Analysis of Income Convergence between Sub-Saharan Africa and High-Income Economies: Role of the Components of Trade

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Abstract
The issue of income convergence among regional blocs has been considered, mostly ignoring international trade. This work set to find out whether sub-Saharan African (SSA) countries are converging with High Income Economies with international trade as a source of convergence. Secondly, the study investigated the causal relationship between convergence and trade. That is whether trade causes convergence or convergence causes trade. Lastly, the study investigated the various components of trade such as merchandise export to high-income economies, merchandise import from high-income economies, merchandise export to developing economies in sub-Sahara Africa, merchandise import to developing economies in sub-Sahara Africa, import of service and export of service. The study used Arellano-Bond and Arellano-Bover and also included both difference and system GMM. Because the data was unbalanced panel, the study also included one-way error component unbalanced model estimation and the results were compared. The results found that trade causes convergence but convergence does not cause trade. The study also revealed that all import components of trade have negative effects on growth and export component of trade has positive effects. This means that SSA should increase the export components of trade especially, services to ensure that gains from trading with high income economies are maximized. Because the trade agreements seek to increase trade between SSA and High Income economies, SSA can fully benefit when they concentrate on export of services.
Keywords: Convergence, International Trade, Trade Agreement

1. Introduction

The world is made up of various regional blocs. Historically, the first bloc came into been in the 13th and 17th centuries when the Hanseatic League was formed (Schott, 1991). Regional blocs' formation gained grounds in 1960s and 1970s and later 1990s after the collapse of communism. According to Schott (1991), regional bloc memberships have common characteristics: similar levels of GDP per capita, geographical proximity, similar trading regimes, and political commitment to regional organization. Opinions are mixed concerning the advantages and disadvantages of regional trade blocs. While some argue that regional trade blocs lead to more disintegrated world economy, others argue that it encourage regional as opposed to world trade. Generally, some advantages of trade blocs include foreign direct investment, competition, economies of scale, and trade effects. Disadvantages may include regionalism verses multinationalism, loss of sovereignty and interdependence.

Basically, trade blocs can fall into different categories; these may include preferential trading areas, free trade areas, customs union, common market and economic and monetary unions. On the whole, there are 29 regional trade blocs worldwide, but the major ones include European Union (EU), African Union (AU), Union of South American Nations (USAN), Caribbean Community (CARICOM) etc. Obviously, some of these unions are well developed and advanced than others. Using per-capita GDP in USD as a measure, the European Economic Area (EEA) and Gulf Co-operation Council (GCC) have 34,400 and 22,200 respectively while Economic Community of West African States (ECOWAS) and East African Communities (EAC) have 904 and 483 respectively.

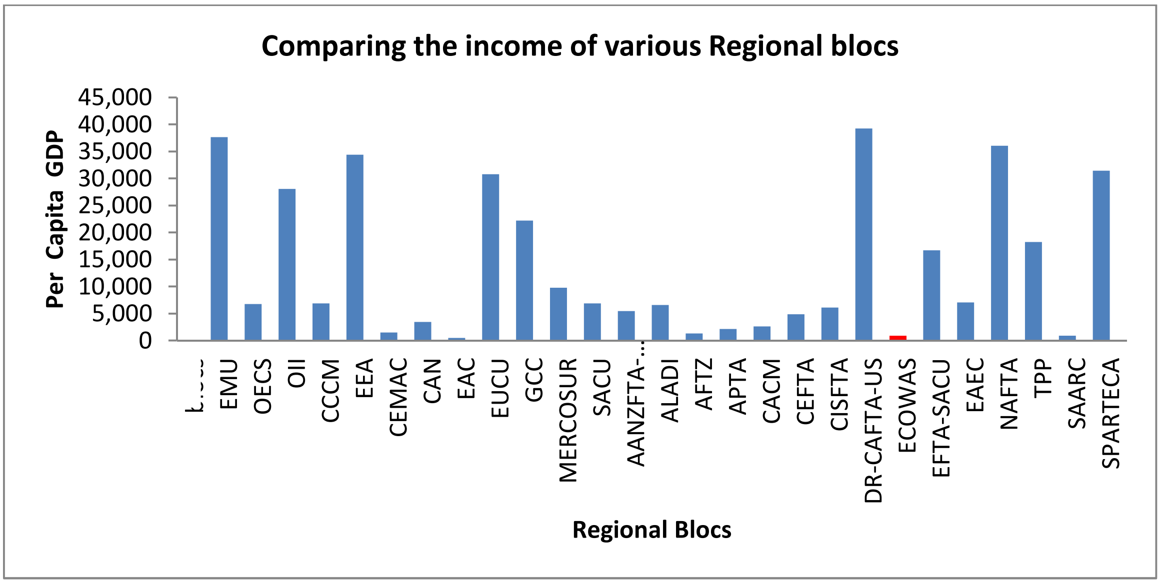

Figure 1: Graph of GDP per capita for the various regional blocs

Figure1 in the appendix shows a bar chart of 27 out of 29 world regional trade blocs. The figure indicates that economic growth varies greatly across different regions. With the new age of free market idea, countries are competing with each other for resources. How are the regions/countries doing relative to one another? Have they been diverging or converging to one another in terms of economic growth? These are vital questions for four reasons: (1) answers to these questions will help us access the impact of trade on developing regions (2) to help us know whether or not trade across regions have deepened the woes of developing region/countries or not (3) to help us investigate the contributions of trade agreement whether it will be of immense benefit or be detrimental to growth of developing regions especially Sub-Sahara Africa.

There have been a number of researches into the causes and nature of differences in growth across regions and countries. In certain times, these differences are small but if accumulated over a considerable period, they have a substantial impact on the standard of living of individuals living in these respective regional blocs. Understanding the causes behind such inequalities are essential to formulate appropriate policies and bring about required institutional changes in order to spread the benefits of growth process across regions. Even though these trade blocs were formed at different periods, it would be necessary to find out whether the growth of the lagging economies is converging with the growth of the leading economies.

The Convergence hypothesis developed by Solow (1956) and documented by Baumol (1986) and Barro and Xavier-Sala-i-Martin (1995) refers to the process by which relatively poorer regions/countries grow faster than the richer regions/countries. Convergence is of two major types: Absolute and Conditional. Absolute Convergence implies that in the long run, countries or regions should not only grow at the same rate, but also reach the same income per capita. Conditional convergence implies that countries/regions are converging to its own steady state (long-run growth).

The motivation of this study is that some literatures on convergence have ignored the issue of trade treating countries as existing independently from others. Thus, there is no need for international trade according to these literatures. Again, existing study uses balanced panel data methodology in their respective. Nevertheless, world data on countries and on different variables sometimes have missing values creating a situation whereby there is an unbalanced panel. This study therefore explores the methodology of an unbalanced panel. Again, the issue of trade openness has mostly been looked at in a holistic manner focusing on net export but not considering other components that make up openness. The sign of the co-efficient of trade openness (negative or positive) in convergence models have been the only element that has informed policy decisions in literatures. Some of the components of trade include merchandise exports and imports and non-merchandise exports and imports. This study therefore contribute to the existing literature by disaggregating trade into its various components in order to find out which of these components is the main driving force behind convergence if it exist by using unbalanced panel data methodology.

The main objective of this study is to undertake an analysis of income convergence between SSA and High Income Economies focusing on the role of international trade components. The specific objectives are (a) to investigate the causal relationship between trade and convergence for High-Income Economies and SSA countries: thus, whether trade has helped strengthen convergence or otherwise (b) to test whether the convergence hypothesis holds for SSA and High Income Economies (c) disaggregate trade into its various components to find out which component is the main driving force behind convergence if it using unbalanced panel methodology.

Having an interest in trade and its various components is worth investigating into because of the following reasons. Firstly, it is argued that international trade serves as a means by which technology, intermediate goods, and knowledge flows to developing countries. Developing countries do not have to create any new technology but gain from this spillover and thus experience higher growth rate. As Grossman and Helpman (1990, 1991) put it, 'imitation is easier than invention'. The component of trade (import of services) that captures such transaction should be looked at closely to ascertain its impact. A positive and significant coefficient could be that SSA countries are benefiting and that such import components should be encouraged. Secondly, as a group, developing countries are more dependent on foreign trade in terms of its share in national income than developed countries (Todaro and Smith, 2012). This dependency is mostly found in the area of merchandise export. But because of the issue of export earnings instability, developing countries could experience lower and less predictability rate of economic growth and thus no convergence. Data on world demand pattern shows that, in the case of primary products which are the major exports of developing countries, the income elasticity of demand is relatively low. That is a percentage increase in quantity of primary agricultural product and most raw materials demanded by importers will rise by less than the percentage increase in their GNI. Therefore, when income rise in developed countries, their demand for food and related products from developing countries goes up relatively slowly, where as demand for manufacturers goes up relatively faster. Moreover, the price elasticity of demand for primary product also tends to be quite low. Together these two elasticity elements contribute to what is known as export earning instability. Because of this, understanding the major components of trade will help policy makers in developing countries appreciate where trade should be concentrated to stimulate growth and accelerate convergence.

Thirdly, some researchers (Das, 2007 and Milanovic and Squire, 2005) have ascertained the relationship between trade and income inequality. It can be seen that if an economy has a relatively equal distribution of income, the gains of economic growth through trade permeates through the entire economy. Thus, via a trickle-down effect, improvements in prosperity reach different strata leading to partial or full eradication of poverty. However, if the economy maintains an unequal distribution, there would be imperfection in absorbing the gains of economic growth, as resources generated would bypass the poor in the economy (Das, 2007). Understanding trade and its component is therefore very important. Milanovic and Squire (2005) have found that for poor nations, tariff reduction on import is associated with higher inequality especially if the tariffs reduction affects merchandise import. But WTO (2013) report suggest an opposite view. That is increased import tariff can be an advantage to the importing country. That is when domestic firms respond to competitive pressure because of such importation by becoming more innovative in moving up the value chain provided they have built the necessary capacity. Therefore, the sign the import coefficient would help policy makers understand which policy to adopt to fully benefit from trade. Lastly, rising shares of international trade accounted for by developing economies are important features of the overall growth in international product and factor movement in recent years (WTO, 2013). Data from WTO shows that North-North trade has shrunk in the last 20 years (1990-2011) from 56% to 36% in merchandise export while those of North-South and South-South trade have expanded. According to UNCTAD, there are changing patterns of inward and outward FDI flows. From 1980 to 2011, developing economies attract proportionately more inward investment and account for a growing share of outward investment. These new patterns of international trade are creating new opportunities and threats for developing countries. It is against this that the components of trade needs to be studied so that any possible threat could be identified and dealt with.

Many researchers have tested the convergence hypothesis. Some have used cross- sectional, time series, and panel data methodologies. While some researchers found evidence in favour of the hypothesis, others found evidence against it. The problem with cross-sectional approach is that having just one data point for a country provides a weak basis for the convergence parameter according to Islam (2003). Again, there is too much heterogeneity across countries to confirm the assumption that cross-country data can be treated as multiple data of the same country. Another problem is the assumption of homogeneity in technological progress. To overcome these problems, the study will use the panel data methodologies, which would be discussed later.

The rest of the paper is arranged as follows. Section 1 gives the introduction, motivation, and objective of the study. In this section, the study shall explore the reason why international trade should be given such prominence in the test for convergence. Section 2 contains the literature review. Both theoretical and empirical literatures are given. This section also contains brief description of economic performance for SSA and High-Income Economics. Section 3 includes the methodology and results. Section 4 addresses the recommendation and conclusion.

2. Literature Review

2.1 Theoretical Perspective

The subject of convergence in general has attracted great attention and large academic literatures are available

(Sala-i-Martin, 2002; Islam, 2003 etc). Convergence in simple terminology is where developing countries grow faster than developed ones and thus will eventually catch up. This is because the Marginal Productivity of capital is higher in developing countries than in developed countries. Apart from the two traditional types mentioned previously, various empirical works have also resulted in other types of convergence. These types may have resulted from the use of different data types: time series, cross sectional or panel data. Other types of convergence that have resulted from these include sigma convergence, convergence within an economy vs. convergence across economies, convergence in terms of growth rate vs. convergence in terms of income level, global convergence vs. local or club-convergence, income-convergence vs. TFP convergence; deterministic convergence vs. stochastic convergence (Islam N, 2003, pp 312).

The convergence hypothesis is very important to the neoclassical growth model particularly Solow model (1956). The model indicates that if two countries (X and Y) are the same except for their initial per capita income, then these countries' growth will be the same at a long run equilibrium point. The figure below tries to explain the model.

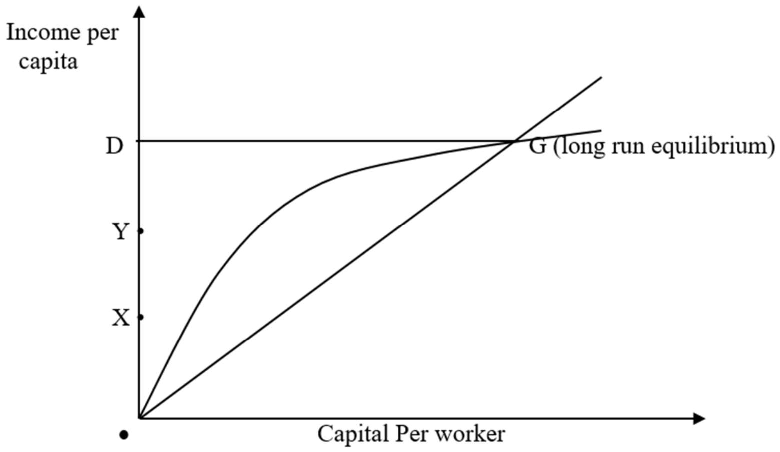

Figure 2: Absolute and Conditional convergence

Consider the explanation of absolute and conditional convergence from the diagram above. Point X in the figure indicates poor country's initial income per capita and point Y is rich country's initial income per capita. If the poor country's initial income per capita is OX, obviously that income is below the rich country's income OY, then the poor country should grow much faster because the poor country has higher marginal productivity and invite capital from abroad than the rich country so that both countries could have the same income per capita at point OD. More than that, when capital is scarce it is very productive, so national income will be large in relation to the capital stock, and this will induce people to save more to offset the wear and tear on existing capital. Thus, capital-deepening process will take place till the steady state level of capital per worker is reached. This is known as absolute convergence because it means that all countries/regions are converging to common steady state level of income.

But it must be noted that each country may have its own structural parameters. Such parameters are different for many countries and regions. Because of these differences, countries may not converge to a common level of per capita income but to their own steady state. These countries with lower income in relation to their steady state income tend to grow faster. This convergence is known as conditional convergence. Some literatures on convergence have however ignored some important variables in their respective analysis. One common conclusion could be drawn for all these studies. That is countries are independent of each other and that the issue of disaggregating trade in its various components among countries was not a major concern in the convergence debate. Are these assertions legitimate? Can the components of trade be ignored? This study shall seek to answer the question using two major trading blocs: Sub-Sahara Africa and High Income Economies.

2.2 Review of Previous Study (Convergence and Trade)

Basically, literatures on convergence have analyzed the subject using per capita incomes and have ignored the disaggregation of international trade into its various components. The reasons for this are not farfetched. Most of these literatures have the theoretical underpinning from the Solow Growth model which considers countries existing independently from each other (Acemoglu, 2007). Convergence arises from cross-country per capita income difference in rates of capital accumulation. Hence, international trade is not a contributing factor. However, the issue of convergence in relation to trade should be given a critical look. Many economists have proposed that with other things given, countries that have 'liberalized' their external sectors and have reduced restrictions to international trade will perform better than their counterparts that have failed to do so (Edward, 1991). But this view has been greatly challenged by other economists who claim that international trade can provide an avenue for developed countries to 'steal' developing countries natural resources, wreck its environment and treat it workers like slaves (Zhang, 2006, pp. 2). These two varying opinions come with their own underlining argument. For those groups that argue in favour of international trade and convergence, the benefits of trading with an advanced country include spillover effects, price parity, and human capital accumulation. For the group against the idea, the demerits of trading with advanced countries include non-protection of infant industries, factor endowments, export pessimism, and demographic transitions. Because countries do not exist independently from each other, international trade may drive any convergence process when considering convergence and trade on a whole. From the usual perspective in terms of Solow Growth model, international linkages do not matter, but from the trade perspective, they are everything.

Slaughter (1997) found some basic relationship between per capita income convergence and international trade. The study identified three ways by which international trade can affect per capita income convergence. The first means is that under certain circumstance, a country in free trade has factor prices equal to the rest of the world. This is known as Factor Price Equalization (FPE) theorem, but can only hold under a set of assumptions. The second means by which international trade causes income convergence is by reconciling international flows of technology. As technology flows from advanced to less advanced countries, the marginal productivity of technology in less advanced countries tends to be higher. The third means is through trade in capital goods. The study concludes that trade may have helped cause income convergence in Denmark, Ireland and United Kingdom and other EC's countries which was also consistent with Ben-David and Sachs and Warner.

Edward (1991) used cross-country data set to analyze the relationship between trade orientation, trade distortion, and growth. The work found evidence of faster growth for countries that have liberalized their international trade and relatively slower growth for countries that have trade distortion. A model presented in the paper showed that 'the rate of growth of aggregate output in a small country will depend negatively on the degree of trade distortion' pp. 10. Even though the convergence aspect is missing from this work, it still gives us some idea about international trade, rate of growth among countries and per-capita income convergence.

Zhang (2006) used Granger-causality and co integration approaches, to study the long-run relationship and two-way causal link between international trade and convergence in three trade blocs, EU, ASEAN and NAFTA. The work found evidence in favour of the International trade enhancing convergence. But there were some careful considerations. According to Zhang, the relationship between trade and convergence depends on the developmental stage of the countries studied. At certain developmental stage, international trade causes divergence but convergence beyond a particular developmental stage.

O'Rourke and Williamson (1999) found evidence for convergence in living standards among 17 OECD national economies. Scandinavian countries converge towards Western European countries. Ireland and Italy converged relatively faster whilst Portugal and Spain failed to converge. All these convergence happened in the 19th centuries and was ascribed to trade. Convergence quickened due to fast falling transport cost in Western Europe and in Asia due to liberal trade policies, which opened up the economies

Ben-David and Kimhi (2000) examined the impact of trade between countries on the changes in the rate of reduction in the size of the income gap that exists between countries. Export and Imports data were used as a criterion for determining bilateral trade between major trade partners. The authors thus created 127 pairs of countries based in export data and 134 pairs based on import data. The study found that an increase in trade between major trade partners especially increased exports by poorer countries is shown to be related to increased in the rate of convergence. Others researcher such as Sachs and Warner (1995); Ben-David (1996); Rassekh (1992); Helliwell and Chung (1990) and Matsuyama (1992) all found evidence in favour of trade-convergence relation.

On the contrary, others have found no real evidence. Notable among them are Wood and Ridao-Cao (1999). The authors used econometric analysis on 90 countries from 1960-1990 and confirmed the assertion that greater openness tend to cause divergence of secondary and tertiary enrolment rates between more-educated and less-educated countries. The divergence of these variables means that there would be divergence in human capital development that would eventually cause divergence in per-capita GDP.

Other researchers such as Singer (1950) and Dutt (1986) have all found evidence against trade and convergence. The general conclusion in these studies are that trade shifts the structure of production in the rich countries towards the sector which is of greater growth potential. For the poor countries trade shift the structure of production away from the sector which is of greater growth potential with faster technical progress. The policy implication is that poor countries should protect or promote sectors with more growth potential, an approach which many observers believe to have contributed to East Asia's exceptional success in catching up (Wood and Ridao-Cano, 1996).

There are also some researchers who have found mixed results (Parikh and Shibata, 2004; Cyrus, 2004). Parikh and Shibata (2004), considered whether international trade openness have resulted in the speeding up or slowing down of convergence of per capita real incomes in Africa, Asia and Latin America. In all, 14 Asian countries, 20 Latin American and 30 African countries were used in the study. The authors employed panel data methodology and concluded that liberalization has accelerated convergence in real per capita incomes to their regional income levels for Asian and Latin American economies while for African countries, liberalization seems to have diverged real per capita incomes from its mean level.

One common criticism for all these studies is that, the trade variable was made up of total exports and imports or sometimes an aggregation the two. But the point is, trade is made up of various components. These components are exports and imports of goods and export and imports of services to either SSA countries or high-income economies. A recommendation from Ben-David and Kimhi (2000) pointed to the fact that poorer countries should increase exports to increase the rate of convergence. But the question is should poorer countries increase export of goods or exports of services or both. Because the study and many others we have considered above did not disaggregate trade into its various components, answering such a question would be difficult. But we should note that export and imports of goods and or services have different degree of impact on growth convergence. This study therefore disaggregate trade into its various components to access which of the components has a greater effect on convergence and which one should be given less attention. This would help policy makers in decision making.

2.3 Sub-Sahara Africa Economic Performance

Sub-Sahara Africa includes oil-producing economies that have relatively high per-capita income and South Africa. Economic growth has generally been low averaging about 3.53 percent from 1960 to 2011 (WDI, 2012), even though there are years in which high growth rate have been attained. From 2004 to 2011, the region recorded an average growth rate of 5.1 percent showing strong potential and resilience to growth (Economic and Social Situation in West Africa in 2011-2012, 2013). This performance was as a result of recovery in prices of raw materials, the improvement of internal demand of countries, the exploitation of new natural resources and the recovery of some economies in West Africa. Basu et al (2000) reports that an increasing number of countries are showing indications of economic progress, that resulted from implementation of better economic policies and structural reforms. These countries have improved upon domestic and external financial imbalances, causing economic efficiency.

Inflation has averaged about 7.7 percent from 1960 to 2011. Thus the rate has generally being high. In 1994 inflation was 19.97 percent and averaged about 10.72 percent from 1973 to 1996. However, from 2000 to 2010, the rate was about 6.64 percent. From 1960 to 1972, inflation rate averaged about 3.4 percent (WDI, 2012). A simple overview of inflation rate depicts that 1960 to 1972 was a period of low rate, 1973 to 1996 was a period of high rate and 1997 to 2011 was also a period of relatively low rate.

Monetary policy is mainly marked by high interest rate in some countries under flexible exchange rate regime. This policy was to deal with the relatively high inflation rate. In 2012 credit to the private sector increased across the sub-region. Concerning public finances countries undertook the policy of re-absorption of budget deficit in 2011-2012 economic years. But deficit in some countries were worsening. The size of budget deficit largely explains the rise in ratios of public debt to GDP for most countries.

Economies in Sub-Saharan Africa countries have been fairly opened. Over the period from 1960 to 2011 international trade as a percentage of GDP has averaged about 55 percent. In 2008 rate was about 75.90 percent. Export of goods is basically made up of agrarian product and raw materials. UNEC for Africa report indicate that external trade, exports of Sub-Saharan countries have benefited from the rise in the world prices of raw materials up to the beginning of 2011. However, with the slowing of world trade in the second quarter of 2011, overall prices fell. Other reasons for the fall include rise in exports of goods and services in a much larger number of countries. These include Eritrea, Guinea, Niger and Central African Republic.

2.4 High Income Countries' Economic Performance

High-income countries form one of the richest economics in the world. It is made up of some of the world's richest nation notably Netherland, Germany and United Kingdom. Economic growth rate have averaged about 2.77 percent from 1960 to 2012 (WDI, 2013). Even though the richest, it has had its fair share of growth problems as characterized by other economies. For example in 2009, the economies grew at an average rate of -4.84 percent. It was as a result of the global economic problems in 2008. Other negative growth was attained in 1975, 1981 and 2008 with rates of -1.08, -0.13 and -0.03 percent respectively. Since then, growth has not been at the level of 1966-69. Per-capita GDP averaged about 29,207 dollars.

Inflation has generally being low for these economies. The rate has averaged 5.02 percent over the period from 1960-2012. In 2013 inflation was 1.38 percent. Again there are years where inflation has risen as high as 13.3 percent. This year was also characterized by high interest rate. Countries such as France and United Kingdom have had rate of 33.1 percent and 37.1 percent respectively. Reasons for such high rate include macroeconomic policy influence (the federal budget deficit in the United States), the impact of taxation (subjecting interest income to tax) and uncertainty about future inflation (Atkinson and Jean-Claude, 1985).

With regards to international trade, high income economies tend to trade more among themselves than sub-

Sahara Africa. Merchandise import and export to and from high-income countries as a total percentage of import and export was about 78.24 percent and 79.58 percent from 1960-2012. Within the same period import and export from sub-Sahara Africa was 2.6 percent and 2.35 percent respectively.

3 Methodology

3.1 Data

Data used was from World Development indicator (WDI, 2013) 1960 to 2012 and Standardized World Income Inequality Database, Version 3.0 from 1960 to 2009. The above span was selected due to constraints in data availability. Again, some countries in SSA and High-Income Economies were dropped because the World Inequality Data series were too short and had a lot of missing values. The study used 37 Sub-Saharan African countries and 31 High Income Countries (*see appendix for the list of countries*). The two time series in Granger-causality test are ratio variables. *GINI* is gini index of GDP per capita among the countries. The Gini index measures the area between the Lorenz curve and a hypothetical line of absolute equality, expressed as a percentage of the maximum area under the line. Thus, a Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality. Trade is the sum of exports and imports of goods and services measured as a share of Gross Domestic Product.

For the test for convergence, the variables are measured in the following ways. The share of investment in GDP is measured with Gross Fixed Capital Formation (GFCF) as a percentage of GDP. GFCF is Gross fixed capital formation includes land improvements, plant, machinery, and equipment purchases; and the construction of roads, railways, etc including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. Human capital development is measured with secondary school enrollment (% gross). Gross enrollment ratio is the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to the level of education shown. Secondary education completes the provision of basic education that began at the primary level, and aims at laying the foundations for lifelong learning and human development, by offering more subject- or skill-oriented instruction using more teachers that are specialized. Trade Openness is measured by export of goods and services as a percentage of GDP plus import of goods and services as a percentage of GDP.

In the trade-augmented test of convergence, the following is defined:

Merchandise exports to high-income economies are the sum of merchandise exports from the reporting economy to high-income economies according to the World Bank classification of economies. Data are expressed as a percentage of total merchandise exports by the economy. Merchandise imports from high-income economies are the sum of merchandise imports by the reporting economy from high-income economies according to the World Bank classification of economies. Data are expressed as a percentage of total merchandise imports by the economy Merchandise exports to developing economies in Sub-Saharan Africa are the sum of merchandise exports from the reporting economy to developing economies in the Sub-Saharan Africa region according to World Bank classification of economies. Data are as a percentage of total merchandise exports by the economy. Merchandise imports from developing economies in Sub-Saharan Africa are the sum of merchandise imports by the reporting economy from developing economies in the Sub-Saharan Africa region according to the World Bank classification of economies. Data are expressed as a percentage of total merchandise imports by the economy. Import of services refers to economic output of intangible commodities that may be produced, transferred, and consumed at the same time. Exports of services refer to economic output of intangible commodities that may be produced, transferred, and consumed at the same time.

Table 1: Descriptive Statistics of main variables

Statistics	**Variables**												
	Gini-Index	International Trade	GDP Per Capita	Investment	FDI	Human capital	Government Expenditure	ME_{SA}	MI_{SA}	ME_{HI}	MI_{HI}	ES	IS
Mean	44.23	73.38	8734.008	19.98	3.06	61.74	16.50	12.16	14.90	71.35	66.89	1.96	2.59
Median	45.07	62.87	10217.29	9.22	0.14	0.83	16.30	6.97	10.60	76.05	68.94	0.00	0.00
Standard Deviation	10.16	41.86	10439310	85.11	7.23	71.79	6.11	13.82	14.25	21.52	17.53	5.90	7.15
Variance	103.40	1752.35	1.81	8.33	52.27	38.48	37.36	190.94	203.20	462.99	307.24	34.84	51.08
Kurtosis	-0.09	3.28	1.43	0.17	53.78	1480.59	4.90	5.15	2.58	0.42	-0.26	5.35	4.08
Skewness	0.17	1.39	59251.33	140.83	4.23	-1.39	1.17	2.01	1.57	-0.96	-0.56	2.70	2.44
Range	52.41	327.21	132.82	-45.80	173.8	-0.09	62.35	91.54	78.02	98.82	86.36	23.44	26.45
Minimum	19.67	6.32	59384.16	95.03	-82.89	158.09	2.05	0.00	0.00	1.18	13.64	0.00	0.00
Maximum	72.08	333.53	3219	2668	91.00	1.06	64.39	91.54	78.02	100.00	100.00	23.44	26.45
Count	1733	3113	4734	3154	2467	1591	3021	1590	1657	1646	1675	1831	1966

Notes: The definition and explanation for each of these variables are given above. Starting from the second column, the variables are gini-index, trade, GDP per capita, investment, foreign direct investment, and government expenditure, merchandise export to SSA, merchandise import from SSA, merchandise export to high-income economies, merchandise import from high-income economies, export of services, and import of services.

3.2 Granger-Causality Test

This section uses current data for sub-Sahara Africa and High Income countries to find the causality between trade and convergence. The study test the following hypothesis: In case of north-south trade:

H_0: Convergence causes trade H_1: Convergence does not cause trade

H_0: Trade causes convergence H_1: Trade does not cause convergence

The most famous procedure used in causal relationship is the Granger-causality test (Granger, 1969). The basic idea is to test whether or not lagged values of one variable improve upon the explanation of another variable from its own past. But it must to noted that this test is carried out with the assumption of stationarity between the variables. When this assumption is violated, the stability condition of vector autoregression is not met and that the test in not valid. Thus, the study performs the stationarity test using Im, Pesaran and Shin W-Stat and PP-Fisher test. The reason for choosing these tests is the unbalanced nature of data used. These tests are confirmed with Hadri Z-Stat. When non-stationarity is present in the series, the cointegration approach and Vector Error Correction Model (VECM) is used. Otherwise, the Vector Autoregression (VAR) model is used. The following estimation of causality under stationarity series is done

$$GINI_{i,t} = a_1 + \sum_{k=1}^{n} \rho_k \, GINI_{i,t-k} + \sum_{k=1}^{q} \varphi_k TRA_{i,t-k} + \varepsilon_{i,t} \quad (1)$$

$$TRA_{i,t} = a_2 + \sum_{k=1}^{n} \rho_k \, GINI_{i,t-k} + \sum_{k=1}^{q} \varphi_k TRA_{i,t-k} + \varepsilon_{i,t} \quad (2)$$

Where GINI is Gini index and TRA is trade. Engle and Granger (1987) pointed out that when a linear combination of two or more non-stationary time series is stationary, then the stationary linear combination could be interpreted as a long-run equilibrium relationship between the variables. In other words if two $I(1)$ variables are cointegrated, then some linear combination of them is $I(0)$. However, this does not determine the direction of causality. To do that, the VECM that include the cointegrating relations is estimated. When the test of non-stationary and cointegration relationship exist, the following two equation of VECM is estimated to investigate causality

$$\Delta GINI_{i,t} = a_1 + b_c ect_{i,t-1} + \sum_{k=1}^{n} \rho_k \, \Delta GINI_{i,t-k} + \sum_{k=1}^{q} \varphi_k \Delta TRA_{i,t-k} + \varepsilon_{i,t} \quad (3)$$

$$\Delta TRA_{i,t} = a_2 + b_T ect_{i,t-1} + \sum_{k=1}^{n} \rho_k \, \Delta GINI_{i,t-k} + \sum_{k=1}^{q} \varphi_k \Delta TRA_{i,t-k} + \varepsilon_{i,t} \quad (4)$$

Where $\Delta GINI$ and ΔTRA are first difference of GINI index and Trade respectively, ect is error-correction term, $a, b, \rho \ and \ \varphi$ are parameters and ε is the error term

3.3 Convergence Hypothesis Test

This section follows Mankiw, Romer and Weil (1992) methodology of augmenting the traditional Solow model with human capital i.e (HC-ASM). The study further augments this model with the components of trade. Human capital contributes positively and strongly to productivity in the same way as physical capital accumulation and thus be regarded as an important input of production. The basic assumptions of the HC-ASM include constant returns to scale production function with diminishing returns to inputs and a closed economy i.e. “each country is an island”. This assumption enables us to analyze the behavior of each economy as a self-standing Solow-model. Based on these assumptions, the general forecast is that when differences in population growth, saving or investment rates 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. A further assumption is that differences in initial capital-labour endowments would be eliminated over time and that along an economy’s transition path growth rate is negatively proportional to the capital-labour ratio. In this work, the “each country is an island” assumption is violated by the inclusion of international trade in the model.

The model starts with the Cobb-Douglas production function of the form

$$\bar{Y} = A(t)K(t)^{\alpha}H(t)^{\beta}L(t)^{1-\alpha-\beta} \qquad 0 < \alpha, \beta < 1 \quad (5)$$

Where $\bar{Y}$ = Total output, *H*= Stock of human capital, *K* = stock of physical capital, *L* = units of labour, A = efficiency parameter, measuring technology and knowledge, α = output elasticity of physical capital, β= output elasticity of labour, $1 - \alpha - \beta$ = output elasticity of labour. Another assumption is that L and A grow exogenously at rate *n* and *g* such that

$$L(t) = L(0)e^{nt} \quad (6)$$

$$A(t) = A(0)e^{gt} \quad (7)$$

The fraction of output, s invested in physical capital stock (K) and human capital stock (H) are assumed to grow as follows

$$g(K) = s_k Y - \delta K \quad (8)$$

$$g(H) = s_h Y - \delta H \quad (9)$$

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, δ = rate of depreciation of both physical and human capital stocks (both are assumed to depreciate at the same rate). The evolution of the economy is determined as

$$\dot{k}(t) = s_k y(t) - (n+g+\delta)k(t) \quad (10)$$

$$\dot{h}(t) = s_h y(t) - (n+g+\delta)h(t) \quad (11)$$

$$y = k^{\alpha}h^{\beta} \quad (12)$$

Where k is 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, $y = Y/AL$, $\dot{k}(t)$ = evolution of physical capital per effective labour, $\dot{h}(t)$ = evolution of human capital per effective labour, n = population growth rate, g = growth rate in technology, δ = rate of depreciation of both physical and human capital and t = time (measured in years).
Solving the model for steady state values of *y, k* and *h* gives the following

$$y^* = \left\{\frac{s_k}{n+g+\delta}\right\}^{\frac{\alpha}{1-\alpha-\beta}} \cdot \left\{\frac{s_h}{n+g+\delta}\right\}^{\frac{\beta}{1-\alpha-\beta}} \quad (13)$$

$$k^* = \left\{\frac{s_k}{n+g+\delta}\right\}^{\frac{1-\beta}{1-\alpha-\beta}} \cdot \left\{\frac{s_h}{n+g+\delta}\right\}^{\frac{\beta}{1-\alpha-\beta}} \quad (14)$$

$$h^* = \left\{\frac{s_h}{n+g+\delta}\right\}^{\frac{1-\alpha}{1-\alpha-\beta}} \cdot \left\{\frac{s_k}{n+g+\delta}\right\}^{\frac{\alpha}{1-\alpha-\beta}} \quad (15)$$

Where k^*, h^*, y^* are steady state value of physical capital per effective labour, human capital per effective labour and steady state value of output per effective labour. To obtain an expression for per capita GDP, steady state output per effective labour is put into the production function (5) to obtain

$$ln\left(\frac{\bar{Y}}{L}\right)^* = lnA(0) + gt + \frac{\alpha}{1-\alpha-\beta}lns_k + \frac{\beta}{1-\alpha-\beta}lns_h - \frac{\alpha+\beta}{1-\alpha-\beta}\ln(n+g+\delta) \quad (16)$$

Since A is total factor productivity at a given time and is also country specific variable which could be time variant or invariant it is decomposed into $lnA(0) = \varphi + \mu$,where μ is a country-specific shock which gives

$$ln\left(\frac{\bar{Y}}{L}\right)^* = \varphi + \frac{\alpha}{1-\alpha-\beta}lns_k + \frac{\beta}{1-\alpha-\beta}lns_h - \frac{\alpha+\beta}{1-\alpha-\beta}\ln(n+g+\delta) + \mu \quad (17)$$

Where $ln\left(\frac{\bar{Y}}{L}\right)^*$ is the log of real per capita income, φ 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), μ_{it} is country-specific shock, *i* measures cross-section of countries and *t* measures time. To test for convergence Solow introduced an initial per capita income to the right hand side of the equation and stated that the sign of the coefficient determines whether there is convergence or divergence. Modify equation 3.13 to be

$$ln\left(\frac{\bar{Y}}{L}\right)^* = \varphi + \omega PC(0)\frac{\alpha}{1-\alpha-\beta}lns_k + \frac{\beta}{1-\alpha-\beta}lns_h - \frac{\alpha+\beta}{1-\alpha-\beta}\ln(n+g+\delta) + \mu \quad (18)$$

Where $\omega PC(0)$ is the log of real income per capita at some initial time (0), $\omega < 0$ implies convergence.

3.3.1 Model Specification 1 (HC-ASM)

The estimable equation from equation 1.18 is specified as follows,

$$Y_{it} = b + \delta Y_{i,t-1} + b_3 INY_{i,t} + b_4 HC_{i,t} + \mu_{i,t} \quad (19)$$

Where $Y_{it,}$ is the average of yearly annual growth rate of real per capita income, $Y_{i,t-1}$ is the lagged dependent variable introduced to test for convergence, INY_{it} is the share of investment in GDP, HC_{it} human capital development and μ_{it} is the error term. The HC-ASM equations which will be used to test the convergence hypothesis for SSA and High Income Economies is given as

$$Y_{it} = b + \delta Y_{i,t-1} + b_3 INY_{i,t} + b_4 HC_{i,t} + b_5 FDI_{i,t} + b_6 GE_{i,t} + b_7 IT_{i,t} + \mu_{i,t} \quad (20)$$

Where FDI_{it} is the share of Foreign Direct Investment as a percentage of GDP, GE_{it} is the share of government expenditure as a percentage of GDP and IT_{it} is Trade openness, which include export and import of goods and services as a percentage of GDP.

The study shall undertake the first part of the estimation with dynamic panel technique using Arellano-Bond (Difference GMM) and Arellano-Bover (System GMM) in xtabond command line and also include both difference and system GMM in xtabond2 command line. The basic estimation methodologies in panel data are Fixed Effect (FE) and Random Effect (RE) procedures. A comparison among the estimators is carried out to assess which one best satisfies equation 3.20. Fixed Effect is used under an assumption that the unobserved cross-country heterogeneity is correlated with the regressors included in the model.

The fixed effect is used whenever one is interested in analyzing the impact of variables that vary over time. It searches for the relationship between predictor and outcome variables within an entity (countries). Each entity has its own individual characteristics that may or may not influence the predictor variables (Torres-Reyna O, 2007). One major assumption of the fixed effect is that the unobserved cross-country heterogeneity is correlated with the regressors included in the model. The fixed-effect model controls for all time-invariant difference between the individual countries, so the estimated coefficient of the fixed-effects models cannot be biased because of omitted time-invariant characteristics. Another assumption of this procedure is that those time-invariant characteristics are unique to the individual and should not be correlated with other individual characteristics. Each entity is different therefore the entity's error term and the constant should not be correlated with the others. One disadvantage of the fixed-effect is that they cannot be used to investigate time-invariant causes of the dependent variables. Random effects on the other hand assume that the entity's error term is not correlated with the predictors which allows for time-invariant variables to play a role as explanatory variables. When using this procedure, those individual characteristics that may or may not influence the predictor variables are specified. The rationale behind random effects model is that, unlike the fixed effects model, the variation across entities is assumed to be random and uncorrelated with the predictor independent variables included in the model. One advantage of the random effects is that it include time invariant variables. In fixed effects model these variables are absorbed by the intercept.

The choice between the use of fixed and random effects have enjoyed long-standing debate. While some argue in favour of the use of fixed effects, others argue in favour of the use of random effect. Both panel fixed effect and random effects estimates suffer from two well known problems: on the one hand they do not allow the estimation of time invariant (or rarely changing) variables, such as institutional variables; on the other hand they do not properly address the issue of endogeneity of some relevant variables. Both these issues, in particular the endogeneity problem is addressed by the use of dynamic panel estimator. Because of an introduction of the lag term in the equation, the study proceeds with the estimation using dynamic panel.

But the data used is an unbalanced panel data and thus a one way unbalanced error component model is estimated and compared with equation 3.20. Such comparison will be useful and reveals whether or not the missing values greatly affect the coefficients and standard errors. This is because Baltagi (2008) stated that when the missing values are not much relative to the data, then unbalanced panel data is not really a problem. The estimation of unbalanced panel follows the Swamy-Arora estimator. This is given as follows

$$Y_{i,t} = b + \delta Y_{i,t-1} + b_3 INY_{i,t} + b_4 HC_{i,t} + b_5 FDI_{i,t} + b_6 GE_{i,t} + b_7 IT_{i,t} + \mu_{it} \quad (21)$$

Where all variables are already explained as before and

$$\mu_{it} = \chi_i + \epsilon_{it}$$

Where χ_i denotes the *ith* unobservable country specific-effect

3.3.2 Model Specification 2 (HC-ASM Extended for Trade Openness)

The difference in methodology of this work as compared to previous literatures is the decomposition of International trade into components that actually represent the concept and not just trade openness. Measurement of International trade include merchandise export to high-income economies as a percentage of total merchandise export, merchandise import from high income economies as a percentage of total merchandise imports, merchandise export to developing economies in sub-Sahara Africa as a percentage of total merchandise export, merchandise import from developing economies in sub-Sahara Africa as a percentage of total merchandise import, import of service and export of service.

Starting from equation (20) replace IT by the following ME_{HI}, MI_{HI}, ME_{SA}, MI_{SA}, IS, ES. International Trade (IT) in equation 3.20 has been decomposed into 6 variables

$$Y_{it} = b + \delta Y_{i,t-1} + b_3 INY_{i,t} + \ + b_5 HC_{i,t} + b_6 FDI_{i,t} + b_7 GE_{i,t} + b_8 ME_{HI\,i,t} + b_9 MI_{HI\,i,t} + b_{10} ME_{SA\,i,t} + b_{11} MI_{SA\,i,t} + b_{12} IS_{i,t} + b_{13} ES_{i,t} + \mu_{it} \quad (22)$$

Where, ME_{HI} is merchandise export to high-income economies, MI_{HI} is merchandise import from high income economies, ME_{SA} is merchandise export to developing economies in sub-Sahara Africa, MI_{SA} is merchandise import from developing economies in sub-Sahara Africa, IS is log (natural) of import of service and ES is log (natural) of export of service. Again a one way unbalanced error component model is estimated and compared with equation 3.22.

$$Y_{i,t} = b + \delta Y_{i,t-1} + b_3 INY_{i,t} + b_4 HC_{i,t} + b_5 FDI_{i,t} + b_6 GE_{i,t} + b_8 ME_{HI\,i,t} + b_9 MI_{HI\,i,t} + b_{10} ME_{SA\,i,t} + b_{11} MI_{SA\,i,t} + b_{12} IS_{i,t} + b_{13} ES_{i,t} + \mu_{it} + \mu_{it} \quad (23)$$

Where all variables are already explained as before and

$$\mu_{it} = \chi_i + \epsilon_{it}$$

Where χ_i denotes the *ith* unobservable country specific-effect

4. Empirical Results, Analysis and Discussions

4.1 Granger causality test

Before this test is performed, the stationarity or otherwise of the data is tested for. There are unit root test for panel data. Some of the test are suitable for balanced panel namely Levin-Lin-Chu (2002), Harris-Tzavalis (1999), Breitung (2000; Breitung and Das 2005). While others are suitable for unbalanced panel namely Im-Pesaran-Shin (2003) and Fisher-type (Choi 2001) tests. But all tests have the null hypothesis that the panel contains a unit root. But Hadri (2000) Lagrange multiplier (LM) test has a null hypothesis that the panel is stationary. Because our panel is unbalanced, the study used Im-Pesaran-Shin (2003) and Fisher-type (Choi 2001) and verifies the results with Hadri (2000) Lagrange multiplier (LM) test.

According to the Im-Pesaran-Shin, Fisher-type test, and Hadri test, the statistics for Gini-index series is statistically significant. Thus, the test reject the null of unit root and accept the alternative of no unit root for Im-Pesaran-Shin and Fisher-type test. But the null of no unit root is accepted and the alternative of unit root is rejected for the Hadri (2000) test. The same can be said for the trade series. Please refer to Table III and IV in the appendix. The study therefore test the vector autoregression model. In estimating the VAR model, lag length three (3) is chosen because it has the smallest AIC and SIC values of 10.8166 and 10.8784. Lag length 1 and 2 had higher AIC and SIC values. Please see table V in the appendix for results on lag length.

Based on the VAR equation, the grange-causality test is run. The test results are displayed in table 2. The results show that the coefficient of the lag of trade in the first equation is statistically significant at 10 percent level of significance and that of the lag of gini index in the second equation is not statistically significant. The conclusion therefore is that there is unidirectional causality between convergence and trade. That is, trade granger causes convergence but convergence does not granger causes trade. This result is consistent with Zhang (2006) using three trade blocs (EU, ASEAN and NAFTA). But further stated the trade-convergence relation depends on the developmental stage of the countries studied.

Table 2: Results of Granger-causality test for Trade and Gini-Index

Dependent Variable: Gini-Index

Variable	Chi-square	df	Prob
TRA_1	8.6311	3	0.0346***
ALL	8.6311	3	0.0346***
Dependent variable: TRA			
GINI_1	4.7597	3	0.1903
ALL	4.7597	3	0.1903

***Statistically significant at 10% level of significance

Source: Author's Estimate (2017)

The implication is that trade Agreement that seeks to increase trade between the two groups of economies will benefit SSA as it reduces the income gap. Based on this, any trade agreement that seeks to reduce openness can possibly cause divergence. The results support the finding that developing countries benefit from trade with rich countries. Therefore, international trade decreases the gap between the rich and poor countries.

4.2 Model Specification 1 (HC-ASM)

Before model specification 1 is tested, the stationarity of all variables was verified. The results are shown in table VI in the appendix. The result reveals that all variables with the exception of IT_{it}, MH_{HI}, IS and ES are stationary at the level form. The variables mentioned above that are not stationary at level form are stationary at first difference. Table 3 shows four equation estimations. These are Arellona-Bond, Arellona-Bover (xtabond), an improved version of these two estimates called xtabond2 by Roodman M. D., (2014) and an unbalanced one-way error component.

Table 1: Results of Four Equations namely Arellona-Bond, Arellona-Bover (xtabond), improved version of these two estimates called xtabond2 and an unbalanced one-way error component.

Variables	Arellano-Bond (xtabond) Difference GMM	Arellano-Bover (xtabond) System GMM	xtabond2 (Difference and System GMM)	Swamy-Arora Estimator (Unbalanced Panel Estimation)
$Y_{i,t-1}$	-0.1519 {0.000}***	-0.1477 {0.000}***	-0.1881 {0.000}***	-0.2313 {0.000}***
INY_{it}	0.0824 {0.000}***	0.0828 {0.000}***	0.0807 {0.000}***	0.0893 {0.000}***
HC_{it}	0.0194 {0.830}	-0.1547 {0.859}	0.1940 {0.306}	0.1916 {0.001}***
FDI	-0.0531 {0.618}	-0.0612 {0.002}***	-0.0169 {0.379}	-0.024 {0.212}
GE	-1.3781 {0.000}***	-0.1570 {0.000}***	-0.1441 {0.000}***	-0.0692 {0.000}***
IT	0.0299 {0.000}***	0.2965 {0.000}***	0.0185 {0.001}***	0.0111 {0.000}***
Constant	-0.1728 {0.825}	0.2965 {0.665}	0.1413 {0.768}	-0.799 {0.019}**

Figures in {} indicates p-value *** statistically significant at 1% level of significance ** statistically significant at 5% level of significance

Source: Author's Estimate (2017)

The main difference between xtabond2 and xtabond is that xtabond2 employs both the difference and system GMM. Roodman (2014) noted that the Arellano-Bond estimators have one and two-step variants. Though asymptotically more efficient, the two-step estimates of the standard errors tend to be severely downward biased. Therefore, to correct for this, xtabond2 offers a finite-sample correction to the two-step covariance matrix derived by Windmeijer (2000). This can make two step robust more efficient than one-step robust, especially for system GMM. However, since the data is unbalanced, an unbalanced panel data estimation was done and compare the results. Before the coefficients were interpreted, a diagnostic test of the three dynamic models was conducted. The Sargan test of over identifying restriction reveals an acceptance of the null hypothesis. This means the restrictions are not valid. If these restrictions are not valid, the result could be spurious. This may be due to the unbalanced nature of the panel. A comparism of the results shows that the unbalanced one-way error component has more statistically significant coefficient and relatively smaller standard errors. For example, the standard error of INY_{it} is 0.017 and 0.016 for difference and system GMM, while it is 0.015 for the unbalanced panel. Again, the standard error for It_{it} variable is 0.008, 0.029 and 0.004 for difference, system and xtabond2 respectively while it is 0.002 for the unbalanced panel results. Please refer to the appendix of table VII, VIII, IX and X. Comparing the three GMM test with the unbalanced panel test, the results is interpreted using Swamy-Arora test.

From table 3 column 5, the co-efficient of the lagged dependent variable is -0.2313 and statistically significant. This supports the theory of convergence meaning SSA countries are catching up with high-income economies in terms of economic growth. The coefficient of investment is statistically significant and positive. This means investment has a positive impact on economic growth. Human capital has a positive coefficient and statistically significant. This result is in line with Asongu (2013) who found that Human Development Index also measured by human capital aids in the convergence process for 38 Africa countries but also stated that this variable moves slower than others do. Khan (2014) also found similar results for 32 African countries over the period 1960-2008. Government expenditure has a negative impact of growth and this is possibly because recurrent expenditure forms a large proportion of government expenditure. FDI is negative but not statistically significant. This may be because of the fact that the negative impact of FDI, i.e. industrial dominance, technological dependence, disturbance of economic plans and profit repatriation outweighs the positive impact.

Trade openness that is the focus of study is positive and significant confirming our initial test of causality that trade causes convergence. This further supports the work of Slaughter J.M (1997), Edward S., (1991), O'Rourke, and Williamson (1999) and Ben-David and Kimhi (2000). This makes an important case for trade agreements between the two groups of countries as it will further increase trade and led to more openness. The various components of trade openness was assessed in model 3

4.3 Model Specification 2 (HC-ASM Extended for Trade Openness)

The results of model 2 from three estimations are displayed in table 4. This helps us to compare the sign of coefficient and level of significance.

Table 2: Results of three Equations namely Arellona-Bond, Arellona-Bover (xtabond), and an unbalanced one-way error component.

Variables	Arellano-Bond (xtabond) Difference GMM	Arellano-Bover (xtabond2) System GMM	Swamy-Arora Estimator (Unbalanced Panel Estimation)
$Y_{i,t-1}$	-0.052 {0.084}**	-0.0511 {0.035}**	-0.1122 {0.000}***
INY	0.1188 {0.000}***	0.1111 {0.000}***	0.0993 {0.000}***
HC	0.1676 {0.212}	0.106 {0.420}	0.1386 {0.234}
FDI	-0.1341 {0.000}***	-0.1440 {0.000}***	-0.0206 {0.059}**
GE	-0.1146 {0.009}***	-0.1087 {0.009}***	-0.0905 {0.003}***
ME_{SA}	0.0047 {0.815}	0.0043 {0.827}	0.0025 {0.874}
ME_{HI}	0.1348 {0.358}	-0.0118 {0.397}	0.0074 {0.000}***
MI_{SA}	-0.0211 {0.468}	-0.0041 {0.881}	-0.0255 {0.156}**
MI_{HI}	-0.0728 {0.001}***	-0.0711 {0.001}***	-0.0313 {0.077}*
ES	1.1229 {0.159}	-1.057 {0.175}	0.5246 {0.053}**
IS	-1.0796 {0.159}	-1.0254 {0.172}	-0.5521 {0.000}***
Constant	5.843 {0.003}***	5.5308 {0.002}***	2.5551 {0.059}**

Figures in {} indicates p-value *** statistically significant at 1% level of significance ** statistically significant at 5% level of significance * statistically significant at 10% level of significance
Source: Author's Estimate (2017)

Before the results are interpreted, diagnostic tests were conducted for the dynamic panel estimation. The Sargan test of over identifying restriction again revealed that the restrictions are not valid. This could cause the results to be spurious. This may be because of unbalanced panel data. The severity of unbalanced data was evidenced by results displayed in xtabond2 which combines both system and difference GMM (*check table XIII at the appendix*). However, the results from unbalanced panel data estimation were much better in terms of significant coefficients and smaller standard error. For example, the standard error for GE variable is 0.043 and 0.041 for difference and system GMM respectively but that for the unbalanced panel is 0.030. Again the coefficient for the IS variable is 0.766 and 0.750 for difference and system GMM respectively but that for the unbalanced panel is 0.151. Please refer to table XI, XII and XIV in the appendix.

Table 4 column 4 shows the results of the unbalanced panel. All the other variables had the same sign as before. The coefficient of investment is statistically significant and positive. Human capital has a positive coefficient but not statistically significant. Government expenditure has a negative impact of growth. FDI is negative and statistically significant. The table further shows that all export coefficients are positive but that of merchandise export to SSA countries is not significant. This means, that component of trade does not have significant impact on the economies of SSA. Because economies of SSA produce virtually primary products that are not differentiated and a few produces semi-finished and finished goods, trade among themselves does not really benefit each other mutually. This defeats the assertion of Linder's Overlapping Product Ranges that economies with similar per capita income tend to trade with each other and benefits from such trade activities. The co-efficient of export of service is positive and statistically significant. This result is consistent with Ben-David and Kimhi (2000). The authors found that exports by poorer countries to richer countries increase the rate of convergence. Thus under any trade agreement, SSA should concentrate on the export of service as that would benefit such countries.

The coefficients of import are all negative and statistically significant. This indicates that import does not benefit SSA under trade agreements. But SSA countries cannot band importation as it is binding under such agreement. Therefore, SSA countries should find means of negating the impact of import by concentrating on increasing merchandise export and increasing export of services. Secondly, SSA countries can concentrate on importing capital goods that could have an immediate negative impact but a future positive impact on growth.

Thirdly, this negative coefficient means that domestic firms in SSA have not yet responded to competitive pressure from industries in High Income economies, have not become more innovative in moving up the value chain of their products, and have not built the necessary capacity to compete effectively. Instead of seeing the negative coefficient of imports as an challenge, it could be used as a measure of the performance of domestic industries. Therefore, the sign of import coefficient would help policy makers understand which policy to adopt to fully benefit from trade

5.0 Conclusion and Policy Recommendation

The following conclusion can be drawn from the results presented. First, there is unidirectional causality between convergence and trade: that is trade causes convergence but convergence does not cause trade. Secondly, the convergence hypothesis holds for SSA countries and high-income economies used in the study. Thirdly, investment, human capital, and trade openness have positive impact on growth while foreign direct investment and government expenditure have negative impact on growth. The expected sign for FDI was positive but a negative sign still means that the negative impact of FDI outweighs the positive impact.

In the model of HC-ASM extended for trade, the coefficients of all export components are positive and significant with the exception of merchandise export to SSA. The co-efficient of all import components are negative and significant. Based on these results, SSA countries can go ahead and sign unto trade agreement such as Economic Partnership Agreement with the following recommendation in mind. Close attention could be paid to exports especially, the export of service since it has a greater magnitude of impact than export of goods. Increasing export of service can go a long way to negate the negative impact that will result from such trade agreement. This recommendation is in line with Patel (2007). Patel (2007) noted that there is certain sub-sector where commitments have already been made under the General Agreement on Trade and Services (GATS). Under this arrangement, SSA countries are enjoying restriction in certain sub-sectors such as tourism and related services, maritime transport; construction; education; financial services and telecommunications. What these restrictions do is that it reduces the import of services. Other suggested restrictions SSA can push for under the EPA is in the area of ability to use precautions and to influence the market access for foreign firms through limitations on: the number of suppliers; the total value of transactions; the number of services operations; the number of persons to be employed; the types of legal entity permitted and the share of foreign capital. Again, SSA could under the same arrangement agree to liberalize sub-sectors where there is lack of capacity and an unlikely quick development pace. These sub-sectors could include the automobile sectors, aviation sectors and Oil refinery. All of these sectors could be looked at again. Where restrictions are, SSA countries should strive to deepen the restrictions and take full advantage of it. Where there are no restrictions but lack development, SSA countries should look at more liberalization for these sectors to be developed and contribute to growth.

Service subsector that needs consideration includes tourism. Figure 2 to 13 at the appendix show a bar chart of tourism direct contribution to GDP in US $billion for some selected SSA countries from 1990 to 2014. From the figures, tourism direct contribution has been increasing over the period consistently. Exploring all avenues in the tourism sector can bring in needed growth under the trade agreements.

Again, governments in SSA countries could look at the possibility of exporting other services such as trained professional such as nurses because of their inability to absorb these professional. Studies have shown that elsewhere in other parts of the world such as Philippians, about 800million dollars is made from exporting health professionals (Willis-Shattuck, 2008). South Africa is the export business making millions of dollars each year (Chen and Boufford, 2005). Others SSA countries could also start similar programs whiles expanding the training of more health professionals. Farrell and Grant (2005) reports that there is shortage of English teachers in China which is affecting services delivery. Meanwhile, so many professionally trained English teachers in SSA are without jobs. These teachers could be exported to China and other Asain countries caught in this problem for foreign exchange. This easily sparks the argument of brain drain. But Shafqat and Zaidi (2005) noted that ‘simply forcing qualified physicians to stay put in impoverished societies where they cannot be absorbed will have little impact on the health of the world's poor'. In any case, these trained professionals especially in the health sector still leave SSA at a fast rate. For instance, Mensah et al (2005) reported that from 1995 to 2005 Ghana lost 50 percent of its professional nurses to Canada, United Kingdom, and USA. It is estimated that at least 5000 South African doctors left the country in 2002. Further, it is estimated that 300 nurses leave the country every month. The situation in Zambia is no different. A study conducted in 2003 by USAID indicates that, of 600 doctors trained after independence, only 50 remained in the country. Measures undertaken by these countries to halt such phenomena have all failed. So if these professionals will eventually leave after training, why not expand the facilities used in training them so that more could be trained and exported for the countries to gain.

In the area of communications, SSA countries have liberalized and that has seen a major expansion in that sub-sector. Voice telephone (local, long distance & international), data transmission services, telexes and faxes, Mobiles (data services, paging, etc), telecommunication equipment sales, telecommunication equipment rentals, maintenance, connection, repair and consulting have all been on the rise. There are still improvement that could be made in the aspects of mobile phone assembly and manufacturing plants.

In the area of construction and engineering services SSA countries can push for restrictions on general construction work for buildings and engineering work. But should liberalize installation and assembly work. Other areas that need liberalization may include aviation, oil refinery, automobile, railway system, electronics etc.

Lastly, because SSA countries cannot stop high-income countries from exporting, then the export volumes of SSA countries should be higher than import volumes for SSA to access the full benefits of trade. Anything short of that will plunge SSA development into serious problems. Not only is the recommendation considering increasing volumes, but processing activities should be carried out to increase the monetary value to goods exported.

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APPENDIX

Table I: List of Sub-Sahara African Countries used in the study

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

Table II: List of High Income Economics used in the study

Germany	Romania	Hungary	Sloviakia	Estonia
United Kingdom	Netherlands	Sweden	Ireland	Cyprus
France	Belgium	Austria	Croatia	Luxembourg
Italy	Greece	Bulgaria	Lithuania	Malta
Spain	Czech Republic	Denmark	Slovenia	Japan
Poland	Portugal	Finland	Latvia	Canada
United States				

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Table III: Results of Unit Roo Test

Null Hypothesis: Unit root (individual unit root process)
Series: GINI
Date: 04/01/16 Time: 17:05
Sample: 1960 2012
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length section based on SIC: 0 to 9
Total number of observations: 1262
Cross-sections included: 55 (13 dropped)

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-2.57356	0.0050
PP - Fisher Chi-square	162.752	0.0028
PP - Choi Z-stat	-0.19883	0.4212
Hadri Z-stat	15.3569	0.0000
Heteroscedastic Consistent Z-stat	12.8201	0.0000

** Probabilities are computed assuming asympotic normality

Table IV

Null Hypothesis: Unit root (individual unit root process)
Series: TRA
Date: 04/01/16 Time: 17:27
Sample: 1960 2012
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 9
Total number of observations: 3022
Cross-sections included: 68

Method	Statistic	Prob.**
Im, Pesaran and Shin W-stat	-2.07282	0.0191
PP - Fisher Chi-square	226.254	0.0000
PP - Choi Z-stat	-1.02861	0.1518
Hadri Z-stat	28.7404	0.0000
Heteroscedastic Consistent Z-stat	22.0227	0.0000

** Probabilities are computed assuming asympotic normality

Table V

Vector Autoregression Estimates
Date: 04/01/16 Time: 17:41
Sample (adjusted): 1963 2008
Included observations: 1141 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	GINI	TRA
GINI(-1)	1.328469	-0.195516
	(0.02540)	(0.12888)
	[52.2920]	[-1.51700]
GINI(-2)	-0.298332	0.293201
	(0.03888)	(0.19723)
	[-7.67380]	[1.48660]
GINI(-3)	-0.058004	-0.134836
	(0.02304)	(0.11689)
	[-2.51747]	[-1.15353]
TRA(-1)	-0.011976	0.831266
	(0.00549)	(0.02785)
	[-2.18122]	[29.8440]
TRA(-2)	0.019167	-0.016351
	(0.00707)	(0.03585)
	[2.71225]	[-0.45606]
TRA(-3)	-0.005790	0.198256
	(0.00542)	(0.02752)
	[-1.06741]	[7.20498]
C	1.152311	2.008782
	(0.22166)	(1.12451)
	[5.19863]	[1.78637]
R-squared	0.976581	0.961242
Adj. R-squared	0.976457	0.961037
Sum sq. resids	2905.831	74788.39
S.E. equation	1.600769	8.121020
F-statistic	7881.387	4687.444
Log likelihood	-2152.320	-4005.272
Akaike AIC	3.784961	7.032905
Schwarz SC	3.815879	7.063823
Mean dependent	45.19553	69.02904
S.D. dependent	10.43276	41.14200
Determinant resid covariance (dof adj.)		168.7840
Determinant resid covariance		166.7194
Log likelihood		-6156.874
Akaike information criterion		10.81661
Schwarz criterion		10.87844

Table VI: ***(Stationarity Properties for all Variables)***

Variables	Test type	Statistic	Prob
Y_{it}	IPS	-33.9828	0.0000**
	PP	1338.36	0.0000**
	Hadri	5.91604	0.0000**
INY_{it}	IPS	-6.2835	0.0000**
	PP	245.609	0.0000**
	Hadri	9.3303	0.0000**
HC_{it}	IPS	-14.5071	0.0000**
	PP	302.262	0.0000**
	Hadri	22.3096	0.0000**
FDI_{it}	IPS	-10.4702	0.0000**
	PP	600.028	0.0000**
	Hadri	11.2470	0.0000**
GE_{it}	IPS	-5.3658	0.0000**
	PP	213.838	0.0000**
	Hadri	23.7011	0.0000**
IT_{it}	IPS	0.4875	0.6871
	PP	153.805	0.1410
	Hadri	30.4656	0.0000**
ΔIT_{it}	IPS	-53.5429	0.0000**
	PP	2228.99	0.0000**
ME_{HI}	IPS	-2.1541	0.0156
	PP	213.601	0.0000**
	Hadri	26.2998	0.0000**
MI_{HI}	IPS	2.3588	0.9908
	PP	135.707	0.3482
	Hadri	29.9332	0.0000**
ΔMI_{HI}	IPS	-51.3826	0.0000***
	PP	2023.13	0.0000***
ME_{SA}	IPS	-5.19072	0.0000**
	PP	319.876	0.0000**
	Hadri	22.7942	0.0000**
MI_{SA}	IPS	-5.41128	0.0000**
	PP	258.405	0.0000**
	Hadri	25.0780	0.0000**
IS	IPS	-0.3303	0.3706
	PP	93.5954	0.8368
ΔIS	IPS	-1.4402	0.0749***
	PP	1533.81	0.0000***
ES	IPS	-0.0570	0.4773
	PP	80.4694	0.8985
ΔES	IPS	-0.3241	0.3721
	PP	1386.06	0.0000***

IPS = Im-Pesaran-Shun test
PP = Phillips-Perron Fisher Unit Root Test
Hadri = Hadri Unit Root Test
**Stationary at level from
***Stationary at first difference

Table VII (xtabond-Difference GMM)

Arellano-Bond dynamic panel-data estimation Number of obs = 2113
Group variable: id Number of groups = 67

Time variable: year
Obs per group: min = 4
avg = 31.53731
max = 42
Number of instruments = 1.2e+03 Wald chi2(6) = 135.84
Prob > chi2 = 0.0000

One-step results

	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
YL1.	-.1519394	.0214122	-7.10	0.000	.1099723	.1939066
iny	.0824243	.0170156	4.84	0.000	.0490743	.1157744
hc	.0194317	.0902393	0.22	0.830	-.157434	.1962974
ge	-.1378102	.0305294	-4.51	0.000	-.1976467	-.0779737
fdi	-.0531567	.1199923	-0.46	0.618	-.0923409	-.0139726
it	.0299891	.0080488	3.73	0.000	.0142138	.0457644
_cons	-.1728697	.7809966	-0.22	0.825	-1.703595	1.357856

Instruments for differenced equation
GMM-type: L(2/.).Y
Standard: D.iny D.hc D.ge D.fdi D.it
Instruments for level equation
Standard: _cons
. estat sargan
Sargan test of overidentifying restrictions
H0: overidentifying restrictions are valid

chi2(1232) = 1609.479
Prob > chi2 = 0.0000

Table VIII (xtabond-System GMM)

System dynamic panel-data estimation Number of obs = 2195
Group variable: id Number of groups = 67
Time variable: year
Obs per group: min = 5
avg = 32.76119
max = 43
Number of instruments = 1.3e+03 Wald chi2(6) = 170.71
Prob > chi2 = 0.0000
One-step results

Y	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
YL1.	-.14779	.0174084	-8.49	0.000	.1136701	.1819099
iny	.0828737	.0163885	5.06	0.000	.0507528	.1149947
hc	-.0154724	.0869533	-0.18	0.859	-.1858978	.1549529
fdi	-.0612852	.0195999	-3.13	0.002	-.0997002	-.0228702
ge	-.1570789	.0290934	-5.40	0.000	-.214101	-.1000569
it	.0298058	.0067076	4.44	0.000	.0166592	.0429524
_cons	.2965367	.6837824	0.43	0.665	-1.043652	1.636725

Instruments for differenced equation
GMM-type: L(2/.).Y
Standard: D.hc D.fdi D.iny D.ge D.it
Instruments for level equation
GMM-type: LD.Y
Standard: _cons
. estat sargan
Sargan test of overidentifying restrictions
H0: overidentifying restrictions are valid

chi2(1275) = 1774.328
Prob > chi2 = 0.0000

Table IX - (xtabond2 – System GMM)

```
. xtabond2 y  y1 iny fdi hc ge it, gmm(y1)
Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: id                      Number of obs      =      2195
Time variable : year                     Number of groups   =        67
Number of instruments = 1277             Obs per group: min =         5
Wald chi2(6)  =    205.47                               avg =     32.76
Prob > chi2   =     0.000                               max =        43
------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
------------------------------------------------------------------------------
        YL1 |   -.1881295   .0211868    -8.88   0.000     .1466042    .2296548
        iny |    .0807272   .0156108     5.17   0.000     .0501305    .1113238
        fdi |   -.0169421   .0192709    -0.88   0.379    -.0547125    .0208282
         hc |    .1940168   .180235      1.07   0.306     .036759     .3512746
         ge |   -.1441268   .0267006    -5.40   0.000    -.196459    -.0917947
         it |    .0185788   .0043821     4.24   0.000     .0099901    .0271675
      _cons |    .141341    .4781584     0.30   0.768    -.7958322    1.078514
------------------------------------------------------------------------------
Instruments for first differences equation
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/52).y1
Instruments for levels equation
  Standard
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.y1
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z = -13.47  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =   0.40  Pr > z =  0.687
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(1270) =1624.45  Prob > chi2 =  0.000
  (Not robust, but not weakened by many instruments.)
Difference-in-Sargan tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Sargan test excluding group:     chi2(1227) =1545.94  Prob > chi2 =  0.000
    Difference (null H = exogenous): chi2(43)   =  78.50  Prob > chi2 =  0.001
```

Table X: Unbalanced one-way error component model (Swamy-Arora Estimation)

```
. xtreg y y1 iny  fdi hc ge it, re theta sa
Random-effects GLS regression            Number of obs      =     2195
Group variable: id                       Number of groups   =       67
R-sq:  within  = 0.0714                  Obs per group: min =        5
       between = 0.6023                                 avg =     32.8
       overall = 0.1257                                 max =       43

Random effects u_i ~ Gaussian              Wald chi2(6)     =   314.58
corr(u_i, X)       = 0 (assumed)           Prob > chi2      =   0.0000

------------------- theta --------------------
  min      5%      median      95%      max
0.0000  0.0000    0.0000    0.0000  0.0000
------------------------------------------------------------------------------
             |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
------------------------------------------------------------------------------
        YL1 |  -.2313559   .0203666  - 11.36  0.000     .1914381    .2712737
        iny |   .0893667   .0117798     7.59  0.000     .0662787    .1124547
        fdi |  -.0214057   .0171323    -1.25  0.212    -.0549844     .012173
         hc |    .191658   .0595705     3.22  0.001     .0749019     .308414
         ge |  -.0692315    .018215    -3.80  0.000    -.1049322   -.0335309
         it |   .0111151   .0028007     3.97  0.000     .0056259    .0166043
       cons |  -.7992089   .3415435    -2.34  0.019    -1.468622    -.129796
------------------------------------------------------------------------------
     sigma_u |          0
     sigma_e |  4.5935986
         rho |          0   (fraction of variance due to u_i)
------------------------------------------------------------------------------
```

Table XI: (xtabond - Difference GMM)

xtabond Y iny fdi hc ge mesa mehi misa mihi es is, lags(1) artests(2)

```
Arellano-Bond dynamic panel-data estimation  Number of obs      =    1021
Group variable: id                          Number of groups   =      34
Time variable: year
                          Obs per group:   min =       4
                                            avg =  30.02941
                                            max =       42

Number of instruments =   1.0e+03         Wald chi2(11)      =    78.93
                          Prob > chi2         =    0.0000
One-step results
```

Y	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
YL1.	-.0521716	.0301594	-1.73	0.084	-.0069396	.1112829
iny	.118844	.0204634	5.81	0.000	.0787366	.1589515
fdi	-.1341467	.0331415	-4.05	0.000	-.1991029	-.0691906
hc	.1676651	.1343421	1.25	0.212	-.0956406	.4309708
ge	-.1146	.0438406	-2.61	0.009	-.200526	-.0286741
mesa	.0047569	.0203666	0.23	0.815	-.0351608	.0446746
mehi	.0134811	.0146629	0.92	0.358	-.0422199	.0152578
misa	-.0211653	.0291514	-0.73	0.468	-.078301	.0359704
mihi	-.0728269	.0224741	-3.24	0.001	-.1168753	-.0287784
es	1.122903	.7974573	1.41	0.159	-2.68589	.4400849
is	-1.079656	.7664824	-1.41	0.159	-.4226224	2.581933
_cons	5.843232	1.941463	3.01	0.003	2.038035	9.648429

Instruments for differenced equation
GMM-type: L(2/.).Y
Standard: D.iny D.fdi D.hc D.ge D.mesa D.mehi D.misa D.mihi D.es D.is
Instruments for level equation
Standard: _cons
. estat sargan
Sargan test of overidentifying restrictions
H0: overidentifying restrictions are valid

chi2(994) = 1043.346
Prob > chi2 = 0.1348

Table XII: (xtabond - System GMM)

. xtdpdsys Y iny fdi hc ge mesa mehi misa mihi es is, lags(1) artests(2)

System dynamic panel-data estimation   Number of obs   =   1061
Group variable: id   Number of groups   =   34
Time variable: year
Obs per group: min =   5
avg = 31.20588
max =   43

Number of instruments = 1.0e+03   Wald chi2(11)   =   86.46
Prob > chi2   = 0.0000

One-step results

Y	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
YL1.	.0511356	.0242635	2.11	0.035	.0035799	.0986912
iny	.1111191	.0197662	5.62	0.000	.0723781	.1498602
fdi	-.1447509	.0322056	-4.49	0.000	-.2078727	-.0816291
hc	.1061828	.1315442	0.81	0.420	-.1516391	.3640048
ge	-.1087589	.0418368	-2.60	0.009	-.1907575	-.0267603
mesa	.0043101	.0197112	0.22	0.827	-.0343232	.0429433
mehi	.0118678	.0140236	0.85	0.397	-.0393535	.015618
misa	-.0041186	.0274134	-0.15	0.881	-.0578479	.0496107
mihi	-.0711457	.0212914	-3.34	0.001	-.1128761	-.0294153
es	1.057424	.780402	1.35	0.175	-2.586984	.4721355
is	-1.025482	.7502359	-1.37	0.172	-.4449533	2.495917
_cons	5.530869	1.811183	3.05	0.002	1.981015	9.080722

Instruments for differenced equation
    GMM-type: L(2/.).Y
    Standard: D.iny D.fdi D.hc D.ge D.mesa D.mehi D.misa D.mihi D.es D.is
Instruments for level equation
    GMM-type: LD.Y
    Standard: _cons
. estate sargan
unrecognized command: estate
r(199);
. estat sargan
Sargan test of overidentifying restrictions
    H0: overidentifying restrictions are valid
    chi2(1037) = 1148.882
    Prob > chi2 = 0.0085

Table XIII (xtabond2)

```
. xtabond2  Y y1 iny fdi hc ge mesa mehi misa mihi es is, gmm(y1)
Favoring space over speed. To switch, type or click on mata: mata set matafavor speed, perm.
Warning: Number of instruments may be large relative to number of observations.

Dynamic panel-data estimation, one-step system GMM
------------------------------------------------------------------------------
Group variable: id                      Number of obs      =      1061
Time variable : year                    Number of groups   =        34
Number of instruments = 1041            Obs per group: min =         5
Wald chi2(11) =     84.02                              avg =     31.21
Prob > chi2   =     0.000                              max =        43
------------------------------------------------------------------------------
           Y |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
------------------------------------------------------------------------------
         YL1 |  -.1103112   .0303889    -3.63   0.000      .05075    .1698723
         iny |    .096878   .0172925     5.60   0.000    .0629853    .1307706
         fdi |  -.0210794   .0279177    -0.76   0.450   -.0757972    .0336384
          hc |   .1406718   .1204845     1.17   0.243   -.0954735     .376817
          ge |  -.0868014   .0311275    -2.79   0.005   -.1478102   -.0257926
        mesa |   .0012557   .0165799     0.08   0.940   -.0312404    .0337518
        mehi |  -.0071809   .0120524    -0.60   0.551   -.0308033    .0164414
        misa |  -.0260646   .0183455    -1.42   0.155    -.062021    .0098919
        mihi |  -.0342068   .0180819    -1.89   0.059   -.0696466    .0012331
          es |  -.4932625   .6769256    -0.73   0.466   -1.820012    .8334873
          is |   .5218591   .6540099     0.80   0.425   -.7599768    1.803695
       _cons |   2.727865   1.361158     2.00   0.045    .0600437    5.395687
------------------------------------------------------------------------------
Instruments for first differences equation
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    L(1/52).y1
Instruments for levels equation
  Standard
    _cons
  GMM-type (missing=0, separate instruments for each period unless collapsed)
    D.y1
------------------------------------------------------------------------------
Arellano-Bond test for AR(1) in first differences: z =  -4.46  Pr > z =  0.000
Arellano-Bond test for AR(2) in first differences: z =   0.36  Pr > z =  0.720
------------------------------------------------------------------------------
Sargan test of overid. restrictions: chi2(1029) =1033.41  Prob > chi2 =  0.456
  (Not robust, but not weakened by many instruments.)

Difference-in-Sargan tests of exogeneity of instrument subsets:
  GMM instruments for levels
    Sargan test excluding group:     chi2(986)  = 948.23  Prob > chi2 =  0.801
    Difference (null H = exogenous): chi2(43)   =  85.17  Prob > chi2 =  0.000
```

Table XIV: Unbalanced one-way error component model (Swamy-Arora Estimation)

```
. xtreg y y1 iny  fdi hc ge  mesa mehi misa mihi es is, re theta sa
y ambiguous abbreviation
r(111);
. xtreg Y y1 iny  fdi hc ge  mesa mehi misa mihi es is, re theta sa
Random-effects GLS regression                 Number of obs      =     1061
Group variable: id                         Number of groups   =       34
R-sq:  within  = 0.0533                     Obs per group: min =        5
       between = 0.4113                                    avg =     31.2
       overall = 0.0771                                    max =       43
Random effects u_i ~ Gaussian                Wald chi2(11)      =    87.68
corr(u_i, X)       = 0 (assumed)            Prob > chi2        =   0.0000
------------------- theta --------------------
  min      5%       median        95%      max
0.0000   0.0000    0.0000    0.0000   0.0000
------------------------------------------------------------------------------
             |   Coef.       Std. Err.      z     P>|z|     [95% Conf. Interval]
------------------------------------------------------------------------------
        YL1 |  -.1122442   .0304592   -3.69   0.000    -.0525453    .1719431
         iny |   .0993184   .016924     5.87   0.000     .066148    .1324889
         fdi |  -.0206328   .0078531   -2.62   0.059    -.0752239    .0339584
          hc |   .1386652  .1165513    1.19   0.234     .0897712    .3671015
          ge |  -.0905204   .030209    -3.00   0.003    -.1497289   -.0313118
        mesa |   .0025753   .0162576    0.16   0.874     .0292891    .0344397
        mehi |   .0074869   .0013984    5.35   0.000     .0306222    .0156484
        misa |  -.0255887   .018056    -1.42   0.156    -.0609778    .0098004
        mihi |  -.0313783   .0177272   -1.77   0.077    -.0661229    .0033663
          es |   .5246154   .2738974    1.91   0.053     1.84543    .7961993
          is |  -.5521401   .151216    -3.65   0.000    -.7242199     1.8285
       _cons |   2.558178   1.357202    1.88   0.059    -.1018878    5.218245
-------------+----------------------------------------------------------------
     sigma_u |          0
     sigma_e |  5.4909927
         rho |          0   (fraction of variance due to u_i)
```

Tourism Direct Contribution to GDP (US$b) for selected Sub-Sahara Africa Countries: Source – African Development bank (2016)

Figure 1-   Benin

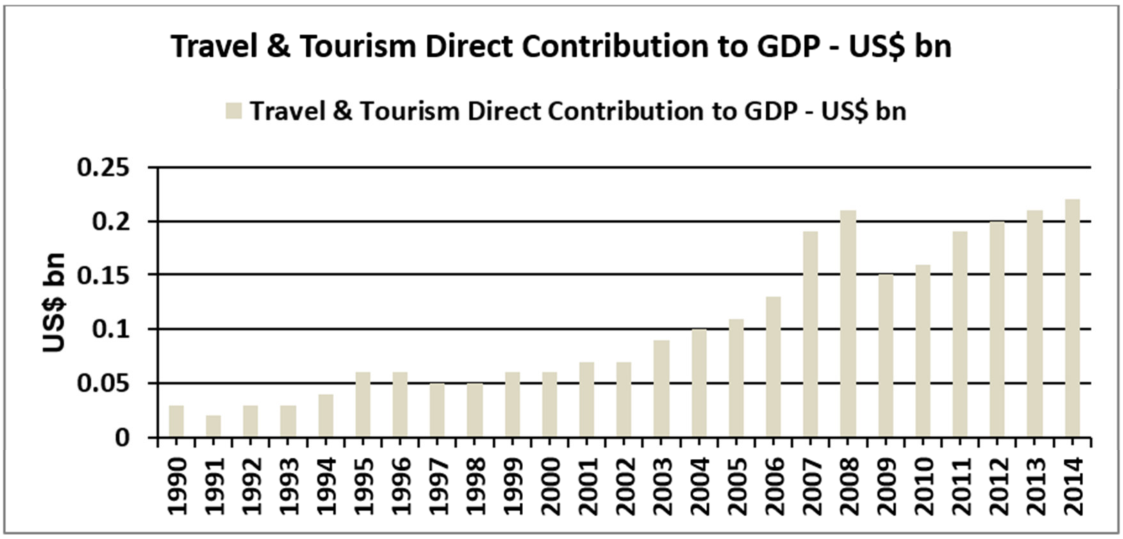

Figure 2- **Botswana**

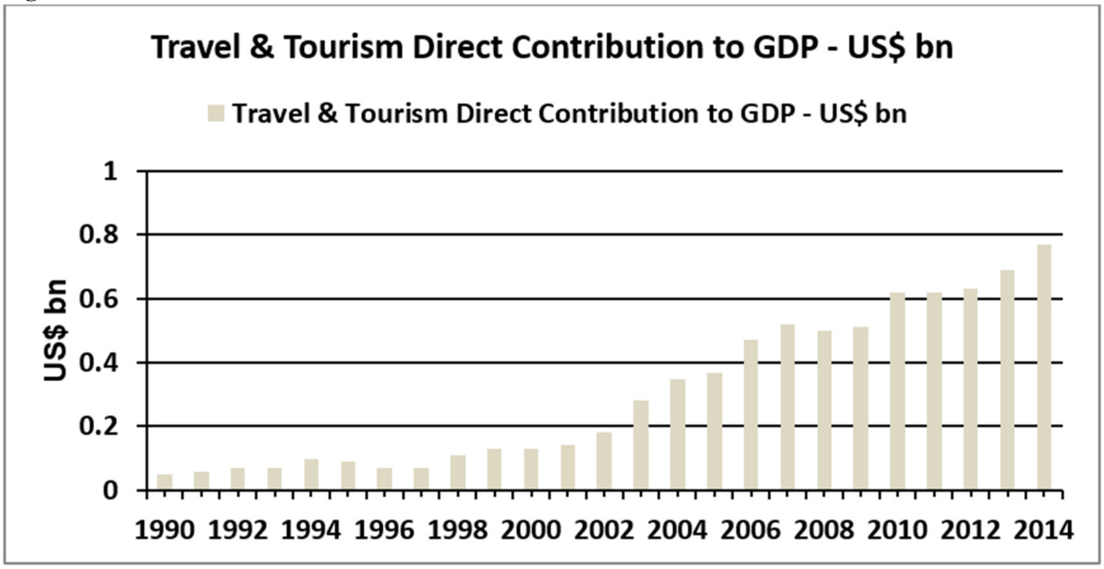

Figure 3- **Mali**

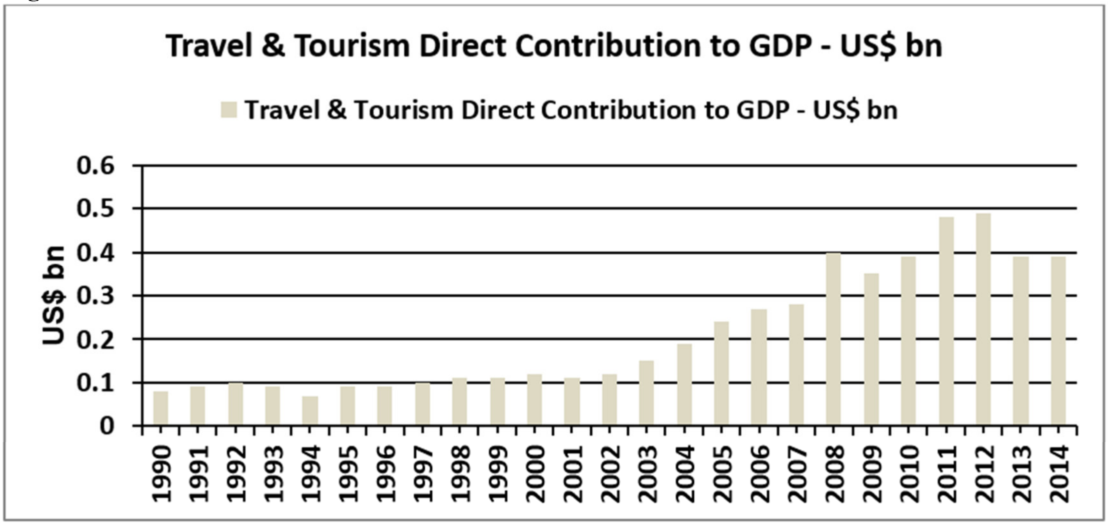

Figure 4- **Burkina Faso**

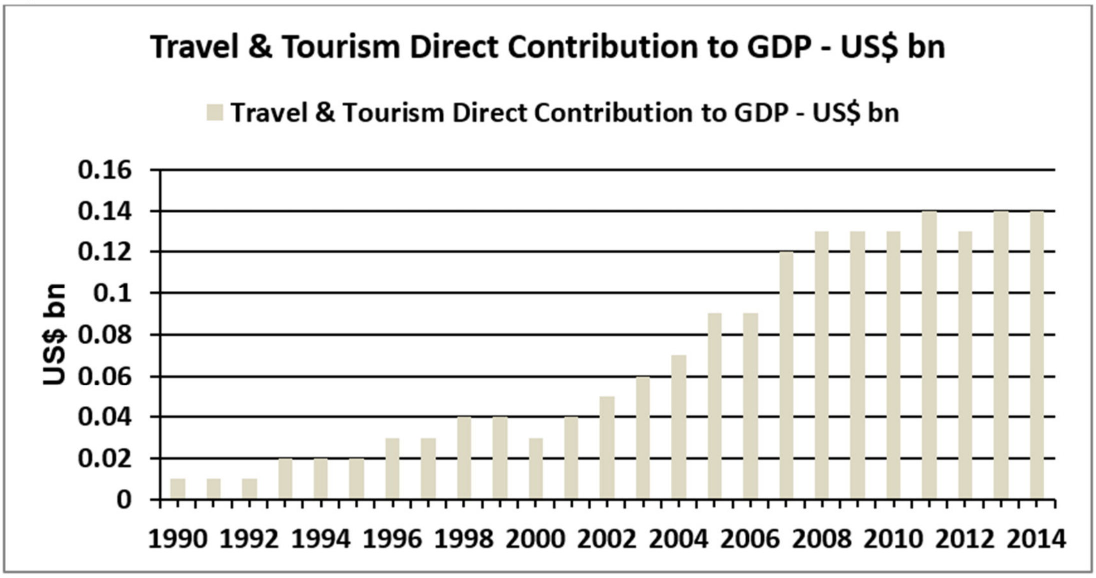

Figure 5- Burundi

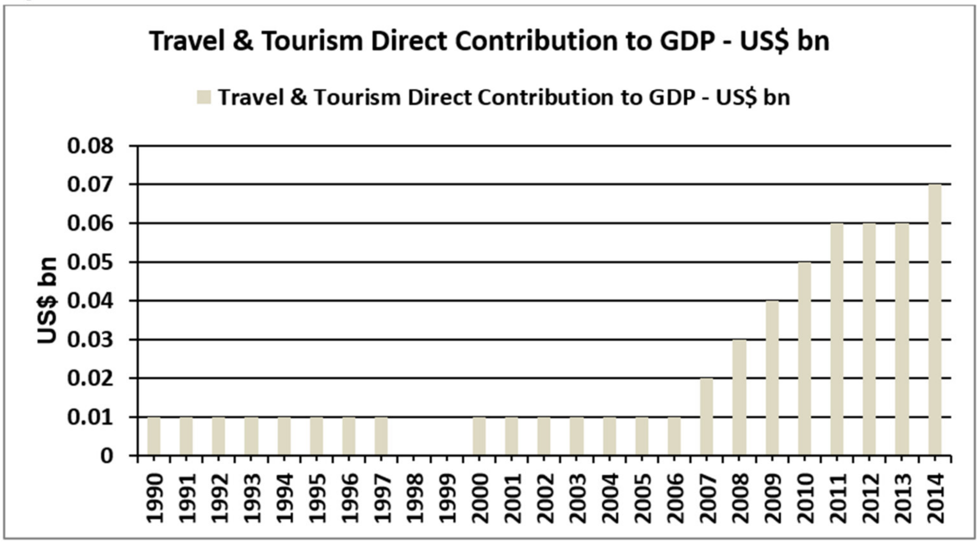

Figure 6- Cameroon

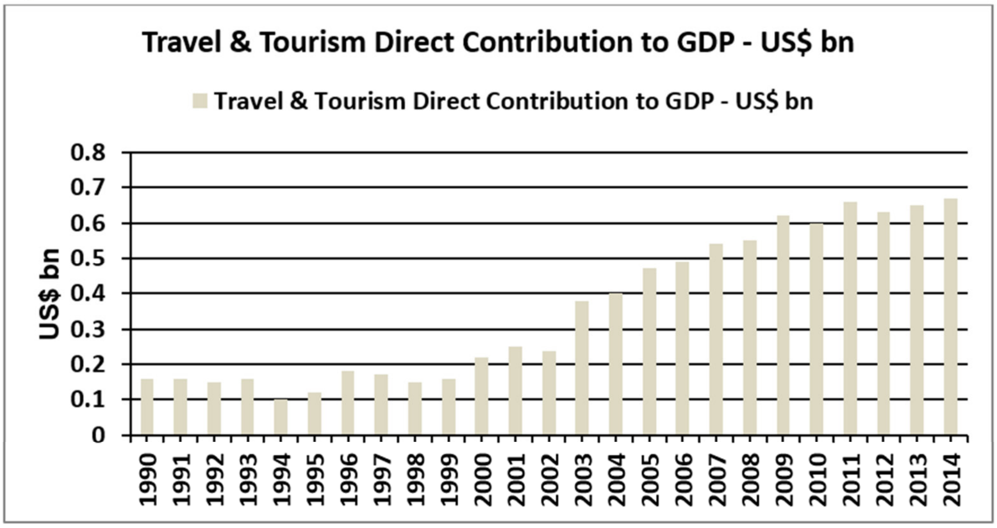

Figure 7- Ghana

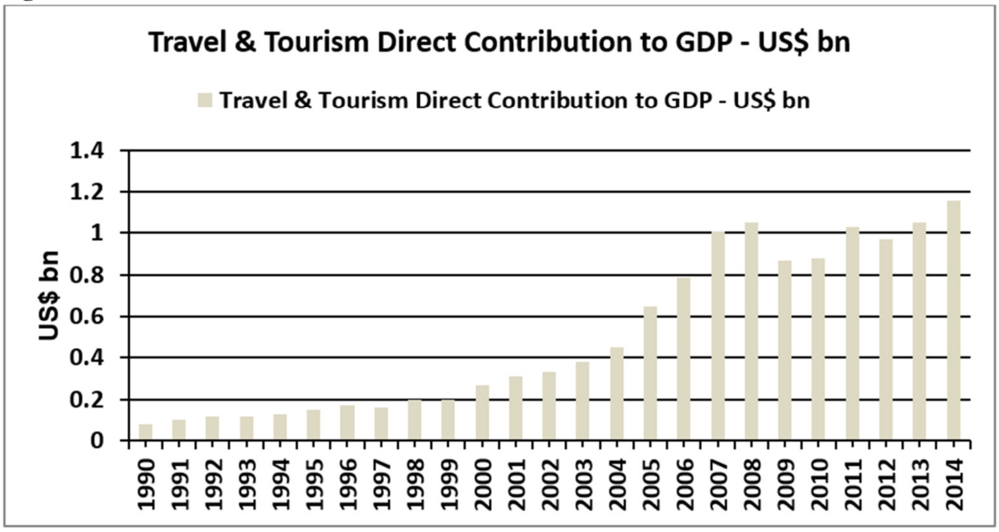

Figure 8- **Mozambique**

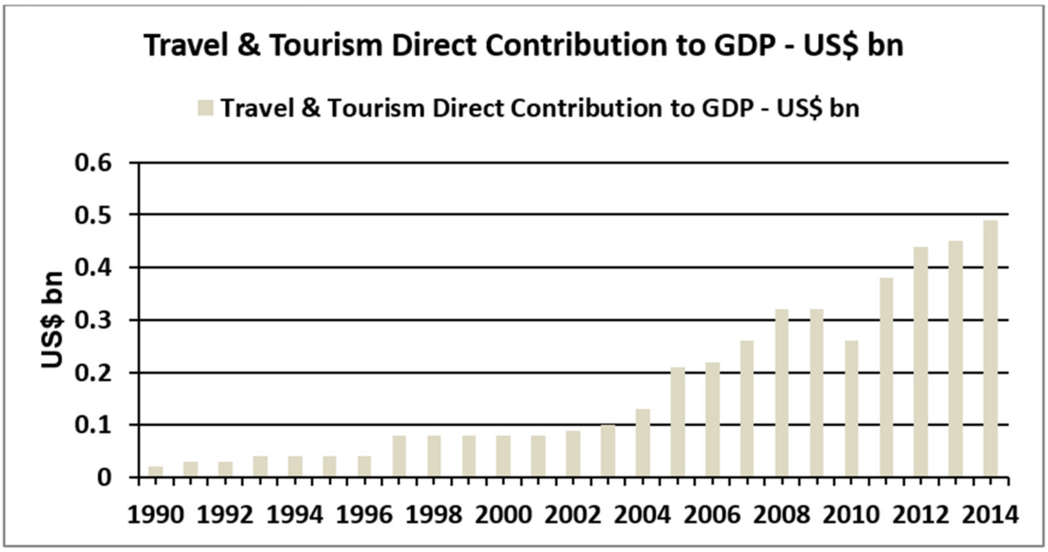

Figure 9- **Senegal**

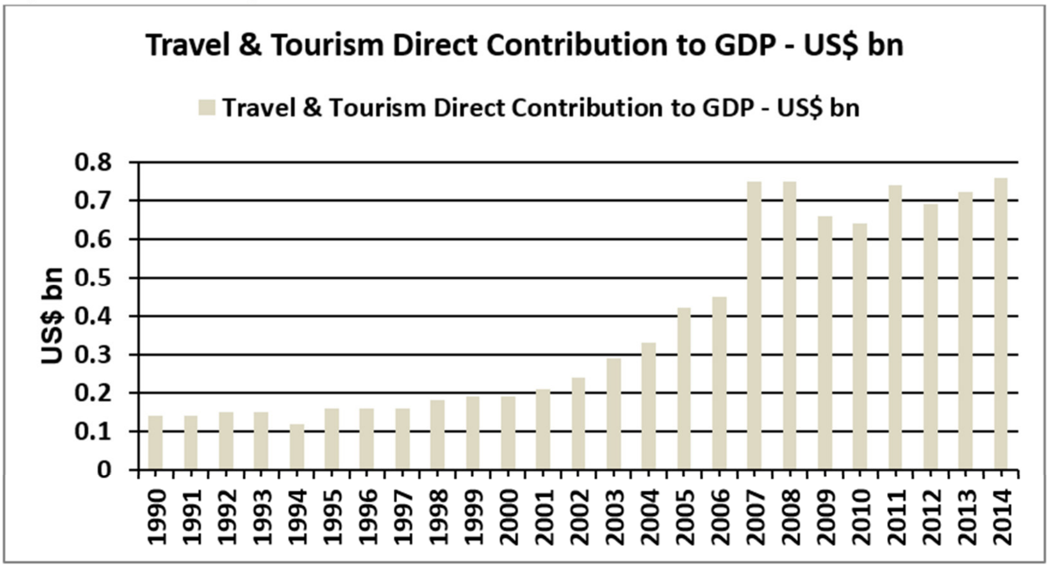

Figure 10 **Kenya**

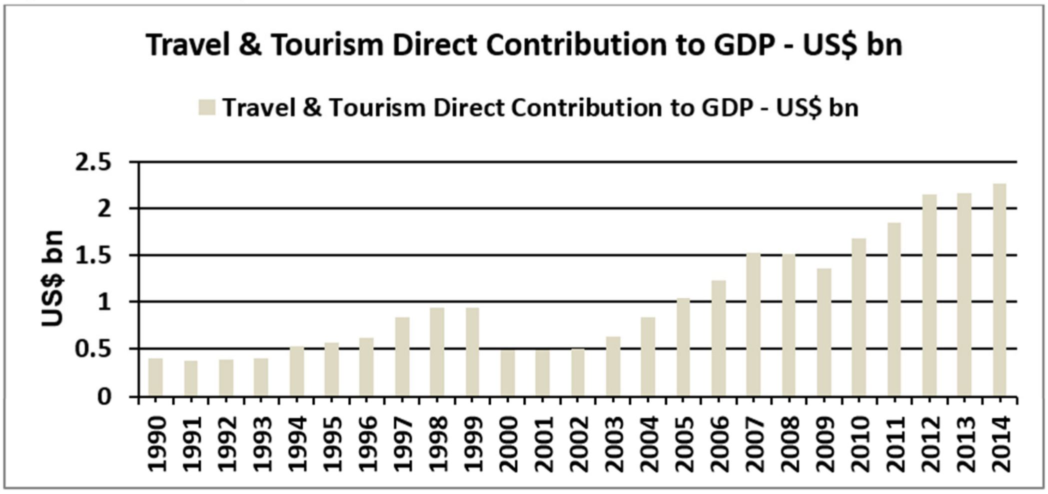

Figure 11 -Gabon

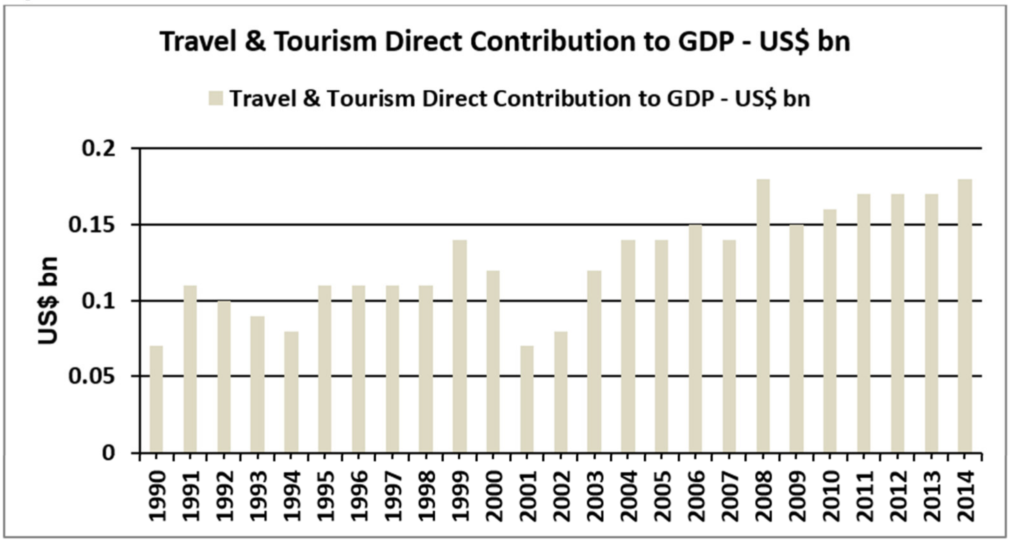

Figure 12 -Gambia