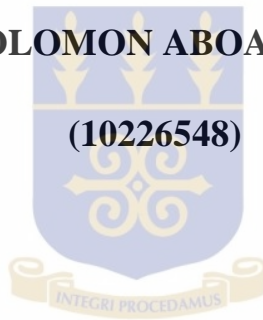


**AN EMPIRICAL INVESTIGATION OF PER CAPITA INCOME
CONVERGENCE HYPOTHESIS IN SUB-SAHARAN AFRICA**

BY

SOLOMON ABOAGYE

(10226548)



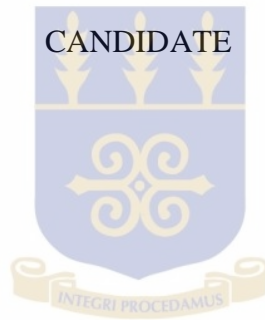
**THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA,
LEGON IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE AWARD OF MASTER OF PHILOSOPHY (M. PHIL.)
DEGREE IN ECONOMICS**

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DECLARATION

This is to certify that this thesis is the result of research undertaken by **SOLOMON ABOAGYE** towards the award of MPhil Economics in the Department of Economics, University of Ghana. I hereby declare that with exception of references made to works of other researchers, this thesis is entirely my own work under the guidance of my supervisors.

.....
SOLOMON ABOAGYE



.....
DR AUGUSTINE FRITZ GOCKEL

SUPERVISOR

.....
DR. F. EBO TURKSON

SUPERVISOR

ABSTRACT

The incidence of cross-country per capita income convergence has been debated for long by economists; all in the attempt to either validate or reject the per capita income convergence hypothesis as predicted by the Human capital - augmented Solow model (HC-ASM). However, researchers seem to have given little attention to Sub-Saharan African (SSA) in this ongoing discourse despite the wide per capita income disparity gap in the region. This present study fills this gap by conducting an empirical investigation of per capita income convergence hypothesis in SSA based on the strict assumption of a closed economy without government activities of the HC-ASM. The hypothesis is further tested by relaxing these restrictive assumptions specifically, by including into the basic model, government spending, FDI and openness to trade.

Using panel dataset on 37 SSA countries selected mainly on the basis of data availability, the study examined the convergence hypothesis employing panel Generalized Least Squares from 1980 to 2010. The study established per capita income divergence among the countries in SSA, with the level of divergence increasing with the inclusion of FDI, trade openness and government spending into the basic model. These findings are in complete disagreement with the prediction of the HC-ASM and further suggest that regardless of the presence of FDI, trade openness and government spending per capita income disparity gap among countries in SSA tends to widen.

Against these findings, it is recommended that poorer countries in SSA should urgently make pragmatic policies to attract FDI and make efficient utilization of these resources to reduce the per capita income gap since FDI was found to positively impact on per capita income growth in SSA.

DEDICATION

This thesis is dedicated to my parents, Mr. George Boafo and Madam Mary Yeboah



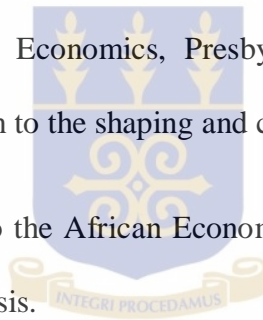
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I wish to express my heartfelt gratitude to the Almighty God for His abundant grace, giving me the knowledge, strength and protection for the successful completion of this thesis. There would not have been an end to this journey without Him.

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Notwithstanding support received from supervisors and colleagues, the researcher takes the sole responsibility for any errors and omissions in this work.

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LIST OF ABBREVIATIONS

Abbreviations	Meaning
3SLS-IV	Three Stage Least Squares – Instrumental Variable
ADF	Augmented Dickey Fuller
ADI	African Development Indicators
AGOA	African Growth and Opportunity Act
ANN	Artificial Neural Networks
CACM	Central American Countries Union
CAN	Andean countries Union
CARICOM	Caribbean Union
CM	Common Market
CU	Custom Union
EL-GH	Export Led – Growth Hypothesis
ESTAR-ADF	Exponential Smooth Auto-Regressive Augmented Dickey- Fuller
EU	European Union
EU-EBA	European Union - “Everything but Arms”
FDI	Foreign Direct Investment
FE	Fixed Effects
FTAs	Free Trade Agreements
GDP	Gross Domestic Product
GLS	Generalized Least Squares
GMM	Generalized Method of Moment
GSP	Generalized System of Preferences
HC-AS	Human Capita – Augmented Solow
HC-ASM	Human Capita – Augmented Solow Model
IFS	International Financial Statistics
IMF	International Monetary Fund
IPS	Im, Pesaran and Shin
LDCs	Least Developed Countries
MCCA	Central American Countries Union
MENA	Middle East and North Africa
MERCOSUR	Southern Cone Countries Union

NMS	New Member States
OECD	Organization for Economic Co-operation and Development
OLS	Ordinary Least Squares
PPP	Purchasing Power Parity
PTAs	Partial Trade Agreements
PWT	Penn World Tables
RE	Random Effects
RECs	Regional Economic Co-operation
SADC	South African Development Community
SAP	Structural Adjustment Programs
SSA	Sub-Saharan Africa
UNCTAD	United Nations Conference for Trade and Development
US	United States
WB	World Bank
WDI	World Development Indicators
WIR	World Investment Report
WTO	World Trade Organization

CHAPTER ONE

INTRODUCTION

1.0 Background

The traditional neoclassical model of growth which was developed¹ by Solow (1956) and Swan (1956) and was subsequently refined by Cass (1965), Koopmans (1965), and Mankiw et al (1992) has guided a number of empirical studies on income convergence. One of the central implications of the basic neoclassical growth model is the notion of economic convergence according to which, poor countries tend to grow faster than rich countries. Adopting a Cobb-Douglas production function in which output depends essentially on stock of physical capital and the amount of effective labour, Solow (1956) predicted that in a country's transition to its long run steady state level, initial per capita income is inversely related to subsequent per capita income growth. In simpler terms, (rich) countries with higher initial per capita income would grow quite slowly compared to (poor) countries with smaller initial per capita income, so that in the long run both groups of countries will converge to identical per capita income level. Thus, there would be per capita income convergence between richer and poorer countries. This prediction was made by Solow under the assumptions of constant returns to output, diminishing returns to inputs, and a closed economy without government activities, among others.

Paola (2010) argued that, although economic convergence is not a recent topic, it is crucial in economics because it is important for development economists, to assess whether countries with lower income levels (i.e. developing countries) are catching up with countries with higher income levels (i.e. developed countries) and also to evaluate whether the differences in incomes across countries tend to decrease or increase with the passage of time. The ability to

¹ Solow (1956) and Swan (1956) followed the work of Ramsey (1928)

recognize income disparities between economies, forces that trigger the disparities and potential disappearance or otherwise of these income disparities can help countries to formulate policies aimed at speeding up the process of economic development.

Per capita income convergence has been defined in diverse ways but according to Paola (2007), the per capita income convergence refers to a situation where two or more economies sharing structural characteristics or otherwise tends to reach similar state of economic development measured by per capita income. Romer (2001) used the concept to refer to the tendency for poor countries to grow faster than rich countries. Thus traditionally, the analysis of income convergence involves an analysis of whether poor countries are set on a path to converge with rich countries in terms of real per capita income (Tirelli, 2010). Resulting from the underlying assertion that, cross-country per capita income convergence implies the elimination of cross-country per capita disparities, the concept (i.e. per capita income convergence) has become a paramount theme in contemporary growth agenda and enormous economic literatures relating to the phenomenon exist for decades.

Typical real life evidence of convergence can be found from the Chinese economic growth since 1980. China, in the 1980's, was described as a poor country based on GDP and as compared to Japan and Germany (Kumo, 2011, World Bank, 2011). However, due to accelerated economic growth during the past three decades, China's GDP levels have become similar to that of Japan and Germany and in the mid-2010 China overtook both Germany and Japan as the second largest economy in the world after the United States of America (World Bank, 2011). Although China's real GDP per capita is still smaller than those of Japan and Germany, its economy has converged in terms of absolute income (Kumo, 2011).

In their seminal papers, both Romer (1986) and Lucas (1988), cited the lack of observed cross-country income convergence as evidence against the neoclassical growth model and in

favour of their theories of endogenous growth models, but some cross – country studies such as Mankiw, Romer and Weil (1992), Barro and Sala-i-Martin (1995), Sala-i-Martin (2002) and Islam (2003) have found a negative relationship between initial per capita income and subsequent growth in per capita income after some variables that affect per capita income growth have been controlled for. In other words, these studies found conditional convergence which is the prediction of the neoclassical growth model of Solow, (1956) and the human-capital augmented Solow model of Mankiw et al (1992).

Sub Saharan African (SSA) engages in several economic interactions with almost all the regional blocs worldwide. As these economic interactions usually result in colossal flows of investment, trade, and technology transfer among others, it is expected that SSA takes advantage of it to enhance its growth process. SSA has since 2002 recorded consistent increases in growth rates (Brückner, & Lederman, 2012). The World Bank (2011) revealed that the region saw growth rate increased from 3.35% in 2002 to 4.1% in 2003 and then to 5.88% in 2004 and steadily to 6.45% in 2007.

Theories of international economics also posit that, a country's growth in GDP and even GDP per capita depends not only on internal factors such as population growth rate, investment in physical capital and/or human capital etc. but also on some crucial external factors such as regional integration, trade, Foreign Direct Investment (FDI) etc. For instance, studies including the works of Samuelson, (1948), Helpman and Krugman, (1985) and Ben – David and Kimhi (2000) revealed that an increase in trade flows leads to an increase in the speed of income convergence. Similarly, Jawaid and Raza (2012) noted that in many developing economies which the SSA is no exception, FDI is one of the key variables around which growth revolves.

Over the past few decades the share of FDI in GDP in the SSA region has been on the ascendency. It averaged at 0.796% between 1970 -1980. Though this average dropped to 0.472% in the 1980s it rose steadily to 1.486% in the subsequent decade. Currently, the share of FDI in GDP averages at 3.481%. Also, the role play of Government in a country is seen as another important source of growth to any country. For instance, if Government fails to execute the appropriate fiscal policies or fails to exercise sound fiscal discipline, a country's growth process is likely to be impeded.

Now, the question is that, have the perceived effects of openness to trade, FDI flows and Government expenditure on growth been translated into per capita income convergence in the SSA? This question is extremely pertinent and quite apt in that for over a decade, the region has been increasingly urged to expand its openness to international trade by reducing tariff and non-tariff barriers, and instituting an array of other liberalization programs (Morris, 2008). Yet, after several years of policy changes and attempts to integrate the region into the world markets through increased trade openness, many countries of the region are still showing meager progress in terms of achieving high income growth (World Bank, 2011). During the same time span, East Asian economies have produced high growth rates, allegedly as a result of their greater openness to international trade (Morris, 2008).

It is also worth-noting that various studies including Mankiw et al, (1992), Barro (1995) Fukuda & Toya (1995), Ben-David (1996) Islam, 2003, Sala-i-Martin (2002) and Ghosh (2007), have established that as a country grows, it approaches its steady state level and this could be a vital source of cross-country convergence. This conclusion is however, not always guaranteed. For instance, while some studies on economic convergence in North America, Europe and East Asia have found evidence for the possible occurrence of cross-country per capita income convergence through the crucial role of exports, regional integration, trade

liberalization, FDI among others (Jawaid and Raza, 2012; Ghosh, 2007; Fukuda & Toya, 1995), some other studies (Willem te Velde, 2008; Puyana & Romero, 2002; Slaughter, 2001) have rather found the contrary to exist. Also, as put by Baliamoune-Lutz (2001, p6), “it is evident from the literature that many scholars and policymakers are convinced that globalization -represented mainly by openness to international trade and FDI- serves as an ‘expressway’ for the engine of growth . Yet, it is not always clear how globalization affects economic growth nor is it obvious which policy instruments would ensure the kind of integration capable of leading to growth-promoting linkages”. The work of Dollar (2001), Martin (2001), and Nunnenkamp (2002) share similar conclusion.

1.1 Problem Statement

The existence of poverty and wide per income gaps among countries in SSA remains a subject of huge concern to the region and owing to the notion that cross-country convergence implies the elimination of cross-country per capita income disparities; the study of cross-country convergence has become a highly popular research area in contemporary development agenda. Also, Baier and Bergstrand (2001) argued that, per capita income convergence is also another essential catalyst for intra-regional trade. This stands to reason that, to eliminate income inequality and to subsequently promote trade among SSA countries which has been blamed as one of the reasons why poverty is persistent and the income gap keeps on widening, there is the need to investigate thoroughly into the per capita income convergence hypothesis. As a consequence, there is an ever-growing body of studies that investigate the occurrence and the underlying driving forces of cross-country income convergence. Even though, economists seemed to be in long debate on the theme especially on the basis of the neoclassical growth model which assumes diminishing returns to capital, a number of studies

in North America, Europe and recently in some parts of Asia that have employed the neoclassical growth model have provided some evidence for per capita income convergence especially through trade liberalizations, regional integration, and foreign direct investments, among others (Ghosh, 2007; Fukuda and Toya, 1995; Ben-David, 1996, 1995, and 1993).

Despite these enormous researches, researchers seem to have given little attention to SSA in this discourse as relatively few studies have been conducted to examine whether the per capita income disparity gap observed among SSA countries has been disappearing over the past few decades so as to identify the forces which tend to trigger the disparity. Thus, relatively few studies have been conducted to examine the validity of the neoclassical convergence prediction in SSA. Also, important is the fact that, although some studies have already confirmed the positive effects of FDI, government expenditure and trade openness on per capita income growth, no substantial works have been done to investigate how these factors are enhancing convergence process in the region through its positive effects on growth (Morris, 2008). Thus, in this study, using the Human capital-augmented version of the neoclassical growth model, the per capita income convergence possibility among SSA countries on the basis of per capita income is examined.

1.2 Research Questions

- Is there any evidence of diminishing per capita income disparity among countries in SSA based on the neoclassical model?
- Does FDI, government expenditure and trade openness have any strong influence on per capita income convergence in SSA?

- If convergence holds for SSA, how many years would it take for income per capita disparity among SSA countries to disappear?

1.3 Research Objectives

The objectives of this study are to:

- Examine, on the basis of the neoclassical model, the convergence possibility among SSA countries to a similar level of income per capita.
- Establish whether FDI, government expenditure and trade openness have any influence on the convergence possibility in SSA.
- Estimate the number of years it would take the per capita income disparity among countries in SSA to disappear if convergence hypothesis holds.

1.5 Significance of the study

According to Baliaoune-Lutz (2001), economists have put increased emphasis on the analysis of the per capita income convergence hypotheses since the 1980s for four main reasons². Firstly, whether income convergence is possible or not, such a discourse helps validate alternative growth theories. For instance, the neoclassical (exogenous) growth model predicts that real per capita incomes of countries converge to a common steady state, regardless of its initial level. Moreover, estimates of the speed of convergence across economies are thought to provide information on the key parameters of growth theory. However, the endogenous growth theory, by emphasizing differences among countries in their initial endowments and the possibility of multiple equilibria, shows that there is no tendency

² Also see Barro and Sala-I-Martin (1995) and Charles et al., (2009).

for the income level to converge in the long run. Secondly, the availability of comparable per capita GDP data on large number of countries since mid-1980s allowed economists to compare per capita GDP figures across these countries and look at the evolution of these levels over time, a necessary feature for the study of convergence hypothesis. Thirdly, whether or not the neoclassical or endogenous growth model is validated, there is a potential for state intervention in the economic growth process, either in the form of regional economic groupings or national priorities. Fourthly, empirical evidences show that there are strong differences among countries, particularly among SSA countries, in terms of real per capita income and economic growth during the past three decades.

In the light of the above discussion, the study is considered significant for two reasons. Firstly, studies aimed at validating the per capita income convergence hypothesis and/or examining whether per capita income disparity in SSA has been disappearing as well as the crucial role played by FDI, Government and trade openness in the convergence process are very sparse. Therefore, this study serves to add to the stock of literature on the theme in the region. Secondly, this research is of immense economic significance as there is a need to examine, if countries in SSA are reaping the benefits associated with FDI, government expenditure and trade openness especially to facilitate their “catch up” process. Thus, the results of the study offer insights into various policy issues regarding government spending, and Trade and FDI flows into the sub-region.

1.6 Organization of the study

The study is organized as follows: Chapter one focuses on the introduction which includes the background of the study, problem statement, objectives, hypothesis, and the significance of the study. Chapter two is devoted to the review of related literature on the study; Chapter

three looks at the trends in FDI, trade, government spending growth, per capita income growth etc. in the SSA region. Methodology and Data is captured in chapter four; while chapter five looks at the Estimation and Discussions of results. Chapter six provides the summary, conclusions and the recommendations of the study.

1.7 Concluding remarks

From the foregoing discussion, it can be deduced that in spite of the strong criticisms levelled against the neoclassical growth model by the proponents of endogenous growth models, a considerable number of studies have found some evidence for the occurrence of cross-country convergence. However, almost none of these studies has focused explicitly on the SSA. Thus, using the Human capital-augmented version of the neoclassical growth model, the long run convergence possibility among SSA countries is assessed on the basis of per capita income.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

The chapter presents a review of the theoretical underpinnings of income convergence highlighting the conditions and policies that trigger the occurrence of the phenomenon. In addition, the study reviews some empirical works on income convergence with much focus on the role of trade openness, FDI and Government expenditure in facilitating the convergence process. This chapter proceeds in two broad sections. The first section reviews the theoretical underpinnings of the study while the second section looks at the empirical studies conducted on the theme following this order: a general review, a review on regional integration and convergence, trade openness and convergence, FDI and convergence and government expenditure and convergence.

2.1 Theoretical literature review

Most studies about income convergence have been essentially guided by the Human Capital – Augmented Solow version of the basic neoclassical growth model that was first developed by Solow (1956) and Swan (1956) and later refined and modified by Cass (1965), Koopmans (1965) and Mankiw, et al (1992). In particular, Mankiw, et al (1992) found human capital as another important input of production. As a consequence they introduced human capital into the production function in addition to the labour and physical capital that were originally proposed by Solow. This modified version of the basic neoclassical growth developed by Mankiw et al (1992) is sometimes referred to as the Human Capital – Augmented Solow model (hereafter referred to as HC-ASM). Key assumptions of the theory include a constant

return production function with diminishing returns to inputs, closed economy without government activities in the economy.

From traditional growth literature, the Solow (1956) model, and the Cass (1965) and Koopmans (1965) and Mankiw et al, (1992) modifications, lie the assertion that differences in initial capital-labor endowments would be eliminated over time and that this in turn leads to a convergence in per capita incomes. In other words, the convergence hypothesis rests on the assumption that, along an economy's transition to its steady state position, growth rate is inversely proportional to the capital-labour ratio, so that the lower the initial capital-labour ratio, the higher the growth rate will be and the converse also holds. Thus countries with lower initial capital per capita tend to grow faster compared to those with higher initial capital per capita. In other words, *if* capital exhibits diminishing returns, *then* an economy with lower capital-labor ratio exhibits a higher marginal product of capital and thus, grows faster compared to a similar economy with a higher capital-labor ratio so that the differences across countries would tend to fade out over time, with per capita income and its growth rate gradually converging until reaching an identical long-run equilibrium level for both rich and poor countries.

The HC – ASM which is the principal theoretical framework of the study also predicts that when differences in population growth rate, saving or investment rates both in physical and human capital among countries are accounted for, cross-country data generally support conditional per capita income convergence. Hence, the Solow-Cass-Koopmans models and more especially, the HC – ASM focus on a closed economy so that convergence occurs even without the need for international trade. However, as argued by Magrini (2002) the open-economy version of the neoclassical model predicts a faster speed of convergence than its closed-economy counterpart. In particular, exports, regional integration, technological

transfers and FDI among others, have been cited by various economists to influence convergence through their positive effects on growth (Jawaid and Raza, 2012; Ben-David, 1996; Ghosh, 2007; Fukuda and Toya, 1995). For instance, according to Feder's model of productivity and development, exports which is somewhat a measure of a country's openness to trade, contribute to economic growth and income convergence in a variety of ways such as greater capacity utilization, economies of scale, incentives for technological improvement and pressure of foreign competition, leading to more efficient management (Feder, 1982). Similarly, an implicit assumption of the Export-led Growth Hypothesis (EL-GH) is that, exports may facilitate convergence through its positive influence on growth.

Also, according to Ahmed and Fida (2009), the theoretical relationship between trade and convergence is examined by incorporating the role of international trade and liberalization. The authors argument is that trade liberalization causes convergence in per capita income—since trade liberalization increases competition and domestic firms' absorption capacity for knowledge and ideas, knowledge levels among countries converge to a common level, leading to per capita income convergence (also see Sachs and Warner (1995), Ben-David (1993, 1995, 1996) and Ben-David and Kimhi (2000) among others). Furthermore, Ben-David and Loewy (1996) demonstrated how a movement towards free trade increases trade volumes and reduces income differentials among liberalizing countries.

Further, from international trade literature, the Factor Price Equalization theorem (Samuelson, 1948; Helpman and Krugman, 1985) implies that if a number of limiting restrictions are met, then free trade in goods should lead to commodity price equalization and to a subsequent equalization of factor prices and an eventual equalization of income per capita. However, Ben-David (1996), Rassekh and Thompson (1996), and Slaughter (1997) strongly disagreed with the conclusion of Samuelson, (1948), and Helpman and Krugman, (1985) and argued

that “factor price equalization need not be synonymous with an equalization of per capita incomes”. As noted, while it is widely upheld that increased openness to international trade and foreign capital promotes economic growth, there are plausible arguments to support the proposition that the benefits may require threshold levels of income and human capital. Poor countries may not be able to compete against multinational firms (from wealthy nations) in world markets. Moreover, poor countries must compete with non-poor developing (emerging) countries to attract FDI.

2.1.1 Concepts and types of convergence

Islam (2003) discussed various concepts of convergence though two appear to be extensively discussed in the literature. In one view, convergence applies to the tendency of a poor country (region) to grow faster than a richer counterpart, so that “all other things being equal”, the poor country tends to catch up with the rich one in terms of the level of per capita income. This is usually referred to as (Beta) β -convergence. The second concept concerns the cross-sectional dispersion of per capita income in which per capita income convergence occurs if the dispersion of per capita income-measured by the standard deviation of the logarithm of per capita income across a group of countries declines over time. This type of convergence is usually referred to in the literature as (Sigma) σ -convergence. Convergence of the first kind (poor countries tending to grow faster than rich countries) works toward convergence of the second kind (reduced dispersion of incomes), but is sometimes offset by new disturbances that tend to increase dispersion.

Beta and Sigma convergence are further classified into Absolute and Conditional convergence. In the former, it is expected that poor countries to grow faster and consequently catch up with rich countries without any considerations to structural or institutional

parameters of the two groups. In the former however, there is due consideration of the similar characteristics shared by the two group of countries (Mankiw et al, 1992 and Lall and Yilmaz, 2000).

2.2 Empirical evidence on convergence

A number of arguments have been raised about the occurrence of income convergence among countries within a region and the potential conditions and policies that trigger convergence through their positive impact on economic growth. Empirical studies have been conducted to support either side of the argument. A number of these empirical works are reviewed in the section below.

2.2.1 General Evidence on convergence

The work of Baumol (1986) is one of the most well-known initial studies of convergence. Baumol (1986) obtained a significant negative coefficient on the initial income variable in a growth-initial level regression for 16 Organization for Economic Co-operation and Development (OECD) countries, and takes this as strong evidence of (unconditional) convergence. Baumol also considered the relationship in an extended sample of 72 countries. In this larger sample, however, convergence did not hold. Thus, Baumol's study produced evidence for and against the convergence hypothesis depending on the sample and the grouping of the countries. As a result Baumol (1986) suggested that, while there is no convergence in the larger sample as a whole, there exist 'clubs' of countries within which evidence of convergence can be seen.

Dowrick and Nguyen (1989) evaluated the convergence hypothesis among the same OECD economy as Baumol (1986) did³. Dowrick and Nguyen also established a significant evidence of convergence within the OECD countries. The authors found that this evidence of convergence is strong even when potential bias due to cyclical differences, different measures of purchasing power parity, potential errors in the backward projection of income levels, and sample selection biases are well controlled for. The work of Baumol, Blackman and Wolf (1989) validates the findings of Dowrick and Nguyen (1989). In particular Baumol et al (1989) argued that if one looks separately at low income, middle income and high income countries, there is a strong evidence of convergence within each group. However, the authors were quick to admit that, income convergence may not necessarily hold across countries of different income statuses or strata.

Again, the work of Mankiw et al. (1992) provided strong evidence that supports income convergence hypothesis in the so-called homogenous group of countries such as the OECD countries. From the studies of Baumol (1986), Dowrick and Nguyen (1989) and Mankiw et al (1992), it is noticed that convergence or otherwise depends to a larger extent on the sample chosen, its size and/or the degree of homogeneity of the sample.

Similarly, Barro and Sala-i-Martin (1991) also found some evidence of convergence across selected U.S. states and European countries implying that poorer regions within a country tend to grow faster than richer ones. This result was based on the per capita gross domestic product of the various states of America and from the different regions of seven European countries. It has been argued that, convergence of growth and per capita income may not be obtained even with the same sample and methodology. That is, the work of Barro and Sala-i-

³ This does not imply the two studies used the same set of countries

Martin (1991) could have obtained other results if the study had employed GDP growth instead of per capita GDP.

Estimating the data for 110 countries selected across the world during 1960-1990, the study of convergence by Sala-I-Martin (1996) showed significant divergence rather than convergence and the speed of divergence was 0.4% per annum. These findings imply that economies may differ in other respects in the real world, such as population growth, saving behavior, technology and political stability. If these differences are considered, the neoclassical model predicts that the growth of an economy will be positively related to the distance that separates the country from its own steady state.

A study by Magrini (2002) to find evidence for per capita income convergence rather tend to lend little support to the convergence predictions of the traditional neoclassical model of growth, particularly when the focus is on the U.S. The study revealed that the traditional tenet is that there is a substantial lack of legal, cultural, linguistic and institutional barriers to factor movements and this should favour a process of rapid (and absolute) convergence across regions. However, his study which was based both on time series and distribution dynamics strongly rejected the hypothesis of absolute convergence and instead suggested that the interregional distribution of per capita income is becoming more polarized. It must be emphasized that the inclusion of legal, cultural, linguistic and institutional barriers is quite laudable as they carry the potential unveiling very key issues.

Also, driven by the inconsistency in the findings reported by earlier studies on the theme, Dobson and Ramlogan (2002) carried out an empirical investigation into growth convergence among Latin American countries over the study period 1960-90. They found evidence of unconditional beta convergence (i.e. poor countries growing faster than richer countries towards a common steady state) but not sigma convergence (distribution of income becoming

more equal) across the full study period. However, by looking at sub-periods, they found that the rates of conditional convergence towards individual steady states are highest during the 1970s-mid 1980s. In addition, the study concludes that the estimates of convergence may be sensitive to how GDP is measured.

To test for per capita income convergence, Stroomer and Giles (2003) used both standard approaches (such as time series and panel approaches) and new approaches (such as the Fuzzy Sets and Fuzzy Clustering approaches) to explore the extent to which the degree of trade openness may affect output convergence among countries. Using annual time-series data for 88 countries selected across various world regions from the Penn World Tables (PWT), the authors obtained somewhat mixed results, but on balance they were quite supportive of a positive relationship (though not necessarily causality) between trade openness and income convergence. These results also suggest certain directions that further research might take in order to shed more light on this per capita income convergence by incorporating this so-called methodology.

Parikh and Shibata (2004) used panel data and the beta-sigma, single difference, and difference-in-differences approaches to evaluate the convergence hypothesis for pre-post liberalized eras. They concluded that there is no evidence of acceleration or deceleration after liberalization for some Asian economies. The sigma-convergence approach showed significant convergence of per capita income, while the difference-in-differences approach also indicated significant income convergence. The study which also employed the dynamic models by using Generalized Method of Moments (GMM) estimations demonstrated no evidence of acceleration or deceleration in convergence. This study happens to be among the few which has actually used a dynamic approach to test the convergence hypothesis among countries though it gave no support to the phenomenon.

Further, Papadas and Estratoglou employed the Barro and Salla-i-Martin (1991) model to examine β convergence for 52 regions of the Greek economy for two periods. Including variables such as percentage share of the total labor force employed in the primary sector, the percentage share of total population with secondary education, investment and unemployment rate, they estimated both conditional and absolute convergence for period of 1981-1991 and 1971- 1991. The study rendered some support to income convergence. The authors also introduced Artificial Neural Networks (ANN) algorithm as a useful tool for studying non-linearity relationship of β convergence. According to this study there has been no other study of ANN application to the empirics of convergence and their study is considered to be the first.

Higgins, Levy, and Young (2007) used U.S. county data (3,058 observations) and 41 conditioning variables to study growth and convergence. Using ordinary least squares (OLS) and three-stage least squares with instrumental variables (3SLS-IV), the study gave the following report on the full sample and metro, non-metro, and regional samples: (1) OLS yields convergence rates around 2%; 3SLS yields 6%–8%; This difference is economically significant: it represents a difference in the half-life of the gap between present levels of income and the balanced growth path of 32–33 years versus 12–13 years, respectively (2) they also found that the convergence rates are quite variable: the Southern counties converge more than two and half times faster than the counties in the Northeast convergence rates (i.e. the Southern rate is 2.5 times the Northeastern rate). The employment of the sub-sample technique is regarded to have made the finding more robust and insightful.

Further, Mcquinn and Whelan (2006) estimated the speed of conditional convergence of economies towards their steady state paths using the empirical behavior of the capital-output ratio. The author found that the conditional convergence speed is about 7% per year. This is

somewhat faster than predicted by the Solow model of 2% and is significantly higher than what has been reported in most previous studies based on output per worker regressions. The findings of the study however revealed that, once there are stochastic shocks to technology, standard panel econometric techniques produce downward-biased estimates of convergence speeds.

Again, after controlling for country specific effects, Paola (2007) in a study in Latin America also found conditional convergence for all unions in Latin America except for the Central American countries union (MCCA). These results however, suggest that neither the southern cone countries union (MERCOSUR) nor the Central American countries union (CACM) members share the same steady-state while the Caribbean union (CARICOM) and the Andean countries union (CAN) are more homogenous and have similar steady-states. Like the studies of Baumol (1986), Dowrick and Nguyen (1989) and Mankiw et al (1992), it is noticed that convergence or otherwise depends to a larger extent on the sample chosen, its size and/or the degree of homogeneity of the sample.

Paas, Kuusk, Schlitte and Vörk (2007) tested the convergence hypothesis in selected European Union (EU) countries and their NUTS 3 level regions during the European Union pre-enlargement period (1995–2002), using both spatial and non-spatial approaches. Their findings confirmed absolute income convergence between regions in both the groups of countries (i.e. the countries of the EU15, or the old member states, and the New Member States (NMS). However, when national effects are included in convergence equations using country dummies, no evidence of regional income convergence can be observed. Therefore, the results of the study underscore the importance of regional policies in inhibiting the increase of regional income disparities and improving conditions for income growth, particularly within the NMS.

Marco (2009) used both linear unit root tests and non-linear unit root test of Exponential Smooth Auto-Regressive Augmented Dickey- Fuller (ESTAR-ADF) unit root test to the time series data for the period 1929-2005. Results from the study suggest an evidence of stationarity for time series variables employed in the study and, thereby supporting beta and sigma convergence among states. The ESTAR-ADF in particular helps to test the convergence hypothesis on the assumption that the underlying relationship between economic growth and the conditions that trigger it is not linear.

As a result of the non-linearity of the underlying relationships, the restrictiveness of assumptions of functional forms and econometric problems in the estimation and application of theoretical models, Sameti Farahmand and Koleyni (2010) advocate the use of ANN algorithms in their recent study: “an inquiry into income convergence in Middle East and North Africa (MENA) countries”. Using a Neural Network Approach, the authors obtained results which show that absolute convergence exists for 22 MENA countries across the world in studied period of 1970-2003. It means that their analysis supports the tendency of poor economies to unconditionally grow faster than rich ones across the MENA countries. In addition, after conditioning some different variables like openness, annual growth rate of population, investment, etc. the authors concluded that conditional β convergence is statistically significant in all of estimated models but the speed of convergence is low. As a consequence, the authors reported that by changing the quantitative tools of analysis and using ANN, the results become more precise in comparison with OLS method. The authors wrap up that the most important point of this study is that the results obtained from the neural network are more accurate when compared with that of the regression model and concluded that neural networks are more capable. However, the authors used the artificial neural networks as a complement algorithm of OLS method, not as the alternative or substitute

approach. The study recommended as Barro and Sala-i-Martin (1992) did that, future studies should survey income convergence, by both regression method and ANN algorithm for more similar economies, like regions of a country or countries of a trading block. In addition, one can use the ANN with other approaches like time series or panel data (Sameti, Farahmand and Koleyni, 2010). This current study employs the regression approach for the investigation.

Anold, Bassanini and Scarpetta (2010) tested whether the growth experience of a sample of 21 OECD countries over the past three decades is more consistent with the augmented Solow model or the Uzawa-Lucas model, by exploiting different non-linear restrictions implied by them as regards the relationship between factor shares and speed of convergence. Using cross-country/time series data, the study specified a growth regression without imposing cross-country homogeneity restrictions on the speed of convergence and short-run parameters. The author reported that both theoretical models (i.e. the augmented Solow model and the Uzawa-Lucas model) imply that the speed of convergence to the steady state differs across countries due to heterogeneity in population growth, technical change or progressiveness of income taxes. However, the estimated speed of convergence was too fast to be compatible with the augmented Solow model which assumes diminishing returns to inputs, but was consistent with the Uzawa-Lucas model with constant returns to scale.

Further, Kalbasi (2010) used fixed effect models to test the hypothesis of convergence among Middle East Countries for the period of 1995-2005. Testing for both absolute and conditional convergence using both GDP and per capita income, the study divided countries into two sub-groups, oil producing countries and non-oil producers. The results suggested that there is the tendency of convergence among Middle East countries at different speed for oil producers compared with non-oil producers. Once again this study also reflects the essence of grouping of the countries as well as the convergence variable (i.e. GDP as against GDP per capita).

Bandyopadhyay (2011) also examined the convergence of growth and incomes across the Indian states using an empirical model of dynamically evolving distributions. The distribution dynamics of incomes across Indian states were examined using the entire income distribution. Unlike standard regression approaches, this approach allows for the identification of specific distributional characteristics such as polarization and stratification. Specifically, the study reveals that the period between 1965 and 1997 exhibited the formation of two convergence clubs: one at 50% and another at 125% of the national average income. Income disparities across the states declined over the 1960s and then increased from the 1970s to the 1990s. Conditioning exercises revealed that the formation of the convergence clubs is associated with the disparate distribution of macroeconomic factors such as capital expenditure and fiscal deficits. In particular, capital expenditure, fiscal deficits and education expenditures were found to be associated with the formation of the upper convergence club. Thus, the findings have strong policy implications for these macroeconomic indicators of these states in that while the upper income group states have been experiencing high levels of economic growth and development, they are also characterized by macroeconomic imbalances.

Contrary to the above findings, Caselli, Esquivel and Lefort (1996) moved by two main sources of inconsistency in existing cross-country empirical works on growth (i.e. correlated individual effects and endogenous explanatory variables) estimated a variety of cross-country growth regressions using a generalized method of moments (GMM) estimator that eliminates both problems. The study focused on a sample of 97 countries from 1960-1985. Since data at 5-year intervals imply missing observations for some countries, the authors modified the GMM estimator to accommodate unbalanced-panel data. By doing this, the study was able to use all 97 countries in the sample, thereby avoiding potential sample-selection bias induced by data availability. Two estimations were carried out: in one application, they found that per

capita incomes converge to their steady state levels at a rate of approximately 10% per year. This result stands in sharp contrast to the current consensus, which places the convergence rate at 2%. In the other application, they performed a test of the Solow model and they rejected both the standard and the augmented version of the model of the Solow model. It must be emphasized here that, even though, the quest to obtain consistent data throughout the sample period is good, some cautions need to be exercised because other econometric problems become somewhat inevitable if this was achieved under the techniques of averages be it simple or moving.

Also, Latif (2010) using an econometric validation based on cross-sectional and panel data, found that the hypothesis of a common convergence path in the Franc Zone has not been carried out uniformly within the zone despite the existence of a convergence club. Moreover, in an earlier study, Islam (1995) using a different econometric methodology using panel data had established that the evidence found by Latif (2010) is true.

2.2.2 Regional Integration and Convergence

Basil (2002) used data from 1960-1980 and Random effects estimations to test for absolute sigma and beta convergence in West Africa on the basis of regional integration by employing both time series and cross-sectional approaches. Convergence test was also conducted for the 1960-1970, 1970-1980 and 1980-1990 sub-sample periods. In a nutshell, the study revealed that although the sub-region forms a convergence club, there is a weak tendency for the occurrence of the phenomenon. The sub grouping of the sample period, to an appreciable extent, accounted for the results obtained by Basil (2002).

Also, to Berg and Krueger (2003), poor regions and countries tend to grow faster than the rich especially if the former group of countries is well integrated into the latter. In particular, they concluded that poor countries may grow and reduce poverty levels if they are open enough to foreign commerce. This finding is validated by Zhang and Zhang (2003). In particular, Zhang and Zhang (2003) developed an empirical method for decomposing the contributions of two major driving forces of globalization/integration, (i.e. foreign trade and FDI) on regional inequality in China. Using data from 1986-98, globalization is found to be an important factor contributing to the widening regional inequality. However, Hallet and Piscitelli (2002) obtained employed a business-cycle model and found that large and stable economies which are well-integrated are more likely to diverge but smaller, more volatile or less well-integrated economies will converge. In effect, the study presented evidence against convergence on the grounds of regional integration.

To test for the convergence hypothesis, Camarero et al. (2006) examined how productivity converges in the MERSOCUR. The study validated the hypothesis in that, productivity convergence was found in the MERSOCUR countries. The authors explained that this evidence of productivity convergence is mainly the result from higher integration of the economies, through increased trade flows among the member countries. On the contrary however, Hammouda et al, (2007) obtained differing results when they conducted an empirical analysis to evaluate how regional integration is facilitating per capita income growth and convergence. Using data on African countries, the authors found the evidence that there has been little progress of income convergence in Africa. The authors concluded that, despite the importance of regional integration there has been limited progress and prospects in the continent and that the African integration process are not as promising as expected to be such an important pillar in Africa's development agenda.

Willem te Velde (2008) examined empirically whether and how regional integration leads to convergence and growth among developing countries. Using standard growth models for nearly 100 developing countries over 1970-2004 the study did not find any robust income convergence effects of regional integration at the aggregated level of analysis even after using alternative measurements of regional integration. Yet, country-specific growth diagnostics do suggest that regional integration can be a key to massive income growth as “deep” regional approaches can help to address crucial rail, road, air and energy links amongst countries.

Kumo (2011), examined the convergence effects of regional integration and found no evidence for economic growth and real GDP per capita convergence in the South African Development Community (SADC). Specifically, real per capita GDP inequality among SADC member countries has in fact increased instead of disappearing. This conclusion is reinforced by the work of Lee et al (1995) which found no evidence of convergence. Using a sample of 102 non-oil producing countries over the period of 1960-1989, the authors tested for various concepts of convergence on the basis of integration. The study obtained results which suggested that, it is unlikely that all countries will possess a common equilibrium (Lee et al, 1998). Similarly, using alternative panel models, Paola (2007) also tested the convergence hypothesis in Latin America on the basis of regional integration. He also found that integration processes have not helped to accelerate convergence in Latin America.

2.2.3 Trade Openness and Income Convergence

The link between convergence and openness across history is noted by Williamson (1991) who argued that convergence and global economic integration is linked to the Industrial Revolution of 1850. He argued that there is evidence of income convergence in two sub-periods during which the movement of goods and factors occurred relatively freely, 1870-

1913 and post-1950. Williamson (1991) reported that even though income gaps appear to grow over time, countries that trade extensively with one another tend to exhibit a higher incidence of income convergence.

Fukuda and Toya (1995) in a cross-country study in East Asia to determine the crucial role of exports in the convergence process found evidence in support of conditional convergence. The authors used a Fixed Effect panel model on a five-year averaged data of G7 and East Asian countries from 1960 to 1984 and a 7-year averaged data from 1985 to 1991. The authors reported that once the special role of exports is accounted for, empirical result supports the convergence hypothesis in East Asian countries. The results of the study however worsened with the inclusion of government expenditure. That is, taking into account the role of government in each of these East Asian countries, the result was that of divergence. This indicates that the presence of government

In an earlier study, Ben-David (1996) examined the liberalization-convergence link by focusing on non-poor countries (which were defined as countries with per capita incomes of at least 25% of the United States, the lead country in 1960). For each of the resultant 25 source countries an export-based group was created that included all countries importing at least 4% of the source country's exports. Similarly, a 4% cutoff point was used to determine each source country's import-based group. By grouping together countries that are major trade partners of one another, the study showed a very high incidence of income convergence within the trade-based groups. As a reference point for determining the uniqueness of the trade-based convergence results, the same countries comprising the trade-based groups were grouped and regrouped repeatedly on a random basis and did not exhibit a prevalence of convergence outcomes supporting the earlier results that, while convergence may be found among the more developed countries, it is more of an infrequent finding than a frequent one.

These earlier studies by Ben-David established that grouping countries according to cross-sectional trade criteria (at a given point in time) produces convergence results considerably more often than do random grouping of countries. What is still not clear from his study, however, is why some trade groups converged faster than others.

Ben – David and Kimhi (2000) set out a study to examine how trade flows influence the process and speed of income convergence. Using 1960-1985 data, Ben-David and Kimhi (2000) showed that an increase in trade flows led to an increase in the speed of income convergence. The study used 127 pairs of countries on the basis of export data and 134 pairs of countries on the basis of import data. This study confirms the conclusion of Sachs and Warner (1995) who found that international trade causes income convergence. Further, Zhang (2001) explored the role of trade and FDI in a cross-country convergence analysis, indicating that export and FDI tend to accelerate the convergence process in the Asian newly industrialized economies and Japan. However, Rodriguez and Rodrik (1999) examined and identified the weaknesses of some prominent empirical studies on the relationship between trade barriers and economic growth. They observed that it is relatively easy to come up with cases of regions of the world which have diverged or converged in ways unrelated to trade policy and therefore casts doubts on whether there is a systematic relationship between trade liberalization and convergence (see also Milanovic, 2006).

Also, Slaughter (2001), used a difference in difference approach to analyze whether trade liberalization contributes to per capita income convergence across countries. The analysis focused on four post-1945 multilateral trade liberalizations. The author did not find any forceful evidence demonstrating that trade liberalization has positive effects on the speed of convergence among countries. In fact, much evidence suggested that trade liberalization diverges incomes among Liberalizers. The work of Balamoune-Lutz (2001) gave an

unambiguous support to the findings of Slaughter (2001). Balioune-Lutz (2001) used panel data to find evidence for income convergence on the basis of trade openness. The results from fixed-effect and adjusted fixed effect (regional-effect) failed to substantiate the proposition that greater openness facilitates convergence to higher income levels.

Stroomer and Giles (2003) used both standard and new approaches to test for convergence in order to explore the extent to which the degree of trade openness may affect income convergence among countries. Using annual time-series data for 88 countries selected across the world, the authors obtain somewhat mixed results, but on balance the results were quite supportive of a positive relationship (though these results do not necessarily imply causality) between trade openness and income convergence. In this regard the authors were quick to admit that future research should take into account other important variable that influence the growth of countries while controlling for selection bias.

Gaulier (2003) investigated into the convergence effects of trade openness as a revisit of Ben-David classic study in 1993. Ben-David (1993) observed that trade-based groups of countries (groups comprising of major trade partners) are more likely to exhibit convergence than groups of randomly selected countries and this what Gaulier sought to address in his study, i.e. to check and assessed the robustness of Ben-David's result. Gaulier (2003) showed that trade intensity *per se* does not bring about convergence. Trade and beta-convergence are robustly linked but there is no evidence that trade induces sigma-convergence. Furthermore, the evidence of beta-convergence within trade-based groups is due to a bias toward selecting big countries in those groups. Even if trading with big countries may be beneficial, the evidence for trade as a channel for convergence is weak (Gaulier, 2003).

Furthermore, Holmes (2005) tested for economic convergence among Latin American countries- a relatively unexplored area- using groupings based on key agreements concerning

trade liberalization and cooperation. For this purpose, convergence was addressed in an alternative way through the application of principal components and cointegration analysis. This multivariate technique has advantages over existing methods because less demand is placed on limited data sets and the qualitative outcome of the test is invariant to the choice of base country. In addition to this, this technique offers a different perspective on convergence based on the co-movements of real per capita outputs rather than the traditional sigma and beta convergence. The study found evidence that convergence is most likely to be found within convergence clubs based on trade agreements. In specific terms, using a sample of 16 Latin American countries, the author found that strong long-run convergence is only confirmed in the cases of the Central American Common Market countries over the period 1960-2000. However, a weaker form of convergence is applicable in the case of the Latin American Integration Association over the period 1981-2000. Such evidence is not present when one considers all Latin American countries considered together or groupings that are based on geographical location. As reported by the authors, the implications of these findings are twofold. First, it is not necessarily the case that convergence is restricted to smaller groups of Least Developed Countries (LDCs). For example, they were able to identify the presence of a single common shared trend driving the 11 countries taken from the Latin American Integration Association. Second, groupings and sub-periods that exhibit little or no evidence of convergence provide a case for additional regional development policies aimed at facilitating closer integration among member states. Bearing in mind the findings from this study, several avenues for future research are brought to light. Researchers may reflect on why some international agreements on increased cooperation are more conducive towards convergence than others. Future research may also reflect on alternative measures of long-run convergence perhaps utilizing improved panel data techniques that enable the researcher to

identify which panel members are responsible for rejecting non-stationary or non-cointegrating null hypotheses.

Serra et al. (2006) presented a model of convergence among the regions of the following countries: Argentina, Brazil, Chile, Colombia, Mexico and Peru. Results suggest the existence, in some cases, of the convergence between "club of regions" (or homogeneous regions inside the countries). Except for Chile, there was little sigma-convergence in the selected countries. A conclusion of Serra et al. (2006) which is worth noting is the fact that the authors verified that regional disparities in the selected countries increased after the implementation of structural reforms and trade liberalization in the 1990s.

Ahmed and Fida (2009) analyzed trade among and the convergence of per capita income for India, Pakistan, Bangladesh, and Sri Lanka. This study was an attempt to examine the impact of trade liberalization on the per capita income convergence of these selected South Asian countries and their trade partners for the sample period 1972-2005. In the study, pre-liberalization and post-liberalization were defined as the periods 1972-1988 and 1989-2005, respectively. The extent of trade and its relationship with the magnitude of income convergence is studied among these countries and their trading partners. The study used intra-trade convergence and the difference-in-differences approach for the estimations. The results demonstrated that an increase in trade between the groups decreases the per capita income differential. The results of the study suggest that trade liberalization policies could be effective in achieving convergence. More importantly, the authors found that the per capita income of source countries converged more rapidly under post-liberalization regimes than pre-liberalization regimes.

2.2.4 FDI and Income Convergence

The United Nations Conference for Trade and Development (UNCTAD) World Investment Report (WIR) defines FDI as “an investment involving a long term relationship and reflecting a lasting interest and control by a resident entity in one economy in an enterprise resident in an economy other than that of the foreign direct investor” (Morris, 2008).

FDI has been found to be an important source of economic development in many developing countries because it reduces unemployment levels by providing more opportunity for jobs and also facilitates growth of developing countries by transferring technologies from developed countries (Jawaid & Raza, 2012). Again, FDI stimulates domestic investment and facilitates improvement in human capital and institutions in the host countries (Jawaid & Raza, 2012; Agenor, 2003). Also new and efficient technologies are crucial to stimulating significant increases in domestic production and FDI is a main source of transferring technologies to developing countries. Thus, FDI provides technological boost in the industry which leads to economic growth. As a result of the growth potential of FDI, developing economies especially, are actively seeking to improve the attractiveness of their domestic economies to FDI in an attempt to realize the gains that are inherent in such investment.

Zhang (2001) investigated the role of FDI in a cross-country convergence analysis. His findings indicated that FDI tend to accelerate the convergence process in the Asian newly industrialized economies and Japan. Similar conclusion was established by Lensink and Morrissey (2001). The authors measured, in addition to the impact of FDI on the level of growth and income convergence, the effect of the volatility in FDI flows on income convergence. They found that although FDI has a positive impact on the overall level of growth and income convergence, significant fluctuations in the FDI flows are actually

inversely related to the growth rate and income convergence. This is due, in part, to the assumption that fluctuations in FDI may be a result of uncertainty in the host country.

Also, Balamoune-Lutz (2001) using panel data, explored the effects of FDI on economic growth and income convergence. The results from fixed-effect and adjusted fixed effect (regional-effect) estimations indicated that FDI has a significant positive impact on income convergence in all specifications. While in case of the fixed effect, time-invariant variables such as geographical distance and language could not be used as regressors, the adjusted fixed effect allowed their inclusion and yet the results from both models were essentially the same.

Wei, Yao and Liu (2007) attempted to reconcile the positive effect of FDI on economic growth with its potential 'negative' effect on regional inequality employing an augmented Cobb-Douglas production function. They examined regional inequality from three different perspectives: inter-province, intra-region and inter-group (each pair of two regions). The study employed more determinants of income growth such as FDI and transportation into the β -convergence estimation, with special attention on FDI and its role in the economic convergence process across the country and within each geo-economic region as well as regional groups. The study further examined the same issue of FDI on spatial growth differences and income inequality with various model specifications and estimations as a means of providing a comprehensive anatomy on whether FDI has caused regional income inequality, which they believe is a controversial issue in the literature with significant policy implications on economic growth and development of China and any other similar less developed economy in the world. Using the largest panel dataset for the Chinese regions over 1979-2003 and employing both cross-section and panel data approaches, their study findings are summarized as follows (1) regional income inequality rises in the data period; (2) regions can converge to their own steady states only after controlling for the differences in saving

rate, population growth, human capital endowment, transportation, and above all FDI and exports; (3) the same factors that have a significant effect with national level data have similar effect with regional (or groups of regions) level data; (4) FDI is singled out to have played a consistent and positive effect on growth differences in all specifications except for the West region and the combined West/Central regions; and (5) FDI is highly unevenly distributed among the regions, with a very small share in the West region. All these findings point to the conclusion that FDI is an important factor of economic growth but it is the uneven distribution across regions rather than FDI itself, which has been a cause of the regional income inequality.

Leitão, and Rasekhi (2010) examined, in addition to the link between economic growth and foreign direct investment for Portugal, the convergence possibility between Portugal and its trading partners. Using a panel data approach, the results show that there is convergence between Portugal and her trading partners. Their findings generally established that FDI and bilateral trade promote economic growth and that the growth is negatively correlated with inflation and more importantly with the initial level of GDP per capita especially when FDI, trade openness and taxes are included as explicit regressors in the convergence model (conditional convergence). This conclusion actually validates the assertion that economic growth may imply convergence.

Similarly, Jawaid and Raza (2012) investigated the impact of FDI on income convergence in addition to the relationship between FDI and economic growth by using seven years average annual data of 129 countries across the world from the period of 2003 to 2009. These countries are grouped into low, middle and high income by the World Bank. Results indicated the significant positive relationships between foreign direct investment and economic growth in all countries. Results of conditional convergence based on foreign direct investment

suggest that the low and middle income countries are converging with each other more rapidly. This shows that chances of converging with high income countries remain steady in the presence of foreign direct investment.

2.2.5 Government Expenditure and Convergence

Empirical econometric literature on the impact of government expenditure on income convergence is very sparse. As far as the researcher knows, only Fuduka and Toya (1995) have conducted a substantive econometric investigation on the impact of government expenditure on income convergence. In particular, Fuduka and Toya (1995) examined the conditional convergence of government spending in East Asia. The authors using a fixed effect panel model reported that the inclusion of government expenditure worsens the initial results obtained when export was the main regressor in the convergence model. The conclusion is that, government expenditure though positive on growth had rather ensured income disparity widening in East Asia.

2.3 Concluding remarks

It is clearer and obvious from the foregoing review that the empirical evidence on per capita income convergence is rather inconclusive and it is sometimes limited to a (smaller) group of countries. Moreover, even though, literature on income convergence generally appears to be enormous, those that are specific to SSA and the crucial role of FDI, trade openness and government expenditure in the region rather seem to be very sparse.

Also, different methodologies including cross-sections, time series, panel and distribution approaches, have been explored by various studies to test the convergence hypothesis.

Though bulk of the test has involved fitting cross-country regressions (Basil, 2002; Baro and Sala-i-Martin, 1995, 1992; Baumol, 1986), others have used time series cross-section data etc. (Tirelli, 2010; Ghosh, 2007). A negative relationship between growth rates and the initial per capita income in these regressions implies convergence.

CHAPTER THREE

TRENDS OF SELECTED MACROECONOMIC VARIABLES IN SUB SAHARAN AFRICA

3.0 Introduction

After the World War II, many countries in the quest to improve the growth of their economies have been implementing various policies most of which are aimed at opening up their economies to international trade (Ackah and Morrissey, 2005). According to Morris (2008), during the early 1980s most of these policies which included the lowering of trade barriers and the increasing of the international competitiveness of domestic exports simply were export-oriented. This is partly due to the failure of import-substitution policies to boost growth in most developing countries and the apparent success of economies that had already implemented export-oriented policies (Loots and Kabundi, 2012). Also, the General Agreement on Tariff and Trade (GATT) has since its inception led to further opening of economies to international activities. However, subsequent pro-growth trade policies have gone beyond export-oriented policy to policies aimed at broadly opening up economies not only to trade but also to investments, technology etc. (Morris, 2008). As a result, many developing countries have actively sought to and are still actively seeking to improve the attractiveness of their domestic economies to FDI, trade, and technology transfer in an attempt to realize the gains that are inherent in opening up domestic economies (Loots and Kabundi, 2012).

Morris (2008) was able to show that the recent remarkable growth rates recorded by economies of East Asia can be attributed to increased openness of their economies. This development towards greater openness to trade seems to be dominant in recent times in SSA especially. Indeed, many economies in SSA have been persistently and motivated and

encouraged to open up its economy in order to tap the positive externalities associated with globalization and liberalization (Morris, 2008). It is commendable to note that, although SSA has seen some progress in this regard, the region continues to lag behind compared to other regions of the world.

Following the discussion above, this chapter looks at the trends of the region's profile with emphasis on FDI, trade, government expenditure and per capita income. But prior to this, the study presents a brief demographic profile of the region.

3.1 Demographic profile of SSA

Sub-Saharan Africa, geographically, refers to countries that lie south of the Sahara. Politically, it consists of all African countries that are fully or partially located south of the Sahara with a total land area of 23,638,000 square kilometers. By the year 2009, SSA has a total population of 841.0 million with an annual growth rate of 2.5% (WDI, 2011). The GDP (in current US\$) of the region in that year was 954,357 million whereas the GDP per capita was \$618 with an annual growth rate of 2.6% (constant 2000 prices) (WDI, 2011).

3.2 SSA's Performance in a Global Perspective

Ackah and Morrissey (2005) reported that compared to other regions, Africa, and especially SSA, has exhibited poor economic performance, at least, over the past two decades. While some countries have been exceptions to this poor trend and had performed very well, the region's growth remains a cause for concern (Ackah and Morrissey, 2005). The dollar value (in current terms) of exports from SSA actually declined in the 1980s and rose by only three percent in the 1990s. SSA's share of world merchandise trade declined between 1990 and

2000, in terms of both exports and imports. It is clear that Africa has not shared in the growth of world trade. The region accounted for just a little over 3% of world merchandise exports in the 1990s, but this had declined to a 2.3% share in 2000s. Over the same period, region's share of world merchandise imports also declined. According to the World Trade Organization {WTO, (2001)}, annual variability in the value of exports was very pronounced in the late 1990s, declining by 17% in 1998 but rising by 27% in 2000. "The value of imports, in contrast, has been quite stable – negligible change throughout the 1980s, and a four percent increase in the 1990s" (WTO, 2001 pp. 77). The story remains the same even to date as the region's share of the world trade stands approximately at 1.3% (Ackah and Morrissey, 2005). In Figure 3.1 below, Trade (% of GDP) of various regions is compared to that of the SSA for the period between 1970 and 2010.

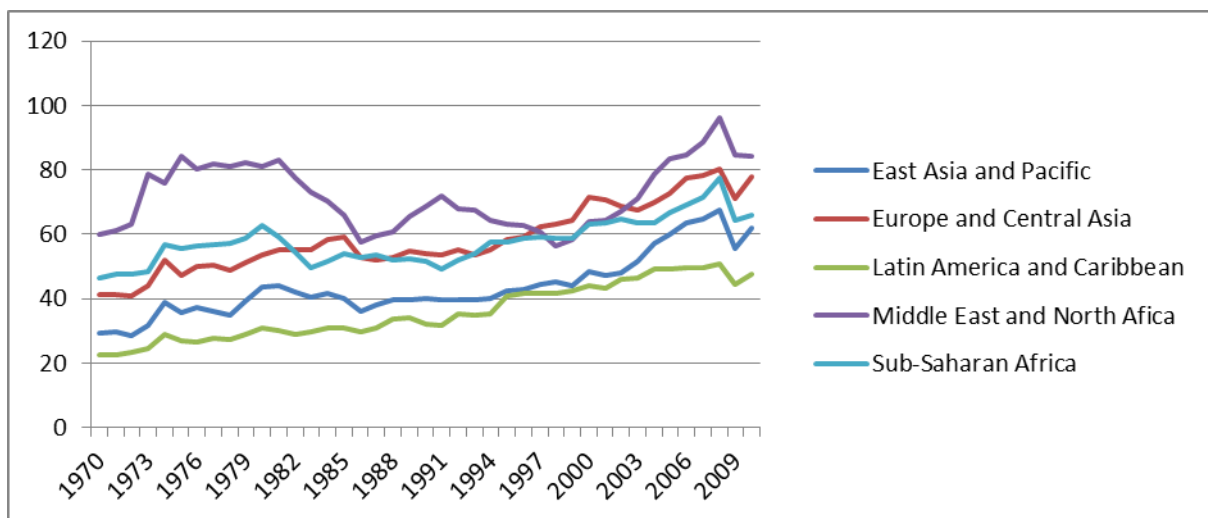


Figure 3.1 Trade (% of GDP) of regions (1970-2010), Source: WDI, 2010

In a report by Rodrik (1997), he showed that the marginalization of Africa and for that matter SSA in world trade is entirely due to the slow growth of African economies and not due to trade ratios (relative to GDP) that are low by cross-national standards. Taken as a whole, the region participates in international trade as much as can be expected according to international benchmarks relating trade volumes to income levels, country size, and geography.

3.2 Trend of FDI inflows in SSA

Reports from UNCTAD suggest that FDI inflows to the various regions of the world have grown radically in the past 2 decades (UNCTAD, 2008).. For instance, the total world FDI inflows, which stood at \$59 billion in 1982, grew considerably to \$648 billion in 2004 and reached its peak of \$1,833 billion in 2007 (UNCTAD, 2008). “Also, it was indicated that despite the relatively poor economic conditions in SSA, FDI inflows have risen from US\$5 billion in 1995 to US\$18 billion in 2005” (UNCTAD 2006, pp. 40-41).

Loots and Kabundi (2012) reported that, nominally, FDI inflow into the region has exhibited exponential increases over the last four decades. In particular, Loots and Kabundi (2012) showed that during the 1970s, inflows to the region averaged US\$ 1.1 billion per year. These annual flows subsequently doubled and tripled to an average of US\$2.2 billion and US\$6.6 billion in the 1980s and 1990s respectively. Also, from the period between 2000 and 2008, the annual flows augmented to US\$35.2 billion on average (Loots and Kabundi, 2012). The year 1997 registered an outstanding FDI flows of about US\$11 billion and again in 2001 US\$20 billion. Since 2005, inflows have grown exponentially from US\$38 billion to a high of US\$72 billion in 2008 (Loots and Kabundi, 2012).

Also, according to Adam (2009 pp. 179), “there has been a shift in the source of FDI, with Asian countries (especially China and India) playing a more active role in the economy of African countries through both Greenfield investments and cross border acquisitions”. Further, Adam (2009) is reported that, of the nearly 442 Greenfield investments, 175 were from Asia, 258 from developed economies and less than 10 were from within Africa. Similarly, UNCTAD (2006) reported that most FDI from within Africa comes from South Africa. Four countries, France, The Netherlands, United Kingdom and United States of Africa (USA) are known to account for about half of the FDI inflows to Africa and half of this goes

to Angola, Equatorial Guinea, Nigeria, Sudan and Egypt. On average, since the beginning of 2000, Nigeria remains the largest recipient of FDI to SSA accounting for 16% of the region's stock (UNCTAD, 2006). UNCTAD (2008) revealed that, by the end of 2007, Africa's total accumulated FDI flows stood at \$393 billion, which is an insignificant amount when compared to the \$249 billion FDI that went to South, East, South East and Oceania for only one year (2007). The increasing trend after 2007 was despite the global financial crises that affected the developed economies since late 2007 (Adam, 2009).

In spite of the exponential increase of FDI inflows to the region, the region's share as recipient in world FDI flows declined from 5.2% during the 1970s to 1.9% during the 1990s, before increasing to 3% over the period 2000-2008 (Loots and Kabundi, 2012). It is however interesting and even surprising to know that the rate of return on FDI in Africa has been rising since 2000 and it is currently at about 12%, which is the highest in the developing world and yet FDI inflows to the region, compared to other developing economies continues to be the lowest (Adam, 2009).

Similar trend is observed regarding the share of FDI in GDP of the region. In particular, during the period between 1970 and 1980 the share of FDI in GDP in SSA averaged at 0.796%. Though this average dropped to 0.472% in the 1980s, it rose steadily to 1.486% in the subsequent decade. Currently, the share of FDI in GDP averages at 3.481%. Despite these observed increases in FDI inflows into the region, the share of FDI in GDP in the region remains below significant. Figure 3.2 below shows the trend of FDI, net inflows (% of GDP) in Sub Saharan Africa, 1980 - 2010.

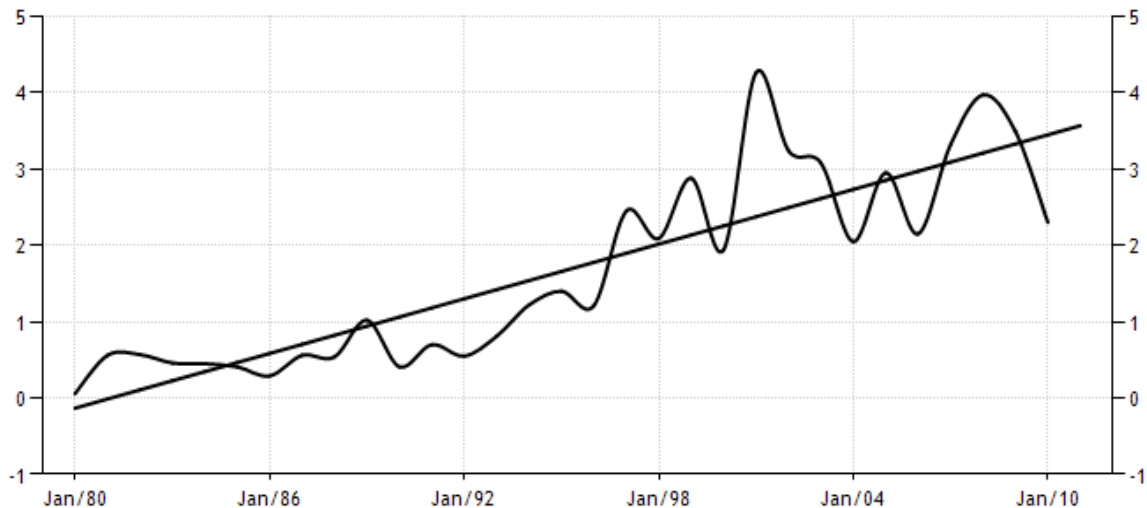


Figure 3.2, FDI, net inflows (% of GDP) to SSA, 1980 - 2010. Source: UNCTAD 2011 (FDI Statistics)

3.3 Trends of Trade in SSA

As part of the strategies to halt and reverse the abysmal growth performance recorded by developing countries during the early post World War II, developing economies are consistently increasing their volume of trade as a means of boosting economic growth through the inherent gains associated with international trade. It is worth noting that, according to UNCTAD (2008), since the Second World War, global merchandise trade has generally grown faster than global income and as means of facilitating growth as well as bridging the observed high per capita income gap across regions and countries; there is a paradigm shift toward greater trade openness. As a result, policy makers in SSA are working assiduously to formulate and implement growth enhancing and trade friendly policies.

According to UNCTAD (2008), the global crisis and the uneven trade recovery have also reinforced the ongoing shift in the world economy, featuring a relative decline of developed countries and rise of developing countries in world trade. The shifting global balance is also

visible in the changing distribution of exports by destination, marked by the rising importance of trade among developing countries.

In particular, during the early 1970s, exports of goods and services (% GDP) for SSA averaged at 25.82% and 26.91% between 1980 and 1989. Also, during the period between 1990 and 1999 and 2000 and 2010 exports of goods and services (% GDP) for SSA averaged at 27.19% and 32.70% respectively (WDI, 2011). This shows that there has been slight increase in the average share of exports in GDP over the past four decades. Over the same decades i.e. 1970 to 1980, 1980 to 1990, 1990 to 2000 and 2000 to 2010, the share of imports in GDP of the region, on average, grew steadily from 27.34% to 27.40%, then to 28.62% and to 34.40. It is also essential to note that over the same past four decades, the growth rates of exports rose from 2.55% during the 1980s to 3.83% during the 1990s and 3.55% between 2000 and 2010 while the growth rates imports rose from 0.78% during the 1980s to 4.46% in the 1990s and then to 6.18% between 2000 and 2010. Figure 3.3 shows Exports share (% of GDP) and Imports share (% of GDP) of the region.

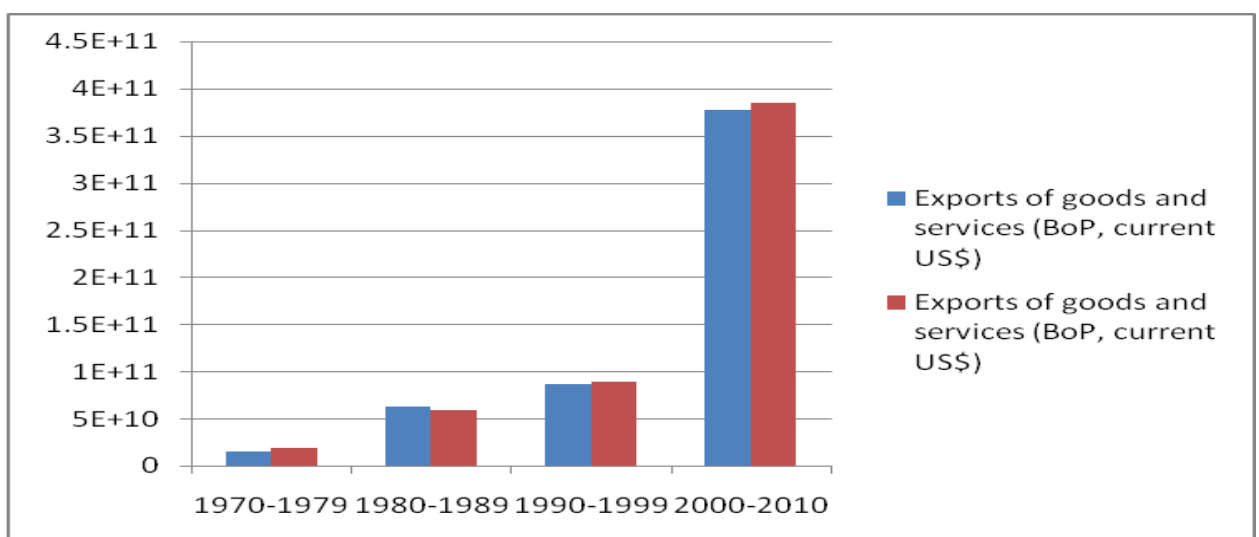


Figure 3.3 Exports and Imports (goods and services), SSA. Source: WDI,

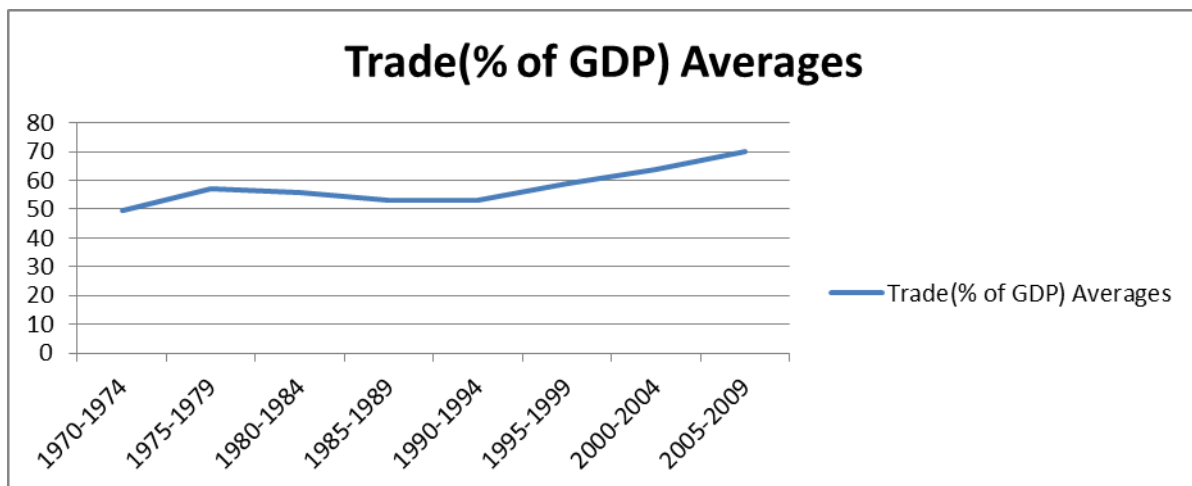


Figure 3.4 Trade (of GDP) of SSA, Source: WDI, 2011

In terms of the share of total trade (exports plus imports) in GDP, the SSA recorded 49.4% during the early 1970s, 56.9% in the period between 1975 and 1980. This average growth rate however saw a marginal fall to 53% from 1980-1990. From period between 1990 and 1995, the share of Trade in GDP rose to 58.3% and has since been growing very steadily. In the just past decade it averaged at 70%. Figure 3.4 above is a chart showing the trend of the region's Trade (% of GDP).

Some key trade policies have been usually cited to have accounted for the observed SSA's trade performance over the past few decades. During the late 1980s and the early 1990s, the Structural Adjustment Program (SAP) was the main driving trade policy. As noted by Rodrik (1997), extensive trade liberalization during the 1980s along with other reforms have helped some of the region's leading reformers, such as Uganda and Ghana, to recover from long periods of economic decline. But neither Uganda nor Ghana has yet reached the level of income per capita it had attained in 1970. In other reformers, such as Mali and the Gambia, trade reforms have boosted trade volumes, even though there is less to show on the growth front. The SAP implored the region to embark on with liberalization, privatization, and commercialization of the economy. It was also accompanied by various macroeconomic

structural reforms (tariffs, fiscal, debt management, financial sector reforms at national levels but harmonized at regional level) as well as signing up on multilateral trade agreements at country level, establishment of regulatory institutions and initiating economic restructuring strategies. In the late 1990s, trade policies were predominated by trade agreements such as the Abuja Treaty provisions, and the Cotonou Agreement that were geared towards further integration of the sub region (WTO, 2001). In the year 2000 and beyond, there is deepening of the African Regional Economic Co-operations (RECs) starting with Free Trade Agreements (FTAs), Partial Trade Agreements (PTAs), Custom Union (CU) and Common Market (CM). There is also a shift of emphasis to Non-reciprocal preferential trading arrangements such as European Union – Everything But Arms (EU-EBA), Generalized System of Preferences (GSP), African Growth and Opportunity Act (AGOA, etc.). In the year 2000 onwards, other aspects of the trade policies include the prioritization of the development, infrastructure and trade facilitation within trade negotiations and the liberalization of the transport sector.

In entirety, three facts summarize trade policies in SSA: First, government-imposed trade barriers have generally been higher in SSA than in East Asia, although the differences are not huge. Second, until the early 1990s, trade barriers in SSA have been very high in magnitude comparable to those prevailing in Latin America. Third, the sweeping trade reforms that have recently taken place in Latin American economies—as well as in most of the former socialist economies of Eastern Europe and central Asia—have left SSA as the only region in the world where substantial tariff and non-tariff barriers to trade are currently the norm rather than the exception (Rodrik, 1997).

3.4 Trends of Government Expenditure in SSA

During the period between 1970 and 1980, Government expenditure as a percentage of GDP stood at an average rate of 14.5%. This increased slightly to 16.5% during the subsequent decades. In the 1990s and in the just past decade the growth rates averaged at 17% and 16% respectively. Figure 3.5 shows the trend of government expenditure in the region.

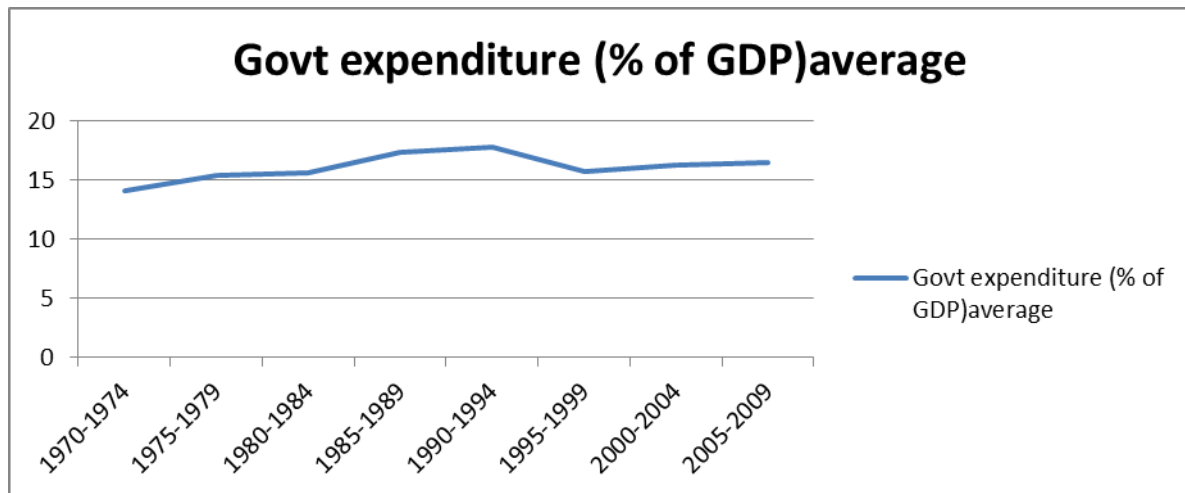


Figure 3.5 Government expenditure (% of GDP), Source: IMF database, 2011

3.5 Trends of Per Capita Income Growth in SSA

Growth of per capita incomes of the region has been consistently low when compared with those of other developing regions (e.g. Latin America) and it is even significantly low when compared with per capita incomes of developed regions (e.g. OECD). Among the key reasons for the substantially lower per capita income of the region is the poor nature of growth experienced by the region for the past decades.

Between 1970 and 1980, the growth of per capita income of SSA stood at an average rate of 1.30% but due to balance of payments problems, political instability, poor growth etc. growth in per capita GDP dropped significantly in the two subsequent decades to the extent that, the

average growth rate of per capita income of the region attained negative values (i.e. -0.70% during the 1980s and -0.56% in the 1990s). However, due to political stability, fiscal discipline on the part of governments in the region it grew steadily from the early 2000s onwards with an average growth rate of 2.51% (Kumo, 2011). The recent per capita GDP growth performance in SSA has been considered remarkable given that, for over four decades since 1960, real GDP per capita growth had been dismal, averaging less than 0.5% per annum (Brückner, & Lederman, 2012). The trend in the growth rates of per capita income is depicted by the figure 3.6 below.

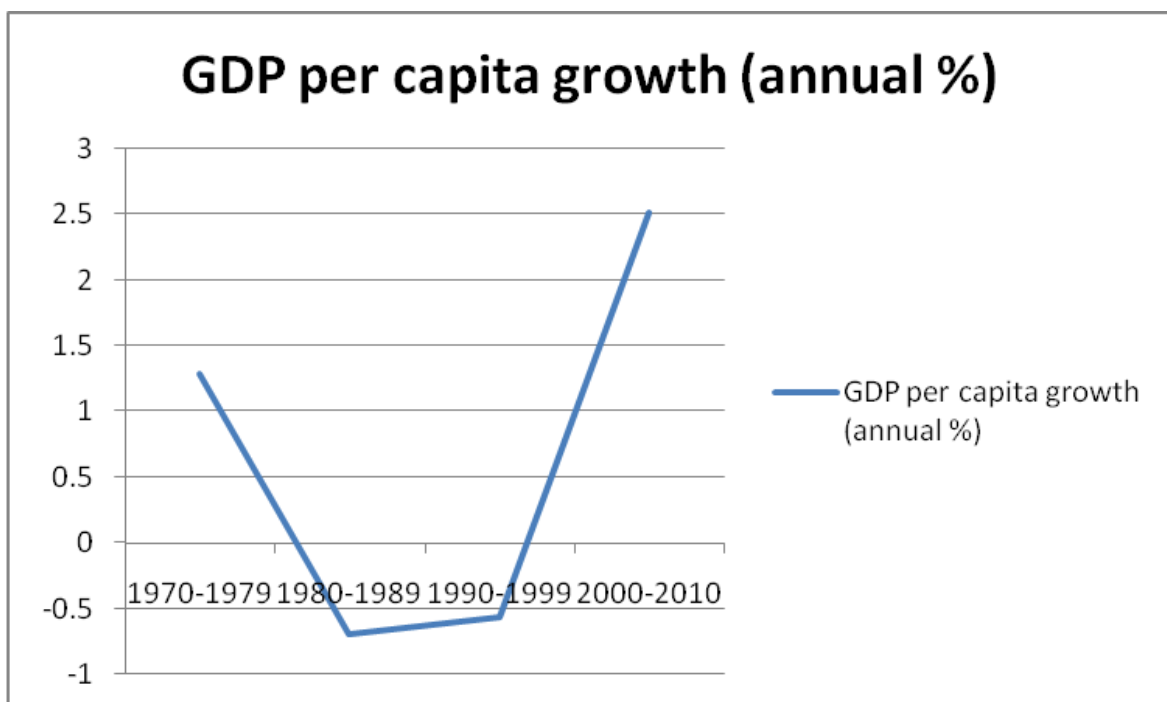


Figure 3.6 Per capita GDP growth (annual %), Source: WDI, 2011.

3.6 Concluding remarks

For nearly fifty years, SSA has undergone various reforms and with the object of transforming the economy and improving upon the growth performance of its economy. This chapter looked at the trend and overview of some key variables of particular interest to the present

study. FDI inflows to the region are reported to grow annually and yet the region's share of world FDI flow remains surprisingly at 1.3%. Also, in spite of the various trade reforms and policies, SSA's share of world trade (goods and services) is much insignificant even if compared to other developing regions. The overview of per capita GDP reveals that until 2002, the region was practically stuck in negative growth rates since the early 1980s.

CHAPTER FOUR

METHODOLOGY AND DATA

4.0 Introduction

This chapter discusses in detail the approaches used to address the various objectives of the study. This includes a discussion of the appropriate empirical model(s) used as well as the econometric estimation technique(s) employed in the study. The chapter also looks at how the various variables employed in the study are measured and defined as well as their *a priori* economic expectations.

4.1 Conceptual Framework

The study is essentially guided by the human capital-augmented version of the basic neoclassical growth model (HC-ASM) which is a modification of the Solow model by Mankiw, et al (1992). The authors found human capital as an important input of production, which also exhibit diminishing returns and therefore, included as a separate variable in the original Cobb-Douglas production function. The addition of human capital to the production function by Mankiw et al (1992) was justified on the grounds that, human capital accumulation contributes positively and strongly to productivity in a similar manner as physical capital accumulation. Human capital which could be defined as acquired skills, knowledge, and health among others is able to improve the productivity and efficiency of labour just like physical capital and therefore, is regarded as a vital input of production. The authors also see human capital accumulation as a factor of and not a resource for production. As a consequence, they argued that human capital accumulation should be an integral

component of the fundamental production function underlying growth and convergence. This conclusion is consistent with the findings of many studies including Kalbasi (2010), Morris (2008), Ghosh (2007), Fuduka and Toya (1995) etc.

Some of the key assumptions of the HC-ASM include a constant return production function with diminishing returns to inputs, closed economy without government activities in the economy. Based on these and other assumptions, the authors predicted that when differences in population growth rate, saving or investment rates, both in physical and human capital among countries are accounted for, cross-country data generally support conditional convergence so that, convergence occurs even without the need for international trade. Moreover, it was assumed by the authors that, differences in initial capital-labor endowments would be eliminated over time which would in turn lead to convergence in per capita incomes. This stands to reason that, the convergence hypothesis rests on the assumption that, along an economy's transition to its steady state position, growth rate is inversely proportional to the capital-labour ratio, i.e. the lower the initial capital-labour ratio, the higher the growth rate will be and the converse also holds. Thus countries with lower initial capital per capita tend to grow faster compared to those with higher initial capital per capita. In other words, if capital exhibits diminishing returns, then an economy with lower capital-labor ratio exhibits a higher marginal product of capital and thus, grows faster compared to a similar economy with a higher capital-labor ratio so that per capita income differences across countries would tend to fade out over time, with per capita income and its growth rate gradually converging until reaching an identical long-run equilibrium level for both countries, respectively.

Further, income convergence holds that, for a group of countries that share similar characteristics or otherwise, the countries with lower initial income tend to grow faster than their richer counterparts. The former relates to conditional convergence while the latter

connotes absolute convergence (Mankiw, et al, 1992). There are several measurements⁴ of convergence but all of which aim at measuring the reduction in the differences of welfare levels among countries or regions within a State. In all case, convergence has to do with growth sources and the conditions and policies that trigger them (Puyana and Romero, 2002). Hence, a cross-country convergence regression requires a negative relationship between initial per capita income and subsequent growth rate in income per capita.

Also, convergence between two series requires that their differences cannot be characterized by a boundless drift. Thus, for two or more non-stationary series, convergence implies that they share a common stochastic trend. This in turn means that, there is convergence if the difference between the per capita GDP of two countries evolves towards a stationary process (Carmignana, 2007, 2006; Greene, 2003).

In this study, income convergence is used loosely to represent a case where the disparity in the growth of income per capita among countries disappears overtime. Sala- i-Martin (2002) found conditional convergence as the most robust empirical evidence in data. In addition, Jawaid and Raza, (2012) and Fuduka and Toya (1995) also found that when the special roles of FDI and exports are accounted for, subsequent growth rates in per capita GDP are negatively related to the initial level of per capita GDP.

Based on these concerns, the econometric model for the study is derived as follows. The model starts with the Cobb-Douglass production function of the form

$$Y = AK^{\alpha}L^{\beta} \dots\dots\dots (4.1)$$

Where $Y = Total\ output$ $K = Stock\ of\ physical\ capital$ $L = Units\ of\ labour$

⁴ This includes absolute beta convergence, absolute sigma convergence, conditional beta convergence, conditional sigma convergence.

A = efficiency parameter, measuring technology and knowledge

α = output elasticity of capital β = output elasticity of labour

Resulting from the argument raised by Mankiw et al, (1992), the Cobb-Douglas production function underlying the Solow growth model is modified is augmented with stock of human capital by Mankiw et al (1992) and this modified Solow model therefore became known as the Human Capital – Augmented Solow model (i.e. HC-ASM) as is explicitly specified as shown in equation (4.2) below

$$Y = AK^\alpha H^\beta L^{1-\alpha-\beta} \dots\dots\dots (4.2)$$

Where:

Y = Total output

K = Stock of physical capital L = Units of Labour

H = Stock of human capital

A = efficiency parameter, measuring technology and knowledge

knowledge

α = output elasticity of capital β = output elasticity of labour

$1-\alpha-\beta$ = output elasticity of labour

It is further assumed by Solow (1956) and Mankiw et al (1992) that L and A grow exogenously at the rates n and g respectively while a constant fraction of output, s , is invested. Also, physical capital stock (\mathbf{K}) and human capital stock (\mathbf{H}) are assumed to grow as follows

$$g(K) = s_k Y - dK$$

$$g(H) = s_h Y - dH$$

Where

$g(K)$ = growth of physical capital stock $g(H)$ = growth of human capital stock

s_k = saving rate in physical capital stock s_h = saving rate in human capital stock

d = rate of depreciation of both physical and human capital stocks (both physical and human capital are assumed to depreciate at the same rate).

Defining k as physical capital per effective labour, $k = K/AL$, and h as human capital per effective labour, $h = H/AL$ and y as output per effective labour, $y = Y/AL$, a country's movement towards its steady state is governed by (4.3) and (4.4)

$$\bullet \quad gk(t) = s_k y(t) - (n + g + d)k(t) \dots\dots\dots(4.3)$$

$$\bullet \quad gh(t) = s_h y(t) - (n + g + d)h(t) \dots\dots\dots(4.4)$$

$$\bullet \quad y = k^\alpha h^\beta \dots\dots\dots(4.5)$$

Where

- gk = evolution of physical capital per effective labour
- gh = evolution of human capital per effective labour
- s_k = saving rate in physical capital
- s_h = saving rate in human capital
- y = output per effective labour
- k = physical capital per effective labour
- h = human capital effective labour
- n = population growth rate
- g = growth rate in technology
- d = rate of depreciation of both physical and human capital
- d and g are assumed to grow at a constant rate

- t is time (usually measured in years)

Solving the steady values of k , h and y in (4.3), (4.4) and (4.5) above yield the following

$$k^* = [s_k / (n + g + d)]^{1 - \beta / 1 - \alpha - \beta} \cdot [s_h / (n + g + d)]^{\beta / 1 - \alpha - \beta} \dots \dots \dots (4.6)$$

$$h^* = [s_h / (n + g + d)]^{1 - \alpha / 1 - \alpha - \beta} \cdot [s_k / (n + g + d)]^{\alpha / 1 - \alpha - \beta} \dots \dots \dots (4.7)$$

$$y^* = [s_k / (n + g + d)]^{\alpha / 1 - \alpha - \beta} \cdot [s_h / (n + g + d)]^{\beta / 1 - \alpha - \beta} \dots \dots \dots (4.8)$$

Where

k^* = Steady state value of physical capital per effective labour

h^* = Steady state value of human capital per effective labour

y^* = Steady state value of output per effective labour

To obtain an expression for per capita GDP, the steady value of output per effective labour given by (4.8) is substituted into the production function in (4.2) above. Linearizing the ensuing production function by taking natural logs yields equation (4.9) as:

$$\ln(Y/L)^* = \ln A(0) + gt + \frac{\alpha}{1 - \alpha - \beta} \ln Sk + \frac{\beta}{1 - \alpha - \beta} \ln Sh - \frac{\alpha + \beta}{1 - \alpha - \beta} \ln(n + g + d) \dots \dots \dots (4.9)$$

The term $A(0)$ does not reflect only technology but also resource endowment, climate, institutions etc. and so it may differ across countries. The term A is usually referred to as Total Factor Productivity (TFP) which measures the growth of output which does not come from either capital or labour stock. Thus, $A(0)$ measures TFP at a given time and it is a country-specific variable which could be time variant or invariant. It is decomposed into two

component i.e. $\ln A(0) = a + \varepsilon$, where a is a constant and ε is a country-specific shock leading to 4.10 as:

$$\ln(Y/L)^* = a + \frac{\alpha}{1-\alpha-\beta} \ln S_k + \frac{\beta}{1-\alpha-\beta} \ln S_h - \frac{\alpha+\beta}{1-\alpha-\beta} \ln(n+g+d) + \varepsilon \dots\dots (4.10)$$

Where

$\ln(Y/L)$ is the log of real per capita income

a is a constant measuring country-specific variables

$\frac{\alpha}{1-\alpha-\beta}$ is the coefficient on saving in physical capital (S_k)

$\frac{\beta}{1-\alpha-\beta}$ is the coefficient on saving in human capital (S_h)

$\frac{\alpha+\beta}{1-\alpha-\beta}$ is the coefficient of the log of population growth rate (n)

ε_{it} is a country-specific shock or a well-behaved error term

i measures cross-sections i.e. countries while t measures time series i.e. years

In effect equation (4.10) shows how income per capita depends on saving in both physical and human capital, and population growth.

Now, to test for convergence, Solow (1956), and Mankiw et al (1992) introduced initial per capita income to the right-side of (4.10) with the crucial assumption that there is convergence if the coefficient on initial per capita income is negative; otherwise there is divergence. This assumption stems from the assertion that, initial income per capita should be negatively related to subsequent growth rates of income per capita so that poor countries will tend to grow faster than rich countries. This modification is given by (4.11)

$$\ln(Y/L)^* = a + \lambda PCY(0) + \frac{\alpha}{1-\alpha-\beta} \ln Sk + \frac{\beta}{1-\alpha-\beta} \ln Sh - \frac{\alpha+\beta}{1-\alpha-\beta} \ln(n+g+d) + \varepsilon$$

..... (4.11)

Where $PCY(0)$ is the log of real income per capita at some initial time (0)

$\lambda < 0$ implies convergence, otherwise divergence

Also, to allow for the estimation of the velocity or speed of convergence in per capita income, the convergence equation in (4.11) can be written as:

$$\ln(y^{(t)}/y^{(0)})^* = a + (1-e^{-\psi t})\lambda \ln PCY(0) + (1-e^{-\psi t})\frac{\alpha}{1-\alpha-\beta} \ln Sk + (1-e^{-\psi t})\frac{\beta}{1-\alpha-\beta} \ln Sh - (1-e^{-\psi t})\frac{\alpha+\beta}{1-\alpha-\beta} \ln(n+g+d) + \varepsilon$$

so that the velocity or speed of convergence (ψ) could be solved through a partial

differentiation (i.e. $\frac{d \ln y(t)}{dt} = -\psi[\ln y(t) - \ln y^*]$)

where $\psi = (n+g+d)(1-\alpha-\beta)$, is the velocity or speed of convergence.

4.1 Specification of Empirical Model

This study is a cross-country study and thus, in specifying the empirical model for the study (4.11) is transformed into an equation conforming to the processes involved in estimating a panel model, given by (4.12)

$$PCYG_{it} = a + a_2 * IPCY_{it} + a_3 * INVC_{it} + a_4 * PG_{it} + a_5 * HCI_{it} + \varepsilon_{it} \dots\dots\dots$$

..... (4.12)⁵

Where:

- log growth rate of real per capita income (*PCYG*),
- log of the initial level of per capita real income (*IPCY*),
- log of the share of investment in GDP (*INVC*),
- log of the rate of population growth (*PG*),
- log of investment rate for human capital, whose proxy is the log of the secondary school enrollment rate (*HCI* is the).
- ε_{it} = a well-behaved error term.

Equation (4.12) is the fundamental HC-ASM equation which will be used to test the convergence hypothesis in SSA

Following Jawaid and Raza, (2012) and Fukuda and Toya (1995), whose works found evidence for convergence among some selected world economies and East Asian countries respectively, this study estimates both equations (4.12) and (4.13) using a pooled (panel) dataset. While equation (4.12) is estimated to either validate or nullify convergence in SSA,

⁵ Notice that, it is the notations of the variables in (4.11) and (4.12) that have changed. Variables meanings are however the same in both equations and this implies that the two equations are essentially the same.

equation (4.13) as shown below is used to evaluate the crucial role play by FDI, trade openness and government expenditure⁶ on convergence in SSA.

$$PCYG_{it} = a + a_2 * IPCY_{it} + a_3 * INVC_{it} + a_4 * PG_{it} + a_5 * HCI_{it} + a_6 * FDIG_{it} + a_7 * GEG_{it} + a_8 * TO_{it} + \varepsilon_{it} \dots\dots\dots (4.13)$$

In both equations (4.12) and (4.13), per capita income convergence holds if $a_2 < 0$, i.e. if the coefficient on initial per capita income is negative. However, if this condition is violated in either equation, then there is divergence of per capita income.

Where:

- log growth rate of real per capita income (*PCYG*),
- log of the initial level of per capita real income (*IPCY*),
- log of the share of investment in GDP (*INVC*),
- log of the rate of population growth (*PG*),
- log of investment rate for human capital, whose proxy is the log of the secondary school enrollment rate (*HCI* is the).
- log of the share of FDI in GDP (*FDIG*)
- log of the share of Government expenditure in GDP (*GEG*)
- trade openness whose proxy will be the log of {(import + export)/ GDP}(*TO*)
- ε_{it} = a well-behaved error term.

⁶ FDI, trade openness and government expenditure enter into the equation as Total factor Productivity and their inclusion reveals the convergence tendency of SSA countries in the presence of openness and government activities.

4.2 Estimation Techniques

The empirical models specified as given by equations (4.12) and (4.13) are estimated using three econometric techniques. This is to help compare and contrast the results generated by the various estimation technique as well as the robustness of results.

The first and second estimations are done using the Fixed Effect (FE) and Random Effect (RE) approaches which are given as

$$Y_{it} = \alpha + X_{it}\beta + u_i + \varepsilon_{it} \dots\dots\dots (4.14)^7$$

Where

Y_{it} = Dependent variable (in this study, Y_{it} = PCYG)

α = Constant term

X_{it} = Vector of explanatory including both time variant and invariant variables

(In this study, X_{it} includes IPCY, INVC, PG, HCI, FDIG, TO and GEG)

β = Vector of coefficients

u_i = Country-specific fixed effect variable

ε_{it} = Well-behaved error term

The FE is applied under a crucial assumption that the unobserved cross-country heterogeneity is correlated with the regressors included in the models while in the RE estimation, the assumption of correlation between the unobserved heterogeneity and included regressors is relaxed.

⁷ Notice that both models specified by 4.12 and 4.13 conform neatly to the FE and RE specifications in 4.14 above.

One of the merits of the use of RE over FE model is that the former allows for the inclusion of time-invariant variables which may be relevant in explaining growth and convergence of per capita GDP. One such time-invariant variable this study could have considered is geographical distance between the SSA countries. But in situation where the unobserved heterogeneity is correlated with the regressors of the model, the FE model produces consistent and efficient estimates while the RE model does not. On the hand, if the null hypothesis of no correlation between the unobserved heterogeneity and regressors is accepted, the RE model produces estimates that are both consistent and efficient. In this situation, the FE model estimates are consistent but inefficient. In this regard, a rule of thumb regarding which of these two approaches (i.e. RE or FE) produces efficient and consistent estimates is very imperative and the Hausman test (1978) provides this rule of thumb. Hence, the Hausman test is used to choose between the FE and RE.

A third estimation is carried out using the Generalized Least Squares (GLS) estimation technique. Usually, owing to problems of autocorrelation and heteroscedasticity, coefficient estimates produced by RE and FE models are inconsistent and inefficient even though unbiased. Baltagi (2008), Greene (2003) and Wooldridge (2002) have argued that estimates produced by both RE and FE panel models are fundamentally inconsistent and inefficient in the presence of heteroscedasticity and autocorrelation. In particular, Baltagi (2008) argued that the application of the RE and FE operates on the strict assumptions of homoscedasticity, no serial correlation among others. Therefore, to obtain parameters which are Best Linear Unbiased Efficient (BLUE), the model needs to be adjusted or transformed. OLS is then applied to the transformed model to obtain estimates that are BLUE. This procedure of applying OLS to a transformed model is referred to as the Generalized Least Squares (GLS).

Hence, the GLS is applied to overcome problems of autocorrelation, heteroscedasticity, multicollinearity, if found present in either the RE or FE.

4.3 Description of Variables and Expected Signs

4.3.1 Dependent Variable

The log of real per capita GDP growth (annual %), **PCYG** is the dependent variable for the study. It is measured as the log of annual percentage growth rate of GDP per capita based on constant US dollars. GDP per capita is gross domestic product divided by end of year population. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies. The variable's appropriateness is justified on the basis that, the study intends to measure how real per capita income gap among countries in SSA is disappearing over the sample period. This variable has been used extensively in income convergence investigations. For instance, the works of Jawaid and Raza (2012), Kumo (2011), Morris (2008), Slaughter (2001) Fuduka and Toya (1995) employed the log of per capita income growth (annual %) as the dependent variable.

4.3.2 Explanatory Variables

Log of initial real per capita GDP (**IPCY**) which is measured as the log of 1980's real GDP per capita (constant 2000 US\$) is the first explanatory variable of the study. This is included to test for per capita income convergence. Indeed, almost all investigations about income convergence have employed this variable. Actually, it is its coefficient that tells whether or not convergence should be expected in the region so as to either validate or reject the per

capita income convergence theory in SSA. The study expects the variable to assume either signs. A (negative) positive sign indicates (convergence) divergence.

The log of Gross fixed capital formation (% of GDP) **INVC**, is serving as a proxy for investment in physical capital (% of GDP) and this is the same proxy employed by Jawaid and Raza (2012) for investment in physical capital. Also, Mankiw, et al (1992) empirically demonstrated that accumulation of physical capital had significant positive effects on growth, indicating that higher levels of physical capital accumulation increases the level of per capita income and eventually ensures cross-country convergence. The study expects its coefficient to be positive because higher level of physical capital accumulation is theoretically known to be associated with growth in real per capita GDP. This variable is included to control for physical capital as key factor of production (Jawaid and Raza, 2012; Morris, 2008 and Mankiw et al, 1992). It is actually one of the variables in standard convergence models

The log of population growth (annual %) **PG**, and is also included as a control variable. Since the population of a country is perceived to influence its growth, the variable is used as one of the control variables in standard convergence models to control for labour as a vital factor of production (Jawaid and Raza, 2012; Morris, 2008; Fuduka and Toya, 1995; Mankiw et al, 1992). It is expected to be negatively related to real per capita GDP growth. This idea is empirically tested by Mankiw, et al, (1992) with the evidence that high population growth negatively affects in per capita GDP.

The log of School enrollment, secondary (% gross) is serving as a proxy for log of investment in human capital (% of GDP), **HCI**. Gross secondary school enrolment is commonly used as a proxy for human capital in the literature⁸. Like physical capital, human capital accumulation

⁸ See Yokohama and Alemu (2009), Fuduka and Toya (1995), Mankiw et al, (1992)

impacts positively the growth of per capita GDP growth because human capital is the amount of skills and knowledge and health embodied in labour and thus it positively impacts on per capita income growth just like physical capital. For instance, Mincer (1981) argues that per capita income growth is affected by human capital in the same way as accumulation of personal human capital yields individual income (economic) growth. He further argues that the contribution of human capital to growth far outweighs that of physical capital. Many empirical studies provide evidence that human capital influences growth positively (Mincer, 1981; Mankiw, et al, 1992). Hence, its coefficient is expected to be positive. This is also included to control for human capital stock as an essential factor of production as argued by Mankiw et al, (1992) and supported by Kalbasi (2010), Morris (2008), Ghosh (2007) and Fuduka and toya (1995). Moreover, it is actually one of the variables in standard convergence models.

FDIG is the log of FDI, net inflows (% of GDP). FDI boosts the growth of GDP and hence per capita GDP, “all other things being equal”, therefore, the study expects its coefficient to be positive (Jawaid and Raza, 2012). It is included as a measure of a country’s openness to international trade involving the flow of capital. Specifically, the ratio of FDI to GDP is used as a measure of integration in world markets. Inward FDI can be a vital source of capital, but more importantly, it can provide the host country with access to advanced technology. The impact of FDI on economic growth in the host economy has been examined in numerous studies. The inclusion of FDI is to relax the highly restrictive assumption of a closed economy.

The log of Trade (% of GDP) **TO**, is serving as a proxy for trade openness. In this study, it is measured by the share of exports plus imports in GDP. It is expected to carry a positive coefficient because a country’s involvement in international trade enhances its growth process

and thereby increasing per capita GDP (Ben-David, 1998). It is also included as a measure of a country's openness to international trade involving the flow of goods and services. Similarly, this measure of openness is chosen ahead of a number of measures because in developing economies and SSA for that matter, trade in goods and services accounts for a larger percentage of GDP. Again, this is to relax the highly restrictive assumption of a closed economy.

Government spending (% of GDP) **GEG**, is measured by the log of general government total expenditure (% of GDP). An increase in government expenditure boosts aggregate demand of an economy and this can boost the growth of real per capita GDP is increased. However, due to its inflationary tendency we expect its coefficient to take either signs. In this study, it is used as a measure of the level of government activities in an economy. This is intended to relax the highly restrictive assumption of an economy without government activities.

4.4 Sensitivity Analysis

Some sensitivity analyses are carried out in the study. They include Unit Root, Heteroscedasticity, Autocorrelation, and Multicollinearity among others tests. While the unit root test is a pre-estimation sensitivity analysis, Heteroscedasticity, Autocorrelation, and Multicollinearity are largely post-estimation analysis. This is to ensure the general fitness of the variables as well as the models that are employed in this present study.

4.4.1 Stationarity or Unit Root Test.

According to Gujarati (2003 pp.713), "a stochastic process is said to be stationary, if its Mean, and Variance are constant overtime and the value of Covariance between two time periods depends only on the distance between the two time periods and not on the actual time at

which the Covariance is computed". Although econometricians generally believe that Unit Root is usually a problem of Time Series data, it is both appropriate and important that the variables in a panel dataset are also tested for stationarity. This is to avoid the occurrence of unrelated regressions, sometimes known as spurious regressions. In the study, the Fisher test ($\rho\lambda$) is employed. The Fisher-type test uses p-values from unit root tests for each cross-section i . The formula of the test looks as follows: $P = -2 \sum_{i=1}^N \ln p_i$. The test is asymptotically chi-square distributed with $2N$ degrees of freedom ($Ti \rightarrow \infty$ for finite N). Hlouskova and Wagner (2006), Choi (2001) and Maddala and Wu (1999) argued that the Fisher test of panel unit root has several advantages over the other techniques; a number of these advantages are summarized below. One advantage of the Fisher test is that it does not require a balanced panel as in the case of the IPS test. Also, one can use different lag lengths in the individual ADF regression. If the Fisher unit root test based on the standard ADF rejects the null test in levels then at least one of the panels of the variable is stationary or does not contain unit root. Another advantage of the Fisher test is that it can also be carried out for any unit root test. Also, the test does not require simulating adjustment factors that are specific to the sample size and specification. A major drawback of the Fisher-type test is that the p-values have to be obtained by Monte Carlo simulations (Choi, 2001).

4.4.2 Heteroscedasticity, Autocorrelation and Multicollinearity

The problems of heteroscedasticity (which is usually associated with cross-sectional data) and autocorrelation (which is usually a time series data) are sometimes observed even in panel datasets. The modified Wald test for group-wise heteroscedasticity in fixed effects regression and the Wooldridge test or the Lagrange-Multiplier test for autocorrelation model is employed

to test for Heteroscedasticity and Autocorrelation respectively. A test for the severity of multicollinearity is carried out using the Variance Inflation Factor (VIF) technique. Since estimates produced by both RE and FE are fundamentally inefficient and inconsistent in the presence of heteroscedasticity and/or autocorrelation, the study uses the GLS instead of RE and/or FE to estimate the models specified above in case either heteroscedasticity or autocorrelation is found present.

4.5 Data, Source and Sample

Datasets for the study is obtained from the databases of International Financial Statistics of the IMF, the World Development Indicators of the World Bank and the UNCTAD. Income per capita convergence is usually a long run phenomenon but due to data unavailability for most countries prior to 1980; the study uses a 31-year sample period i.e. from 1980 to 2010. The study involves all the 48 SSA countries except for those on which data on per capita income do not exist for the year 1980. This sample selection criterion is very crucial because the study takes 1980 as the initial period at which economies begin to move towards their respective steady state position. This in turn implies that the per capita income values for 1980 represents the initial per capita GDP of the countries. As a result, the study cannot plausibly include countries without data on per capita income in 1980 which has been chosen as the initial year. By this sample selection criterion, 37 out of 48 SSA countries are considered for the present study.

4.6 Concluding remarks

This chapter explored the main theoretical underpinning for the study. Based on theory and empirical studies, a number of variables which are thought of influence per capita income convergence have been included in the model of the current study. The chapter also dealt with the issue of variable description, measurement, justification for their choice as well as their *a priori* economic expectation particularly, in terms of signs.

Initial per capita income, population growth rate and investment in physical and human capital are employed in the first estimation to examine per capita income convergence based on the closed economy without government activity assumption while in the second estimation, initial per capita income, population growth rate and investment in physical and human capital, FDI, openness and government spending are employed to examine per capita income convergence based on the relaxation of the assumption of closed economy without government activity. In both estimations, per capita income growth is the dependent variable. Also, in both estimations, a negative coefficient on initial per capita income implies convergence, otherwise, there is divergence. The third objective is addressed if per capita income convergence holds.

Further, empirical models and some econometric estimation techniques relevant to the study have been specified and discussed. Discussion on the various sensitivity analyses aimed at ensuring the fitness of variables and models has also been made. By this, the chapter has set out a good platform for the estimation and discussion of results.

CHAPTER FIVE

DATA ANALYSIS AND DISCUSSION OF RESULTS

5.0 Introduction

The chapter commences with an analysis of the datasets used for the study. This is followed by an elaborate discussion of results with special emphasis on addressing the various objectives of the study. Particularly, the descriptive statistics of the dataset is presented and is followed by a pre-estimation sensitivity analysis. The first estimation seeks to test the convergence hypothesis for SSA as predicted by the neoclassical growth. In the second estimation, the study examines the crucial convergence effects of FDI, Trade openness and Government expenditure. The study further estimates the number of years within which per capita income convergence (i.e. per capita income disparity disappearance) in SSA should be expected. However, the third estimation regarding estimating the number of years income convergence is expected in SSA is carried out if and only if the first two estimations give support to per capita income convergence; otherwise the third estimation is neglected.

5.1 Descriptive Analysis

Based on data availability, a total of 37 out of 47 countries of the SSA were surveyed for the study⁹. In all 8 different macroeconomic variables were employed in the study to test the convergence hypothesis in SSA. The critical statistics discussed include the mean, maximum and minimum values and the standard deviation of the variables. Table 5.1 shows the descriptive statistics of the variables.

⁹ see Appendix II

Table 5.1: Summary Statistics of study variables, 1980 – 2010

Variable	Mean	Std. Dev.	Min	Max
PCYG	0.890221	1.157	-6.92642	4.528138
IPCY	4.601862	1.909981	-4.90649	8.568902
INVC	2.845863	0.528975	0.65782	4.33981
PG	0.841191	0.530678	-3.1952	2.279367
HCI	3.174668	0.805977	0.851995	4.826295
FDIG	0.079574	1.901991	-13.4953	4.51094
TO	4.172477	0.526212	1.843773	5.502696
GEG	3.176458	0.36905	1.691202	4.219405

Source: Author's computation (WDI, 2011; IMF, 2011 and UNCTAD, 2011)

The Mean values of the variables are reported in the third column. It is a measure of central tendency for the variables. For instance, initial per capita income and trade openness have the largest Mean values while FDI (% of GDP) has the least. The last two columns of the table show the maximum and minimum values and the difference between the latter and the former gives the Range of the variable. The fourth column is the standard deviation. Range and standard deviation are both measures of dispersion. Higher values of range and/or standard deviation indicate greater dispersion or fluctuation in a variable. For instance initial per capita

income and FDI (% of GDP) have the largest dispersion measured by their range and standard deviation values of 13.48 and 18, and 1.91 and 1.90 respectively.

5.2 Pre-estimation Sensitivity Analysis

In the section that follows, a pre-estimation sensitivity analysis carried out to check the stationarity properties of the variables and the result of the pre-estimation sensitivity test is discussed below.

5.2.1 Stationarity or Unit Root Test

The results of Stationarity test of the variables employed in the study are presented by Table 5.2. For the null hypothesis of unit root, it can be observed from Table 5.2 that at least one of the panels has no unit root. As a measure of robustness, four different unit root test statistics were computed. All the four tests strongly reject the null hypothesis that all the panels contain unit roots. Choi (2001) argued that, when the number of panels is finite, the inverse χ^2 test is powerful and applicable. The study has a finite number of panels and as a consequence, on the basis of the inverse χ^2 test, the null hypothesis of unit root is strongly rejected. The conclusion is that at least one of the panels has no unit root and this removes the tendency of possible spurious regressions or unrelated regressions.

Table 5.2: Fisher Unit root test of Variables based on ADF

Variable	Inverse χ^2		Inverse Normal		Inverse Logit t		Modified inv. χ^2	
	Statistic	Prob.	Statistic	Prob.	Statistic	Prob.	Statistic	Prob.
PCYG	100.8412	0.000	-4.4979	0.000	-4.6830	0.000	6.0593	0.000
IPCY	102.7230	0.000	-5.9977	0.000	-6.1465	0.000	7.4242	0.000
INVC	240.3579	0.000	-10.1809	0.000	-10.7292	0.000	14.0298	0.000
PG	245.8262	0.000	-9.3010	0.000	-10.0103	0.000	14.1240	0.000
HCI	135.1378	0.000	-5.9198	0.000	-5.8748	0.000	6.5680	0.000
FDIG	273.1857	0.000	-10.9470	0.000	-12.0152	0.000	16.3730	0.000
TO	247.5643	0.000	-10.2929	0.000	-10.9328	0.000	14.2669	0.000
GEG	183.1397	0.000	-7.6961	0.000	-8.0142	0.000	9.8731	0.000

Source: Author's computation

5.3 Estimation of models

5.3.1 Random and Fixed effects estimations

5.3 Testing the per capita income convergence hypothesis

Fixed Effects and Random Effects estimations: Dependent variable: PCYG

Variables	FIXED EFFECTS				RANDOM EFFECTS			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
IPCY	0.1504** (0.067)	.174** (.0726)	.174** (.0733)	.299** (.1186)	.083* (.046)	.106** (.048)	.107** (.049)	.183*** (.064)
INVC	.2977 (.223)	.471** (.227)	.4687* (.243)	.1936 (.296)	.228 (.171)	.314* (.183)	.365* (.204)	.156 (.253)
PG	-.202 (.144)	-.171 (.143)	-.1711 (.1461)	-.032 (.141)	.080 (.113)	.091 (.121)	.0515 (.123)	.056 (.128)
HCI	-.330** (.166)	-1.975* (-1.41)	-.352* (1.849)	-1.0*** (.3111)	-.079 (.0991)	-.1145 (.1113)	-.0990 (.1172)	-.52*** (.153)
FDIG		-.0395 (.0534)	-.0398 (.0546)	-.007 (.0677)		.017 (.044)	.021 (.0453)	.045 (.058)
TO			.012 (.389)	-.123 (.4325)			-.126 (.2182)	-.2368 (.2508)
GEG				.965** (.478)				.72** (.316)
Constant	.6884 (.824)	.1309 (.9204)	.086 (1.71)	-.102 (2.542)	.218 (.559)	-.0337 (.6251)	.3199 (.861)	.1624 (1.22)
R²	0.0084	0.0232	0.0229	0.1133	0.025	0.0557	0.06	0.1457
Prob.	0.0462	0.0395	0.0702	0.0556	0.181	0.0535	0.0934	0.0038

*, **, *** corresponds to 10%, 5% and 1% level of significance respectively. Standard errors are in parenthesis. Source: Author's computation

The results of the RE and FE estimations of the per capita income convergence hypothesis are presented in Table 5.3. Model 1 in either RE or FE is a test of per capita income convergence based on the closed economy without government activity assumption of the HC-ASM while in model 4, this assumption is relaxed by including FDI (% of GDP), Trade openness and government expenditure (% of GDP) as shown in Table 5.3 below.

The result of the Hausman test which selects the estimation whose parameters are consistent and efficient is also presented in Table 5.4 under the null hypothesis that RE is efficient and consistent. The p-value is significantly less than 1% and 5% in models 1 and 4 respectively and thus, the null hypothesis is strongly rejected in both models. This implies that the results of the FE is preferable to that of RE.

Table 5.4 Hausman test for Fixed effects and Random effects

Null hypothesis: Random effect is efficient and consistent

	Model 1
Chi2(4)	$(b-B)'[(V_b-V_B)^{-1}](b-B)$ = 13.48
Prob.>chi2	= 0.0092
	Model 4
Chi2(7)	$(b-B)'[(V_b-V_B)^{-1}](b-B)$ = 10.81
Prob.>chi2	= 0.0147

Source: Author's computation

5.4 Post-estimation sensitivity analysis

The Hausman test chose the FE results at the expense of the RE. Hence, in what follows, a post-estimation sensitivity analysis is carried to ascertain the efficiency and consistency of the FE results.

5.4.1 Heteroscedasticity test

The Modified Wald test for group-wise heteroscedasticity in fixed effects regression model is employed to test for heteroscedasticity. The results for models 1 and 4 are shown in Tables 5.5 (a) and (b) respectively below. From the results in Table 5.5 the null hypothesis of homoscedasticity is significantly rejected at 1%. Therefore, heteroscedasticity is said to be present in the FE model.

Modified Wald test for group-wise heteroscedasticity in fixed effect model

Table 5.5(a) Heteroscedasticity test in Model 1

H0: Homoscedasticity	chi2 (31) = 7.7e+31
	Prob.>chi2 = 0.0000

Modified Wald test for group-wise heteroscedasticity in fixed effect model

Table 5.5(b) Heteroscedasticity test in Model 4

H0: Homoscedasticity	chi2 (31) = 410.51
	Prob.>chi2 = 0.0000

5.4.2 Autocorrelation test

The Wooldridge test or the Lagrange-Multiplier test for autocorrelation is also carried out to test for autocorrelation. The results for the basic HC-ASM and the second model are reported by Tables 5.6 (a) and (b) respectively. Again, the null hypothesis of no serial correlation among the error terms is rejected at 5%. Therefore, there is first-order serial correlation in the FE model.

Wooldridge test for Autocorrelation in panel model

Table 5.6(a): Autocorrelation test in Model 1

H0: No first-order autocorrelation	$F(1, 21) = 70.30$
	Prob. > F = 0.0411

Wooldridge test for Autocorrelation in panel model

Table 5.6(b): Autocorrelation test in Model 4

H0: No first-order autocorrelation	$F(1, 21) = 62.70$
	Prob. > F = 0.0442

5.4.3 Multicollinearity Test

The presence of multicollinearity among the regressors is also tested using the Variance Inflation Factor (VIF). From Table 5.7, the individual VIF and mean VIF are significantly less than 10. Hence the level multicollinearity among the independent variables is not severe.

Table 5.7 VIF test for Multicollinearity

Variabl e	TO	HCI	IPCY	PG	GEG	INVC	FDIG	Mean VIF
VIF	2.84	2.07	2.04	2.04	1.83	1.71	1.5	2.00
1/VIF	0.3524 8	0.4820 9	0.4898 8	0.4902 3	0.5462 5	0.5859 9	0.6662 6	

The post-estimation sensitivity analyses carried out give support to the use the GLS as an appropriate estimation technique as against the FE which was chosen by the Hausman test. It was showed in the methodology that the GLS overcomes the problems of heteroscedasticity and autocorrelation when present in a model and thus, would be employed if these problems are found in the RE or FE model. This is because estimates produced by both RE and FE have been shown by Balgati (2008) Greene (2003) to be fundamentally inconsistent and inefficient in the presence of heteroscedasticity and especially autocorrelation. The RE and FE operates on the assumption of strict homoscedasticity and no serial correlation (Greene, 2003 and Balgati, 2008). This problem is however overcome by the use of GLS as discussed in chapter four.

5.5 Generalized Least Squares estimations

Resulting from the ability of the GLS to overcome the problems of heteroscedasticity and autocorrelation, it is employed for the estimation of the models. The results as shown in Tables 5.8 and 5.9 relate to the first and second objectives respectively.

A glance look at the results of the panel GLS estimations shown in Tables 5.8 and 5.9 below and that of the FE¹⁰ estimation chosen by the Hausman test to be efficient and consistent over the RE, some few observations is worth-noting. There are much substantial differences

¹⁰ The FE results are reported by Table 5.3. Only models 1 and 4 are relevant to the current comparison

between the FE and the GLS estimations in terms of the significance of variables, the values of the R^2 , the significance of the overall model given by the F-statistic and among others. For instance, the R^2 produced by the FE estimations are very low compared to that of the panel GLS which implies that the latter estimation explains much of the variations in PCYG than the former estimation. Similarly, compared the GLS to the FE model, very few of the regressors were found to be significant in the FE estimation. Further, the F-statistic in the FE model rejects the significance of the overall model at 1%. However, in the panel GLS estimations, the F-statistic were significantly lower than 1% implying a confirmation of the significance of the overall model at 1%. All these observations stand to render support to the argument that the GLS is a better estimation technique than the FE especially in the presence of heteroscedasticity and autocorrelation. This argument also justifies the choice of the GLS over FE in this current study.

Objective 1

In objective, the study seeks to examine, on the basis of the neoclassical model, the convergence possibility among SSA countries to a similar level of income per capita. He results of the GLS estimation are reported in Table 5.8

The results shown below in Table 5.8 are the output of GLS estimation. Here, the per capita income convergence hypothesis is tested on the HC-ASM assumption of closed economy without government activity. Thus, population growth (PG), investment in physical (INVC) and human capital (HCI) and initial per capita income (IPCY) are employed as independent variables¹¹. Initial per capita income and Population growth are significantly positive at 1% while Investment in physical capital is significant and positive at 5%. Investment in human

¹¹ The choice of these variables are justified in chapter four

capital is however not significant. The F-statistic shows that all the variables included in the model are jointly significant at 1%. The adjusted R^2 indicates that the model explains about 8% of the variation in growth in per capita income.

Table 5.8: Testing the per capita income convergence hypothesis based on HC-ASM.

Generalized Least Squared estimation: Dependent variable: PCYG

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	-0.078555	0.377065	-0.208333	0.8351
IPCY	0.121746	0.031343	3.884345	0.0001
INVC	0.255664	0.113606	2.250447	0.0252
PG	0.186392	0.068190	2.733415	0.0067
HCI	-0.068377	0.067151	-1.018258	0.3094
Statistics				
R-squared	0.092966	Mean dependent var.		1.584947
Adjusted R-squared	0.080055	S.D. dependent var.		1.252407
S.E. of regression	1.034000	Sum squared residual		300.4326
F-statistic	7.200278	Durbin-Watson stat		1.949517
Prob.(F-statistic)	0.000016			

Source: Author's computation

The DW statistic reveals the evidence of no first order autocorrelation. Positive coefficients on initial per capita income (IPCY), investment in physical capital (INVC), and population growth rate (PG) indicate that higher levels of initial per capita income, capital, and

population growth would be accompanied by increase in the growth of per capita income in SSA.

In general, the estimation results do not render support to the hypothesis of per capita income convergence among countries in SSA during the period under consideration. Initial per capita income is found to be significant and positively related to per capita income growth which is a clear indication of divergence. Thus, there is no evidence that countries in the region have exhibited convergence to a common steady growth path and that SSA does not form a convergence club as there is no evidence of a potential convergence because the magnitude of divergence is quite substantial. As a consequence, the per capita income convergence is strongly rejected for SSA. This is in sharp contrast to the prediction of Anold, et al, (2010), Paola (2007), Mcquinn and Whelan (2006), Stroomer and Giles (2003), and especially Mankiw et al (1992) whose work concluded that once population growth, investment in physical and human capital are controlled for, cross-country data generally support per capita income convergence. These results are however consistent with the conclusions of Parikh and Shibata (2004), Sala-I-Martin (1996), Islam (1995).

Objective 2

Secondly, a test for per capita income convergence based on the relaxation of the two assumptions of the HC-ASM is also carried out by including FDI (% of GDP), trade openness and government expenditure (% of GDP). The results are reported by Table 5.9

Table 5.9: Testing the per capita income convergence theory under relaxed assumptions.**Generalized Least Squared estimation: Dependent variable: PCYG**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0.506765	0.553475	0.915606	0.3612
IPCY	0.159318	0.031635	5.036212	0.0000
INVC	0.124854	0.154659	0.807285	0.4207
PG	0.146299	0.054998	2.660095	0.0086
HCI	-0.364592	0.068063	-5.356653	0.0000
FDIG	0.093756	0.033322	2.813584	0.0055
TO	-0.258261	0.134781	-1.916150	0.0571
GEG	0.520137	0.163082	3.189430	0.0017

Statistics

R-squared	0.400333	Mean dependent var.	1.732733
Adjusted R-squared	0.374260	S.D. dependent var.	2.148235
S.E. of regression	0.811856	Sum squared residual	106.1166
F-statistic	15.35460	Durbin-Watson stat	1.921232
Prob.(F-statistic)	0.000000		

Source: Author's computation

These results are the output of a GLS estimation testing the per capita income convergence hypothesis in an open economy with government participation in economic activities which is

a relaxation of the strict HC-ASM assumption by including FDI (% of GDP), Trade openness and Government expenditure (% of GDP) into the model.

Once again, initial per capita income and population growth are significantly positive at 1% while Investment in physical capital is found as not significant. Investment in human capital is significant but with a negative coefficient. FDI (% of GDP), Government expenditure (% of GDP) and Trade openness are all significant. FDI (% of GDP) and Government expenditure (% of GDP) have positive coefficients while Trade openness has a negative. The F-statistic shows that all the variables included in the model are jointly significant at 1%. The adjusted R^2 indicates that the model explains about 37% of the variation in growth in per capita income. The DW statistic reveals the evidence of no first order autocorrelation. The results show that higher of initial per capita income, population growth, FDI, Government spending and lower level of openness and investment in human capital would cause an increase in the growth of per capita income in SSA.

Further, a positive coefficient on IPCY indicates that the estimation result in general does not support the hypothesis of conditional convergence in SSA during the period under consideration even in the presence of FDI, trade openness and government. Thus, there is no evidence that countries in the region will converge in anytime soon and that the presence of FDI, trade openness and government does not only cause per capita income divergence but also widens the per capita income disparity in the region. This is because, the coefficient on initial per capita income is found not only to be significant and positive but also larger in the second estimation as compared to its coefficient in the first estimation. Therefore, the presence of FDI, government activities, and trade openness is found to have caused much per capita income disparities among countries in SSA. This conclusion supports the findings of Wei et al, (2007), Serra et al. (2006), Slaughter (2001), Baliaoune-Lutz (2001), Bernard and

Jones (1996) but contrasts with the works of Jawaid and Raza (2012), Ben-David (1993) and Fuduka and Toya (1995).

However, it is also worthy to note in the results indicate that FDI is found to be positively related to per capita income growth implying that FDI is an important source of per capita income growth and that it could be that it is the uneven distribution of FDI across the countries rather than FDI itself, which has been a cause of the regional per capita divergence. At least from the trends of the regional performance, it was revealed that nearly half of the FDI inflows into the region go to Nigeria and South Africa. Usually, countries with substantial deposits of natural resources seem to attract most the FDI that come to the region. Thus, countries in SSA do not receive equal proportion of the world FDI and hence, the impact of FDI on growth in each country may differ. Moreover, it could be the case that, some countries are better able to channel their FDI inflows into pro-growth ventures than others. For instance, Wei et al, (2007) argued that when FDI is highly unevenly distributed among regions or countries, income divergence is an inevitable outcome.

Also, the study has revealed important result about the role of openness in the process of income convergence that contrasts with the findings of Ben-David (1996) and Sachs and Warner (1997). While Ben-David (1996) and Sachs and Warner (1997) found openness to facilitate income convergence, this study shows that, the contrary rather exists in SSA. Openness actually helps 'relatively rich' countries in SSA more than it does poor countries. As argued by Baliamoune-Lutz (2001), globalization, measured by greater openness to international trade, may be harmful to economies with very low per-capita income. Perhaps the influence of trade on income expresses the effect of human capital, as these two variables tend to have a strong positive correlation¹².

¹² See Correlation matrix in appendix III

Further, Mankiw et al (1992) predicted conditional income convergence for similar (homogeneous) countries but contrary to this prediction and the perception of some economists, the SSA does not form a homogenous set of countries in many respects. Countries in the region differ strongly in terms natural endowment, educational system, macroeconomic targets, population structure, political administration and structure *inter alia*, all of which tend to affect their per capita income growth. As a result the convergence hypothesis as predicted by Mankiw et al, (1992) may not apply to the SSA. Also, though Basil (2002) investigated into the convergence effect of regional integration in West Africa on the assumption of cross-country homogeneity, he failed to find a strong evidence for per capita income convergence among the so-called homogeneous ECOWAS countries.

Also, the role of government in economic activities in these countries is not uniform in that, while some countries (such as South Africa, Botswana and Mauritius) concentrate on expanding the economy, maintaining macroeconomic stability, others (such as Sudan, Mali, and Ivory Coast) spend much resources in conflict resolution, political stability etc. (Kumo, 2011). As a result, some countries would grow consistently such that others cannot catch with them. Thus, it is not very surprising that the results indicate the existence of per capita income divergence even in the presence of government involvement in the economy.

To further demonstrate the consistency of these findings (i.e. per capita income divergence in SSA), the standard deviations (σ) of real GDP per capita for the 37 countries surveyed for the study for the period 1980 to 2010 is computed¹³. The results are presented by Table 5.10. Decreasing standard deviations overtime imply falling dispersions in per capita income overtime which in turn represent a case of convergence and the converse is also true.

¹³ This computation is done by following the work of Kumo (2011)

Table 5.10: Dispersion of Initial per capita Income, 1980-2010 (Sigma Convergence)

Year	Std. Dev.(σ)	Year	Std. Dev. (σ)	Year	Std. Dev. (σ)
1980	0.94052	1990	1.71541	2000	2.02959
1981	1.35639	1991	1.90956	2001	1.83594
1982	2.43914	1992	2.29241	2002	1.77005
1983	1.36506	1993	2.53631	2003	1.77248
1984	1.93943	1994	2.17259	2004	1.70269
1985	1.53233	1995	1.93605	2005	1.69308
1986	1.75080	1996	2.51360	2006	1.67444
1987	1.66397	1997	1.98747	2007	1.67442
1988	1.69146	1998	1.85278	2008	1.74759
1989	2.05407	1999	2.11141	2009	1.76173
				2010	1.61529

Source: Author's computation (WDI, 2011)

Though some fluctuations¹⁴ are observed in the dispersion of per capita income, it be said that, on the average dispersion of per capita are on the ascendancy. In particular, standard deviations of log real GDP per capita in 2010 is clearly greater than the dispersion in the initial level of real income in 1980. This is an indication that there is no tendency for SSA countries to converge because the dispersion in per capita income has rather been increasing instead of diminishing. This result in a way validates the results of the GLS estimations of Conditional convergence hypothesis and it is consistent with findings of Kumo (2011).

Owing to the results obtained from the various estimations, the study could not possibly estimate the number of years it would take countries in SSA to converge. Thus, the third of objective of this current study is neglected¹⁵.

¹⁴ The fluctuations could be due to the fact that the panel dataset employed for the study is unbalanced as some of the countries selected for the study drop in and out in terms of data as the year go by

¹⁵ Refer to the introduction of this chapter

5.6 Concluding remarks

This chapter analyzed the per capita income convergence hypothesis under two assumptions (i.e. closed economy without government activities and open economy with government activities). Other measures of per capita convergence are also employed. Also the stationarity property of the variable was examined. Further, the presence of heteroscedasticity and autocorrelation in the models was also tested.

The results suggest a per capita income divergence among the 37 selected countries in SSA. This divergence can be described as persistent and increasing even in the presence of FDI, trade openness and government spending. Even though FDI and Government spending are found to impact positively on per capita income growth, they do not ensure the disappearance of income disparity in the region. These findings are in complete disagreement with the prediction of the HC-ASM and further suggest that the presence of FDI, trade openness and government turns to widen to per capita income disparity gap among countries in SSA. These findings cast doubt on the per capita income convergence potentials of the region.

Also, since per capita income convergence hypothesis did not hold for SSA the study did not estimate the number of years it would take SSA countries to converge which is the final objective of the study. That is, since the results indicate divergence the study cannot possibly estimate the years of convergence

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.0 Introduction

This chapter presents the summary and conclusions of results and findings of the study. Further, some recommendations for policy and further research are offered. The first section of this chapter section looks at the summary and conclusions of the study while the subsequent section presents the recommendations of the study. The limitations of the study are discussed in the final section of this chapter.

6.1 Summary and Conclusions

A central implication of the basic neoclassical growth model is the notion of economic convergence and a vast body of studies relating to it exists, even though there is no overall consensus among researchers as to the occurrence of the phenomenon. Despite these enormous studies, there still remains a gap to be filled because studies aimed at examining whether income per capita disparity observed in SSA is disappearing or widening as well as the crucial role play by FDI, Trade and government spending is very limited and this was the motivation behind this study. Hence, the objectives of the study included examining the validity of the convergence hypothesis in SSA on the basis of the HC-ASM of the neoclassical model; assessing how FDI, trade and government spending are facilitating per capita income convergence in the region and finally estimating the number of years the phenomenon should be expected to occur in SSA.

The relevant theoretical literature reviewed showed that once the assumption of diminishing returns to reproducible factors hold; and variables such as population growth rate, investment in both physical and human capital are well controlled for, data generally support cross-country per capita income convergence hypothesis. It was also revealed that, the process of convergence is enhanced in the presence of international trade. Also, most of the empirical studies reviewed gave support to income convergence with a few reporting otherwise. In addition, it was revealed that bulk of these studies employed cross-country (panel) regressions to investigate the phenomenon.

The study further conducted a trend analysis of the most essential variables. It was realized that for nearly fifty years, SSA has undergone various reforms and with the object of transforming the economy and improving upon growth. Despite a myriad of efforts by the region, little progress appears to be observed as it continues to lag behind almost all other regions of the world. Also, in spite of the various trade reforms and policies, SSA's share of world trade (goods and services) is much insignificant even if compared to other developing regions. The trend of per capita GDP revealed that until 2002, the region was practically stuck in negative growth rates since the early 1980s.

To test for the income per capita convergence hypothesis in SSA using data from 1980-2010 generated from mainly the WDI of WB, IFS of IMF and UNCTAD databases, the study subjected the models and their variables to various sensitivity analyses. Most of the sensitivity analysis gave support to the use of GLS estimation technique. The results of the study generally did not support the per capita income convergence hypothesis in all specifications. Absolute¹⁶, conditional convergence and sigma convergence tests were conducted. The evidences found by the study are indications of per capita income divergence among the

¹⁶ The results of Absolute convergence are shown in Appendix IV

countries in SSA, and that the divergence persists and increases even in the presence of FDI, trade openness and government spending. These findings are in complete disagreement with the prediction of the HC-ASM and further suggest that the presence of FDI, trade openness and government turns to widen the per capita income disparity gap among countries in SSA. These results cast doubt on the per capita income convergence potentials of the region indicating that countries in SSA are not likely to converge in any time soon.

From these results and conclusion, the third objective of the study which was concerned with estimating the years of income convergence in the SSA could not be calculated since there was no evidence of convergence.

Baliamoune-Lutz (2001) argued that results such as those found by this current study are by no means surprising, particularly when one considers that the last two decades of the 20th century, which had witnessed intensified globalization, had also been marked by a slowdown in economic growth in many parts of the continent.

6.2 Recommendations for Policy and Future research

This study which aimed at examining the validity of the per capita income convergence prediction of the neoclassical Solow model and Human capital-augmented Solow model under different assumptions in SSA has shown results that are contrary to the prediction of these models. Based on the findings of the study the following recommendations are offered:

Based on the sample period, methodological procedures and econometric validations followed, this study which sought to validate the per capita income convergence prediction of the HC-ASM could not establish per capita income convergence in SSA. This casts some doubts on the application of the per capita income convergence hypothesis as postulated by

Mankiw et al, (1992) and Solow (1956) to the region. Hence, future research should explore per capita income convergence in SSA using alternative growth models such as the R&D and AK growth models. However, caution must be exercised regarding the exact endogenous model to use by giving due considerations to the various underlying assumptions of these growth models.

Further, the fact that the empirical results of the study showed that trade openness, FDI and government spending do not promote the disappearance of per capita income in SSA does not imply that SSA countries should totally decline in their efforts of opening up the economies to more trade or attracting more FDI. Even though the presence of FDI, trade openness and government in the region could be the cause of the widening per capita income gap among the countries in the region, at least, it is found that both FDI and the role of Government (measured by government spending) had significant and positive effects on per capita income growth. As a result, the divergence could be that, bulk of the FDI that comes to SSA goes to relatively richer countries of the region¹⁷ and as a consequence, they are able to grow faster than the relatively poor countries. In this light it is recommended that economies in SSA, especially the poorer countries should make pragmatic policies to attract more FDI and subsequently make efficient utilization of these resources to reduce the per capita income gap. Further, for many SSA countries in particular, the recommendations pertaining to the role of governance could also be the key to the gate that leads away from the per capita income stagnation cycle. Thus these countries should consistently modify and structure their economies in the areas such as maintaining macroeconomic stability, good governance, fiscal discipline etc.

¹⁷ This conclusion was also established in chapter three

Furthermore, though the presence of physical capital accumulation might have also cause per capita income divergence in the region, it had significant and positive impact on per capita income growth. This suggests that some policies should be formulated to ensure more physical capital accumulation in SSA.

Moreover, beside the fact that the presence of trade openness might have contributed to the widening of the per capita income gap, it was also found to be negatively related to per capita income growth. This result indicates that trade openness has not yet have a positive impact on per capita income growth which is quite an unattractive and unfortunate development especially when one consider the considerable efforts put in so far by the region¹⁸. It could be that some of the trade policies are not growth-friendly enough or that the region imports more than it exports. In this respect, countries in SSA should formulate sound and pragmatic pro-growth trade policies.

Furthermore, from the results, there is much evidence of per capita income divergence which implies that it is not likely that there can be any per capita income convergence among countries in SSA in any time soon. To halt and probably reverse the divergence tendencies among countries in SSA, more efforts must be put into formulating and implementing policies that can bridge the per capita income gap among these countries. Some of these policies may include setting common macroeconomic targets in terms of monetary growth, inflation targeting, debt management, sound fiscal and monetary policies, etc.

¹⁸ Refer to chapter three

6.3 Limitations of the Study

The principal drawback of this study relates to but not limited to unavailability of data. Only 37 SSA countries were selected for the study because of unavailability of data for some of the countries. Countries like Ethiopia and Tanzania would have been interesting additions but unavailability of consistent data on them warranted their exclusion. Data on the variables are not consistently available from 1950 to 2010 which was the original sample period of the study. As a consequence, the study has to settle on 1980 to 2010 as the study period and even with that, some countries still needed to be dropped. In fact, it worthy to emphasize here that, no country actually had consistent data on all the chosen variables for the period under study. This compelled the study to conduct the various estimations using an unbalanced panel dataset. This can sometimes affects the reliability of the findings of the study in ways that may be undesirable. Hence interpretation of the results should be embraced with care.

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APPENDICES

APPENDIX I

Summary of some key and recent literature

Study/ Author	Period of study/ sample	Methodology and Variables	Findings	Gap
“Regional Integration, Foreign Direct Investment and Income Convergence” (Morris, 2008)	1985 – 2000 39 countries grouped into 4 regional blocks	Fixed effect model Bilateral trade Regional integration FDI	Apart from Asean free trade area, FDI There is per capita income convergence especially in the CARICOM region	Did not account for the effect of total trade Failed to include time invariant variables that have influence on integration
Foreign Direct Investment, Growth and Convergence Hypothesis: A Cross Country Analysis (Jawaid and Raza, 2012)	1980 – 2009 95 countries classified into low, middle and high income groups	Random effect model FDI	FDI stimulates per capita income convergence for all groups especially the low income group	Did not make room for other variables that affect per capita income growth i.e. deterministic regression
“Regional integration, growth and convergence” (Willem Te Velde, 2008)	1970-2004 100 developing countries	Fixed effect model Regional integration	Integration did not facilitate convergence but argue that “deep” regional integration approaches can help to address crucial rail, road, air and energy links amongst countries e.g. EAC	Failed to incorporate time invariant variables which influence the strength of integration. Other variables were ignored making the study to o deterministic

Study/ Author	Period of study/ sample	Methodology and Variables	Findings	Gap
“Bilateral Trade and Per Capita income Convergence of Selected South Asian countries and among their major trade partners” (Ahmed and Fida, 2009)	1972-2005 India, Pakistan, Bangladesh, and Sri Lanka	Difference-in-differences approach Trade	Trade leads to per capita income convergence for all the trade liberalizing countries	The study extensively on only bilateral and consequently ignored the volume of total trade
“Economic integration and convergence in West Africa” (Basil , 2002)	1960 – 1990 14 West African countries	Random effect model Regional integration	Integration ensures convergence West Africa forms a convergence club but there is a weaker tendency for them to converge	Did not consider recent remarkable growth rates of the sub region. Other variables were ignored making the study too rigid
“Reopening the convergence debate: A new look at cross-country growth empirics” (Caselli, Esquivel and Lefort ,1996)	97 countries 1960-1985	General Method of Moments	Found per capita income convergence: approximately 10% per year	

APPENDIX II

List of SSA Countries selected for the study

Benin	Congo, Dem. Rep.	Lesotho	Namibia	Sudan
Botswana	Congo, Rep.	Liberia	Niger	Swaziland
Burkina Faso	Cote d'Ivoire	Madagascar	Nigeria	Togo
Burundi	Gabon	Malawi	Rwanda	Zambia
Cameroon	Gambia, The	Mali	Senegal	Zimbabwe
Cape Verde	Ghana	Mauritania	Seychelles	
Central African	Guinea-Bissau	Mauritius	Sierra Leone	
Chad	Kenya	Mozambique	South Africa	

APPENDIX III Correlation matrix

	PCYG	IPCY	INVC	PG	HCI	FDIG	TO	GEG
PCYG	1							
IPCY	0.1334	1						
INVC	0.12	0.0738	1					
PG	0.0861	-0.5341	0.094	1				
HCI	-0.1057	0.651	0.1261	-0.481	1			
FDIG	0.1378	0.3688	0.3868	-0.2109	0.3333	1		
TO	-0.0429	0.4918	0.4331	-0.5482	0.5586	0.5171	1	
GEG	0.1269	0.4166	0.3986	-0.4008	0.486	0.3944	0.6118	1

APPENDIX IV Absolute Beta Convergence

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	0.704738	0.103632	6.800379	0.0000
IPCY	0.089471	0.020408	4.384153	0.0000

Statistics			
R-squared	0.044990	Mean dependent var.	1.377921
Adjusted R-squared	0.042650	S.D. dependent var.	1.171523
S.E. of regression	1.036245	Sum squared residuals	438.1120
F-statistic	19.22079	Durbin-Watson stat	1.938570
Prob.(F-statistic)	0.000015		

Source: Author's computation