology diffusion across 40 economies – 20 less developed and 20 developed economies. The major contribution of the paper is that it seeks to probe the impact of technology diffusion on productivity growth. In many studies carried out on the productivity enhancing impact of multinational corporations, technology diffusion was not treated in isolation. Findings of the research would therefore go a long way in increasing our understanding of the specific technology diffusion effect of manufacturing multinational corporations on productivity growth. Analysing data on the relevant variables covering the period 1966 – 1994, a number of findings emanated from the study.

Comparing less developed economies to developed ones in terms technology diffusion effect of USA multinational enterprises on productivity growth reveals a striking difference. Contrary to the case of less developed economies, there is evidence that developed economies' productivity growth is linked to technology diffusion of USA multinational enterprises. In numeric terms, for the period under study there was 1.34 percentage points increase in the annual productivity growth in developed countries. This increase in productivity was a result of a joint effect of USA multinational enterprises and international trade. Disaggregating this effect reveals that 40 percent of the effect is a product of technology diffusion resulting from activities of USA

manufacturing multinational corporations. The study further explored on the possible reason for the lack of technology diffusion effect of USA multinationals on productivity growth in less developed countries. As noted by the author, reaching certain threshold of human capital level is a necessary condition for the technology diffusion of USA multinationals to foster productivity growth. However, a teeming majority of less developed economies do not attain such minimum threshold of human capital level.

Ciruelos and Wang (2005) carried out a study similar to that of Xu (2000). The study aims at estimating the impact of FDI and trade on technology diffusion as measured by international research and development (R&D) diffusion. The work of Ciruelos and Wang differs from previous studies on the effect of trade and FDI on technology diffusion in three vital perspectives. Firstly, the effect of both trade and FDI on technology diffusion was estimated. There are many reasons to believe that trade aids technology diffusion as there are to believe that FDI helps technology diffusion. Therefore, neglecting the role of trade in estimating the relationship could amount to overstressing the effect FDI on technology diffusion. Secondly, the study covers both Developed Countries (DCs) and Less Developed Countries (LDCs). The authors discern the effect of trade and FDI on international technology diffusion in DCs from that of LDCs. The authors opine that pooling data from DCs and LDCs could be misleading. As the authors highlight, the flow of FDI into DCs differs from that of LDCs in terms of both the nature and volume. As such DCs and LDCs are expected to have varying technology diffusion effect of FDI. Thirdly, data on FDI flows rather than stocks was used for the study. The justification for using the FDI flows is that it gives a better opportunity to compare data on FDI with that on trade.

Obtaining data spanning 1988 – 2001 for a sample of 20 OECD member countries and 27 LDCs, fixed effects panel data regression model was used to estimate the relationships of interest. The choice of fixed effects model over pooled OLS and random effects models was informed by the outcome of Hausman specification test. For the investigation on technology diffusion effect of FDI and trade amongst 20 OECD countries, bilateral trade and FDI data were used. On the other hand, data on FDI flows from 20 OECD countries to the 27 LDCs was used to estimate the impact of trade and FDI on technology diffusion for the LDCs.

Interestingly, findings of Ciruelos and Wang (2005) are similar to those of Xu (2000) in some respects. Both FDI and trade were found to have a positive impact on productivity growth through technology diffusion among 20 DCs in the sample. This is opposed by the case of LDCs, where it was observed that the flow of FDI from DCs does not foster productivity growth. This finding also concurs with that of Xu (2000). Moreover, similar to the finding of Xu, trade was found to have a stronger effect on productivity growth in DCs compared to FDI. Finally, certain level human capital development was identified as a requirement for FDI to have any positive productivity growth impact via technology diffusion among LDCs.

Xu and Wang (2000) probe on the relationship between international trade and FDI on one hand and technology diffusion on the other hand. Unlike Xu (2000), Xu and Wang is restricted to the impact of international trade and FDI on the technology diffusion across a sample of advanced economies. Constrained by data availability, investigation on the effect of FDI on technology diffusion was conducted using data covering the period 1983 – 1990 for a panel of 13 OECD economies. As for the effect of trade on

technology diffusion, longer span data, 1971 – 1990, was obtained, and the relationship estimated using relativity larger sample of 21 OECD countries. Employing OLS, the authors estimated the relationships and reported a couple of findings.

Xu and Wang (2000) reported that there are empirical evidences in support of the proposition that trade in capital goods has a positive link to technology diffusion. As for the other objective of the study, it was reported that inward FDI does not exert any significant impact on technology diffusion of the host economy. On the contrary, outward FDI was found to transmit foreign technology back. However, the authors caution that the insignificant impact of inward FDI on technology diffusion in the host country should be handled with extra care mainly due to the poor nature of the FDI data.

In their study, Bitzer and Kerkes (2008) make use of industry-level data from seventeen OECD countries for the period 1973 – 2000 to examine the impact of FDI on knowledge spillover and technology transfer. Using Cobb-Douglas production function, estimation results from the study are generally supportive of the argument that FDI facilitates technology transfer and knowledge spillover. This finding therefore by extension implies that FDI has contributed to the convergence amongst the sampled economies since by receiving FDI the economies have gained access to superior technology and knowledge spillover. On the other hand, the researchers further delve on the impact of outbound FDI on technology transfer and knowledge spillover. Findings from this investigation show that outbound FDI is detrimental to knowledge spillover and technology transfer.

In a similar research, Branstetter (2006) obtained industry level data to examine the knowledge spillover the technology transfer effect of Japanese multinationals undertaking investment in USA. On the effect the technology spillover from Japan to USA, the author finds evidence that USA benefits from technology and knowledge spillover from Japanese firms undertaking investments in its territory. Contrary to the finding of Bitzer and Kerkes (2008) the outbound FDI is detrimental to technology and knowledge spillover to the source economy, Branstetter reports that Japanese firms as well benefited from knowledge spillover and technology transfer back to Japan for their investments in the USA. In a related research, using panel data covering the Chinese provinces over the course of 1995 – 2000, Cheung and Ping (2004) probe on innovation spillover effect of inward FDI in China. Finding from Cheung and Ping appear to support previous studies that are supportive of technology and knowledge spillover effect of FDI.

Neto and Veiga (2013) obtained panel data on a large sample of 139 economies for the period 1970 – 2009 to examine the role of FDI in aiding growth and economic convergence amongst world economies. The study delve on the link between FDI and technology diffusion and innovation and by extension economic growth and catchup. Interesting findings evolve from the study. Related to this work is the convergence effect of FDI on productivity growth amongst the sample economies. Relating to this issue of FDI-convergence nexus, the authors observe that economies with larger share of world FDI tend to exhibit high degree of catchup with high performing economies. This leads the authors to the conclusion that, through its technology diffusion and innovation effects, FDI plays a very significant role in aiding economic convergence amongst world economies.

As highlighted previously, central to the argument that FDI aids economic growth and by extension convergence is its technology transfer believed to be associated with inward FDI. Using micro level data on Indonesia, Blomström and Sjöholm (1999) examines the technology spillover roles of presence of multinationals on domestic firms' performance. This study is found to be relevant to this work owing to the convergence effect associated with technology spillover effect of FDI on domestic firms.

Findings from Blomström and Sjöholm (1999) reveal that multinationals are generally characterized by high labour productivity owing to their access to superior technology and domestic firms are found to benefit from such superior technology. This therefore could lead us to the conclusion that economies with relatively more presence of foreign firms tend to benefit from superior technology available to the foreign firms and by extension have tendencies to converge to the productivity level of such high performing economies. In another study, constructing oligopoly model, Glass and Saggi (2002) investigated the role of multinationals with superior technology in transferring its technology to domestic firms via learning by employees hired by multinationals. The authors observe that host economies can benefit from superior technology of multinationals. The authors observe that local employees are exposed to the superior technology available with multinationals that hire them and allow them to work for domestic firms. However, in the event that the multinationals pay wage premium to prevent their employees from working for domestic firms, governments of the host economy have no incentive to attract FDI.

Damijan, Knell, Majcen and Rojec (2003) examine the role of FDI in transferring technology to a sample of eight transition economies over the course of five years, 1994 – 1998. Interestingly, whereas the researchers establish some evidence of technology transfer effect of FDI via direct foreign linkages, it was found that there is absence of intra-industry transfer of technology amongst domestic firms. The implication of this finding could be that the rate of transfer of technology across industries is likely to be slower than in the case whereby there is presence of intra-industry transfer of technology amongst domestic firms. In a similar research, Veugelersa and Cassimanc (2004) probe the role of foreign firms on technology transfer in Belgium. Firm level data was used in carrying out the research. The study further affirms believe that FDI aids technology diffusion and by implication having some effects on economic convergence of hosting economy to the source economy.

2.6 Trade and Economic Convergence

Ben-David (1993) examined the link between trade and degree of disparity in per capita incomes across six original member countries of European Economic Community (EEC). The author established that a reduction in the level of disparity in the level of income among ECE countries colludes with the periods characterized by the removal of trade barriers among member countries. Furthermore, in a bid to establish whether or not this improvement stems from liberalization of trade among member countries, a comparison of income differentials of pre-liberalization period was made to the periods of trade liberalization. Moreover, the proposition that convergence in income levels among six pioneer member countries could be due to post world war restructuring among affected economies was also investigated. Observing the disparity among a set of three countries that joined the EEC later clearly reveals that the countries recorded

serious disparity among them, and the disparity faded away after they have joined the EEC.

In a related study, Ben-David (1996) investigated on the relationship between trade and income convergence. The initial sample covers 43 countries. Excluding countries that are primarily oil exporters, formerly Communist countries and countries with per capita income below 25 percent of the USA per capita income of 1960, a sample of 25 countries was arrived at. For each of the 25 countries in the new sample, trade groups based on both exports and imports were formed. With trade groups varying in number of countries from a minimum of three to a maximum of nine, over the course of 1960 – 1985, convergence parameters ware computed for each group. The main goal the research pursues was to probe whether countries forming trade partners show any evidence of convergence in terms of per capita income more than other group of countries that are randomly formed, not based on any trade relationship criteria.

Interestingly, except for one group, all of the groups in export-based groups have convergence parameter estimate of less than one, an indication of convergence. However, of the 24 groups with a parameter estimate of less than one, the parameter estimate is significant at 10 percent in 16 cases. Similarly, of the 25 import-based groups, 22 have a convergence parameter estimate of less than unity, out of which in 17 cases the parameter estimates are also significant at 10 percent. In addition, forming groups based on the union of export-based groups and import-based ones, similar results were discovered. In the majority of the groups, the convergence parameter estimate is less than unity, thus indicating evidence of convergence.

To establish whether the evidence of convergence highlighted above is a product of trade partnership among the groups or not, similar convergence models were estimated for 7,300 randomly formed groups – 2,300 groups comprising of three countries and 5,000 consisting of nine countries. Graphing the parameter estimates depicts more recurrence of divergence than convergence.

The contributions of Ben-David (1996) are twofold. One, the study adopts new and simpler way of estimating convergence. The method takes into cognizance more of annual dispersion in the variable of interest. To some extent, the approach is an improvement over the primary way of regressing current income against initial level of income suggested by authors such as Baumol (1986), Dowrick and Nguyen (1989) and Barro (1991). Two, the study tries to establish a link between trade and convergence process among countries, an issue that suffers serious neglect in convergence literature.

In a similar study, Lane (2001) contributed to the growing body of literature on income convergence effect of trade. The study explored the role trade plays in aiding income convergence among countries via improving their access to international capital markets. The major argument of the paper is that, given the imperfect nature of international capital markets, participating countries have better access to debt from overseas. This in turn gives such countries more funds to finance domestic investments with higher returns and hence stand a better chance of to grow faster.

Lane (2001) documented a positive and robust link between countries' degree of openness to trade and access to external debt measured by the level of external liabilities. Compared to other studies conducted on the relationship between economic

growth convergence and trade, this study has made a remarkable contribution methodology wise. The study was unequivocal about the transmission mechanism of trade's effect on income convergence among countries. In most of the previous studies, such as Ben-David (1993), convergence parameters were estimated for a group of countries believed to partake in trade and conclusion drawn that trade contributes to income convergence. Conclusions from such studies can be misleading for the fact that convergence during the periods of trade liberalization does not necessarily mean causation of effect from trade to convergence.

Existence of a positive link between international trade and income convergence is one aspect. However, the extent of change in the reduction of income gap between countries due to changes in the extent of trading among the countries is another. Ben-David and Kimhi (2004) carried out a study intended at exploring on the extent of reduction in income gap among countries resulting from increase in the intensity of international trade. Using bilateral trade data, covering the period 1960 – 1985, 127 pairs of countries were formed based on export data and 134 on the basis of import data. Results from the study turn out to indicate that increasing the intensity of bilateral trade speeds up growth convergence between the countries. This finding is consistent in both import-based and export-based pairings.

Moreover, Parikh and Shibata (2004) utilized GMM estimation procedure to examine the trade liberalization effect on real income convergence among 36 countries across three regions – Africa, Asia and Latin America. In addition to beta convergence, the authors computed two measures of sigma convergence: standard deviation of real income per capita and deviations from regional mean. Using both 'single difference'

and ‘differences-in-differences’ approaches on the data, the researchers reported mixed findings. ‘Single difference’ approach involves comparing pre-liberalization and post liberalization convergence for only the countries under study. On the other hand, the ‘difference-in-differences’ approach compares pre-liberalization and post-liberalization convergence for countries under study and that of a control group. For the difficulty involved in forming a control group that captures the heterogeneity of the three different regions the study covers, the authors inclined toward results from ‘single difference’ approach.

Results from Parikh and Shibata (2004) indicated that there is no significant difference in terms of absolute convergence between pre-liberalization and post liberalization periods for Asia and Latin America. Conversely, for Africa, there appears to be a beta divergence for the periods characterized by trade liberalization. Moreover, the results for sigma convergence are as well mixed. While it was found that there is huge improvement in terms of sigma convergence during post-liberalization periods for the Asian and Latin American countries, liberalization periods are characterized by divergence in the case of African countries.

In a more recent study, Choi (2009) contributed to the existing body of literature on the relationship between trade and growth by exploring the link between bilateral trade and reduction in income gap. The main objective of the paper was to examine whether with the increase in the intensity of trade between two countries the income gap between the countries tends to diminish. To achieve the set goal, Choi utilized bilateral data for 63 countries and 62 exporting partners of each country for the periods 1970, 1980, 1990 and 1992. Employing both pooled OLS and random effects panel regression models,

results from the research provide additional support for the positive link between bilateral trade and reduction in income gap. In addition, the research reveals the bilateral trade effect on convergence to be more pronounced when the two countries share same language and are located closely. The author therefore concludes that that the mechanism via which bilateral trade aid convergence between two countries is transfer of knowledge, which in turn depends on geographical proximity and common language.

According to Slaughter (1997), there is the possibility of a reverse causality from income convergence to liberalization and trade. In his view, there is the tendency for the countries that are similar in terms of income to liberalize and as a consequence trade more with one another. In his opinion, this possibly therefore calls for undertaking research from the view point of income convergence causal effect on trade and liberalization. In line with this argument advanced by Slaughter, Liu (2009) conducted a research to investigate whether the argument is a valid one.

Using disaggregated bilateral trade data for a large sample of 165 countries for the years quinquennial years between 1965 and 2000 the author reported a couple of finding. One, evidence of a bi-directional causality between trade in differentiated and reference-priced sectors was discovered. On the contrast, the causality runs from trade to income convergence when data on trade in homogenous product is used. In line with his findings, the researcher therefore concludes that there is evidence that trade induces income convergence.

A careful survey of studies conducted on absolute convergence would reveal that such studies relied basically on cross-section data. On the other end, majority of studies

investigating on sigma convergence have utilized panel data regression. However, recent researches have shown some sort of inclination towards time-series approaches to investigating 'sigma convergence' in what is referred to as 'stochastic convergence'. One of the studies carried out using time-series methodology is Giles (2005). The researcher explored on the convergence in per capita output of New Zealand and each of her four major trade partners – Australia, Japan, the UK and the USA. Using both bivariate and multivariate time-series approaches on the data covering 1950 – 1992, the author reported a number of findings.

In the case of bivariate approach, using difference between a pair series both ADF and KPSS tests were carried out to test for 'stochastic convergence'. As revealed by the ADF test, there exist a stochastic convergence in output between Japan on one hand, and the UK and the USA on the other. As opposed by the ADF test, results from KPSS test suggest some evidence of stochastic convergence in the output levels of Australia the USA was observed. Moreover, in order to test for the existence or lack of thereof stochastic convergence in the series for the group of countries, the Johansen likelihood ratio 'trace test' was employed. As for this test, the outcome reveals no evidence of stochastic convergence.

Following Giles (2005), similar study was undertaken by Stroomer and Giles (2008). The study involves forming three clusters from a sample of 88 economies. The clusters were formed on the basis of the degree (high, medium and low) of openness of the countries. Using both ADF (drift and trend version) and KPSS tests, unit root tests were carried out on the series of the difference between per capita output of each country and that of the leading country for the three clusters. Although the results from such tests

turn out to be mixed, on the balance, there is more of evidence in support of convergence than its absence.

Bivariate analysis of convergence for the three clusters indicates that the high openness cluster comprising of Luxembourg as the leader and 16 other countries has the highest percentage of countries converging to the per capita output of the leader. However, the corresponding percentages for the medium openness and low openness clusters are 40 percent and 45 percent respectively. On the other hand, multivariate stochastic convergence test between groups of economies under each cluster was carried out by employing Johansen (1988, 1995) ‘‘trace test’. Moreover, the outcome of multivariate analysis appears to be a sort of affirmation of the bivariate analysis.

Conversely, Slaughter (1997) holds countervailing view on the impact of international trade and income convergence across countries. The author is of the view that an extra caution should be exercised in concluding that international trade is a catalyst for income convergence among countries. As noted by Slaughter, the leading papers that investigated on the relationship between international trade and income convergence across countries suffer a number of methodological weaknesses. For instance, in studying the impact of trade on convergence across countries, reduction in income disparity among countries during a given period characterized by trade barriers removal should not be enough to justify that trade has any impact on growth. Instead, there is a need to carry out the studies from causation methodological point of view. Therefore, the fact that there is whole range variables believed to have some impact on income convergence, income convergence after trade liberalization among countries does not necessarily connote that trade is the cause.

Moreover, Slaughter (1997) highlighted that the proposition that free trade among nations brings about factor prices equalization does not necessarily translate to income convergence among countries. Slaughter further pointed to the fact that Factor Price Equalization (FPE) theorem is built upon very strict assumptions in such a way that a slight change can render the theory invalid. Giving this problem associated with the theorem, even though factor price equalization may result to income convergence, it is difficult to simply attribute income convergence among countries to trade liberalization.

Most of the studies linking trade to income/growth convergence have used single comparison of at most two groups of countries. Contrary to this popular approach, Slaughter (2001) adopted 'differences-in-differences' methodology to investigate on liberalization impact of income convergence among liberalizing economies. As opposed by many studies reporting positive impact to liberalization on growth, Slaughter document a negative impact. Analyzing four different post-1945 trade liberalization episodes, the author found that liberalization has divergence effect on income rather than convergence. This result was found in both 'single difference' approach and 'difference-in-differences approach and each of the four liberalization episodes the study covered.

2.7 Government Size and Economic Convergence

The effect of government size on economic growth and economic convergence amongst economies revolves around its link to capital accumulation process. Moreover, by whatever measure of government size, economies differ in terms of government size.

Such differences may have some impact on the capital accumulation capacity of the economies and by extension convergence process amongst world economies. However, minds of scholars are divided regarding the nature of the relationship between government size on one hand and economic growth and convergence on the other.

As highlighted in Ram (1986), theoretically, the view that larger government size is detrimental to economic growth is justifiable by the fact that government operations are to a larger extent commonly undertaken with high degree of inefficiency which translates into low productivity and growth. In addition, larger government size is associated with excessive cost relating to regulatory process thereby exposing the whole economic system to a severe burden. At the other end, some scholars maintain the view that government size is beneficial to economies. To these scholars, larger government size play significant roles that are capable of boasting economic growth. According to these scholars, among many justifications of positive link between larger government and economic growth is that larger governments play a vital role of preventing exploitation of country by foreigners.

Yamamura (2011) examines the effect of government size on economic growth via its role on capital accumulation. Employing two-way fixed effects regression model on the data covering a total of 57 OECD and non-OECD economies, the author finds evidence that government size hampers economic growth mainly by hindering capital accumulation. Examining the effect of government size on economic growth via the channel of capital accumulation for the sample of OECD and non-OECD economies separately, the author observes the negative effect of government size on capital accumulation to be persistent only for the sample of non-OECD economies. The author

therefore concludes that, as opposed to the situation of developed nations, public sector crowds out private sector in developing economies. In a related effort, Kolluri, Panik & Wahab (2000) probe on the effect of government size on economic growth using a sample of G-7 countries for the period 1960-1993. Findings emanating from the study show evidence that economic growth has both long run and short run effects on government size.

In a related study, Afonso and Furceri (2010) explores the effect of volatility and composition of government expenditure and revenue on economic growth of OECD and EU countries. Interestingly, findings from Afonso and Furceri are in line with those of Yamamura (2011). Afonso and Furceri observe that each of the components of government expenditure employed in the study to examine the effect of government size on economic growth of EU and OECD member economies turns out to show negative and statistically significant effect of government expenditure on economic growth.

Dar and AmirKhalkhali (2002) also use data from 19 OECD member countries to examine whether government size plays any significant role in explaining the differences in output growth of the sampled economies. Utilizing random effects model on the data spanning 1971 – 1999, the author come up with the conclusion that government size is generally detrimental to economic growth amongst sampled economies.

Literature on the link between government size and economic growth and convergence is dominated by studies undertaken mainly using data from developed economies.

However, of the few studies carried out using data from developing economies is Guseh (1997). The study examines the effect of government size on economic growth disaggregating the sample based on economic system with the view to probe whether the relationship depends on the type of economic system. Using data from 51 middle income economies over the course of 1960 – 1985, the author reports findings suggesting adverse effect of government size on economic growth and productivity and by extension economic convergence. Moreover, the study examines discovers that the negative effect of government size on economic growth is more pronounced in countries with nondemocratic socialist system compared to economies with democratic market system.

In the view of Folster and Henrekson (2011), studies on the impact of government size on economic growth, and by extension economic convergence, are commonly plagued by serious econometric problems. In a bid to provide more robust findings regarding the nature of the relationship between the variables, the authors employ extreme bound analysis on data mainly from a sample of rich economies covering the period 1970 – 1995. Findings from the study appear to affirm the view that government size is detrimental to economic growth.

Another study carried out using data on developing economies only is Devarajan, Swaroop and Zou (1996). The study utilize data on a sample of 43 developing economies over the course of 20 years. One of the contributions of the study is that it investigates the effect of disaggregated government spending on economic growth. Contrary to the findings reported in the teeming majority of the studies that government size has negative effect on growth and economic convergence, Devarjan, et al., find

positive and significant relationship between government size, as measured by recurrent expenditure, and economic growth. On the contrast, the authors observe that there is negative impact of capital expenditure on economic growth. The study therefore suggests that previous studies have found negative effect of government size on economic growth due using aggregated measures of government size. In line with their findings, the authors recommend governments in developing economies should pay much attention in making appropriate allocation of expenditure to ensure economic growth and convergence to the output of relatively richer economies.

2.8 Population Growth and Economic Convergence

Of the implications of Solow (1956) growth model is the proposition that economies tend to convergence in terms of real GDP per capita in absolute terms providing they are similar in terms of savings propensity, technology and population growth. However, economies vary in terms of population growth rates. This leads to the emergence to the term of conditional convergence. According Solow growth model, an increase in population growth rate of a country causes an increase in the break-even level of investment, which in turn leads to lower steady state level of capital.

Studies on the determinants of economic growth and by extension economic convergence have commonly included population growth rate as one of the determinants of economic growth and convergence. For instance, in the words of Caselli *et al.* (1996) “there is by now both a strong theoretical case and solid empirical support for the view that economic growth affects the population growth rate”.

Pioneer among the studies that consider population growth rate as one of the important variables in determining economic growth and convergence is the work of Dowrick and Nguyen (1989). The study utilize data for a large sample of OECD economies over the period 1950 – 1985. Using OLS to regress 1950 level of GDP growth rates of sampled economies against annual growth rates, annual population growth rates and a host of other variables the authors report a number of interesting findings. Before controlling for population growth, the authors observe fewer occurrences on convergence across different samples compared to the results obtained after controlling for population growth rates of economies. This finding therefore implies that population growth rate plays a vital role in determining economic convergence across economies.

Moreover, Grier and Tullock (1989) probe on the effect of seven variables on economic growth using cross country regression on a sample of 113 world economies comprising of 24 OECD member economies and 89 other economies. Averaging data over five-year non-overlapping periods for 24 OECD economies and four observations for each of the remaining 89 economies the authors employ traditional OLS in estimating the relationship of interest. For both OECD and other economies, the researchers find evidence of positive and statistically significant relationship between population growth and initial level of real GDP per capita.

Glaeser, Scheinkman and Shleifer (1995) explore the link between urban characteristics in 1960 and urban income and population growth rates for the period 1960 – 1990 for a sample of 203 USA cities. The authors observe that there is a positive link between population growth rate and income growth rates amongst USA cities. On the contrast, Barlow (1994) observes that there is significant negative relationship between

population growth and economic growth. Similary, Barro (2001) reports a statistically significant negative relationship between output growth and fertility rate. The author therefore concludes that additional population growth rates come at the expense growth rates in real GDP per capita.

Moreover, estimating Cobb-Douglas incorporating growth model for a cross section of world economies, Benhabib and Spiegel (1994) examines the role of human capital in determining cross country variations in economic growth. Findings from the study shows that human capital does not significantly determine variations in economic growth across countries. Using the growth rate of total factor productivity as an alternative measure of economic growth, Benhabib and Spiegel find evidence in support of positive relationship between human capita and economic growth. Galor and Weil (1993) examines the relationship between fertility rate and capital and output per worker. Results from the study indicate that there is positive feedback from low fertility rate to the growth in output and capital per worker.

2.9 Literature Gap

Several studies were conducted on the phenomena of per capita income convergence. However, there still exist a lacuna in the literature. One, as far as developing economies are concerned, there is glaring dearth of studies on the convergence process either among or across such economies. Two, there is limited number of studies undertaken on the determinants of per capita income convergence. Many of the studies carried out using data from developed economies are concerned with the speed of convergence, investigating the link between economic convergence and such variables as trade openness and FDI. Three, there is also apparent shortage of researches on the impact of

regional communities in developing economies, such as ECOWAS, on economic convergence across and amongst member countries.

2.10 Conclusion

A closer look at the literature on growth and income convergence related issues reveals that researchers differ greatly in terms of the validity of convergence hypothesis, rate of convergence, and speed of convergence. One thing that is palpable from the literature is that nearly all of the studies that utilized single cross country regression equation in studying the phenomena of convergence tend to document findings in support of the hypothesis. Similar trend can be observed from studies that utilized panel data approach to investigating the phenomena of economic convergence. In contrast, studies that have utilized time series approach to examining convergence hypothesis documented more conflicting results.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter is devoted to methodology and conceptual framework of the study. This introduction inclusive, the chapter divided into eight main sections. Section 3.2 contains conceptual framework for the study. In Section 3.3, models to be estimated to achieve the objectives of the study were presented. Justification for the variables included in the study is provided in Section 3.4. Before explaining the study sample and timeframe in Section 3.6, Section 3.5 gives data sources. Section 3.7 hosts methods applied in analysing the data to achieve the set objectives of the research. Finally, the chapter is concluded in Section 3.8.

3.2 Conceptual Framework

The central focus of this research is the phenomena of income convergence among ECOWAS member countries of West African. This section deals with the conceptual framework for this research.

One of the most important and popular thesis of Solow-Swan neoclassical growth theory is that of convergence. The theory predicts that economies that are relatively poor tend to grow faster than their relatively richer counterparts to the extent that a point of convergence would be reached over the course of long run. The genesis of this proposition of the theory stems from the assumption of diminishing marginal return to capital the theory maintains. By their nature, poor countries are not capital abundant, therefore, assuming diminishing marginal return of capital implies that any additional

capital investment tend to yield relatively higher amount of output in poor countries compared to output increase from similar additional capital investment in relatively richer economies. This phenomenon of poor countries growing faster than the richer ones in terms GDP per capita or economic growth is what is referred to as absolute convergence.

The phenomenon is seen as absolute since it is automatic as its emergence relies solely and absolutely on lower initial level of capital of a particular economy. In view of this, the study therefore expects low-income WACs to exhibit higher rate of per capita growth evolution during the period under review compared to the lower middle-income countries.

One of the much related intricacies of neoclassical growth theory is the hypothesis of conditional convergence. Empirical investigations on this hypothesis received the attention of researcher only in the recent years (Barro & Sala-i-Martin, 2004:17). Unlike absolute convergence, this hypothesis proposes that the higher the deviation in initial level of per capita GDP relative to the steady state for a particular economy, the faster it grows. Convergence of this type is called conditional because the level of growth depends on the distance of an economy from its steady state, which in turn is depends upon the population growth rate, savings rate and position of the production function. Therefore, to examine whether conditional convergence holds for a particular group of economies, it requires examining the phenomenon of convergence after controlling for differences in the levels of steady states across economies.

Technological advancement a particular economy attains relative to the rest of the world plays an important role in the catch-up performance of the economy. However, there appears to be a consensus among economists on the role of FDI in facilitating technology transfer from advanced economies to the less developed ones. In view of this, other things being equal, the more FDI an economy is able to attract the more access it gets to the new and advanced technology. This access to superior technology in turn facilitates narrowing per capita income gap between the economy and the rest of the world. This study therefore hypostasize a positive impact of FDI on per capita income convergence among ECOWAS member countries.

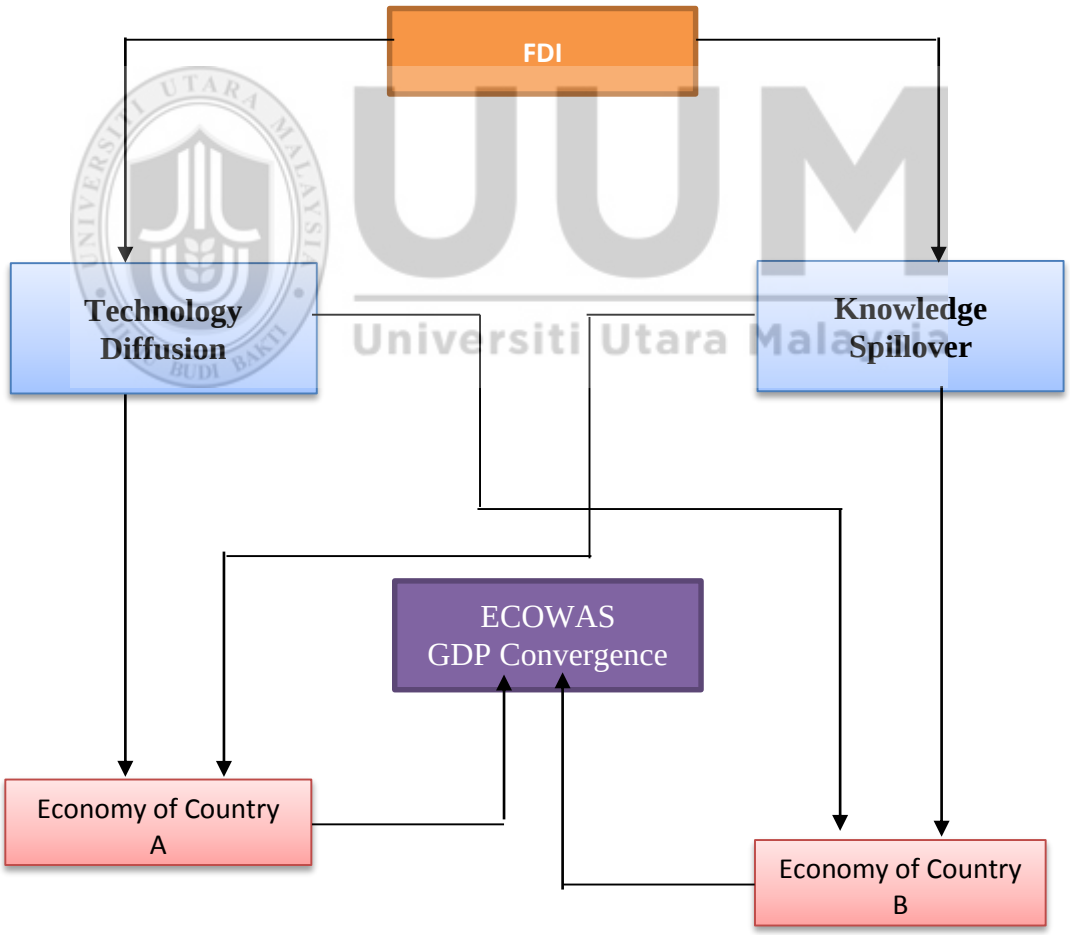


Figure 3.1
Research Framework

3.3 Model Estimation

3.3.1 Absolute Convergence

Examining the phenomena of absolute convergence among West African countries is another set goal of this research. Achieving this goal obviously requires different approach, methodology wise. Cross section regression based studies have utilized what is called 'regression to mean' to examine absolute convergence across countries.

However, the traditional 'regression to mean' approach has been largely criticised for a couple of drawbacks associated with it. For instance, as contained in Friedman (1992) and Quah (1993), the approach is prone to regression to the mean bias. Additionally, cross-section regression approach may not be appropriate for investigating convergence for a small sample of countries (Ben-David & Bohara, 1997). Moreover, by simply regressing initial per capita income against annual averages of per capita income, cross country regression studies wastes a lot of useful information. In view of these, this study employed approach similar to that in Ben-David (1993); Ben-David and Bohara (1997) and Pesaran (2007). The model for absolute convergence is shown in equation [3.1]

$$y_{i,t} - \bar{y}_t = \varphi(y_{i,t-1} - \bar{y}_{t-1}), \qquad [3.1]$$

where y_{it} represents per capita income in economy i at period t, $\bar{y}_t$ is the average per capita income for a group of n economies during year t. φ is the coefficient and the convergence term. A result of $\varphi < 1$ ($\varphi > 1$) indicates convergence (divergence). Let $z_{i,t} = y_{i,t} - \bar{y}_t$, Equation [3.1] becomes:

$$z_{i,t} = \varphi z_{i,t-1}. \qquad [3.2]$$

Equation [3.2], according to Nelson and Plosser (1982), can be presented within the framework of ADF as:

$$z_{i,t} = \varphi z_{i,t-1} + \sum_{j=1}^{p} \delta_{i,j} \Delta z_{i,t-j} + \varepsilon_{i,t} \qquad [3.3]$$

where φ is the coefficient of lagged dependent variable, p is the order of lags included in the equation, δ is the coefficient of differenced (Δ) lagged dependent variable.

Therefore, it can be observed that test for convergence narrows down to testing for unit root of $\varphi < 1$ in Equation [3.3].

3.3.2 Conditional Convergence

Succinctly, the set goal of this study is to investigate the phenomena of income convergence within each income group (lower income and lower middle-income) of WACs and across the entire panel of ECOWAS countries. In addition, the study explored the impact of FDI on the rate of income convergence among the economies. Given these objectives, following Mankiw *et al.* (1992), Islam (1995), Caselli *et al.* (1996) and Badinger *et al.* (2004) the study estimated equation [3.14]. The equation is derived as shown in the subsequent steps.

Given a labour-augmenting technological progress Cobb-Douglas production function:

$$Y_t = F(K_t L_t) = AK_t^{\alpha} L_t^{1-\alpha} \qquad [3.4]$$

where Y_t is the output for period t, K_t and L_t respectively represent capital stock and labour input for period t, A is the level of technology and α and $1-\alpha$ are the elasticities of the production function. Both L and A are assumed to grow at exogenous population growth rate, n, and technology growth rate, g, such that Equations [3.5] and [3.6] are arrived at

$$L_t = L(0)e^{nt} \qquad [3.5]$$

$$A_t = A(0)e^{gt}. \qquad [3.6]$$

Defining output in per-effective-labour terms, Equations [3.7] and [3.8] were obtained

$$y_t = \frac{Y_t}{L_t} = \frac{AK_t^{\alpha} L_t^{(1-\alpha)}}{L_t} = Ak_t^{\alpha} \quad \text{and} \qquad [3.7]$$

$$k_t = \frac{K_t}{L_t}. \qquad [3.8]$$

where k_t is capital accumulation equation.

Supposing a fixed proportion of output (s) is saved and invested, the dynamic equation of k_t is given by:

$$k_t = sy_t - (n + g + \delta)k_t, \qquad [3.9]$$

where δ represents depreciation rate of capital. Putting Equation [3.7] into Equation [3.9], Equation [3.10] is arrived at:

$$k_t = sAk_t^{\alpha} - (n + g + \delta)k_t . \qquad [3.10]$$

Steady state level of capital stock, k^*, can be arrived at by setting Equation [3.10] to zero as below:

$$k^* = \left(\frac{s}{n + g + \delta} \right)^{1/(1-\alpha)} . \qquad [3.11]$$

Upon substituting k_t in Equation [3.7], with steady state level of capital stock, given by Equation [3.11], Equation [3.12] is arrived at – steady state level of per capita income, y^*:

$$lny^* = lnA_0 + gt + \frac{\alpha}{1-\alpha}\ln(s) + \frac{\alpha}{1-\alpha}\ln(n + g + \delta) . \qquad [3.12]$$

Using Taylor series approximation around the steady state, the standard specification of convergence is obtained

$$lny_t = (1 - e^{-\lambda\tau})\frac{\alpha}{1-\alpha}\ln(s) - (1 - e^{-\lambda\tau})\frac{\alpha}{1-\alpha}\ln(n + +g + \delta) + e^{-\lambda\tau} lny_{t-\tau} + (1 - e^{-\lambda\tau})A_0 + g(t - e^{-\lambda\tau}(t - \tau)), \qquad [3.13]$$

where λ is the rate of convergence and τ stands for the time period of reference in Equation [3.13]. The credit of pioneering extending the above convergence specification to panel data is due to Islam (1995).

Transforming Equation [3.13] to conventional panel data literature notation, Equation [3.14] is obtained:

$$y_{it} = \varphi y_{i,t-1} + \sum_{j=1}^{2} \beta_j x_{it}^{j} + \rho_t + \pi_i + \varepsilon_{it}\,, \qquad [3.14]$$

where $\varphi = e^{-\lambda\tau}$, $\beta_1 = \left(1 - e^{-\lambda\tau}\right)\frac{\alpha}{1-\alpha}$, $\beta_2 = -\left(1 - e^{-\lambda\tau}\right)\frac{\alpha}{1-\alpha}$, $x_{it}^1 = \ln(s)$, $x_{it}^2 = \ln(n + g + \delta)$, $\pi_i = (1 - e^{-\lambda\tau})\ln A(0)$, and account for country-specific effect. $\rho_t = g(t - e^{-\lambda\tau}(t - \tau))$, accounting for time-invariant effect. ε_{it} is the for error term assumed to white noise process or $e_{it} \sim IID\ (0, \sigma_{eit}^2)$.

Estimating Equation [3.14] entails obtaining rate of conditional convergence – one of the objectives the study pursues. The model measures conditional convergence, λ, since it was derived using steady state level of capital, k^*, given by Equation [3.11].

3.3.3 Foreign Direct Investment and Real GDP Per capita Convergence

Following Choi (2004), this study hypothesised that as a particular pair of economies convergence in terms of FDI, the economies tend to converge in terms of real GDP per capita. This study therefore estimates the Equation [3.15]

$$LPGDPR_{ijt} = LFDIR_{ijt} + LOPN_{ijt} + LGOVSIZ_{ijt} + LPOP_{ijt} + \varepsilon_{ijt}, \qquad [3.15]$$

where;

$LPGDPR_{ijt}$ = the log of real GDP per capita ratio

$LFDIR_{ijt}$ = the log of real FDI per capita ratio

$LOPN_{ijt}$ = the log of openness

$LGOVSIZ_{ijt}$ = the log of government size

$LPOP_{ijt}$ = the log of population growth rate

ε_{ijt} = the error term.

On the role of FDI in facilitating β convergence in real GDP per capita amongst ECOWAS and two income groups within the ECOWAS, the following relationship is setup for estimation.

$$RGDP_{it} - \overline{RGDP_t} = (FDI_{it} - \overline{FDI_t}) + OPN_{it} + GOVSIZ_{it} + POP_{it} + \varepsilon_{it} \quad [3.16]$$

where:

$RGDP_{it}$ = Real GDP per capita of economy *i* at time *t* measured in constant 2005 USD

$\overline{RGDP_t}$ = $\frac{1}{n}\sum_{i=1}^{n} RGDP_t$, which is the average annual real GDP per capita

$\overline{FDI_t}$ = $\frac{1}{n}\sum_{i=1}^{n} FDI_t$, which is the average annual FDI stock in USD

OPN_{it} = Trade openness of economy *i* in year *t*

$GOVSIZ_{it}$ = Government size of economy *i* in year *t*

ε_{ijt} = the error term

3.4 Justification of Variables

This section is meant to provide a justification for the explanatory variables included in the model estimation for this study.

3.4.1 Real GDP Convergence

Real GDP convergence is the dependent variable for this study. On convergence across economies (pairwise convergence), it is measured at the ratio of differences of real GDP per capita between each pair of economies the study covers. As for the convergence amongst economies, it is measured as the deviation of individual economies from annual average real GDP per capita for the sampled economies. Previous studies such as Choi (2001, 2009) and Ben-David and Bohara (1997) have employed similar approach in the examining the phenomena of convergence.

The variable is measured as: $PGDPR_{ijt} = (PGDP_{it} - PGDP_{jt})/(PGDP_{it} + PGDP_{jt})$, for pairwise convergence, and, $RGDP_{it} - \overline{RGDP_t}$ for convergence amongst economies.

Given the wide belief that FDI has the capacity to transfer technology across borders and income convergence effect associated with technology, it is expected that there would be a positive relationship between FDI and real GDP per capita convergence.

3.4.2 Foreign Direct Investment

According to World Bank (2014), FDI refers to "direct investment flows in the reporting economy. It is the sum of equity capital, reinvestment of earnings, and other capital. Direct investment is a category of cross-border investment associated with a resident in one economy having control or a significant degree of influence on the management of an enterprise that is resident in another economy". For the purpose of this study, data on total stock of FDI measured in USD is used. The variable is measured using the formula of $FDIR_{ijt} = (FDI_{it} - FDI_{jt})/(FDI_{it} + FDI_{jt})$.

The role of technology in determining growth and income convergence across countries has been largely emphasized in the economic growth and income convergence literature (Bernard & Jones, 1996; Gong & Keller, 2003). According to Keller (2004) and Bijsterbosch and Kolasa (2010), FDI is one of the principal candidates believed to have a significant positive impact on technology transfer from technologically advanced economies to the developing nations. By extension, a positive link between FDI and technology transfer should translate into a positive relationship between FDI and income convergence across host economies.

3.4.3 Trade Openness

Trade openness measure the extent to which a given economy restricts its trading with the rest of the world. For the purpose of this research, trade openness is controlled for. The variable is measured as the average of trade openness of each pair of economies using the formula of $OPN_{ijt} = (OPN_{it} + OPN_{jt})/2$.

Commonly measured as the ratio of total trade to GDP, many studies have considered it as an important source of technology diffusion (Xu, 2000; Xu & Wang, 2000; Ciruelos & Wang, 2005). On the other hand, studies such as Ben-David (1996), Ben-David (2001) and Zhang (2001) have emphasized on the role of trade openness in ensuring economic convergence across economies. This study, therefore, include international trade in the model estimated in order to control for its impact on income convergence via technology transfer.

3.4.4 Population Growth Rates

Population growth rate refers to the percentage annual increase in the total population of a given economy. Countries differ in their population rate. Neoclassical growth theories developed by Solow (1956), Cass (1965) have predicted that economies tend to converge in terms of per capita income and economic growth providing they are identical in terms of population growth rate (Ben-David, 1993). On the basis of this strong theoretical background, population growth rate is controlled for in estimating the impact of FDI on income convergence amongst and across countries the study covered. For each pair of economies, this research compute average population growth as $POP_{ijt} = (POP_{it} + POP_{jt})/2$.

3.4.5 Government Size

Government size refers to the degree of involvement in the economy in terms of its final consumption expenditure. Government size is identified by economic literature as one of the determinants of economic growth. Several studies on economic growth and convergence across economies have controlled for government size. Such researches include Barro and Sala-i-Martin (1992). For each pair of economies, this study controls of government size by including the average of government final consumption expenditure as a proxy for government size. Therefore, government size is measured as: $GOVSIZ_{ijt} = (GOVSIZ_{it} + GOVSIZ_{jt})/2$.

3.5 Sources of Data

Data for the study was obtained from secondary sources using library research method of data collection. Data on real GDP per capita and FDI were sourced from United Nations Conference on Trade and Development (UNCTAD) database. Data for the

variables are in constant 2005 USD. As for data on trade openness and population growth, the study resorts to World Bank database of World Development Indicators (WDI). Finally, data on government size was obtained from Penn World Trade Tables. All data were collected using library method of data collection. The choice of data source for each variable is informed by either the availability of data or longer time span and better quality of data in situations where the data on the variable is available in two or more sources. As for the timespan, the study covered the period 1970 – 2014.

3.6 Study Sample

The study covered a sample of 15 West African countries that are members of Economic Community of West African States (ECOWAS). This sample of 15 ECOWAS member countries is further broken down into two – 10 low-income and 5 lower middle-income countries. However, it is worth mentioning that the time span for achieving the objective of investigating the impact of FDI on income convergence covered a shorter sample period of 1986 – 2014. This variation in the sample period is necessitated by lack of FDI data for the ECOWAS member countries of equal length to that of real GDP per capita. Table 3.1 shows the list of economies in sample and their income group.

Table 3.1
Economies in the Sample

Low income	**Lower middle income**
Benin	Cabo Verde
Burkina Faso	Cote d'Ivoire
Gambia	Ghana
Guinea	Nigeria
Guinea-Bissau	Senegal
Liberia	
Mali	
Niger	
Sierra Leone	
Togo	

3.7 Method of Data Analysis

This section explains the methods adopted in analysing the data to achieve the objectives of the study. The study basically employs panel data analytical tools in achieving the set goals of the research. The choice of panel data approach is informed by a number of methodological advantages it offers. For example, Quah (1994) postulates that there appears to be a resolution that panel data allows for exploration of many effects that are otherwise unidentifiable using cross-section and time series data. From the view point of economic convergence related studies, Caselli *et al.* (1996), Islam (2003) and Badinger *et al*. (2004) observe that nearly all the cross country regression studies conducted on the phenomena of economic convergence are plagued by a serious methodological problem of omitted variable bias. In the view of Quah (1996), findings from cross country regressions cannot be taken on trust on the basis that most of the studies that have utilized the methodology suffer from the problem of sample selection bias.

3.7.1 System Generalized Method of Moments

Dynamic linear panel data models include q lags of the dependent variable as independent variables in estimating the relationship of interest. In their generic form, dynamic panel data models are presented as:

$$y_{it} = \sum_{j=1}^{q} \gamma_j y_{i,t-j} + x_{it}\beta_1 + W_{it}\beta_2 + v_i + \varepsilon_{it}, \qquad [3.17]$$

Developed by Blundell and Bond (1998), system GMM uses additional moment conditions to serve as an improvement in terms of performance of estimators in the

models developed in Arellano and Bond (1991, 1995). System GMM estimator can appropriately country-specific unobserved effects in a situation where the lagged dependent variable is included in a model as a regressor. In addition to handling country-specific unobserved effect, system GMM offers a number of advantages over other static and dynamic panel data estimation techniques. For instance, according to Wooldridge (2002) GMM has the capacity to efficiently take good account of twin problems of serial correlation and heteroskedasticity. Moreover, in the view of Baum and Schaffer (2003), GMM has the advantage of ensuring consistency in the parameter estimates even in the presence of arbitrary heteroskedasticity. Finally, the study is not the first to employ panel GMM in estimating convergence. Studies that employed panel GMM include Weeks and Yao (2003) and Badinger *et al.* (2004).

In the words of Nikoloski (2010), "the difference and system GMM estimators can be seen as part of broader historical trend in econometric practice toward estimators that make fewer assumptions about the underlying data-generating process and use more complex techniques to isolate useful information".

The general data generating process of system GMM is given by Equation [3.18]

$$y_{it} = \alpha y_{i,t-1} + x_{it}^{'}\beta + e_{it} \qquad [3.18]$$

$$e_{it} = u_i + v_{it}$$

$$E[\mu_i] = E[v_{ii}] = E[\mu_i v_{ii}] = 0$$

In Equation [3.18], the error term has two orthogonal components – fixed effects, μ_i, and the idiosyncratic shocks, v_{it}. System GMM estimators overtakes differenced GMM estimator by introducing additional moment condition. The additional moment condition is given by Equation [3.19].

$$E\ (\Delta y_{i,t-s}\left[\alpha_i + \mu_{i,t}\right]) = 0, \text{ for all values of } i, t \text{ and } s = 1, \ldots \infty \qquad [3.19]$$

Thus, Equation [3.19] implies that System GMM requires that lagged changes in the dependent variable are valid instruments for the level of the lagged dependent variable in the level equation. For either Differenced GMM or System GMM, the degree of serial correlation of ε will determine the validity of any instruments based upon the dependent variable.

3.7.2 Unit Root

3.7.2.1 Time Series Test

Traditional unit root testing procedure developed by Dickey and Fuller (1979) is employed to test for convergence hypothesis using Equation 3.3. Employing ADF test also serves two purposes: 1) the methods has to be used to provide input for performing simulations to apply SURADF procedure. The RATS codes for performing SURADF test for unit root requires using single equation ADF coefficients as well as the lower triangle variance-covariance of errors obtained by estimating ADF within SUR framework. Finally, besides using single equation ADF output as input for conducting SURADF simulations, using it is deemed important for the purpose of comparing the method with SURADF. Unique to this study, employing SURADF to investigate the

phenomena of convergence in ECOWAS would mitigate the problems associated with traditional ADF and other panel unit root testing procedures (Breuer, *et al.*, 2001; 2002).

In its generic form, the test assumed the true model to be represented by Equation [3.20];

$$y_t = \alpha + y_{t-1} + u_t, \qquad [3.20]$$

where u_t is $u_t \sim IID\ (0, \sigma^2_{eit})$.

The test involves using OLS to estimate Equation [3.21]. However, Equation [3.21] is likely to be affected by autocorrelation.

$$y_t = \alpha + \rho y_{t-1} + \delta t + u_t \qquad [3.21]$$

As a remedy to such situation, new version of Dickey-Fuller unit root test was developed. Known as Augmented Dickey Fuller unit root test, the method fits Equation [3.22].

$$\Delta y_t = \alpha + \beta y_{t-1} + \delta t + \zeta_1 \Delta y_{t-1} + \zeta_2 \Delta y_{t-2} + \ldots + \zeta_k \Delta y_{t-k} + \epsilon_{t,} \qquad [3.22]$$

where:

k is the number of lags included,

α is the constant term

y is the series on which test is being performed

ζ is the coefficient of differenced lagged dependent variable

δt is time trend, and

ϵ_t is the error term

After estimating Equation [3.22], the null hypothesis H_0: $\beta = 0$ is tested against the alternative, H_1: $\beta < 0$. The test statistic used in testing the null hypothesis against the alternative is given by the formula:

$$Z_t = \frac{\hat{\beta}}{\hat{\sigma}_\beta}, \qquad [3.23]$$

where: $\hat{\beta}$ is the estimated parameter from Equation [3.22] and $\hat{\sigma}$ is the standard error of estimated β.

3.7.2.2 Panel Unit Root Test

As against the common approach of employing single equation time-series based methods, such as ADF, and traditional panel data based procedures as suggested in Levin, Lin and Chu (2002) and Im, Pesaran and Shin (2003), this study employs Seemingly Unrelated Augmented Dickey-Fuller (SURADF) test. The test was proposed in Breuer, McNown and Wallace (2001, 2002). Compared to the traditional ways of testing the convergence hypothesis, SURADF procedure offers a number of advantages.

As for the single equation time-series based methods, conclusions on the convergence hypothesis are prone to being erroneous. This is the case because, as noted in Ben-David and Bohara (1997), for a small sample of closely located economies that are open to one another, it may not be realistic to assume such economies as being independent of one another. In contrast, shocks are easily transmitted across such economies. As a

consequence, it is obvious that the error covariance structure of ϵ_{it} is not a diagonal one and hence economies cannot be treated in isolation. This argument therefore calls for using panel data based approach in testing for convergence hypothesis.

On the other hand, traditional panel data unit root testing procedures suffer a couple of inherent problems. For instance, in the pioneer panel data unit root testing method proposed in Levin *et al.* (2002), rejecting the null hypothesis of unit root implies that all panel members are stationary. However, this may not be the case always. There could be a mixture of I(*0*) and I(*1*) for a particular series amongst a set of panel entities. In such instances, conclusions about unit root behavior of a series could be erroneous.

Moreover, the procedure imposes common autoregressive parameter under both the hypotheses (Breuer *et al.*, 2001, 2002). This restriction also has a problem. The issue of serial correlation may not be adequately addressed and hence could lead to spurious rejection of the null hypothesis. However, whereas newer versions of panel data unit root testing procedure such as ones proposed in Im *et al*. (2003), Maddala and Wu (1999) and Sarno and Taylor (1998) addressed the problem of applying common autoregressive coefficient across panel member, the methods fail to address the problem of "all or nothing" identified with Levin *et al.* (2002).

SURADF procedure entails estimations of the following system of ADF equation within the framework of seemingly unrelated regressions.

$$\Delta y_{1,t} = \propto_1 + (\rho_1 - 1) y_{1,t-1} + \sum_{i=1} \delta_i \Delta y_{1,t-i} + u_{1,t} \quad [3.24]$$
$$\Delta y_{2,t} = \propto_2 + (\rho_2 - 1) y_{2,t-1} + \sum_{i=1} \delta_i \Delta y_{2,t-i} + u_{2,t}$$
$$\vdots$$
$$\Delta y_{N,t} = \propto_N + (\rho_N - 1) y_{N,t-1} + \sum_{i=1} \delta_i \Delta y_{N,t-i} + u_{N,t}$$

where *y* stands is the series for which unit root test is being performed on, ρ_i stands for the AR coefficient for a given series *i*, the methods involves testing for the significance of each ($\rho_i - 1$) against the simulated critical values. RATS codes were obtained from the proponents of the method for implementing the procedure.

3.7.3 Diagnostic Tests

3.7.3.1 Serial Correlation

One of the unique properties of SURADF is that, unlike traditional methods for testing unit root (such as ADF and IPS), the procedure allows for heterogeneity of autoregressive terms across individual panel members. In turn, this property of the procedure helps in handling the problem of serial correlation more adequately, and by extension ensuring correct specification of ADF equation for each panel member. To ensure appropriate lag length selection in implementing SURADF procedure outlined in Section 3.7.2, this study employs serial correlation test developed in Breusch (1978) and Godfrey (1978). The choice of the method is informed by the advantage it offers of handling high-order serial correlation, as opposed in the method developed by Durbin and Watson (1950, 1951) another serious drawback of D-W test which makes it unsuitable for application in this study is that it cannot be implemented on dynamic models, an apparent feature of models estimated in this study. Consider a regression Equation [3.25]:

$$y_t = \beta_1 x_{1t} + \ \ldots \ + \beta_k x_{kt} + u_t, \qquad [3.25]$$

where x_{it} are the lags of the dependent variable. Computing the residual $\hat{u}_t$ and estimating auxiliary regression of the residuals on all the regressors and q lags of $\hat{u}_t$, as specified by Equation [3.26],

$$\hat{u}_t = \gamma_1 \hat{u}_{t-1} + \ldots + \gamma_q \hat{u}_{t-q} + \phi_1 x_{it} + \ldots + \phi_k x_{kt} + e_t \qquad [3.26]$$

In Equation [3.26], $\hat{u}$ is the computed residual from estimation of Equation [3.25] and e is the error term.

Computing Breusch-Godfrey test statistic as NR^2 where both N and R^2 are obtained from the auxiliary Equation [3.26], asymptotic χ^2 distribution with $F(q, N\text{-}q\text{-}k)$ is used to test the null hypothesis of no serial correlation against the alternative hypothesis.

3.7.3.2 Test for Overidentifying Restrictions

This study employed Sargan test for the validity of over-identifying instruments as a post-estimation test to access the consistency of estimators derived from system-GMM estimators. The test was proposed by Sargan (1958, 1975) and later extended to include non-linear models by Hansen (1982). As the case is with all other GMM estimators, estimates from system GMM can only be consistent if the moment conditions used are valid. The null hypothesis states that over-identifying moment conditions used are valid. The test uses asymptotic χ^2 distribution with $(m - k)$ degrees of freedom, where m and k are respectively the number of instruments and exogenous variables.

The test statistic which is generated using errors of instrumental variable regression equation is given Equation [3.27]

$$\sum_i \frac{\tilde{u}^2}{\frac{1}{n}\sum_i \tilde{u}^2} = nR_{\tilde{u}}^2 . \qquad [3.27]$$

where; $\tilde{u}^2$ is the squared residuals from auxiliary regression,

n is the sample size, and

R^2 is the coefficient of determination for the auxiliary regression

3.7.3.3 Test for Autocorrelation

The validity moment conditions used in system GMM depends largely on the absence of serial correlation on successive errors (Blundell & Bond, 1998). Arellano and Bond (1991) proposed a test to detect the presence or absence of serial correlation. In performing Arellano-Bond test for serial correlations, the concern is on the second order serial correlation. This is the case because, first-difference errors are serially correlated. The test statistic for the second-order test of the null hypothesis that the errors are not serially correlated against the alternative is given by Equation [3.28]

$$m_2 = \frac{\hat{v}_{-2}^{'}\hat{v}_*}{\hat{v}^{1/2}}\, a\,N(0,1), \qquad [3.28]$$

where $\hat{v} = \sum_{i=1}^{N} v'_{i(-2)}\hat{v}_i * v'_i * \hat{v}'_{i(-2)} - 2v'_{-2}X_*(X'ZA_NZ'N)^{-1}X'ZA_N\left(\sum_{i=1}^{N} Z'_i\hat{v}_i\hat{v}'_i * \hat{v}_{i(-2)}\right) + \hat{v}'_{-2}X_* avar(\hat{\delta})X'_*\hat{v}_{-2}$.

3.8 Conclusion

The chapter provides detailed information on the conceptual framework and various econometric techniques applied in achieving the objective of the study. After providing conceptual link between FDI and per capita income convergence in Section 3.2, Section 3.3 highlighted on the various models estimated in the study. Specifically, the section highlighted on the model of estimating both absolute and conditional convergence. The Section also set up the model on the relationship between economic convergence and FDI both within and across ECOWAS. As for the Section 3.4, detailed justification for the inclusion of each variable is provided using standard economic literature. Sources of data used in estimating various relationships of interest to the study were mentioned in Section 3.5. Study sample and timeframe the study covered are explained in Section 3.6. Various methods employed in analysing the data were described in Section 3.7. The Section consists of six subsections. The subsection are: System GMM, Augmented Dickey-Fuller unit root test, panel unit root test and L-M test for serial correlation. Other subsections the section cover includes system GMM post-estimation test – Sargan test for the validity of instrument and Arellano-Bond test for serial correlation of errors.

CHAPTER FOUR

DISCUSSION OF RESULTS

4.1 Introduction

This chapter is devoted to the analysis and discussion on the results. The chapter is divided into two main sections – descriptive and econometric analysis. In the econometric analysis section, results on both conditional and unconditional convergence were discussed. Results on the role of FDI in enhancing convergence to ECOWAS average real GDP per capita are discussed in addition to 'within-group' convergence effect of FDI. Finally, results on the effect of FDI on pairwise convergence across and within-income groups were discussed.

4.2 Descriptive Analysis

Table 4.1 describes data on the convergence variable. The table shows average, minimum, maximum and standard deviations of deviation of individual economies from their respective income groups averages as well as from ECOWAS average over the course of 45 years, 1970 – 2014. On the convergence to the group average, lower middle income ECOWAS member countries have exhibited high tendencies towards divergence than convergence compared to the low income economies. This is evident by the high overall average deviation of the lower middle income economies from their average compared to the low income economies.

Furthermore, on the average deviation of individual economies from their respective group averages, it can be observed that only Benin, Liberia and Niger recorded average deviation higher than that of low income group. In other words, it can be observed that

majority of low income economies have achieved lower level of average deviations of real GDP per capita from that of their group. On the other hand, only Cabo Verde and Ghana have average deviation from the group average real GDP per capita higher than that of their group.

Beside deviations in real GDP per capita of individual economies from their respective group average, Table 4.1 also reports deviations of each economy from entire ECOWAS average. Reading form the table, it can be deduced that low income countries have shown evidence of convergence to the ECOWAS average real GDP per capita as clearly depicted by low level average deviation of the countries in the group compared to those in the lower middle income category.

Analysing group level convergence using overall deviation series, it can be observed that Benin, Burkina Faso, Gambia, Guinea-Bissau, Mali and Togo low income economies have achieved lower deviations than the overall average deviation of the group. As for the group of lower middle income economies, Ghana, Nigeria and Senegal have achieved lower deviation of real GDP per capita than the overall average real GDP per capita of the ECOWAS.

Table 4.1
Convergence of Real GDP per Capita amongst Income Groups and across ECOWAS, 1970 – 2014

Income	**Country**	**Group Convergence**				**Overall Convergence**			
		Mean	**Min.**	**Max.**	**Standard Deviation**	**Mean**	**Min.**	**Max.**	**Standard Deviation**
Low Income	Benin	143.51	52.93	178.82	37.94	42.75	1.78	115.58	41.84
	Burkina Faso	58.51	2.66	122.65	38.56	183.62	160.81	222.54	17.13
	Gambia	62.92	10.89	100.77	23.84	120.34	20.96	281.91	75.39
	Guinea	77.99	55.47	126.72	22.57	261.25	177.20	419.53	72.56
	Guinea-Bissau	74.99	0.24	218.17	62.91	131.02	7.79	292.57	87.07
	Liberia	191.50	105.92	264.33	46.51	346.64	2.36	489.81	117.33
	Mali	43.96	1.19	104.52	30.06	178.00	127.42	259.43	34.32
	Niger	93.59	59.41	128.97	23.00	276.86	171.41	419.57	87.31
	Sierra Leone	38.89	1.23	108.33	29.01	201.88	79.94	290.38	70.55
	Togo	34.20	0.45	95.42	27.76	149.32	45.50	282.98	86.67
Average		***82.01***	***29.04***	***144.87***	***59.43***	***189.17***	***79.52***	***307.43***	***111.03***
Lower Middle Income	Cabo Verde	727.67	10.43	1495.74	560.28	1090.41	161.41	2045.06	696.64
	Cote d'Ivoire	266.99	39.39	547.55	136.42	480.75	217.99	753.43	152.33
	Ghana	431.61	291.22	605.91	104.99	75.34	6.41	154.10	30.12
	Nigeria	214.03	109.66	330.43	62.94	152.57	1.18	385.28	127.47
	Senegal	195.30	0.82	496.02	161.19	174.04	89.59	232.71	35.88
Average		***367.12***	***90.30***	***695.13***	***335.15***	***394.62***	***95.32***	***714.12***	***493.54***
ECOWAS		**177.04**	**49.46**	**328.29**	**240.26**	**257.65**	**84.78**	**442.99**	**313.74**

Table 4.2 describes real GDP per capita for the 15 ECOWAS member countries the study covers. The analysis is disaggregated on the basis of income level of the economies as categorized by the World Bank (2014). The table provides some insights on the mean, minimum, maximum and standard deviation of real GDP per capita.

As the table contains, the average annual real GDP per capita for the low income countries over the course of 45 years stood at $383.22. This performance is well below that of lower middle income economies with an average real GDP per capita of $1,051.08. This shows that lower middle income countries have achieved an average that is nearly three-times more than one recorded by low income economies.

Reading Table 4.2, it can also be observed that Burkina Faso, Guinea, Liberia, Mali and Niger have achieved average real GDP per capita higher than their group average. Conversely, Benin, Gambia, Guinea-Bissau, Sierra Leone and Togo have recorded average real GDP per capita lower than the group average. As for the group of lower middle income countries, only Cabe Verde and Cote d'Ivoire have average real GDP per capita higher than the group average. On the other hand, Ghana, Nigeria and Senegal have average real GDP per capita lower than their group average.

Table 4.2
Real GDP per Capita ($) of ECOWAS Member Countries, 1970 – 2014

Income Level	Country	Mean	Min.	Max.	Standard Deviation
Low Income	Benin	476.16	379.86	596.64	59.99
	Burkina Faso	330.54	225.93	537.79	81.30
	Gambia	436.34	400.63	486.98	19.57
	Guinea	276.71	221.35	306.47	21.63
	Guinea-Bissau	457.43	378.69	549.88	42.32
	Liberia	306.34	56.14	521.93	148.14
	Mali	359.67	219.92	499.69	89.64
	Niger	314.48	245.85	498.76	72.57
	Sierra Leone	412.06	216.90	524.38	90.23
	Togo	462.46	360.53	625.32	77.09
Average		***383.22***	***270.58***	***514.78***	***105.09***
Lower Middle Income	Cabo Verde	1,599.69	718.62	3,008.77	770.86
	Cote d'Ivoire	1,164.41	934.30	1,667.29	197.52
	Ghana	732.15	507.65	1,231.44	173.21
	Nigeria	1,043.45	742.49	1,708.97	275.40
	Senegal	715.72	619.45	799.84	52.64
Average		***1051.08***	***704.50***	***1683.26***	***501.80***
ECOWAS		**605.84**	**415.22**	**904.28**	**436.25**

Another relevant information in Table 4.2 is the standard deviation of real GDP per capita. Comparing the standard deviations for the two groups, it can be deduced that low income countries exhibited relatively lesser dispersion of the real GDP per capita for the sample period. Moreover, country level analysis for the group of low income countries reveals that countries within the group achieved relatively stable dispersion in GDP per capita in comparison to those in the other group.

Data relating to FDI per capita has been clearly described in Table 4.3. As the table shows, the average FDI per capita for the low income countries was observed to be lower than that of lower middle income countries. This indicates that low income countries were on the average not FDI attractive compared to the lower middle income

countries over the period 1986 – 2014. Table 4.3 further reveals that only Liberia and Cabo Verde boast of average per capita FDI higher than their respective group averages.

Table 4.3
Real FDI per Capita Stock ($) – ECOWAS Member Countries, 1986 – 2014

Income Level	Country	Mean	Min.	Max.	Standard Deviation
Low Income	Benin	29.69	5.36	94.98	24.37
	Burkina Faso	12.71	1.84	60.61	14.62
	Gambia	184.06	87.04	381.97	101.55
	Guinea	43.03	1.24	163.22	47.94
	Guinea-Bissau	21.87	0.92	53.21	17.13
	Liberia	1,294.64	915.28	1,635.87	232.88
	Mali	59.87	19.56	148.72	33.78
	Niger	45.75	5.09	189.19	48.17
	Sierra Leone	92.83	39.86	241.03	45.74
	Togo	72.72	13.18	145.12	32.05
Average		***185.72***	***108.94***	***311.39***	***382.77***
Lower Middle Income	Cabo Verde	746.85	0.00	2,449.82	851.59
	Cote d'Ivoire	205.57	90.76	319.58	86.49
	Ghana	127.10	18.44	527.52	135.83
	Nigeria	235.47	60.62	328.92	81.95
	Senegal	54.99	23.94	144.67	34.05
Average		***274.00***	***38.75***	***754.10***	***455.77***
ECOWAS		**215.14**	**85.54**	**458.96**	**410.13**

Table 4.3 also provides information on the dispersion of the FDI per capita over the sampled period in the form of standard deviation. The distribution of FDI per capita among lower middle income economies exhibited higher level of dispersion compared to the dispersion of the variable within the group of low income economies.

Of the control variables in this study is trade openness. Trade openness data is described in Table 4.4. As the table unveils, the group of lower middle income economies, comprising of five economies, appeared to be more open compared to their counterparts in the group of low income economies. Having an average of 67.20 percent, the lower

middle income countries are well above the average of low income economies by nearly 10 percentage points.

Analysing openness variable for each of the two groups in isolation can be informing. Starting with the group of low income economies, with an average openness of 57.25 percent a number of conclusions can be drawn. Of the 10 economies belonging to the group, seven countries recorded an average of openness variable that is well below the group average. The economies are: Benin, Burkina Faso, Gambia, Guinea-Bissau, Mali, Niger and Sierra Leone. As for the Guinea, Liberia and Togo, the economies attained an average openness that is well above the group average.

Table 4.4
Trade Openness (%), 1970 – 2014

Income Level	**Country**	**Mean**	**Min.**	**Max.**	**Stand. Dev.**
Low Income	Benin	46.98	35.11	53.34	5.45
	Burkina Faso	41.42	30.69	57.99	8.05
	Gambia	56.88	33.32	83.48	15.41
	Guinea	72.31	53.60	107.00	13.58
	Guinea-Bissau	35.63	12.65	59.19	15.41
	Liberia	89.02	30.47	188.70	45.64
	Mali	51.84	38.62	65.52	7.17
	Niger	49.65	37.76	58.11	4.46
	Sierra Leone	45.21	29.11	62.68	11.68
	Togo	83.56	45.54	123.90	19.76
Average		***57.25***	***34.69***	***85.99***	***25.14***
Lower Middle Income	Cabo Verde	75.06	66.18	80.89	4.18
	Cote d'Ivoire	76.16	56.32	94.69	12.57
	Ghana	63.81	39.49	114.39	18.67
	Nigeria	52.24	41.28	71.29	7.08
	Senegal	68.72	65.09	72.21	1.84
Average		***67.20***	***53.67***	***86.69***	***13.74***
ECOWAS		**60.57**	**41.02**	**86.23**	**22.48**

Turning to the group of lower middle income economies, the situation is glaringly different. In contrast to the group of low income economies, majority of the lower

middle income countries achieved an openness average well above the average for the group.

The three economies with average openness above the group average are: Senegal, Cabo Verde and Cote d'Ivoire. At the other end, Ghana and Nigeria each have average openness below the group average with 63.81 percent and 52.24 percent respectively. In fact the average for Ghana can be seen as almost equal to that of group as the deviation is only 3.89 percentage points.

By and large, ECOWAS countries can be regarded as open to international trade. This can be deduced from the average of the openness performance of the 15 ECOWAS economies over the sample period. As the table indicates, the average openness over the sample period is 60.57 percent.

Government size is believed to have some impact on output performance as well as per capita convergence among countries. Government size is measured as government consumption share of GDP at 2005 constant prices. Table 4.5 is meant to describe the government size variable. Starting the discussion from the mean, it can be read from the table that low income economies and lower middle income countries have respective averages of 11.01 and 7.85 over the period 1986 – 2014.

Table 4.5
Government Size (%), 1970 – 2014

Income Level	Country	Mean	Min.	Max.	Stand. Dev.
Low Income	Benin	9.35	6.87	15.23	2.10
	Burkina Faso	15.87	12.24	17.71	1.25
	Gambia	9.90	2.45	23.44	5.06
	Guinea	8.03	5.48	15.25	2.66
	Guinea-Bissau	9.10	3.37	15.22	4.33
	Liberia	6.33	3.99	8.55	0.85
	Mali	14.83	10.87	18.77	1.66
	Niger	16.47	9.95	22.99	3.98
	Sierra Leone	9.65	3.92	14.80	3.36
	Togo	10.61	7.95	16.73	2.20
Average		***11.01***	***6.71***	***16.87***	***4.46***
Lower Middle Income	Cabo Verde	13.40	11.54	18.14	1.58
	Cote d'Ivoire	6.56	5.15	8.22	0.95
	Ghana	7.69	5.94	9.83	1.01
	Nigeria	4.64	0.90	14.08	4.28
	Senegal	6.98	5.28	8.94	1.12
Average		***7.85***	***5.76***	***11.84***	***3.67***
ECOWAS		**9.96**	**6.39**	**15.19**	**4.46**

By this finding, it can be concluded that the share of government consumption expenditure of real GDP is on the average higher in low income countries than in the lower middle income economies. As can be observed from the table, of the 10 low income economies, a total of seven countries – Liberia, Guinea, Guinea-Bissau, Benin, Sierra Leone, Gambia and Togo – have recorded government expenditure as a share real GDP below that of the group average. For these economies, with average below that of the group, Liberia ranked least (6.33 percent) and Togo as the highest with 10.61. However, the remaining three economies – Mali (14.83 percent), Burkina Faso (15.87) and Niger (16.47) – have annual averages for government size variable above the group's average.

Similarly, of the five member countries belonging to the group of lower middle income economies, only Cabo Verde (13.40 percent) recorded an average for the government

size variable above the group average (7.86 percent). By and large, it can be concluded that, for the period under review, low income economies have on the average higher government size compared to the lower middle income countries. This is palpable looking at the average for the full sample of 15 economies. The average percentage for government consumption as a percentage of real GDP for the ECOWAS countries is 9.96 percent.

Table 4.6 describes data relating to population growth rate of the sampled economies. The table shows that the average population growth for the sample of low income economies is 2.80. On the other hand, the average population growth for the group of lower middle income economies is 2.48. Looking at the ECOWAS average population growth rate of 2.69, it can be deduced that whereas low income economies have average population growth rate higher than the ECOWAS average, lower middle income economies have lower average. On the average population growth of individual economies, for the group of low income economies, it can be seen that a total of exactly five economies have average higher than the group average. In contrast, four lower middle income economies have average population growth higher than the group average, with Cabo Verde being the exception.

Table 4.6
Population Growth (%), 1970 – 2014

Income Level	Country	Mean	Min.	Max.	Stand. Dev.
Low Income	Benin	3.12	2.64	3.73	0.29
	Burkina Faso	2.84	2.59	3.07	0.15
	Gambia	3.34	2.77	4.78	0.58
	Guinea	3.04	1.74	5.86	1.24
	Guinea-Bissau	2.22	2.12	2.45	0.10
	Liberia	2.39	-1.83	7.84	2.76
	Mali	2.69	1.44	3.32	0.57
	Niger	3.54	2.79	4.03	0.35
	Sierra Leone	2.07	-0.91	4.97	1.67
	Togo	2.70	2.40	3.34	0.21
Average		***2.80***	***1.58***	***4.34***	***1.21***
Lower Middle Income	Cabo Verde	1.70	0.53	2.77	0.72
	Cote d'Ivoire	2.69	1.76	3.77	0.67
	Ghana	2.57	2.25	3.00	0.18
	Nigeria	2.58	2.50	2.69	0.07
	Senegal	2.84	2.41	3.15	0.24
Average		***2.48***	***1.89***	***3.08***	***0.61***
ECOWAS		**2.69**	**1.68**	**3.92**	**1.06**

Table 4.6 also provides information on the minimum and maximum population growth rate amongst ECOWAS member countries. The minimum and maximum population growth in low income ECOWAS are respectively -1.83 percent and 7.84 percent. In contrast, the minimum and maximum population growth rates for the group of lower middle income economies for the period under study is 0.53 percent and 3.77 percent, respectively.

Table 4.7 contains correlation coefficients for each pair of the variables under consideration for the sub-samples of low income and lower middle income economies as well as for the entire ECOWAS. Besides providing insight on the nature and degree of association among individual variables, correlation coefficient serves the purpose of preliminary diagnostic check for the problem of multicollinearity.

Table 4.7
Correlation Matrix of the Variables

	LRGDP	LFDI	LOPN	LGOVSIZE	LPOP
Panel A: Low Income					
LRGDP	1.000				
LFDI	-0.374	1.000			
LOPN	-0.273	0.352**	1.000		
LGOVSIZE	-0.069	-0.381*	-0.099	1.000	
LPOP	-0.135*	0.031	0.052	0.081*	1.000
Panel B: Lower Middle Income					
LRGDP	1.000				
LFDI	0.861**	1.000			
LOPN	0.446*	0.289**	1.000		
LGOVSIZE	0.594	0.255	0.358*	1.000	
LPOP	0.015	0.015	0.025	0.072*	1.000
Panel C: ECOWAS					
LRGDP	1.000				
LFDI	0.417*	1.000			
LOPN	0.209**	0.331*	1.000		
LGOVSIZE	-0.028	-0.193	-0.084	1.000	
LPOP	-0.041	0.045	0.051*	0.015*	1.000

** and * represents significance at 5% and 10% levels of significance respectively.

The variables of primary interest in this study are convergence in real GDP per capita and FDI. Looking at the magnitude and signs of correlation coefficients for the pair of these variables for each of the two sub-samples, a couple of interesting issues can be highlighted.

A sharp contrast can be seen in terms of the magnitude of the correlation coefficients for the pair of the variables between low income countries and lower middle income countries. Compared to the correlation coefficient of -37.40 percent for the group of low income countries, the correlation coefficient is 86.10 percent for the group of lower middle income countries. The implication of this finding is that the degree of association between real GDP and FDI is stronger among lower middle income

countries compared to the low income countries. The possible explanation to this finding could be that lower middle income countries of West Africa have attained far higher level of absorptive capacity to benefit from the positive externalisations associated with the FDI. A host of studies on the link between FDI and economic growth have emphasized on the impact of absorptive capacity of hosting economy for the FDI to have any positive effect on the growth performance the of economy.

Regarding the sign of the correlation coefficient, the sub-samples have exhibited different signs. This finding has the implication that FDI could be detrimental to the per capita output performance of countries that have not achieved certain threshold of absorptive capacity in respect of human capital development and technological advancement. However, this finding cannot be relied upon in drawing the conclusion that FDI can be detrimental to growth of the hosting economy. This is so because correlation coefficient cannot provide a robust result as it only merely measures the degree of association between two variables.

4.3 Unconditional Convergence

4.3.1 Ranking of Real GDP per Capita

One of the simple and crude ways to explore the phenomenon of convergence in a given series within a panel of countries, is to examine the series ranking of such economies over time (Habibullah *et al.*, 2012). In order to achieve the first objective of this study of examining the extent of convergence in per capita levels of ECOWAS member countries, real GDP per capita of the ECOWAS member countries were ranked using a sample of six data points for each economy. Results from the ranking are presented in Table 4.8.

Table 4.8
Ranking of Real GDP per Capita among ECOWAS Members, 1970 – 2014

Country	1970	1980	1990	2000	2010	2014
Benin	12	10	9	6	6	6
Burkina Faso	13	14	14	11	9	7
Cabo Verde	2	3	1	1	1	1
Cote d'Ivoire	1	1	2	2	3	4
Gambia	11	12	10	7	8	10
Ghana	4	5	5	4	4	3
Guinea	15	15	12	12	13	14
Guinea-Bissau	8	9	7	8	10	12
Liberia	7	8	15	15	14	13
Mali	14	13	11	10	7	9
Niger	10	11	13	13	15	15
Nigeria	3	2	3	3	2	2
Senegal	5	4	4	5	5	5
Sierra Leone	9	7	6	14	12	8
Togo	6	6	8	9	11	11

As Table 4.8 reveals, Cabo Verde ranked second and third in 1970 and 1980, respectively. Starting from 1990, the economy ranked first and maintained the position for the rest of the period under review. Cote d'Ivoire, on the other hand, ranked first for the first two sample periods, 1970 and 1980 and suffers contentious loss of position to Cabo Verde. As far as the ranking of real GDP per capita is concerned, Niger is one of the poorly performing economy in terms of catch up. For the entire period under review, the economy has not succeeded in overtaking any of the economies under study. Succinctly, it can be said that there are lots of catch ups and overtaking in the real GDP per capita ranking of ECOWAS economies.

To have better understanding of the real GDP per capita ranking of ECOWAS member countries, Table 4.9 provides 'within-income-group' ranking of real GDP per capita the countries.

Table 4.9
Ranking of ECOWAS Real GDP per Capita by Income Groups, 1970 – 2014

Country	1970	1980	1990	2000	2010	2014
Low income:						
Benin	7	5	4	1	1	1
Burkina Faso	8	9	9	6	4	2
Gambia	6	7	5	2	3	5
Guinea	10	10	7	7	8	9
Guinea Bissau	3	4	2	3	5	7
Liberia	2	3	10	10	9	8
Mali	9	8	6	5	2	4
Niger	5	6	8	8	10	10
Sierra Leone	4	2	1	9	7	3
Togo	1	1	3	4	6	6
Lower middle income:						
Cabo Verde	2	3	1	1	1	1
Cote d'Ivoire	1	1	2	2	3	4
Ghana	4	5	5	4	4	3
Nigeria	3	2	3	3	2	2
Senegal	5	4	4	5	5	5

Results from Table 4.9 indicate similar trend in terms overtaking and catch-ups. For the group of low income economies, the only economy that maintains poor performance of persistent loss of position in Niger. On the other hand, Benin recorded a success of continues overtake of other economies in the sample to rank first in 2014 from seventh position in 1970. As for the group of lower middle income economies, Cabo Verde has best performance of persistent overtake. On the contrasts, Senegal ranked fifth in four instances and fourth only in two cases.

Whereas ranking of a given series for a group of countries provides us with a simple and crude measure of convergence in the series across a set of countries, the measure is by no means a sufficient and reliable one. In the standard literature on economic convergence, several other measures were employed in exploring convergence amongst/across countries. One of the measures is examining the unit root behaviour of group mean-deviation series of economies (Ben-David & Bohara, 1997).

As outlined in the previous chapter, testing for the per capita income convergence for a group of countries boils down to performing ADF test on the series of individual economies deviations from annual averages of real per capita GDP of the group (Ben-David, 1993; Ben-David & Bohara, 1997). To achieve the first objective, annual averages of real per capita GDP for 15 ECOWAS member countries were computed to enable generating deviation series as the difference between annual real GDP per capita of each country and annul average for the entire group. Data for the real GDP per capita for each economy spans 1970 – 2014, thereby making a total of 45 observations for each economy.

To provide insight on the degree of deviations of individual economies from their group averages, Figure 4.1 and Figure 4.2 were generated. Whereas Figure 4.1 depicts graphical presentation of deviations of individual low income economies from their group annual averages. Figure 4.2, on the other hand, shows graphical representation of the same variable for the group of lower middle income economies.

Figure 4.1 shows that deviation from mean of log real GDP per capita amongst low income economies is relatively stable. With the exception of Liberia, the mean deviation fluctuates between -0.5 and +0.5 over the course of 1970 – 2014.

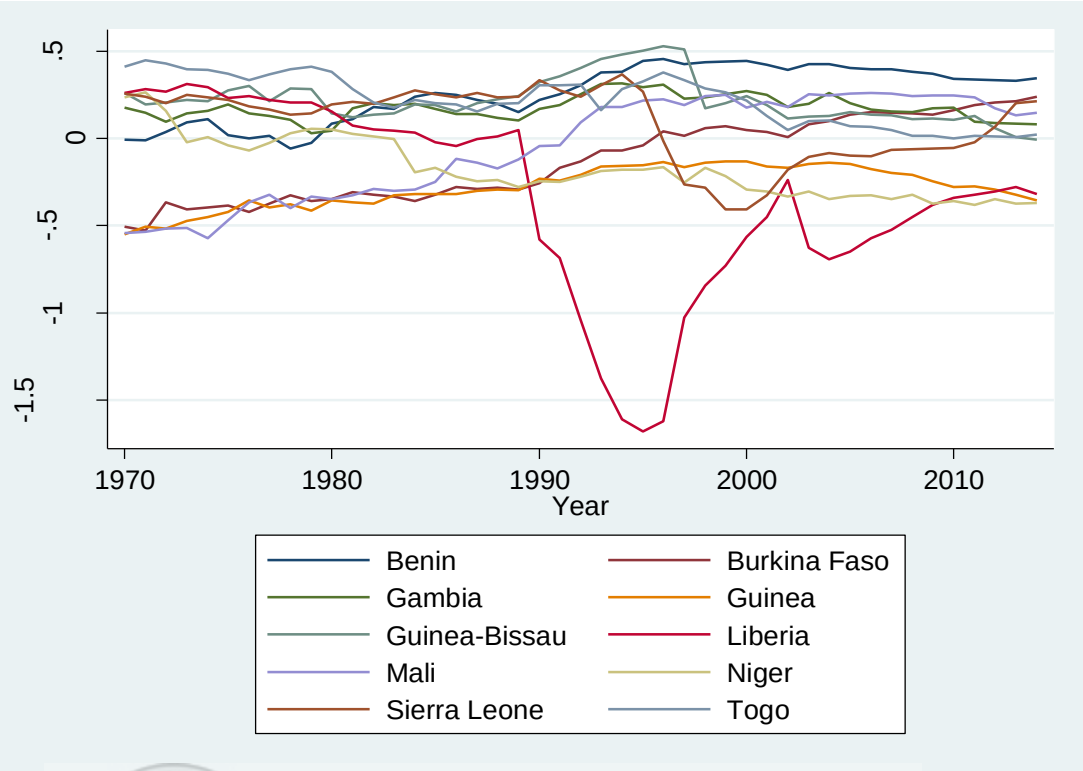


Figure 4.1
Annual Deviations of Real GDP from Group Average – Low Income Countries, 1970 – 2014

This low range of mean deviation serves as a preliminary indication that the economies in the sample have tendency towards converging to the group average. However, this can only be confirmed when a more robust and reliable inferential test is performed.

In contrast, Figure 4.1 shows that lower middle income ECOWAS economies are to some extent characterised by wider range of deviation from the group average over the course of 1970 – 2014.

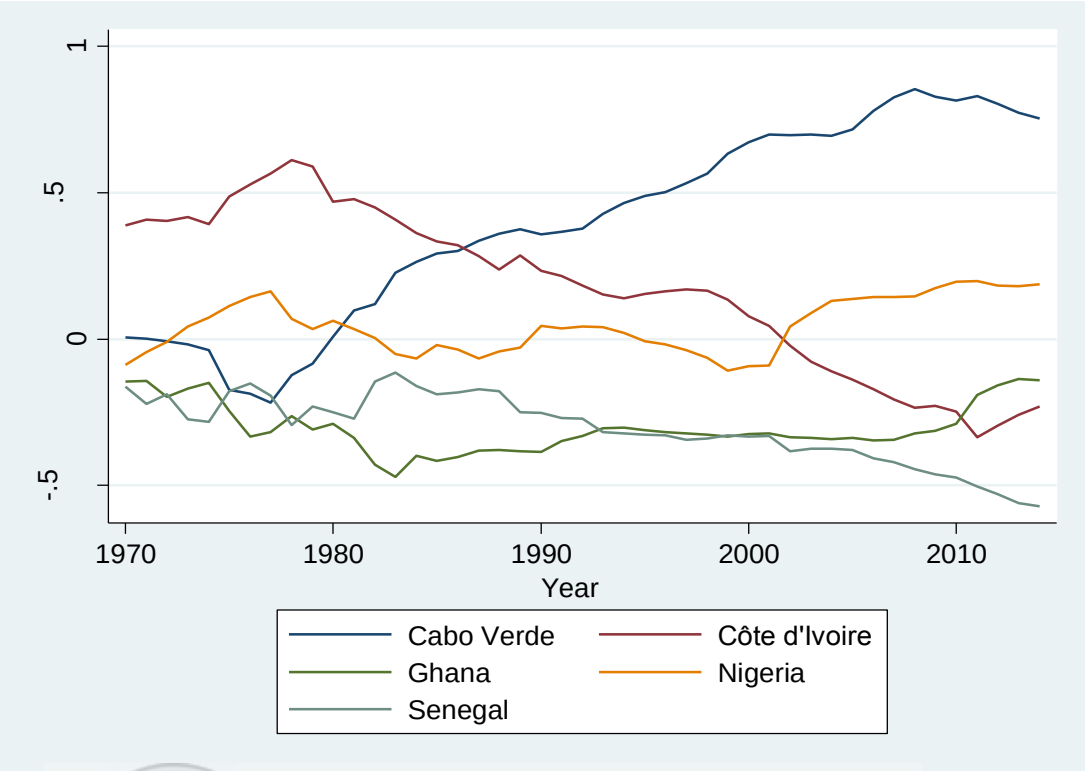


Figure 4.2
Annual Deviations of Real GDP from Group Average – Lower Middle Income Countries, 1970 – 2010

As evidently shown in Figure 4.2, mean deviation for the group of lower middle income ECOWAS economies ranges between -0.5 to +1. This indicates that it is less likely that convergence would be found amongst lower middle income ECOWAS countries.

4.3.2 Unit Root Test

Having generated the real GDP per capita deviation series (y_i - $\bar{y}_t$) for each economy, the next step involves performing unit root test for each of the deviation series for each economy. Rejecting the null hypothesis that the series does not contain a unit root supports convergence. In order to justify the assertions made regarding the superiority of SURADF as against traditional ADF as well as other techniques for performing unit root test, results for traditional ADF test for stationarity were reported alongside the

chosen SURADF for each of the 15 series. Results for the tests on deviation series from ECOWAS average real GDP per capita are presented in Table 4.10.

Table 4.10
Seemingly Unrelated Regression Based Augmented Dickey-Fuller Unit Root Test ECOWAS

$y_i-\bar{y}_t$	*t*-statistic		SURADF critical values		
	ADF	**SURADF**	***0.01***	***0.05***	***0.10***
$(y_i-\bar{y}_t)_{\text{Benin}}$	-2.092[1]*	-4.083[1]*	-4.574	-3.498	-2.938
$(y_i-\bar{y}_t)_{\text{Burkina Faso}}$	-1.379[1]**	0.433[1]	-3.425	-2.470	-1.982
$(y_i-\bar{y}_t)_{\text{Cabo Verde}}$	-0.900[2]	-1.865[2]	-3.692	-2.822	-2.341
$(y_i-\bar{y}_t)_{\text{Cote d'Ivoire}}$	-0.750[1]	-1.493[1]	-3.310	-2.355	-1.874
$(y_i-\bar{y}_t)_{\text{Gambia}}$	-1.470[1]**	-2.717[1]*	-3.218	-2.325	-1.828
$(y_i-\bar{y}_t)_{\text{Ghana}}$	-0.376[1]	-0.558[1]	-4.678	-3.467	-2.937
$(y_i-\bar{y}_t)_{\text{Guinea}}$	-1.435[1]**	-2.756[1]*	-2.899	-2.040	-1.588
$(y_i-\bar{y}_t)_{\text{Guinea-Bissau}}$	-0.744[1]	-1.156[1]	-4.578	-3.455	-2.867
$(y_i-\bar{y}_t)_{\text{Liberia}}$	-1.748[1]*	-3.974[1]*	-3.404	-2.399	-1.804
$(y_i-\bar{y}_t)_{\text{Mali}}$	-2.073[1]*	-3.150[1]*	-4.140	-3.047	-2.451
$(y_i-\bar{y}_t)_{\text{Niger}}$	-2.111[1]*	-1.624[1]**	-2.858	-1.997	-1.509
$(y_i-\bar{y}_t)_{\text{Nigeria}}$	-0.617[1]	-1.066[1]	-3.458	-2.407	-1.903
$(y_i-\bar{y}_t)_{\text{Senegal}}$	-2.732[1]*	-3.732[1]*	-2.518	-1.576	-1.100
$(y_i-\bar{y}_t)_{\text{Sierra Leone}}$	-1.526[2]**	-1.570[2]	-4.381	-3.268	-2.707
$(y_i-\bar{y}_t)_{\text{Togo}}$	-0.874[1]	0.138[1]	-4.149	-3.062	-2.495

Note:

a) * and ** indicate rejection of the null hypothesis that real per capita GDP of a particular economy is not converging to the group average at 5% and 10% levels of significance, respectively.
b) numbers in brackets represent the lags included to ensure that serial correlation is removed.
c) the critical values for ADF test statistic are: 2.423, for 1% level of significance; 1.684, for 5% level of significance; and 1.303, for 10% level of significance.
d) critical values for SURADF are generated by Monte Carlo simulation using 10,000 replications based on the underlying dataset.

As can be observed from Table 4.10, using traditional ADF, nine of the 15 ECOWAS member countries have registered evidence of convergence in their real per capita GDP to the group average over the period 1970 – 1975. Such economies for which the null hypothesis of no-convergence rejected include: Benin, Burkina-Faso, Gambia, Guinea, Liberia, Mali, Niger, Senegal and Sierra Leone. The test results further shows that the

null hypothesis of no-convergence is rejected at 5 percent level of significance in the case of Benin, Liberia, Mali, Niger and Senegal. On the other hand, the null hypothesis of no-convergence is rejected at 10 percent level of significance in the cases of Burkina-Faso, Gambia, Guinea and Sierra Leone.

As opposed to the case of nine countries mentioned above, the null hypothesis of no-convergence cannot be rejected in six cases, namely: Cabo Verde, Cote d'Ivoire, Ghana, Guinea-Bissau, Nigeria and Togo. However, looking at income profile of these non-converging economies, according to single-equation ADF, one would come up with the understanding that majority of them are lower middle income countries. The expectations are Guinea-Bissau and Togo, both of which belong to the group of low income economies. Owing to the fact that the sampled economies are closely located and are opened to each other due to their common membership of ECOWAS, economic shocks are much likely to transmit across the economies. This therefore implies that examining the convergence phenomenon of individual economies cannot be treated in isolation.

Results using SURADF procedure are somewhat different from those obtained from single-equation ADF approach. According to results from SURADF method, only seven economies can be said to have achieved convergence to the group average real GDP per capita over the course of 1970 – 2014. This therefore shows that traditional ADF is more likely to reject the null hypothesis that a given economy is not converging to the group average. The probable explanation to this discrepancy is that, as opposed to the SURADF, single-equation ADF treats economies in isolation, of which this is not be the case.

According to the SURADF approach, Benin, Gambia, Guinea, Liberia, Mali, Niger and Senegal showed evidence of convergence to the group average. A closer look at the SURADF results show that the null hypothesis of no-convergence is rejected for Benin, Gambia, Guinea, Liberia, Mali and Senegal at 5 percent level of significance. However, only in the case of Niger that the null hypothesis is rejected at 10 percent level of significance. Again, compared to what is found in single-equation ADF, majority of the countries with evidence of convergence to the group average also belongs to low income group. Specifically, according to SURADF method, of the seven economies converging to the regional real per capita GDP, only Senegal belongs to the group of lower middle income economies. Such consistency of the results from two methods reveals that low income countries have more tendencies towards converging to the group average than their lower middle income counterparts. This, therefore, leads us to a related question of whether ECOWAS member countries would show different convergence behaviour depending on their income categorization. To answer this question, this study carried out the test for convergence based on the income categorization of the countries in the sample. Results of the test of null hypothesis that an economy is converging to its income group average are provided in Table 4.11 and Table 4.12.

Table 4.11
Seemingly Unrelated Regression Based Augmented Dickey-Fuller Unit Root Test – Low Income

y_i-$\bar{y}_t$	*t*-statistic		SURADF critical values		
	ADF	**SURADF**	***0.01***	***0.05***	***0.10***
$(y_i-\bar{y}_t)_{\text{Benin}}$	-1.702[1]*	-3.164[1]*	-3.413	-2.619	-2.211
$(y_i-\bar{y}_t)_{\text{Burkina Faso}}$	-0.826[1]	-1.772[1]	-3.665	-2.833	-2.395
$(y_i-\bar{y}_t)_{\text{Gambia}}$	-2.330[1]*	-3.894[1]*	-3.422	-2.518	-2.117
$(y_i-\bar{y}_t)_{\text{Guinea}}$	-2.101[1]*	-3.585[1]*	-2.530	-1.683	-1.245
$(y_i-\bar{y}_t)_{\text{Guinea-Bissau}}$	-1.410[1]**	-2.496[1]**	-3.459	-2.565	-2.110
$(y_i-\bar{y}_t)_{\text{Liberia}}$	-1.806[1]*	-4.688[1]*	-4.370	-3.454	-3.019
$(y_i-\bar{y}_t)_{\text{Mali}}$	-1.747[1]*	-3.125[1]**	-4.081	-3.232	-2.793
$(y_i-\bar{y}_t)_{\text{Niger}}$	-2.759[1]*	-1.810[1]	-3.234	-2.319	-1.879
$(y_i-\bar{y}_t)_{\text{Sierra Leone}}$	-2.291[1]*	-1.613[1]	-4.240	-3.398	-2.976
$(y_i-\bar{y}_t)_{\text{Togo}}$	-1.434[1]**	-0.972[1]	-4.434	-3.562	-3.147

Note:

a) * and ** indicate rejection of the null hypothesis that real per capita GDP of a particular economy is not converging to the group average at 5% and 10% levels of significance, respectively.
b) numbers in brackets represent the lags included to ensure that serial correlation is removed.
c) the critical values for ADF test statistic are: 2.423, for 1% level of significance; 1.684, for 5% level of significance; and 1.303, for 10% level of significance.
d) critical values for SURADF are generated by Monte Carlo simulation using 10,000 replications based on the underlying dataset.

Table 4.11 contains results for the test of the null hypothesis of no-convergence against the alternative of convergence for the subsample of 10 low income economies. Both traditional ADF and SURADF tests results are presented in the table. Traditional ADF test shows that overwhelming majority of the economies in the low income group showed evidence of converging to their group average real GDP per capita over the period of study. According to the results, with the exception of Burkina Faso, the null hypothesis that an economy does not converge to the group average can be rejected in all other cases. The null of that a particular economy is not converging to the group average is rejected at 5 percent level of significance in the cases of Benin, Burkina Faso, Gambia, Guinea, Liberia, Mali, Niger and Sierra Leone. As for Guinea-Bissau and Togo the null hypothesis is rejected at marginal level of 10 percent.

In contrast to overwhelming support for the convergence hypothesis revealed by the traditional ADF results for the group of low income economies, SURADF results indicate that only six of the 10 economies in the group of low income countries registered evidence of convergence to their group average real GDP per capita. The economies are: Benin, Gambia, Guinea and Liberia 5 percent level of significance; and Guinea-Bissau and Mali at 10 percent level of significance.

In a nutshell, using SURADF results, it can be said that majority of the low income ECOWAS counties have shown evidence of convergence to both regional average and their own average of real GDP per capita over the course of 45 years the study covers. In both cases – convergence to the regional average and convergence to the own income group average – six of the 10 low income economies have shown evidence of convergence. Of these six economies, five economies namely; Benin, Gambia, Guinea, Liberia and Mali show evidence of consistence in convergence to both regional and their income group real GDP per capita averages. On the other hand, as opposed to the case of Niger that shows evidence of convergence only to the regional average real GDP per capita, Guinea-Bissau registered evidence of convergence to low income group average real GDP per capita only.

Furthermore, Table 4.12 contains results for traditional ADF and SURADF tests for the group of lower middle income economies of ECOWAS. The economies include: Cabo Verde, Cote d'Ivoire, Ghana, Nigeria and Senegal.

Table 4.12
Seemingly Unrelated Regression Based Augmented Dickey-Fuller Unit Root Test – Lower Middle Income

y_i-$\bar{y}_t$	*t*-statistic		SURADF critical values		
	ADF	**SURADF**	***0.01***	***0.05***	***0.10***
$(y_i-\bar{y}_t)_{\text{Cabo Verde}}$	-1.020[3]	-2.292[3]**	-3.289	-2.462	-2.023
$(y_i-\bar{y}_t)_{\text{Cote d'Ivoire}}$	-0.134[1]	-1.021[1]	-3.403	-2.716	-2.349
$(y_i-\bar{y}_t)_{\text{Ghana}}$	-2.013[1]*	-1.054[1]	-2.836	-1.951	-1.535
$(y_i-\bar{y}_t)_{\text{Nigeria}}$	-1.737[1]*	-1.011[1]	-3.542	-2.856	-2.488
$(y_i-\bar{y}_t)_{\text{Senegal}}$	0.005[1]	-1.241[1]	-2.944	-2.127	-1.684

Note:

a) * and ** indicate rejection of the null hypothesis that real per capita GDP of a particular economy is not converging to the group average at 5% and 10% levels of significance, respectively.
b) numbers in brackets represent the lags included to ensure that serial correlation is removed.
c) the critical values for ADF test statistic are: 2.423, for 1% level of significance; 1.684, for 5% level of significance; and 1.303, for 10% level of significance.
d) critical values for SURADF are generated by Monte Carlo simulation using 10,000 replications based on the underlying dataset.

Traditional ADF results in Table 4.12 show that two out of five lower middle income economies can be said to have converged to their income group average over the course of 1970 – 2014. The countries are Ghana and Nigeria, with the null hypothesis of no convergence rejected at 5 percent level of significance in both the cases.

Conversely, SURADF test results shows entirely different results. According to the approach, the only country with tendency to convergence to the group average is Cabo Verde, at 10 percent level of significance. Comparing these results to the ones obtained in the test for convergence to the ECOWAS average real GDP per capita, one would conclude that lower middle income countries on the whole have lesser tendencies toward convergence to both ECOWAS average real GDP per capita and own income group average. This is evident by what is shown in Table 4.10 where the only lower middle income country that registered evidence of converging to the group average is

Senegal. Interestingly, the null hypothesis of no convergence cannot be rejected for this economy using either of the methods used in this study – Traditional ADF and SURADF.

4.4 Conditional Convergence

Table 4.13 contains results from estimation of Equation [3.11]. Estimates from the equation shows that speed of convergence, λ, varies significantly depending on the method of estimation used. At the onset, the equation was estimated using system-GMM. Results from system-GMM shows lagged of the dependent variable to be greater than one. This has the implication of obtaining a negative sign for the convergence speed term.

Table 4.13
Estimation of the Speed of Convergence

Variables	**POLS**	**LSDV**	**System GMM**
$ln\bar{y}_{i,t-1}$	0.990	0.966	1.259
	[0.022]*	[0.060]*	[0.028]*
lnx_{it}	0.023	0.016	0.011
	[0.014]	[0.016]	[0.010]**
Convergence rate			
λ	0.003	0.011	-
Diagnostic test:			
Sargan Test (*p*-value)	-	-	0.872
AR (1) test	-	-	0.025*
AR (1) test	-	-	0.356

Note:
a) * and ** indicate rejection of the null hypothesis that a parameter estimate is not statistically different from zero at 5% and 10% levels of significance, respectively.
b) numbers in brackets are standard errors.

As a remedy to the above challenge, this study resorts to using pooled OLS and LSDV estimators to obtain the speed of convergence amongst ECOWAS member countries. As Table 4.13 shows, the speed of convergence amongst ECOWAS member countries is 0.30 percent. On the other hand, higher estimates for the speed of convergence was

obtained using OLS estimators. According to LSDV estimators, the speed of convergence is 1.10 percent. As for the post-estimation diagnostic test for the validity of instrument used in estimating the relationship, the null hypothesis that the instruments used in estimating the relationship are valid cannot be rejected. Moreover, Arellano-Bond test for autocorrelation indicates that the null hypothesis of no-autocorrelation cannot be rejected. However, it can be observed that the speed of convergence is very slow. Using results from OLS estimator as our benchmark result, it shows that an average poor economy in ECOWAS grew faster than an average relatively richer economy by 1.10 percent for the whole period under review. This speed of convergence appear to be very low compared to what is reported in studies that have utilized panel data methods to study the phenomena of convergence. Prominent among such studies is Caselli *et al.*, (1996). Using data spanning 1960 – 1985 on real GDP per capita measured in constant 1980 international prices for a sample 97 economies, the authors reported a convergence speed of 12.90 percent.

However, our contrasting finding in terms of speed of convergence between the work of Caselli *et al.,* (1996) and present study may not be unrelated to the sample used. One, in contrast to the sample of this study, which covers only a sample of 15 economies located within a given region, Caselli *et al.,* use data for a larger sample of economies comprising of both developed and developing economies. Moreover, whereas the sample periods of Caselli *et al.* is 1960 – 1985, this study covers the period 1970 – 2014.

Another study that contrasts present study in terms of the speed of convergence is that of Tondl *et al.,* (2001). In the study, the authors reported a speed of convergence of 21

percent. The researchers employ spatial dynamic panel data tools to examine the speed of convergence for a large sample of 196 European NUTS 2 regions using data converging the period 1985 – 1999. Looking at both timespan and sampled economies in Tondl *et al*., the difference between their discovered speed of convergence and that of present study can be justified.

Interestingly, in contrast to what is discovered of convergence speed of 1.10 percent, which appears to be very much lower than what is reported in other studies that utilized panel data methods, findings from this study are much closer to those in many cross-section based researches. For example, in the famous study carried out by Barro and Sala-i-Martin (1992), it was observed that 48 USA states convergence a speed of about two percent.

4.5 Foreign Direct Investment and Convergence to the Group Average Real per Capita GDP

To give a picture of the relationship between FDI and per capita income convergence across ECOWAS member countries, Figure 4.3 was generated. The figure shows the plots of standard annual deviations of real GDP per capita and FDI for 15 ECOWAS member countries over the period 1986 – 2014. The logic behind using standard deviations of the series is to examine whether the dispersion of the two series share common trend.

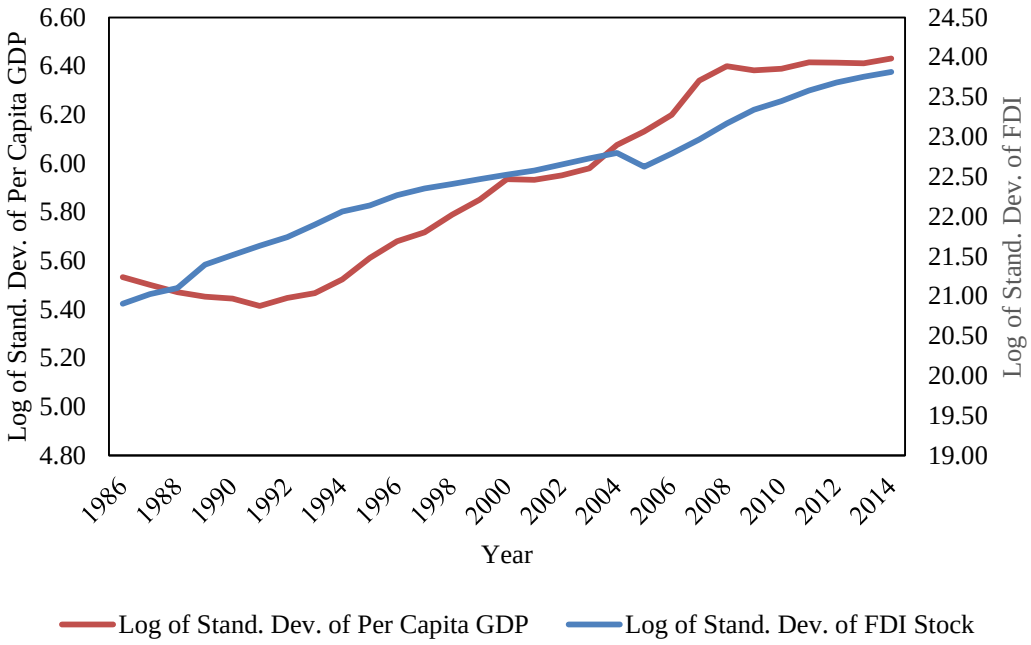


Figure 4.3
Standard Deviations of RGDP per Capita and FDI (1986 – 2014)

Standard deviations of a series depicts the degree of dispersion of the series over time. As the figure shows, the trends of standard deviations of log of the series quite similar. This indicates preliminary evidence that per capita income convergences is partly determined by FDI.

Table 4.14 shows results from the estimation of the relationship between deviations in real GDP per capita and FDI from their respective group averages. The purpose of estimating the relationship is to achieve the objective of examining the impact of FDI on per capita income convergence amongst ECOWAS member economies.

The table contains estimations using full sample data. In order to examine the sensitivity of the relationship of interest to various controls, four models were estimated. The first model is univariate in nature. It does not control for any other variable in examining the impact of FDI on per capita income convergence. Model 2, on the other hand, controls

for only trade openness of economies in examining the relationship between per capita income convergence and deviation of individual economies from the group annual averages.

Table 4.14
System-GMM Estimations Results for Convergence amongst ECOWAS Countries

Variable	**Model 1**	**Model 2**	**Model 3**	**Model 4**
LFDI	0.091	0.041	0.043	0.057
	[0.015]*	[0.008]*	[0.008]*	[0.017]*
LOPN		0.345	0.381	0.459
		[0.012]*	[0.082]*	[0.036]*
LGOVSIZE			-0.049	-0.033
			[0.047]	[0.025]
LPOP				-0.406
				[0.099]*
Sargan (*p*-value) Test	14.107	12.017	12.024	10.596
	(0.366)	(0.526)	(0.526)	(0.645)
AR (1) test	-1.286	-1.226	-1.222	-1.322
AR (1) test	-0.213	-0.031	-0.007	0.122

Note:
a) * and ** indicate rejection of the null hypothesis that a parameter estimate is not statistically different from zero at 5% and 10% levels of significance, respectively.
b) numbers in brackets are standard errors

As for the Model 3, in addition to trade openness of economies, government size is controlled for in estimating the relationship. Finally, Model 4 controls for population growth rate, in addition to trade openness and government size.

Results from the estimation of Model 1, as contained in Table 4.14, show evidence of positive and statistically significant relationship at 5 percent level of significance between deviations from group annual averages of real GDP per capita and FDI as a share of GDP amongst ECOWAS economies. This preliminary result indicates that, on the average, countries with lower deviations from group average FDI tend to converge to the group average real GDP per capita. This finding is therefore supportive of the

hypothesized relationship that FDI facilitates convergence to the group average real GDP per capita amongst ECOWAS member countries. In numeric terms, it can be deduced from the results that, one the average, a one percent decrease in the deviation of FDI of a given economy from the group average is associated with 0.091 percentage decrease in the deviation of same economy from the group average real GDP per capita.

Results from the estimation of Model 2, which controls for trade openness (LOPN) appear to be similar to those obtained from Model 1. After controlling for degree of trade openness of economies, similar positive and statistically significant relationship was found to exist between the GDP per capita deviation series and deviations from group average FDI. The relationship is statistically significant at 5 percent level of significance. In specific terms, a one percent decrease in the deviation of a particular economy from the group average of FDI is, on the average, associated with 0.041 percent decrease in the deviation of the economy from the group average real GDP per capita. However, obtaining lower magnitude of estimated parameter of the explanatory variable of interest as compared to what was obtained in Model 1 shows that the role of FDI in aiding convergence in per capita GDP is exaggerated if no control variable is used in estimating the relationship.

On the impact of trade openness to per capita income convergence, results from our estimates show that economies that are more open are very much likely to convergence to the group level of real GDP per capita. This is evident positive by a statistically significant relationship, at 5 percent level of significance, established between deviations of an economy from group level of real GDP per capita and deviations from average degree of openness for the economies. As shown by the results, a 0.345 percent

decrease in the deviation of a give economy from group average level of trade openness is capable of reducing the real GDP deviation of that particular economy from group average by one percent.

As for Model 3, which controls for both trade openness and government size, the results are very similar to those of Model 2, which controls for trade openness only. In specific terms, after controlling for trade openness and government size, a statistically significant positive relationship at 5 percent level of significance was observed. It was observed that a one percent decrease in the deviation of an economy from the group average of FDI leads to 0.043 percent decrease in the deviation of the economy from group average real GDP per capita. Similarly, a positive and statistically significant relationship between the dependent variable and trade openness is observed. According to the estimated parameter for the control variable of trade openness, a one percent decrease in the deviation of an economy from group average level real GDP per capita is associated with 0.382 percent decrease in the deviation of that particular economy from the group annual average degree of trade openness.

As for the control variable of government size, a negative relationship was found between deviations in real GDP per capita of a given economy from group average and government size in the economy. The implication of this result is that economies higher level of government participation tend to convergence less compared to the countries for which government size is less. However, caution need to be exercised in drawing such conclusion as the estimated parameter is not statistically significant any conventional level of significance.

Estimation results for Model 4 indicate that introducing additional control of population growth does not change the sign of the variable of interest. The estimated parameter is positive and statistically significant at 5 percent level of significance. According to the estimated parameter, one the average, a one percent decrease in the deviation of an economy from group average FDI is leads to 0.057 percent fall in the deviation of the economy from group average real GDP per capita. As for the control variables, positive and statistically significant relationship at 5 percent level of significance was discovered to exist between trade openness and government size on one hand and convergence in real GDP per capita on the other. The implication of this finding is that economies that are more open in terms of trade and with high level of government participation are more likely to show high level of convergence to the group average real GDP per capita than economies that less open to trade with little government participation as measured by government final consumption expenditure as a percentage of GDP.

Results obtained on the relationship between per capita income convergence and FDI in our benchmark model, which incorporate all controls are in accordance with the findings reported in Choi (2004) and Zhang (2001). In both studies, the authors observed that FDI plays a very significant role in aiding convergence amongst economies. For the work of Choi, the author employs various static paned data regression models to examine the effect of bilateral FDI on income convergence across a sample of 16 source economies and 57 host countries. Controlling for distance and language difference between host and source economy, the author concludes that as intensity of bilateral FDI between a pair of economies increases, the income gap between the economies tends to diminish. Zhang (2001) on the other hand uses a sample

of 10 East Asian Economies to examine the effect of trade and FDI on income convergence across the economies over the period 1960 – 1996. The author also finds evidence supportive of positive link between FDI and income convergence.

In addition to the estimation results, lower part of the table provides results for two important post-estimation tests associated with system GMM – test for serial correlation and Sargan test for validity of instruments. As can be seen from the table, our benchmark model, which controls for trade, government size and population growth, has passed both tests. According to Sargan test, the null hypothesis that the instruments used in estimating the relationship are valid cannot be rejected. Moreover, Arellano-Bond test for autocorrelation indicates that the null hypothesis of no-autocorrelation cannot be rejected.

As a recap, it can be concluded that, on the average, ECOWAS economies with lower degree of deviations from ECOWAS average FDI, measured as a percentage of GDP, tend to perform better in terms of convergence to the group average real GDP per capita. This is clearly evident by the consistent positive sign obtained from estimation of the relationship of interest using varying control variables.

Using data for a sample of 10 low-income economies, this study examines the relationship between deviations in real GDP per capita and FDI. This is aimed at examining the role of FDI in facilitating per capita income convergence amongst low-income ECOWAS economies. Estimation results are presented in Table 4.15.

Table 4.15
System-GMM Estimations Results for Convergence amongst Low Income Countries

Variable	Model 1	Model 2	Model 3	Model 4
LFDI	0.221	1.182	0.219	0.221
	[0.086]*	[0.081]*	[0.094]*	[0.096]*
LOPN		0.215	0.186	-0.155
		[0.103]*	[0.094]*	[0.447]
LGOVSIZE			0.160	0.837
			[0.353]	[0.934]
LPOP				0.151
				[0.237]
Sargan (*p*-value) Test	6.081	5.379	4.144	3.527
	(0.943)	(0.966)	(0.990)	(0.995)
AR (1) test	-1.336	-1.216	-1.003	-0.473
AR (1) test	-0.486	-0.010	0.190	-0.891

Note:
a) * and ** indicate rejection of the null hypothesis that a parameter estimate is not statistically different from zero at 5% and 10% levels of significance, respectively.
b) numbers in brackets are standard errors

As can be observed, Table 4.15 shows evidence of the existence of positive and statistically significant relationship at 5 percent level of significance between convergence in real GDP per capita and deviations of economies from group average FDI in all the four models. For Model 1, on the average, for a particular low-income economy, a percentage decrease in the annual deviation of FDI from group average has the capacity to reduce deviation in real GDP per capita of that particular economy group average real GDP per capita by 0.221 percent.

However, in the case of Model 2, after controlling for trade openness of economies, coefficient for the explanatory variable was obtained. In contrast to estimates for Model 1, with estimated parameter of 0.221, Model 2, which controls for trade openness has a positive and statistically significant relationship between deviations in from group average level of FDI and convergence in real GDP per capita. The estimated parameter

is 1.182. This impliedly shows that, on the average, a one percent decrease (increase) in the annual deviation of FDI of a particular economy from the group average, is capable of reducing (increasing) deviation of the economy's real GDP per capita deviation from group average by 1.182.

As for the controlled trade openness, the results show that there is a positive and statistically significant relationship between the degree of openness of an economy and its ability to converge to the group level of real GDP per capita. A percentage decrease in the level of deviation of a given economy from group average level of trade openness is associated with 0.215 percent reduction in deviation of that particular economy from group average real GDP.

Moreover, after controlling for both trade openness and government expenditure in Model 3, the estimated parameter for the variable of interest maintain the same significant positive sign. As the results show, on the average, a low-income economy would benefit from 0.219 percent decrease in the deviation of its real GDP from the group average as a result of one percent decrease in its annual deviation from group average FDI. On trade openness and government size, our estimated parameters for both variables are positive, indicating the role of government size and trade openness in aiding real GDP per capita convergence amongst low income countries in ECOWAS. However, it is worth-noting that only estimated parameter for trade openness is observed to be statistically significant at 5 percent level of significance.

Interestingly, after controlling for trade openness, government size and population growth, the estimated parameter for deviations of FDI turns out to be exactly the same

with the results obtained before controlling for anything. The estimated parameter is also statistically significant at 5 percent level of significance, as the case is Model 1. However, for the fact that the results are exactly the same, explaining the degree of the relationship between deviations in real GDP per capita and FDI is regarded as needless at this point. Regarding out controls, none of the estimated parameters is statistically significant at any of the conventional levels of statistical significance. This result shows how important FDI is in facilitating real GDP per capita convergence amongst low-income ECOWAS economies. Going by the results discussed so far, it can be concluded that FDI plays a very significant role in aiding real GDP per capita convergence amongst low-income ECOWAS countries. Results obtained in this study showing positive link between per capita income convergence and FDI enjoy the support of other prominent studies, such as Lee (2009) and Choi (2004).

In the work of Lee (2009), industry level data is used to compare the impact of FDI and trade on productivity convergence. Results from the comparative study indicate that although both FDI and trade tend to have positive effect on convergence, the author observes that trade has high capacity to boast economic convergence compared to the FDI. This therefore led the author to the conclusion that trade has more technology transfer capacity that FDI.

Lower part of Table 4.15 shows post-estimation diagnostic test. According to Sargan test for the validity of instruments used in estimating the relationship of Model 4, the null hypothesis that the instruments are valid cannot be rejected and hence the instrumentation is valid. Also, Arellano-Bond test for serial correlation indicates that there is no serial correlation in the estimated relationship.

The relationship between per capita income convergence and deviations from annual average FDI is also estimated for the sample of lower middle-income ECOWAS economies. The aim of performing the test using data on lower middle-income ECOWAS separately is to examine the impact of FDI in enhancing per capita income convergence within the group of lower middle income economies. Results for the estimation are presented in Table 4.16.

Table 4.16
System-GMM Estimations Results for Convergence amongst Lower Middle Income Countries

Variable	**Model 1**	**Model 2**	**Model 3**	**Model 4**
LFDI	0.314	0.229	0.265	-0.333
	[0.272]	[0.285]	[0.343]	[0.710]
LOPN		3.689	4.030	12.031
		[2.400]	[2.909]	[6.344]
LGOVSIZE			-0.149	-0.430
			[0.705]	[3.946]
LPOP				10.694
				[19.743]
Sargan (*p*-value) Test	1.724	0.046	0.000	0.000
	(0.999)	(1.000)	(1.000)	(1.000)
AR (1) test	-2.327	0.980	0.942	0.718
AR (1) test	-0.875	0.911	0.795	0.354

Note
a) * and ** indicate rejection of the null hypothesis that a parameter estimate is not statistically different from zero at 5% and 10% levels of significance, respectively.
b) numbers in brackets are standard errors

Before introducing any control, a positive relationship between per capita income convergence and deviations from group annual average FDI is observed. Although the relationship is not statistically significant, it is still encouraging going by the fact that

we obtained the expected positive sign between the variables. As the results show, on the average, a one percent decrease in the deviation of an economy from group annual average FDI is associated with a reduction of 0.314 percent in the deviation of the economy from group average real GDP per capita.

Moreover, after controlling for trade openness, similar results in terms of sign of the coefficient is obtained, although with lower magnitude compared to estimation results for Model 1. The estimated parameter positive, although not statistically different form zero. It was observed that, on the average, a one percent decrease in annual deviation of a given economy from group average FDI has the capacity of reducing deviation from group average real GPP per capita of the economy by 0.229 percent. Regarding the statistical significance of estimated parameter for the variable of interest, the null hypothesis cannot be rejected. Therefore, despite acquiring the expected positive sign, conclusion cannot be drawn with full certainty on the effect of FDI on real GDP per capita convergence amongst lower middle-income ECOWAS countries. This finding of insignificant positive link between per capita income convergence and FDI is similar to what is reported in Mayer-Foulkes and Nunnenkamp (2009).

In Mayer-Foulkes and Nunnenkamp (2009) the authors establish significant link between the level of economic development of a given economy and its ability to convergence to the GDP per capita of a high performing economy, regardless of its access to FDI. Therefore this finding may not be unrelated to the fact that lower middle income economies have more access to FDI from very high performing economies. Given their level of development, such economies may not benefit from technology diffusion effect of FDI compared to their lower middle income counterparts.

Similarly, trade openness has the expected positive sign, although not statistically significant. Estimated parameter for trade openness variable shows that a percentage decrease in the level of real GDP per capita deviation of a given economy from its group annual average real GDP per capita is on the average associated with 3.689 percent decrease in the deviation of that particular economy from group annual average degree of openness to trade.

Estimations results of Model 3, which controls for both trade openness and government size appear to only slightly differ from those obtained in Model 2 in respect of the magnitude of the relationship. In addition, the null hypothesis that the estimated parameter for the variable of interest is not statistically different from zero cannot be rejected in both cases. Finally, Model 4, which controls for openness, government size and population growth turns out to indicate evidence in support of divergence effect of FDI on per capita income convergence for a sample of lower middle-income countries. However, in what can be seen as a point of consolation is that the estimated parameter for FDI variable is not statistically significant at any conventional level of significance. Regarding the post-estimation diagnostic tests, Table 4.16 shows that Model 4, which controls for trade openness, government size and population growth have neither the problem of invalid instruments nor that of serial correlation

In a nutshell, unlike the case of the sample of low-income countries, system GMM results show that FDI does not play significant role in facilitating per capita income convergence amongst lower middle-income countries.

4.6 Foreign Direct Investment and Pairwise Convergence of GDP per Capita

In the previous section, a discussion was made on the relationship between deviations from averages of FDI and those of real GDP per capita for low income, lower middle income economies and ECOWAS at large. The discussions have achieved the objective of examining the role of FDI in achieving per capita income convergence within each of the two income groups and ECOWAS. However of the objective of this study is to examine convergence across economies and role of FDI in aiding low income ECOWAS economies to catchup of lower middle income group of the same region. Achieving this objective therefore calls of examining pairwise convergence across each ECOWAS. In a bid to achieve this set objective, the following sub-sections discuss the results from the estimation of pairwise convergence. As outlined in chapter three, pairwise deviation series for per capita income and FDI were generated for a total of 15 ECOWAS member countries. Thus arriving at a total of 105 pairs of economies over the course of 29 year, 1986 – 2014.

4.6.1 Foreign Direct Investment and Pairwise Convergence – Low-income

Table 4.17 reports results on the estimation of the impact of FDI on real GDP per capita convergence within sub-sample of low income countries using pairwise FDI and real GDP per capita gap ratios. The estimation was carried out using pooled observations for 45 possible pairs for the sub-sample of 10 low income countries.

Table 4.17
System-GMM Estimations Results for Convergence across Low Income Countries

Variable	Model 1	Model 2	Model 3	Model 4
LFDI	0.115	0.040	0.061	0.068
	[0.001]*	[0.004]*	[0.004]*	[0.005]*
LOPN		0.142	0.297	0.387
		[0.005]*	[0.011]*	[0.011]*
LGOVSIZE			-0.324	-0.308
			[0.013]*	[0.024]*
LPOP				-0.338
				[0.020]*
Sargan (*p*-value) Test	43.664	43.548	44.846	44.093
	(0.443)	(0.448)	(0.394)	(0.425)
AR (1) test	-3.892	-3.777	-3.806	-3.709
AR (1) test	-2.781	-2.862	-2.785	-2.660

Note:
a) * and ** indicate rejection of the null hypothesis that a parameter estimate is not statistically different from zero at 5% and 10% levels of significance, respectively.
b) numbers in brackets are standard errors

Interestingly, the estimated parameters for the variable of interest carry the expected sign for each of the four models. This is indicative of the fact that FDI exerts positive impact on per capita income convergence for the sample of low income ECOWAS countries. According to estimation results for Model 1, other things being equal, there is a positive and significant impact of FDI on per capita income convergence across low income ECOWAS countries. As the table shows, the GDP gap ratio between a pair of two low income economies in ECOWAS shrinks by 0.115 percent as a result of a percentage decrease in the FDI gap ratio between the two economies. In other words, lower FDI gap ratio is associated with lower GDP gap ratio between any pair of low income economies in ECOWAS.

Similarly, after controlling for trade openness of economies, a positive and statistically significant relationship at 5 percent level of significance is identified to exist between

the gap ratios of per capita GDP and FDI amongst low income ECOWAS economies. However, in contrast to the estimate for Model 1, it has been observed that the magnitude of the estimated parameter for the variable of interest is smaller after controlling for trade openness. In specific terms, compared to the coefficient of 0.115 obtained in Model 1, Model 2 indicates that the estimated parameter for FDI gap ratio is 0.040. This implies that, controlling for trade openness, on the average, two low income economies in ECOWAS would achieve 0.040 percentage reduction in the GDP gap ratio as a result of percentage point decrease in FDI gap ratio between the economies.

On the impact of trade openness on convergence between a given pair of low income economies, it is can be deduced that the lower the gap between a pair of economies in terms of trade openness the closer the GDP gap ratio between the economies. The relationship is statistically significant at 5 percent level of significance. In specific terms, a percentage decrease in the GDP gap ratio between a pair of low income ECOWAS economies is associated with 0.142 decrease in trade openness gap between the economies. This implies that economies that are closer in terms of trade openness with the rest of the world are much more likely to converge in terms of real GDP per capita than a pair of economies that are not close in terms of trade openness to the rest of the world.

In Model 3, in addition to trade openness, a control for government size was introduced. Estimates from the model show positive and significant relationship between FDI and pairwise real GDP per capita convergence. As can be observed, a one percentage point decrease in the FDI gap ratio between a pair of low income economies is on the average

capable of leading to a shrink of 0.061 percent in the GDP gap ratio between the economies.

Interestingly, the estimated parameter for the trade openness and government size variables are statistically significant. However, whereas trade openness variable carries a positive sign government size variable is observed to have a negative sign. According to our results, 0.297 percent reduction in trade openness gap between a pair of economies is capable of reducing real GDP gap ratio between a pair of economies on the average. As for the government size, it is observed that it has diverging effect on average pair of economies. On the average, a percentage decrease in in the convergence rate between a pair of low income ECOWAS economies is likely to be caused by 0.324 percent decrease in pairwise convergence between the economies. However, this unexpected finding is not final since our benchmark model is the one that controls for all the three variables.

Finally, introducing population growth rate to the model as additional control variable it is observed that the estimated parameter for FDI gap ratio registered slight increase in the magnitude of the relationship and is statistically significant at 5 level of significance. According to the results for Model 4, a percentage point decrease in the FDI gap ratio between a pair of low income economies has, on the average, the capacity of reducing the GDP gap ratio between the economies by 0.068 percent. On trade openness variable, we found a statistically significant relationship between trade openness and convergence. According to the results, a percentage decrease in the GDP gap ratio between a given pair of low income economies is associated with 0.387 percentage decrease in the trade openness gap between the economies. Moreover, both

government size and population growth rate were observed to have negative and significant effect on pairwise convergence of low income economies in ECOWAS.

In essence, this finding has the implication that both faster population growth and sizable government involvement have diverging effect across low income ECOWAS member countries. However, the model is considered a good finding for the fact the variable of main interest turns out to have the expected positive sign, which is an indication of positive effect of FDI on convergence across low income economies.

In addition, results obtained from the estimation are in conformity with what Bijsterbosch and Kolasa (2010) reported that FDI contributes to convergence.

Using industry level data across 19 sectors for a sample of eight EU member economies over the course of 10 years, Bijsterbosch and Kolasa (2010) observed increased productivity in output and convergence of the sampled economies coinciding the period of increased flow of foreign capital in the form of FDI into the economies.

As for the results of Sargan's test for the validity of instruments, it can be observed that the Model 4 fails to reject the null hypothesis that the instruments are not valid. In a nutshell, FDI is found to facilitate pairwise convergence across the sample of low income ECOWAS economies.

4.6.2 Foreign Direct Investment and Pairwise Converge – Lower Middle-income

Table 4.18 contains results on real GDP per capita pairwise convergence effect of FDI across lower middle income ECOWAS countries. Interestingly, it has been observed

that, the estimated parameter for FDI is negative using controls. This implies that FDI has divergence effect on real GDP per capita across lower middle income economies.

Table 4.18
System-GMM Estimations Results for Convergence across Lower Middle Income Countries

Variable	**Model 1**	**Model 2**	**Model 3**	**Model 4**
LFDI	-0.093	-0.196	-0.193	-0.226
	[0.003]*	[0.044]*	[0.043]*	[0.026]*
LOPN		0.262	0.232	0.371
		[0.204]	[0.198]	[0.679]
LGOVSIZE			0.123	0.168
			[0.105]	[0.140]
LPOP				0.176
				[0.599]
Sargan (*p*-value) Test	8.380	6.887	6.576	6.720
	(1.000)	(1.000)	(1.000)	(1.00)
AR (1) test	-1.287	-1.557	-1.482	-1.479
AR (1) test	-1.728	-1.690	-1.577	-1.248

Note:
a) * and ** indicate rejection of the null hypothesis that a parameter estimate is not statistically different from zero at 5% and 10% levels of significance, respectively.
b) numbers in brackets are standard errors

According to Model 1, a percentage point decrease in FDI gap ratio between two lower middle income economies can cause 0.093 percent increase in the GDP gap ratio between the economies. The estimated parameter is further observed that the relationship is statistically significant at 5 percent level of significance. One the other hand, results from Model 2 indicate a negative and statistically significant relationship between pairwise real GDP per capita gap ratio and FDI across lower middle income economies of ECOWAS. Specifically, on the average two lower middle income economies would record 0.196 percentage increase in their GDP gap ratio owing to a decrease in the FDI gap ratio between them. As for the control variable of trade openness, although the estimated parameter carries the expected positive sign, it is observed that it is not statistically significant.

In Model 3, the study controls for both trade openness and government size to examine the effect of FDI on real GDP per capita convergence after controlling for both the variables. Similarly, the estimated parameter for FDI gap is found to be negative and statistically significant at 5 percent level of significance. Estimation results indicate that 0.193 percent reduction in the FDI gap between a pair of lower middle income economies leads to a percentage increase in the GDP gap ratio between a particular pair of lower middle economies.

Moreover, estimation results further reveal that both trade openness and government size have positive, although insignificant relationship with real GDP per capita gap ratio across lower middle income economies. According the results, a percentage decrease in the GDP gap ratio between a pair of lower middle income economies is associated with a decrease of 0.232 percent in the trade gap between the economies. On the other hand, a 0.123 percentage decrease in the gap between a pair of lower middle income economies in terms of the size of government in the economy could lead to one percent reduction in the real GDP gap between the economies. However, it is worth noting that the estimated parameter for both variables

Finally, after controlling for trade, government size and population growth, a negative and statistically significant parameter estimates was obtained for the variable of interest – FDI gap. In numeric terms, it has been deduced that on the average, two lower middle income economies in ECOWAS would record a 0.226 percent increase in their GDP gap ratio as a result of percentage point decrease in their FDI gap ratio. Regarding the control variable used in the estimation, each of the estimated parameter for each is

observed to carry positive and insignificant sign. This indicates joint GDP gap reduction effect is associated with trade openness, government participation and population growth.

However, although the estimated parameters of the variables are not statistically significant, discussion on the magnitude of the effect could be of some relevance owing to the fact that sign and magnitude of an estimated parameters reveals a lot about the nature of the relationship between variables. For the trade openness, the results show that 03.71 percentage decrease in trade openness gap between a given pair of lower middle income ECOWAS economies could lead to one percent increase in the GDP gap ratio of that given pair of economies. As for the government size, a 0.168 percent decrease in gap between a pair of economies could lead to one percent increase in the GDP gap ratio between the economies. Finally, for population growth rate, economies that are closer by 0.176 are likely to exhibit one percent increase the GDP gap ratio between them.

Regarding the post-estimation test, Model 4, which controls for trade, government size and population growth is found to pass the two test. This impliedly means the instruments used in estimating the model are valid and the errors are not serially correlated.

4.6.3 Foreign Direct Investment and Pairwise Converge – Low-Income to Lower Middle-Income

Table 4.19 reports results obtained from the estimation pooled observations of all possible pairs of low and lower middle income economies. Having a total of 10 low income economies and five lower middle income countries in our sample, the study

arrived at a total of 50 possible pairs of low income and lower middle income economies. As outlined in Chapter 1, of the objectives this study pursues is examining the role of FDI in facilitating per capita income catch-up of low-income countries to per capita GDP of lower middle income economies. Annual deviations of real GDP per capita and FDI were pooled for the 50 pairs and employing system GMM, the relationship was estimated.

The relationship was estimated controlling for averages of trade openness, government size and population growth rate. To examine the sensitivity of the relationship to various controls, the controls were introduced into the model gradually.

As Table 4.19 shows, across the four models, the sign of deviation of FDI is persistently positive. This indicates how important FDI is in facilitating convergence of low income countries to the real GDP per capita in lower middle income countries.

According to the bivariate model which does not control for any variable, FDI is observed to play a significant role in aiding convergence of low income economies to the real GDP per capita in lower middle income economies. This finding simply implies that, for a given pair of low and lower middle income economies, the real GDP per capita ratio gap between them tend to narrow as the gap between them in terms of FDI narrows.

Table 4.19
System-GMM Estimations Results for Convergence of Low Income to Lower Middle Income Countries

Variable	**Model 1**	**Model 2**	**Model 3**	**Model 4**
LFDI	0.169 [0.001]*	0.021 [0.001]*	0.0181 [0.001]*	0.026 [0.001]*
LOPN		0.292 [0.001]*	0.008 [0.003]*	0.139 [0.005]*
LGOVSIZE			0.624 [0.004]*	0.702 [0.008]*
LPOP				-0.529 [0.009]*
Sargan Test (*p*-value)	49.369 (0.234)	49.733 (0.223)	49.676 (0.225)	49.651 (0.225)
AR (1) test	-1.856	-1.985	-1.969	-2.026
AR (1) test	-0.782	-0.686	-0.253	-0.053

Note:
a) * and ** indicate rejection of the null hypothesis that a parameter estimate is not statistically different from zero at 5% and 10% levels of significance, respectively.
b) numbers in brackets are standard errors

On the magnitude of the parameter, the results reveal that a percentage point decrease in the FDI gap ratio between a low income economy and a lower middle income counterpart, is on the average, associated with 0.169 percent decrease in the real GDP per capita gap ratio between the economies. This result indicates that without controlling for anything, FDI facilitates per capita income convergence performance of low income countries to the real GDP per capita of lower middle income economies in ECOWAS.

After controlling for trade openness in Model 2, it was examined that the degree of the relationship between the variables of interest is relatively lower compared to the univariate model. According to Model 2, there is a positive and significant relationship between FDI and trade on one hand and real GDP per capita convergence across low

and lower middle income economies in ECOWAS. According to the results, a percentage point decrease in the FDI gap ratio between a given low income economy and a lower middle income counterpart economy is, on the average, capable of reducing real GDP per capita gap ratio between the economies by 0.021 percentage.

Controlling for both openness and government size in examining the role of FDI in facilitating catch-up performance of low income countries to the real GDP per capita in lower middle income economies, lower estimate was observed. Compared to Model 2, which controls for only trade openness, Model 3 shows that a percentage point reduction in the FDI gap ratio is associated with 0.0181 percent decrease in GDP gap ratio between an average low income economy and a lower middle income counterpart. Furthermore, it is examined that the estimated parameter for the FDI gap ratio is statistically different from zero at 5 percent level of significance.

As for the Model 4, which controls for trade, government size and population growth, it was further observed that the estimated parameter is statistically different from zero at 5 percent level of significance. Regarding the magnitude of the relationship, results indicate that a percentage point decrease in FDI gap ratio is associated with 0.026 percent decrease in the per capita GDP gap ratio between a low income economy and lower middle income ECOWAS economy. Findings of this study are in line with those of Choi (2009) who carry out a research on technology diffusion effect of FDI and trade on convergence from 20 source OECD economies to a sample of 20 LDCs. The author reports a significant positive effect of FDI on income convergence.

Post-estimation test results provided beneath Table 4.19 indicate that the Model 4 passed both autocorrelation test and Sargan's test for the validity of instruments. This implies that the estimated model does not have either autocorrelation problem or invalid instruments.

To sum it up, it can be concluded that low income ECOWAS economies tend to close their per capita GDP gap ratio with lower middle income ECOWAS economies as the FDI gap ratio between the economies shrink. In conclusion, FDI is found to play a significant role in facilitating pairwise per capita income convergence across the two income groups in ECOWAS – low income and lower middle income economies.

4.7 Conclusion

This chapter discusses all the results obtained from estimations performed. First, the chapter provides description of the dataset used in conducting the analysis. Each variable by computing mean, minimum, maximum and standard deviation. The chapter contains the test for absolute convergence amongst ECOWAS member countries and each income group. The link between FDI and real GDP per capita convergence is investigated both at the level of ECOWAS and each of the two income groups. On the whole, a significant effect of FDI on real GDP per capita convergence is observed. Carrying out similar analysis at the level of income group, it has been found that the role of FDI in facilitating real GDP per capita convergence is more pronounced in low income countries than lower middle income economies.

CHAPTER FIVE

SUMMARY AND CONCLUSIONS

5.1 Introduction

This chapter is devoted to summary and conclusions of the entire research. This introduction inclusive, the Chapter is divided into seven main sections. Section 5.2 gives summary of findings for the research. Policy implications of each of the findings is presented in Section 5.3. Whereas limitation of this study are provided in Section 5.4, Section 5.5 is dedicated to recommendations for future research. Finally, section 5.6 concludes the chapter.

5.2 Summary of Findings

Using SURADF approach to examine absolute convergence of ECOWAS member countries to the group average real GDP per capita, it was found that, seven economies show evidence of converging to the ECOWAS average. Specifically, the economies are: Benin, Gambia, Guinea, Liberia, Mali, Niger and Senegal. It was further observed that, for these economies, the null hypothesis of no-convergence is rejected at five percent level of significance in all cases except that of Niger. As for the Niger, the null hypotheses is rejected at 10 percent level of significance. Interestingly, of the seven economies identified as showing evidence of convergence to the ECOWAS average real GDP per capita, only Senegal is categorized as lower middle income economy. Therefore, there is more presence of absolute convergence to ECOWAS average amongst low income economies compared to lower middle income economies.

Examining absolute within each category of countries in ECOWAS, it was found that six out of 10 low income economies have tendency towards converging to their group average. The economies are: Benin, Gambia, Guinea, Guinea-Bissau, Liberia and Mali. With the exception of Guinea-Bissau and Mali, in which the null hypothesis of no convergence is rejected at 10 percent level of significance, the null hypothesis of no convergence is rejected at 5 percent level of significance in the remaining economies. On the other hand, as opposed the case of low income economies, where majority of the economies tend to converge to their group average, lower middle income economies show very low chances of converging to their group average real GDP per capita. In clear terms, only Cabo Verde was found to show evidence of convergence to the group average real GDP per capita at the marginal 10 percent level of significance.

On the conditional convergence, the annual speed of convergence amongst ECOWAS member economies was found to be 1.1 percent. By this finding, it can be concluded that compared to other world regions, ECOWAS member countries have exhibited very low speed of conditional convergence.

Of the objectives of this research is to investigate on the difference between low income and lower middle income ECOWAS member countries on the relationship between per capita income convergence and FDI. Prior to estimating the relationship between per capita income convergence and FDI for the two sub-samples, the relationship between the variables was estimated using full sample data. The study found a statistically significant positive relationship between economic convergence and FDI across 15 ECOWAS member countries. The observed relationship was obtained after controlling for trade openness of individual economies being it another important source of

technology to developing economies. The study also controls for government size and population growth rate.

However, as for the group of low income economies, results similar to those obtained for the entire sample were obtained. The study found a statistically significant impact of FDI on economic convergence after controlling for trade openness, government size and population growth rate. Moreover, the estimated model passed the necessary Sargan and Arellano-Bond post-estimation tests. Hence assuring the validity of the results.

The relationship between per capita income convergence and FDI is also estimated for the sample of lower middle-income ECOWAS economies. In contrast to what was observed of positive impact of FDI on income convergence amongst low income ECOWAS economies, there is no evidence of significant relationship between per capita income convergence and FDI amongst lower middle income economies. Although the expected positive sign was obtained, inference cannot be drawn on the relationship between the variables. This is owing to the fact that the null hypothesis that the estimated parameter is not different from zero cannot be rejected at any unconventional level of significance.

In a nutshell, the study finds that, whereas low income economies tend to converge to their own group average real GDP per capita as they converge in terms of FDI, the same conclusion cannot be drawn for the sub-sample of lower middle income economies.

Besides exploring the role of FDI in facilitating per capita income convergence amongst ECOWAS member countries and with the two income groups, this study explored the impact of FDI in facilitating convergence of low income economies to the real GDP per capita of lower middle income economies. The study also delved on the pairwise convergence effect of FDI across each income group.

For the group of low income economies, evidence of positive relationship between per capita income convergence and FDI was observed. In other words, it was found that reduction in pairwise real GDP per capita gap is associated with low FDI gap ratio between a give pair of low income economies in ECOWAS. Furthermore, the estimated parameter for the GDP gap ratio is statistically different from zero at 5 percent level of significance. On post-estimation diagnostic tests, it was found that the estimated model does not suffer from the problem of serial correlation of errors or invalid instruments.

In complete contrasts to what is obtained of positive pairwise convergence effect of FDI on real GDP per capita, it was discovered that FDI has significant divergence effect on the real GDP per capita across lower middle income economies. The implication of this finding is that, as two lower middle income economies converge in terms of FDI, the economies are bound to experience divergence in terms of their real GDP gap ratio.

To examine the impact of FDI in facilitating the ability of low income countries to catch up with lower middle income economies of ECOWAS, the relationship was estimated using data on pairwise GDP and FDI gap ratios for low and lower middle income economies.

Results from the study further reveal that FDI has the capacity to boost the ability of low income country to catchup with richer lower middle income counterpart in ECOWAS. This is evident by the statistically significant positive relationship observed to have existed between FDI gap ratios and convergence across low and lower middle income economies.

The estimated relationship passed both autocorrelation test and Sargan's test for the validity of instruments. This implies that the estimated model does not have either autocorrelation problem or invalid instruments. As a recap, it can be concluded that low income ECOWAS economies tend to close their per capita GDP gap ratio with lower middle income ECOWAS economies as the FDI gap ratio between the economies shrink.

Another interesting finding this study makes deals with the speed of convergence amongst ECOWAS member countries. As opposed to what is commonly found in the literature, the speed of convergence amongst ECOWAS countries is very slow. In specific terms this study reveals that the speed of convergence amongst the sampled economies is only 1.10 percent.

5.3 Policy Implications

On the convergence to ECOWAS average real GDP per capita, the finding that a total seven economies converging to the group average real GDP per capita revels evidence that, on the whole, ECOWAS did not so far achieve the goal of promoting economic co-operation amongst its members to a very large extent. Promoting economic co-operation is expected to lead to implementing policies that are capable of ensuring

convergence in absolute sense. This is evident by having less than half of the members converging. Another interesting aspect of this finding is that of the seven economies converging to ECOWAS average real GDP per capita, six are low income economies. To a minimal extent, this finding could be a point of consolation since it shows more than half of low income economies are converging to ECOWAS average. This finding therefore calls for re-visiting the Treaty of ECOWAS to come up better ways to attaining maximum economic co-operation amongst member countries.

On within group absolute convergence of real GDP per capita, low income registered evidence of forming a convergence club with more than half of the economies converging to own group average real GDP per capita. The implication of this finding is that there evidence that such converging economies are similar in respect of steady state level of capital. In other words, there is an indication that majority of low income economies are at the same level in terms of their distance from steady state level of capital. Given this, low income economies have the motivation to pursue convergence in terms of policies.

On the contrast, group level convergence in absolute sense appear to be absent amongst lower middle income group with only Cabo Verde converging to the group average level of real GDP per capita. This implies that lower middle income ECOWAS economies do not form a convergence club. To put differently, lower middle income ECOWAS member states are at different levels away from their steady state level of capital.

Regarding the speed at which relatively poor economies converge to the level of real GDP per capita of relatively richer economies in the sample, a very slow speed of convergence is observed. This therefore implies that relatively poor economies need to put in place better policies to improve on their savings rates to boast capital accumulation for investment to facilitate faster convergence to the level of real GDP per capita in relatively richer economies. To improve on domestic capital formation for investment to ensure higher speed of convergence to per capita GDP level in relatively poor economies, governments in economies should pay much emphasis in formulation policies capable of improving the savings culture in the economy.

For ECOWAS as a whole it has been examined that FDI facilitates convergence amongst member states. This implies that as countries in ECOWAS have similar access to the inflow of FDI from the rest of the world, the economies tend to become closer in terms of the level of real GDP per capita. For such reasons, ECOWAS member countries should put in place policies capable of attracting more FDI into the region. Incentive measures such removal of too much bureaucratic bottleneck for new multinationals to setup should be removed. Additionally, governments in ECOWAS should pay much attention in developing human capacity which commonly observed to have direct effect on the ability of an economy to reap the benefits associated with FDI inflow.

5.4 Limitations of the Study

Like many other studies, this research has a number of limitations. The time span used in achieving the objective of examining the impact of FDI on per capita income convergence is relatively short. The study used annual data covering the period 1986 –

2014. Higher frequency data would have been better for it is expected to lead to a more reliable results and by extension making proper conclusions.

Besides the issue of relatively short time span, FDI stock data for developing economies are generally poor and as such unreliable. Part of the reasons for such poor quality of FDI has to do with the differing perceptions of world economies on what actually constitutes FDI. In other words, FDI means different things to different countries. For instance, Xu (2000) notes that even within the OECD, different countries define FDI differently. Such conflicts across economies on what constitutes FDI may limit the reliability its convergence effect found in this study.

Another limitation of this study that has to do with the issue of data is the use of FDI stock data by this study. When studying convergence of relatively poor economies to relatively richer ones, data on bilateral FDI from economies with superior technology could be a better alternative rather than the stock of FDI from entire world economies. This is justifiable by the fact that the whole argument that FDI aids convergence rests on its technology transfer capacity. Therefore, by using bilateral FDI data a researcher could limit his choice of FDI source economies to economies with superior technology rather than relying on the stock of FDI that comes from entire world economies.

5.5 Recommendations for Further Research

Broadly speaking, studies on economic convergence using data mainly from ECOWAS in particular, and Sub Saharan Africa at large are quite scant. Owing to this fact, on the whole, there is the need to conduct more researches on economic convergence amongst

and across SSA economies. However, in the subsequent paragraphs, more specific recommendations for further studies are provided.

There are numerous economic communities within SSA with available data on GDP for many decades for nearly all the member countries of such economic communities, it is therefore recommended that more economic convergence related studies should be carried out in order to examine the impact of the existence of such economic communities on economic convergence of member countries. Furthermore, besides conducting studies on individual economic communities within SSA, there is the need of undertaking comparative studies on the performance of such economic communities as it relates to economic convergence.

This study is mainly concerned with the impact of FDI in achieving economic convergence amongst and across two income groups in ECOWAS. Given the welfare implications of per capita income convergence and present globalized world, policy makers in SSA and ECOWAS would be better informed by studies examining the economic convergence performance of SSA and ECOWAS to the rest of the world. In line with this, future researches should be directed towards examining the role of FDI in facilitating economic convergence of SSA and ECOWAS countries to the income levels of better-performing economies in the rest of the world.

From data perspective, this research resorted to data on the stock of FDI owing to the dearth of data on bilateral FDI. Data on bilateral FDI in Africa at large covers only a very short time span. As time passes, more data on bilateral FDI is expected to be

available and it is therefore suggested that future studies should consider using bilateral FDI data as it is more appropriate in studying the phenomena of convergence.

5.6 Conclusion

In conclusion, this study as a whole investigates the phenomena of real GDP per capita convergence amongst ECOWAS member countries at large and within each of the two income groups in the community. The study also delves on the role of FDI in facilitating real GDP per capita convergence within and across each income group and ECOWAS as a whole. This final chapter concludes the entire research by providing a summary of the findings made by the research, policy implications of the findings as well as making recommendations. In the chapter, limitations of this study were highlighted as well as suggestion made for future research.

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