

**KWAME NKRUMAH UNIVERSITY OF SCIENCE AND
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**KNUST
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**STUDIES ON ECONOMIC GROWTH AND INCOME IN SUB-
SAHARAN AFRICA**

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AWARD OF DOCTOR OF PHILOSOPHY IN ECONOMICS**

BY

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DECLARATION

I declare that this thesis submitted herein is an original work I have personally undertaken under supervision except where due acknowledgement has been made in the text.

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To Hagar and Christa

KNUST



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TO GOD BE THE GLORY

Michael Kwame Asiedu

ABSTRACT

For several years, sub-Saharan Africa (SSA) continues to struggle to achieve high growth rates and income necessary to pull its population from poverty and underdevelopment. This situation has resulted in high incidence of poverty and deteriorating standard of living among vast majority of the people. Despite persistent implementation of policies and structural reforms over the years, the region still lags behind when matched with other regions such as East Asia which it started on the same growth path with.

It is against this background that this study was carried out to find out the key variables that drive the growth and income of sub-Saharan African countries. In an attempt to achieve this objective, the study addresses three broad questions: (i) What is the impact of trade openness and foreign aid on income in sub-Saharan Africa? (ii) Do democracy and corruption have impact on the levels of income among sub-Saharan African countries? (iii) What are the key determinants of economic growth in sub-Saharan Africa? Each of these questions has been addressed in a full length paper.

The first paper analyses the impact of foreign aid and trade openness on income. Using the Pool Mean Group (PMG) estimator, the paper showed that aid has significant positive effect on income over the period under consideration which is consistent with other previous studies that conclude that aid promotes growth and income. Contrary to our expectation, trade openness rather has negative effect on income in SSA over the period considered in this paper. The paper also emphasized the important role played by foreign direct investment, capital stock and democracy in promoting income in sub-Saharan Africa. From a policy perspective, the study suggests that aid should be channelled to assist small and medium scale businesses which can help to reduce rural and urban poverty. Also, the export sector should be more competitive relative to the import sector through export diversification.

Paper II examines the relationship between democracy and corruption and income differences in sub-Saharan African countries using dynamic panel data techniques. Using several indicators that could proxy for governance in eight

alternative specifications, the study employed the within-mean group and the system GMM estimations. The paper finds that corruption has adversely affected income levels in SSA. The results also showed that whether or not democracy has income effects depends on a particular indicator used. This result is further confirmed by the indexes created from the principal component analysis. While property rights and political stability have had positive income effects rule of law and government effectiveness have shown negative impact on income. The paper therefore concludes that policy reforms should target programmes that seek to develop and build the capacities of state institutions. For research, the findings suggest that researchers should seriously take into account the selection of proxies when investigating the impact of democracy on economic performance.

Paper III applies a nonparametric regression to identify the determinants of economic growth in sub-Saharan Africa. The findings suggest that there is a positive and nonlinear relationship between economic growth on one hand as well as investment in physical capital, population and democracy on the other hand. Again, while we find that human capital and inflation have no significant effect on economic growth over the study period, foreign aid was found to have negative effect on economic growth in SSA. All in all, the results obtained in this paper provide strong evidence that investment in physical capital, population, democracy, trade openness and foreign aid are important determinants of economic growth in SSA over the period under consideration. The findings obtained in the paper have important implications particularly for growth policy in SSA and growth empirics generally. Growth policies should thus consider population control, expanding and improving the quality of education and enrolment especially at the higher levels and strengthen democratic institutions. For research, the findings imply that researchers should be cautious in specifying the functional form of growth models when investigating the determinants of economic growth.

LIST OF PAPERS FOR PUBLICATIONS

This thesis is based on the work contained in the following articles, referred to by Roman numerals in the text:

- I. Asiedu, M.K. Foreign aid, trade openness and income in sub-Saharan Africa: A panel cointegration investigation (Submitted to the Journal of African Business)
- II. Asiedu, M.K. Democracy, Corruption and Income: Evidence from sub-Saharan Africa (Submitted to African Development Review)
- III. Asiedu, M.K. A nonparametric approach to estimating growth determinants in sub-Saharan Africa (Submitted to the Journal of International Development)

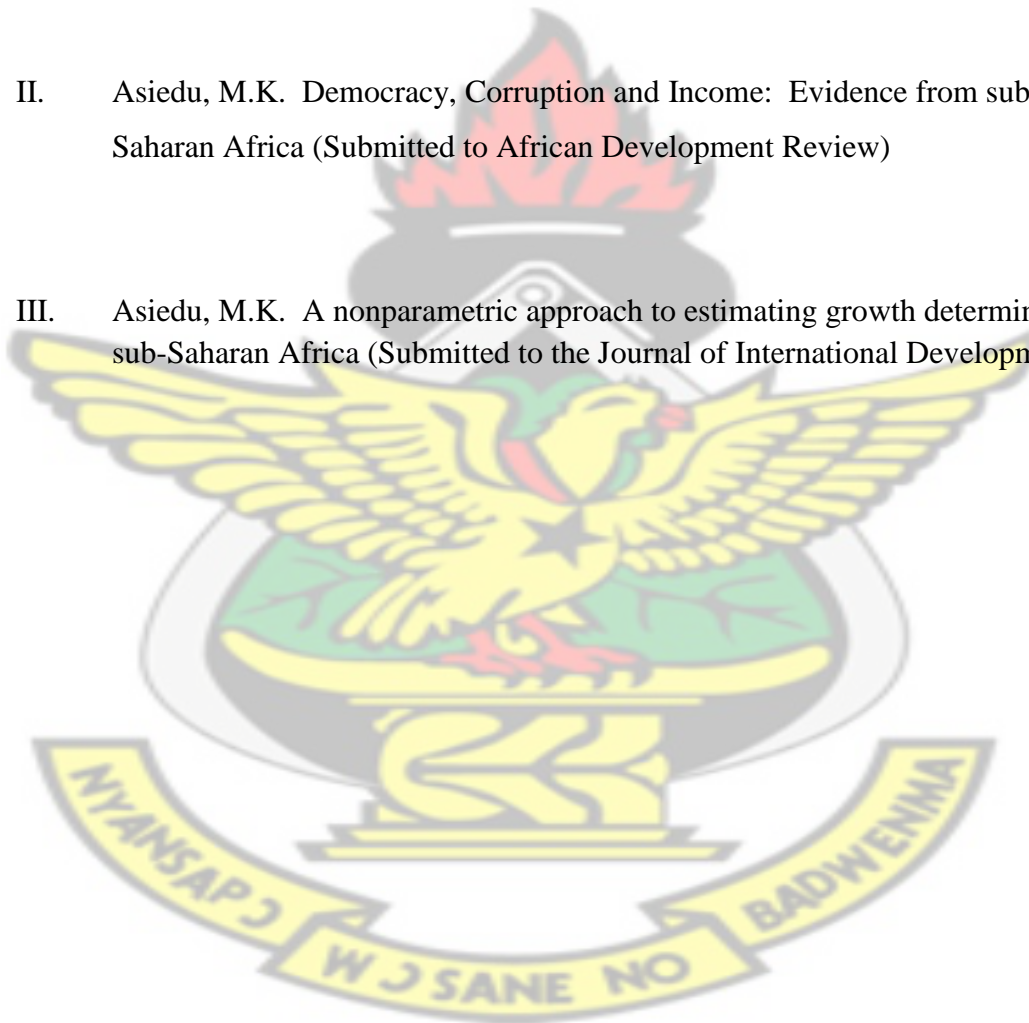


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Section I

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1. INTRODUCTION

1.1 Background

Economic growth continues to be one of the key issues on the agenda of economists as well as governments and policy makers. Interest in factors that cause differences in growth rates and levels of wealth among countries over time thus has gained prominence in economic literature after Solow's publication in 1956.

Obviously, economic growth is one of the targets of macroeconomic policy and as a result it has assumed a central role in the development agenda of every economy. Therefore, economic growth is sine qua non of economic development since there can be no development without growth. Of course, growth per se does not necessarily imply development since development involves growth plus structural changes in the economy. As a result, economists, policy makers and politicians from all countries developed and less developed, rich and poor, industrialised and agrarian, socialist, capitalist and mixed have all sought to look for the sources of economic growth in their countries. In view of the fact that economic growth and income per capita are important measures of economic performance in every country and/or region, it is important to investigate the underlying factors that drive growth and income in sub-Saharan Africa.

A significant feature of post-independence Africa is that governments and policy makers have focused attention on ways to achieve sustained growth rates and poverty reduction. It is worth mentioning that an important prerequisite to better policies is a better understanding of economic growth.

Sub-Saharan African (SSA) countries since independence have adopted various approaches to achieving acceptable levels of economic growth and development. This has resulted in a wide range of policies and interventions in their respective economies. The early post-colonial era (between 1960 and 1975) saw many sub-Saharan African countries pursuing rigorous industrialisation policy in an attempt to restructure, modernise and diversify their economies. Economic growth during this period was comparatively better. For instance, in the early 1960s, Ghana pursued a strategy of import substitution industrialization with the objective of modernizing and diversifying the economy. Several industries were established to produce varieties of products (e.g. Volta Aluminium Company, Cocoa Processing Plants, Tema Oil Refinery, among others). During this period, growth rates were relatively high with the highest rates of GDP growth and per capita income growth of 9.72% and 7.2% respectively being recorded in 1970. Similar economic policies and agenda were pursued in other SSA countries such as Nigeria, Cote d'Ivoire, Cameroun, among others.

In addition, many sub-Saharan African countries have subscribed to a number of comprehensive reform and adjustment programmes which were supposed to translate into improved economic performance. Many SSA countries such as Ghana, Cote d'Ivoire, Nigeria, Kenya, Republic of Congo, Zambia, Uganda and others subscribed to several reform programmes especially in the late 1980s under the auspices of the World Bank and IMF. These reform programmes led to a more liberalized economy in SSA resulting in massive inflows of aid and foreign direct investment. This relatively resulted in an improved economic performance among several SSA countries.

Notwithstanding, unsuccessful and unsuitable macroeconomic and development policies as well as various international shocks have resulted in unsustainable growth rates and severe deterioration in economic performance resulting in low standard of living among the people. Of course, policies and programmes adopted to enhance economic performance and subsequently conditions of living and economic development have often been disrupted by socio-economic and political factors which in most cases are incompatible. Hence, economic policies are in most cases designed to achieve globally acceptable levels of economic performance which do not necessarily reflect the exact situation in many sub-Saharan African countries.

Indeed, average growth rate of GDP in sub-Saharan Africa was 0.8% between 1965 and 1990. Around the same time, economies of the fastest growing countries in the developing world excluding Africa grew at an average rate of 5.8 %, while the remaining countries in the developing world grew at 1.8% (Sachs and Warner, 1999). Additionally, SSA's per capita GDP was 60 percent in the early 1960s of the average of the remaining countries in the developing world. This had however, declined to 35% by 1990. Much of the decline occurred during the period 1980-94. However, the sub-region began to experience an improvement in economic performance after 1995 when a number of countries adopted reform programmes.

Though sub-Saharan Africa in recent times has been described as the fastest growing region among the developing world, the incidence of poverty still continues to be relatively high. As indicated by Romer (1996) although it is difficult to make exact comparison, the best available estimates suggest that real per capita income in industrialised nations like United States, United Kingdom, Germany as well as Japan

far exceed those in sub-Saharan Africa by more than twenty times. Countries such as China, Indonesia, South Korea, Israel and Turkey are seen to be making transition to membership in the group of relatively wealthy industrialised economies compared with their counterparts in sub-Saharan Africa.

It is, therefore, understandable from the perspective of achieving a sustained growth rates, poverty reduction and in particular the achievement of the Millennium Development Goals (MDGs) that there is a significant policy interest in the underlying factors that determine economic growth and income in the context of sub-Saharan Africa. It is for this course that the basic thrust of this study is placed.

1.2 Statement of the Problem

A noticeable feature of the economic performance of sub-Saharan Africa is that the growth and income records have been uneven when the early post-independence era is compared with the latter period. Between 1960 and 1973, economic performance in most sub-Saharan African nations was quite strong. Notwithstanding, the following two decades presented some obstacles to many sub-Saharan African countries which resulted in stagnation or decline in economic performance. For example, in Ghana growth performance continued to be poor and negative between 1975 and 1984 with GDP growth rate and per capita growth rate respectively reaching -14.49% and -12.43% . Similar economic conditions existed in some other SSA countries. Since 1990s a lot of SSA countries (Ghana, Cote d'Ivoire, Tanzania, Mauritius, Equatorial Guinea, Gabon, Botswana, among others) have exhibited a modest recovery. Yet levels of economic performance remain quite below the immediate post independence era. In a

whole, the 0.9% average per capita income growth falls short by 1.5% in relation to other developing regions (such as South Asia and Latin America) , and just about 3% below that of East Asian Economies and the high performing African (Botswana and Mauritius).

Furthermore, there is large disparity in the economic performance of individual SSA countries. Indeed, it is significant to mention that few countries (mainly Botswana, South Africa, Equatorial Guinea, Nigeria and Mauritius) account for nearly 80 percent of the GDP of sub-Saharan Africa and exhibited reasonably strong economic performance while several other countries (Niger, Chad, Mali, Burundi, Central African Republic, Democratic Republic of Congo and others) show persistent decline with rates of economic growth less than 1.5%. In addition, the rates of growth attained by Botswana and Mauritius show up against those of East Asian economies. With the exception of these two, a lot of SSA nations have either gone through series of ups and downs or remained stagnant at least over the past four decades.

The end result of the relatively long period of stagnation in economic performance for most SSA countries coupled with the rapid growth of population implies no or slow progress in improving conditions of living in those countries. Indeed, over the period 1960 and 2000, of thirty-five countries in sub-Saharan Africa for which similar data exist, sixteen experienced at least 20 percent decline in per capita income measured in 1995 constant US dollars. Most of the losses were registered after 1975. Developed countries in comparison with the situation of sub-Saharan Africa have sustained outstandingly stable growth rates of per capital of about 2% for roughly hundred years while emerging industrializing countries have preserved growth rate of

income above 3 percent for close to a period of three decades. In all, while annual GDP growth rate and per capita income in SSA as at 2014 stood at 4.31% and \$1431 respectively the annual GDP growth rate and per capita income in East Asia over the same period respectively stood at 6.83% and \$6221 (World Bank, 2015). These statistics suggest that SSA sub-region as a whole is far lagging behind East Asia which it started on the same path with not even to mention the economies of the developed and industrialised countries.

It is therefore not surprising that sub-Saharan Africa continues to face major challenges including sustained economic performance, reducing poverty and ensuring an improved standard of living as well as integrating into the global economy.

From the foregoing analysis, the economies of sub-Saharan African countries have been characterized by relatively low growth rates of GDP and per capita income, a situation which has resulted in high incidence of poverty and low standards of living. The key questions that arise from these discussions are: ‘what are the factors (variables) that can propel sub-Saharan African countries to a sustained rate of economic growth and income in the long run? What factors explain the observed differences in growth and income among sub-Saharan African countries? This study would thus attempt to elicit answers to these questions by identifying the key determinants of economic growth in sub-Saharan Africa and also account for the growth and income differences among SSA countries.

1.3 Objectives of the Study

The main objective of this study is to identify the factors or variables that affect long run economic growth and income in sub-Saharan Africa.

Specifically, this study seeks to answer the following critical questions about growth and income differences within the sub-Saharan African region.

- i. What is the impact of trade openness and foreign aid on income in sub-Saharan Africa?
- ii. Do democracy and corruption have impact on the levels of income among sub-Saharan African countries?
- iii. What are the key determinants of economic growth in sub-Saharan Africa?

1.4 Research Hypotheses

Following from the research problem and the objectives, the study seeks to test and validate the following empirical hypothesis:

1. H_0 : Openness to trade **does not** have positive impact on income in SSA.
 H_1 : Openness to trade does have positive impact on income in SSA.
2. H_0 : Foreign aid **does not** have positive impact on income in SSA.
 H_1 : Foreign aid has positive impact on income in SSA.

3. H_0 : Democracy **does not** have positive effect on income in SSA.

H_1 : Democracy has positive effect on income in SSA.

4. H_0 : The popular parametric specification of the determinants of growth **does not** suffer from functional misspecification.

H_1 : The popular parametric specifications on the determinants of growth suffer from functional misspecification.

1.5 Justification for the Study

It is without doubt that one of the key targets of every economy is to obtain the highest rate of economic growth. A rise in growth is usually taken to mean an improvement in the aggregate welfare of the people. For this reason, governments of developing countries particularly those in sub-Saharan Africa over the years have been pursuing various forms of policies that would lead to growth and income. Obviously, the role of free international movement of goods and services and factors as well as foreign institutions and governments through the provision of development assistance in achieving growth cannot be overemphasized. Similarly, economic activities and hence economic growth thrive well on efficient and effective institutions. Nonetheless, economic performance of sub-Saharan African countries continues to be abysmal compared with other developing countries of the same category. The region continues to struggle to achieve a sustained economic growth and enhance the conditions of living of the people, a situation that has made the region more susceptible to both domestic and external shocks.

It is worth mentioning that development programmes in developing countries are assessed based on the extent to which their national output and incomes are growing. This implies that economic growth has assumed a central role in modern economies and more importantly in developing regions like sub-Saharan Africa in global assessment of economic performance. In view of this, it is significant to investigate the underlying factors that determine growth and income in sub-Saharan Africa, hence the justification for this study.

This study is thus anticipated to help researchers and policy makers to understand the growth process of sub-Saharan Africa by throwing more light on the key variables that determine long run economic growth in sub-Saharan Africa. It is also expected to bring to light the factors that account for the differences in growth and income among sub-Saharan African countries. In an attempt to achieve this, the study utilises varied empirical strategies (methodologies) to generate more consistent and efficient estimates. This way, it is expected that the study provides invaluable feedback for the formulation and implementation of policies aimed at achieving sustained growth rates and reduce the high incidence of poverty in sub-Saharan Africa.

1.6 Organisation of the Study

This thesis follows the article-based format of thesis presentation. It is made up of five broad sections with each section further divided into sub-sections. The first section looks at the general introduction. Section two focuses on review of relevant literature on growth and its covariates. The third section presents some facts about growth and income differences in sub-Saharan Africa. The fourth section provides summaries of the appended papers. The rest of the thesis contains the full details of the three

appended papers referred to by Roman numerals. Paper I analyses the impact of trade openness and foreign aid on income in sub-Saharan Africa. Paper II looks at the effect of democracy and corruption on the levels of income among sub-Saharan African countries. The last paper (Paper III) is devoted to investigating the determinants of long run economic growth in sub-Saharan Africa using nonparametric regression.



2. LITERATURE REVIEW

2.0 Introduction

This section focuses on the review of relevant literature on growth and its covariates. The section consists of four broad sub-sections with each section touching on each of the three papers contained in the study. The first section highlights the neoclassical growth models and endogenous growth theory which actually are the two major theories that dominate economic growth literature. Section two deals with the review of theoretical and empirical works on trade, foreign aid and growth. The third section considers theoretical and empirical review of the nexus between democracy, corruption and economic growth. Finally, the fourth section provides a review of some other covariates of economic growth considered in the third paper especially.

2.1 Theories of Economic Growth

In a very simple term, economic growth involves increases over time in the volume of a country's per capita gross national product (GNP) of goods and services. Such continuing increases can raise average standard of living substantially and provide a stronger base for other policy objectives such as national defence, various kinds of capital investment or public welfare services in the economy. Thus, economic growth is measured by comparing the total output of the economy at different times.

It is indeed an indisputable fact that the current understanding of economic growth is largely based on the neoclassical growth model developed by Robert Solow (1956). The neoclassical growth models highlight technological progress as the engine of economic growth in an economy. In the neoclassical growth model, capital

accumulation is a major factor that contributes to economic growth. Productivity growth (largely measured as an increase in output per worker) occurs due to increases in the amount of capital per worker, or capital accumulation. As explained by Jones (1998) capital deepening increases till the economy reaches its steady state. At the steady state net investments grow at the same rate as the labour force and the capital-labour ratio remains constant. An important implication of this is the existence of principle of transitional dynamics. That is, as the economy is below its steady state, it should be able to grow faster and as it is above its steady state, it should grow slower. In the steady state, all per capita income growth is due to exogenous technological change. The rate of technological process is assumed to be constant and not impacted by economic incentives. By this also, the neoclassical growth models predict that if a group of countries have the same steady state, then all things being equal, the poor countries in the group should grow faster than the rich countries. That is to say that the conditional convergence should hold.

In the late 1980s and early 1990s, new growth theory which eventually became known as the endogenous growth theory became prominent in growth literature. This theory was championed by Paul Romer (1986, 1990) and Robert Lucas (1988). The essential point of New growth theory is that knowledge drives growth. Because ideas can be infinitely shared and reused, they can be accumulated without limit. They are not subject to what economists call “diminishing returns.” Instead, the increasing returns to knowledge propel economic growth. That is to say that one special aspect of knowledge that makes it critical to growth is that knowledge is subject to increasing returns and as a result it is a non-rival good. As explained by Romer (1990) the main

drivers of knowledge and for that matter technological change are research and development activities. Thus, the competition in the market compels profit-maximising firms and investors to undertake intensive research and development activities which lead to discovery of new ideas and knowledge resulting in improvement in technology. Technology in the context of growth and development is the way inputs to the production process are transformed into output.

Romer (1989) suggests five more stylized facts that growth theories should be able to explain.

- ❖ In cross-section, the mean growth rate shows no variation with the level of per capita income.
- ❖ The rate of growth of factor inputs is not large enough to explain the rate of growth of output; that is, growth accounting always finds a residual.
- ❖ Growth in the volume of trade is positively correlated with growth in output.
- ❖ Population growth rates are negatively correlated with the level of income.
- ❖ Both skilled and unskilled workers tend to migrate towards high-income countries.

New growth theory incorporates two important points. First, it views technological progress as a product of economic activity. Previous theories (mainly the neoclassical models) treated technology as given, or a product of non-market forces. New Growth Theory is often called “endogenous” growth theory, because it internalizes technology into a model of how markets function. Second, New Growth Theory holds that unlike physical objects, knowledge and technology are characterized

by increasing returns, and these increasing returns drive the process of economic growth.

Following from the above discussions and in particular the publication of two famous papers by Robert Solow in 1956, several works on economic growth have flourished. Indeed, a search in the literature reveals that a wide range of studies have investigated the variables underlying economic growth. These studies have identified varied factors that explain differences in economic growth across countries over time using diverse methodologies (For example, Lucas, 1988; Romer, 1990; Barro, 1991; Summers and Heston, 1991; Mankiw, Romer and Weil, 1992; Sachs and Warner, 1997; Barro and Sala-i-Martin, 2004; Lensink and Morrissey, 2006).

2.2 Trade, Foreign Aid and Growth

This section reviews both theoretical and empirical literature on trade, foreign aid and growth.

2.2.1 Trade and Growth

Traditional explanations of trade as “the engine of growth” and the impact of trade on economic development are rooted in the theory of comparative advantage. The theory of comparative advantage arises from nineteenth century free trade models associated with David Ricardo and John Stuart Mill, which were modified by trade theories embodied in the factor proportions or Hechsher–Ohlin Theory (1933) and Stolper-Samuelson (1941) and Rybzsnski Effects (1955). These trade models collectively and in various ways predict that an economy will tend to be relatively

effective at producing goods that are intensive in the factors with which the country is relatively well endowed. In other words, comparative advantage provides that when nations specialize, they become more efficient in producing a product (and indeed a service), and thus if they can trade for their other needs, they and the world will benefit.

The theory of comparative advantage predicts that protectionist measures in the form of tariffs or quotas could lead to reduced output and export growth and overall welfare. The direct implication of these conclusions is that unrestricted trade would tend to be associated with higher levels of growth.

Put differently, specialisation on the basis of comparative advantage enables the maximum level of output to be produced from a given amount of factor resources. Production increases, consumption increases, and therefore global welfare increases.

The essence of dynamic gains is that they increase the productive capacity of the economy by augmenting the availability of resources for production through increasing the productivity of resources and increasing their quantity. One of the major dynamic benefits of trade is that export markets widen the total market for a country's producers. If production is subject to increasing returns, export growth becomes a continual source of productivity growth. There is also a close connection between increasing returns and the accumulation of capital. For a small country with no trade there is very little scope for large scale investment in advanced capital equipment; specialisation is limited by the extent of the market.

But if a poor small country can trade, there is some prospect of industrialisation and of dispensing with traditional methods of production. It is worth

remembering that at least 60 countries in the world classified as developing, and 31 in Africa, have populations of less than 15 million. Without export markets, the production of many goods would not be economically viable.

Other important dynamic benefits from specialisation and trade consist of the stimulus to competition; the acquisition of new knowledge, new ideas and the dissemination of technical knowledge; the possibility of accompanying capital flows through foreign direct investment, and changes in attitudes and institutions. In the context of 'new' growth theory, these are all forms of externalities which keep the marginal product of physical capital from falling, so that trade improves the long run growth performance of countries.

Under endogenous models, growth reflects the contribution to productivity from structural and governance reforms on the one hand, and the adoption of new technology on the other. Trade is seen as affecting long run growth through its impact on technological change. Endogenous growth models, therefore, hold that trade provides access to imported products, which embody that new technology. Additionally, trade alters (mainly increases) the effective size of the market facing producers which raises returns to innovation; and affects a country's specialization in research-intensive technologies and production systems.

It can be summarised from the above theoretical discussions that trade gives a poor country the opportunity to remove domestic shortages, to overcome the diseconomies of a small domestic market and accelerate the learning rate of the economy. Hence it can be concluded that if trade increases the capacity for growth and

development, then the larger the volume of trade, the greater the potential for economic growth and development.

Following from the above theory, a number of empirical studies assessing the impact of trade on economic growth have emerged.

A recent study by Sakyi *et al* (2014) investigates the link between trade openness and economic growth for a sample of 115 developing countries over the period 1970–2009. Using the composite trade share (CTS) as a measure of trade openness and the Common Correlated Effects Mean Group (CCEMG) estimator, their results showed that there exists a positive bidirectional relationship between trade openness and economic growth.

Akilou (2013) investigated the relationship between trade openness and economic growth for the West African Economic and Monetary Union (WAEMU) countries. According to the findings, apart from the Côte d'Ivoire, and at the 10% level, trade openness did not cause economic growth in those countries. Moreover, it was observed that economic growth did not cause trade openness.

Gries and Redlin (2012) studied a total of 158 countries, and questioned the causality between the growth in GDP per capita and openness in the 1970–2009 period. In this study, the researchers used panel cointegration tests and panel error-correction models (ECM) in combination with GMM estimation to explain the causality relationship between economic growth and openness. Long-term results of the model suggested a positive causality relationship from openness to growth. However, the short-term coefficients identified a negative short-run adjustment. In other words, it was

observed that openness could be painful for an economy undergoing short-term adjustments.

Awokuse (2007) examines the impact of export and import expansion on growth in three transition economies on country level. The results show bidirectional causality between exports and growth for Bulgaria, the Czech Republic exhibits unidirectional causality from exports and imports on growth, and for Poland only the import-led growth hypothesis can be supported.

Yanikkaya (2003) estimated the effect of trade openness on per capita income growth for 120 countries for the period 1970 to 1997. He finds that openness based on volume trade and openness based on trade restrictions all had positive and significant effect on economic growth.

2.2.2 Aid-Growth Nexus

The theoretical or conceptual underpinning of the link between aid and growth remains rooted in the two-gap model pioneered by Chenery and Strout (1966). The analytical framework is grounded in a Harrod-Domar growth model where savings are needed to fund the investment required to attain a target growth rate, conditional on the productivity of capital. Poor countries lack sufficient resources to finance investment and requirements to import capital goods and technology. Aid to finance investment can directly fill the savings-investment gap and, as it is in the form of hard currency, aid can indirectly fill the foreign exchange gap. As official aid is issued to government, it can also fund government spending and compensate for a small domestic tax base. It supplements insufficient domestic saving by providing foreign income for the

importation of desired capital goods to augment the level of capital stock used for domestic production (Hudson, 2004). It is believed that an aid-financed imports and investment would be growth enhancing for the many developing countries constrained with saving and foreign exchange earnings.

This phenomenon has led many developing countries become highly dependent on foreign aid, and it is not surprising that following the Monterrey consensus in 2002 (based on the need to help achieve the MDGs by 2015) developed countries pledged massive inflow of foreign aid to developing countries. Bacha (1990) demonstrates that government fiscal behaviour represents an important channel through which aid flows can influence growth. Recent studies also highlight the potential importance of government policy as a determinant of the effects of aid on growth. As Morrissey *et al* (2005) points out, there are a number of mechanisms through which aid can contribute to economic growth. These include: aid increases investment in physical and human capital; increases the capacity to import capital goods or technology; does not have indirect effects that reduce investment or savings rates; and aid is associated with technology transfer that increases the productivity of capital and promotes endogenous technical change.

Studies by some researchers have argued that there is a positive and significant relationship between aid and growth. Gyimah-Breimpong *et al* (2010) estimated the impact of aid on growth for a panel of 77 developing countries over the period 1995–2004. Applying dynamic panel data estimator, their results showed that aid has positive effect on GDP per capita.

A study by Karras (2006) investigates the relationship between foreign aid and growth in per capita GDP using annual data from the 1960 to 1997 for a sample of 71 aid-receiving developing countries. This paper concludes that the effect of foreign aid on economic growth is positive, permanent, and statistically significant. More specifically, a permanent increase in foreign aid by \$20 per person results in a permanent increase in the growth rate of real GDP per capita by 0.16 percent. These results are obtained without considering the effects of policies.

Ouattara (2006) analyzes the effects of aid flows on key fiscal aggregates in Senegal. This paper utilizes data over the period of 1970–2000 and primarily focuses on the interaction between aid and debt. The author determined three main outcomes of his study. First, that a large portion of aid flows, approximately 41%, are used to finance Senegal's debt and 20% of the government's resources are devoted to debt servicing. Second, that the impact of aid flows on domestic expenditures is statistically insignificant, and third that debt servicing has a significant negative effect on domestic expenditure. As a result, his paper suggests that debt reduction could become a more successful policy tool than obtaining additional loans.

Gomanee, Girma, and Morrissey (2005) address directly the mechanisms via which aid impacts growth. Using a sample of 25 Sub-Saharan African countries over the period 1970 to 1997, the authors determined that foreign aid has a significant positive effect on economic growth. Furthermore, they identified investment as the most significant transmission mechanism. This paper concludes that on average, each one percentage point increase in the aid/GNP ratio contributes one-quarter of one

percentage point to the growth rate. As a result, Africa's poor growth record needs to be attributed to factors other than aid ineffectiveness.

A study conducted by McGillivray (2005) demonstrates how aid to African countries not only increases growth but also reduces poverty. The author points out the important fact that continuously growing poverty, mainly in sub-Saharan African countries, compromises the MDGs (Millennium Development Goals) main target of dropping the percentage of people living in extreme poverty to half the 1990 level by 2015. His research econometrically analyzes empirical, time series data for 1968-1999. The paper concludes that the policy regimes of each country, such as inflation and trade openness, influence the amounts of aid received.

Other studies such as Dowling and Hiemenz (1982), Gupta and Islam (1983), Hansen and Tarp (2000), Burnside and Dollar (2000), Gomanee, *et al.* (2003), Dalgaard *et al.* (2004), and Karras (2006), find evidence to support the positive impact of foreign aid on growth.

On the contrary, Herbertson and Paldam (2007) investigate the relationship between aid and growth rates of GDP in developing countries. Their results show that aid has negative and significant relationship with economic growth.

Griffin and Enos (1992) report a negative impact of aid on growth for a sample of 32 Latin American countries for the 1957-90 period. Studies by other authors like Rajan and Subramania (2008), Tang (2007), , Easterly (2003) have also argued that foreign aid has no significant positive effect on growth.

Notwithstanding these arguments, whether aid is effective for spurring economic growth still depends on the policies of both donor and recipient countries and

the potential side effects of aid inflows. On the one hand, aid may have a positive effect on economic growth if appropriate policies are in place. This argument is based on the hypothesis that market forces in association with the government adopting sound management may be enough to generate economic development.

On the other hand, aid may have a negative effect on growth if a high level of aid inflows leads to the decline in the productivity of capital investment, and if the volatility of aid inflows leads to delaying or cancelling investment decisions. For instance, Dowling and Hiemenz (1993) examine the aid-growth nexus using data covering the 1968-1989 period for 13 Asian countries, and control for a number of policy variables such as trade, finance and government intervention. They obtain a positive and significant impact of aid on growth. Boon (1994; 1996) employs data covering the 1970-1992 period for a sample of 56 developing countries to examine aid effectiveness. He finds no significant relationship between aid and growth and criticized recipient governments for not having appropriate economic policies.

Similarly, Burnside and Dollar (1997) examine the interactive effect of aid and policy conditionality on growth for a sample covering 56 developing countries over the 1970-1993 period. While their results indicate a negatively insignificant statistic of the aid-growth coefficient, they illustrated that sound policy management is conditional for aid to have a positive effect on growth. They conclude that aid only works when government policies are good, and that aid should be given to countries where governments pursue sound policy management.

The afore literature review clearly indicates that the empirical works on trade-growth and aid-growth nexuses are still far from a conclusive one. This situation could

be attributed to how aid and trade openness are measured and/or methodological problems. While some use aggregated aid data others also use disaggregated aid data. Similarly, studies rely on various different measures of trade openness such as real international trade share (RTS), composite trade share (CTS), among others. Thus, this makes it difficult to identify the actual effect of aid on growth. Besides, most of the studies use ordinary least square which is usually unbiased and inconsistent. Only few recent studies make use of more robust estimators that generate efficient estimates.

2.3 Democracy, Corruption and Growth

This section reviews related literature on the relationship between democracy, corruption and growth.

2.3.1 Democracy and Growth

Indeed, as a type of government and also a measure of governance and institutional quality, democracy has been touted as having a relationship with economic performance of countries. This relationship has however been highly contentious in literature. While some authors highly recognise that there is a strong and positive association between the democratic institution of a country and its economic performance other authors also hold on to an opposing view.

Indeed, authors such as Jalles (2010), Persson (2005), Olson (1993), Clague *et al* (1996), Minier (1998), recognise that democracy propels an economy to economic growth and prosperity. They strongly argue that the democratic process of a country enhances stable political environment, fundamental civil liberties and open society;

promotes property protection, business freedom, as well as contract enforcement; discourages corruption and lawlessness. All these in the end would lead to economic growth.

A study by Jalle (2010) presented some new panel data-based evidence supporting statistically positive effects of extreme-type democratic regimes on economic growth. After controlling for initial income, human capital, investment and policy variables, Jalle (2010) showed that sustained democratic (electoral) transitions, by themselves, increase per capita GDP growth while almost no support was found for the hypothesis that sustained autocratic transitions, by themselves, increases it.

Rigobon and Rodrik (2005) used identification through heteroskedasticity to study the interrelationship between rule of law, democracy, openness, and income and concluded that democracy is good for economic performance.

Roll and Talbott (2003), in a cross-country investigation for between 134 and 157 countries over the period 1995-1999, find highly significant positive impact of political rights and civil liberties on Gross National Income per capita.

Adding to the already existing studies, Boko (2002) investigated the impact of democracy on economic growth for 27 African countries and concluded that democracy has a significant positive effect on economic growth.

In a related study by Kaufmann *et al.* (1999) they found empirical evidence to support the positive relationship between democracy (proxied by voice and accountability) and economic growth.

Further, in a study conducted by Sirowy and Inkeles (1990), they concluded that overall, the extension and protection of civil liberties and basic freedoms are thought to

generate the security of expectation necessary to motivate citizens to work, save, and invest. They further argued that popular political participation not only has the consequence of breaking down the privilege and vested interests of a few but also feeds a participative mentality that carries over into the economic arena and greatly increases the flow of information so essential to effective and efficient governments. All in all, political pluralism acts to release energies and foster conditions conducive to change, entrepreneurial risk, and economic development.

In another study by Kormendi and Meguire (1998), they discovered that countries with a high standard of civil liberties experience about 1 percent greater economic growth *ceteris paribus*.

Also, Scully (1998) indicates that politically open societies grew at a compound real per capita rate of 2.5 percent per year compared to politically closed societies, which grew at 1.4 percent per year.

Notwithstanding the above argument, other authors have pessimistic view about democracy and how it affects economic performance. They argue that there is a negative relationship between democracy and growth and that democracy undermines the economic performance of a country. Thus, the pressures from different interest groups may cause democratic institutions to suffer from inefficiencies in making decisions resulting in difficulty in implementing crucial policies which will lead to rapid economic growth. Again, “premature” democracy in developing countries possibly lowers the economic growth rate and even results in economic disorder, political instability and ethnic conflict (see Schmitter and Karl, 1991; Persson and Tabellini, 1992; Blanchard and Shleifer, 2000).

Sakyi (2011) investigated the link between democracy, economic globalisation and income in sub-Saharan Africa. He used three indicators of democracy namely Polity2, political rights and civil liberties and adopted Dynamic Ordinary Least Square and Fully Modified Least Square estimators. The coefficients on all indicators of democracy were negative and statistically significant for both estimators. Sakyi (2011) therefore concluded that democracy has negative impact on income in sub-Saharan Africa.

Veiga and Aisen (2011) investigated the link between democracy and economic growth over the period 1960–2004 for 169 countries. Using, GMM estimation techniques, they found that democracy has a slightly negative impact on economic growth.

A study by Barro (1996) which used the Gastil measure of political rights and concludes that once the maintenance of the rule of law, free markets, small government consumption, human capital, and the initial level of real per capita GDP are held constant, the overall effect of democracy on growth is weakly negative.

Olson (1993), for instance, argues that special interest groups tend unduly to influence state policy, reaping particularistic privileges that damage the overall economy. Besides, because the democratic state reflects at least to some degree, the political make-up of its constituents, there are more voices represented in government, leading to political sclerosis. The result is decreased efficiency and, therefore, decreased economic performance.

Using the Gastil indices as proxies for democracy and adjusting for the simultaneous determination of income and democracy, Helliwell (1992) finds the direct effect of democracy on economic growth to be negative but insignificant.

2.3.2 How corruption affects growth

It is an indisputable fact that corruption in a country has several consequences in the economy. Indeed, it has been found by recent empirical studies that economic growth is adversely affected by corruption. This takes place through several channels.

Indeed, in a country where there is a prevalence of corruption, investors and entrepreneurs are aware that some of the proceeds from their investments may be claimed by corrupt officials. In such countries, payment of bribes is often required before necessary permits will be issued. Therefore, investors may perceive corruption as a tax – and one of a particularly pernicious nature, given the need for secrecy and the uncertainty that come with it. This reduces the incentives to invest.

Corruption could result in loss of tax revenue especially when it takes the form of tax evasion or the improper use of discretionary tax exemption. This situation could be described as corrupt practice particularly when there is a counter payment to the tax official responsible.

Further, the allocation of public procurement contracts through a corrupt system may lead to inferior public infrastructure and services. For instance, corrupt state officials may allow the use of cheap and substandard materials in the construction of projects such as roads, buildings, bridges, among others.

It is also important to mention that corruption could have adverse effect on government budget by affecting tax collection or the level of public expenditure. Corruption could affect the composition of government expenditure. Corrupt government officials may prefer those types of expenditure that allow them to collect bribes and to keep them secret. Indeed, one might expect a priori that substantial bribes are easier to collect on large infrastructure projects. This situation is what is observed in many African countries like Ghana where political party officials (or government officials) demand that some percentage of contract sums be paid into coffers of the political party in power. The essence is to finance the activities of the political party. All these result in shoddy projects being executed by contractors.

Furthermore, in many developing countries including Sub-Saharan Africa there is the possibility that corruption might reduce the effectiveness of aid flows through the diversion of funds from their intended projects.

Hanousek and Kocenda (2011) investigated the link between corruption and the level of per capita income among a panel of 35 countries. They argued that corruption affects levels of income through public investments. The results of their estimation show that reductions in corruption either increase or decrease public investment, depending on the country and its institutions.

A more recent paper by Hanousek and Kochanova (2014) attempts to provide an explanation to the divergent effects found in the previous literature. They examine whether bureaucratic corruption, measured as the frequency of unofficial payments to public officials to 'get things done', impacts the productivity growth of firms in Central and Eastern European countries. Using firm economic performance

data from the Amadeus database, they find that the ambiguous consequences of corruption found in previous studies could be explained by divergent effects of the mean and dispersion of corruption. In particular, a higher bribery mean retards productivity growth of firms hence, economic performance.

According to Aidt *et al.* (2005) corruption reduces productivity growth through two mechanisms: by its negative impact on innovation and, also, by reducing learning-by-doing externalities, thereby limiting the possibilities of exploiting previous technology developed by other economies.

Lambsdorff (2003) investigates how corruption affects productivity growth. His conclusion suggests that the negative impact of corruption on productivity is manifest in the correlation of this variable with a poor quality of the bureaucracy.

Gyimah-Brempong (2002) investigates the effect of corruption on economic growth and income inequality for a panel of 21 sub-Saharan African countries over the period 1992-1999. Using Instrumental Variable estimators, he concludes that corruption has a negative impact on the growth rates of GDP and income. Thus, a one point increase in corruption decreases the growth rates of GDP by between 0.75 and 0.9 percentage points per year and of per capita income growth rate by between 0.39 and 0.41 percentage points per year, respectively. He argues that corruption decreases the growth rate of income directly through reduced productivity of existing resources as well as decreased investment in physical capital.

Rose-Ackerman (1997) also concludes that corruption results in reduction in economic growth. She argues that corruption generates more distortion than does mere taxation. Just as an incentive to bribe exists, one to receive bribes also exists. Put

differently, there is an underappreciated supply-side to the market for rent-seeking. One manifestation is that policymakers may promote initiatives (public works projects are an excellent example) not to satisfy social need, but because such projects increase opportunities for bribes.

According to Mauro (1995), corruption lowers investment and economic growth. He argues that the observed effects are considerable in magnitude. Using the Business International (BI) indices of corruption, Mauro (1995) finds that a one-standard-deviation improvement in the corruption index causes investment to rise by 5% and annual rate of growth of GDP per capita to rise by half a percentage point. He concludes that much of the effects on economic growth take place through the effects on investment.

The literature review discussed above on the democracy-corruption-growth nexuses reveals two major conclusions. First, it reveals that the empirical evidence on the impact of democracy on growth is still far from a conclusive one. Thus, while some authors are optimistic that democracy leads to economic growth others hold pessimistic view that democracy exerts negative influence on economic growth. This lack of conclusive evidence could be attributed to the fact that there are so many indicators used to measure democracy and each of them affects economic growth in different ways. Besides, many of the existing studies are cross-section in nature some of which focus on developing countries while others look at developed countries with each of the regions having completely different political and institutional structures which can affect results and conclusions.

Secondly, corruption produces negative growth effects. Corruption can harm the chances of success for small, medium and large scale enterprises which limit their ability to grow and become job and income generating. It leads to higher costs and declining quality of public sector infrastructure projects, diminishing economic efficiency and macroeconomic instability. In summary, corruption in a country increases the levels of poverty and income inequality which inhibit the economic growth and performance of the country.

2.4 Other Determinants of Economic growth

Human capital is a very important variable that explains differences in growth across countries. Various proxies such school enrolment rate, literacy rates, teacher-pupil ratio, among others have been used to measure education. Education enhances not only the skills of the population but also improves the efficiency and marginal productivity of the population. Barro (1991) examined the relationship between human capital (proxied by gross primary and secondary school enrolment rates) and rates of economic growth (proxied by growth rate of per capita GDP) from 1960 to 1980 for a number of countries. The results of most of Barro's regression showed that both gross primary and secondary school enrolment rates have positive and significant effects on rates of economic growth. In examining the role of education in economic growth, Barro and Lee (1994) used census and enrolment data to construct a variable that approximates the average years of schooling of adult population (age 25 and above). Their major results show that the average years of male secondary schooling is significantly positively related to economic growth. However, the average years of female secondary schooling has a significantly negative effect on growth.

Another study by Sala-i-Martin (2004) which are based on a new data set with more observations and presumably better data still find a positive and statistically significant effect for male secondary education while they find female secondary education is insignificant. Other studies by Kyriacou (1991), Mankiw, Romer and Weil (1994), Benhabib and Spiegel (1994) all concluded that education enhances economic growth.

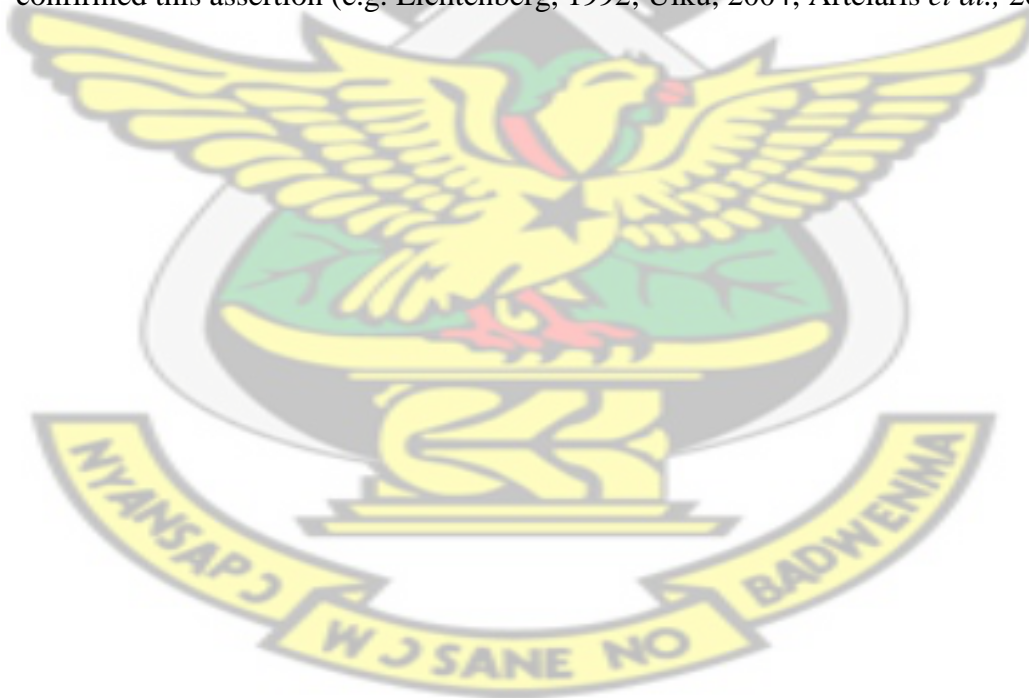
The foregoing analyses suggest that improvement in human capital through enhanced education contributes immensely to economic growth. Perhaps, it is this argument and conclusion that underscores the increased public spending on education in many developing countries particularly in sub-Saharan Africa.

Throughout growth literature, both theoretical and empirical studies, one other variable that has gained popularity as a driving force of economic growth among countries is investment in physical capital stock. Many of the studies found in the growth literature argue and conclude that investment in physical capital stock is the most fundamental variable that determines economic growth (See Lichtenberg, 1992; Levine and Renelt, 1992; Mankiw *et al.*, 1992; Easterly, 1997; Barro and Sala-i-Martin, 2004; Artelaris *et al.*, 2007).

The prevailing macroeconomic conditions as well as the economic policy stance of the government have also been emphasised as important determinants of economic growth. Generally, a relatively more stable macroeconomic conditions reduce risks and uncertainties associated with investment and hence provide a conducive environment for growth. Conversely, a macroeconomic instability resulting from high inflation tend to harmfully affect economic growth. Also, good economic policies

resulting in improved infrastructures, investment in human capital and efficient institutions can spur economic growth. Barro and Sala-i-Martin (1995), Easterly and Rebelo (1993), Fisher (1993), Barro (1991, 1998), Grier and Tullock (1989) and Kormendi and Meguire (1985) have all concluded that macroeconomic conditions and economic policies play a significant role in economic growth.

Within the endogenous growth models, Research and Development (R&D) has been highlighted as an important source of economic growth. Research and Development activities result in inventions and innovations which lead to technological progress. This brings about the introduction of new and superior products which spur productivity growth and consequently economic growth. Other studies have empirically confirmed this assertion (e.g. Lichtenberg, 1992; Ulku, 2004; Artelaris *et al.*, 2007).



3. FACTS ABOUT GROWTH AND INCOME DIFFERENCES IN SUB-SAHARAN AFRICA

3.1 An overview of the current economic conditions of sub-Saharan Africa

Like any other sub-region, the economies of sub-Saharan African (SSA) countries consist of agriculture, industry and services. Africa was described as the poorest inhabited region in the world in March, 2013. In spite of this, economic growth in sub-Saharan Africa picked up reasonably in 2014, to 4.5%, relative to the 4.2% posted in 2013. The rate of GDP growth in the sub-region generally was anticipated to remain unchanged at 4.6 percent in 2015 (World Bank, 2014). Notwithstanding these headwinds, economic growth is expected to reach 5.1% by 2017, championed by significant investment in infrastructures, increase in agriculture production as well as vibrant services. On the basis of these, it is predicted by the World Bank that most sub-Saharan African countries would get to "middle income" status (defined as income per capita of at least US\$1,000 a year) by 2025 if present rates of growth are sustained. In addition, gross domestic product is also projected to go up by an average of more than 6 percent a year over the period 2013 and 2023 (World Bank, 2014).

It is also significant to emphasise that economic growth has been taking place all over the sub-region, with over one-third of SSA countries recording 6 percent or higher rates of growth while another 40 percent is growing at a rate between 4 percent and 6 percent per annum. While it is predicted that sub-Saharan Africa could record US\$29 trillion in terms of GDP by 2050 income inequality is seen to be a major challenge to wealth distribution (World Bank, 2014).

It is also worth noting that the fastest growing countries in sub-Saharan Africa achieved rates of growth that are quite above the world average rate. Of course, the top countries as of 2009 consist of Mauritania, Angola, Sudan, Mozambique and Malawi with growth of 19.8% 17.6%, 9.6%, 7.9% and 7.8% respectively. Other fast growing economies include Chad, Ethiopia, Burkina Faso, Rwanda and Niger. On the other hand, there has been dismal, negative or slow growth in many countries of the sub-region. Some of these countries include Zimbabwe, the Democratic Republic of the Congo, the Republic of the Congo and Burundi. Indeed, foreign direct investors are gradually gaining confidence in investing in African emerging economies especially as African continues to maintain high economic growth (African Development Bank, 2012).

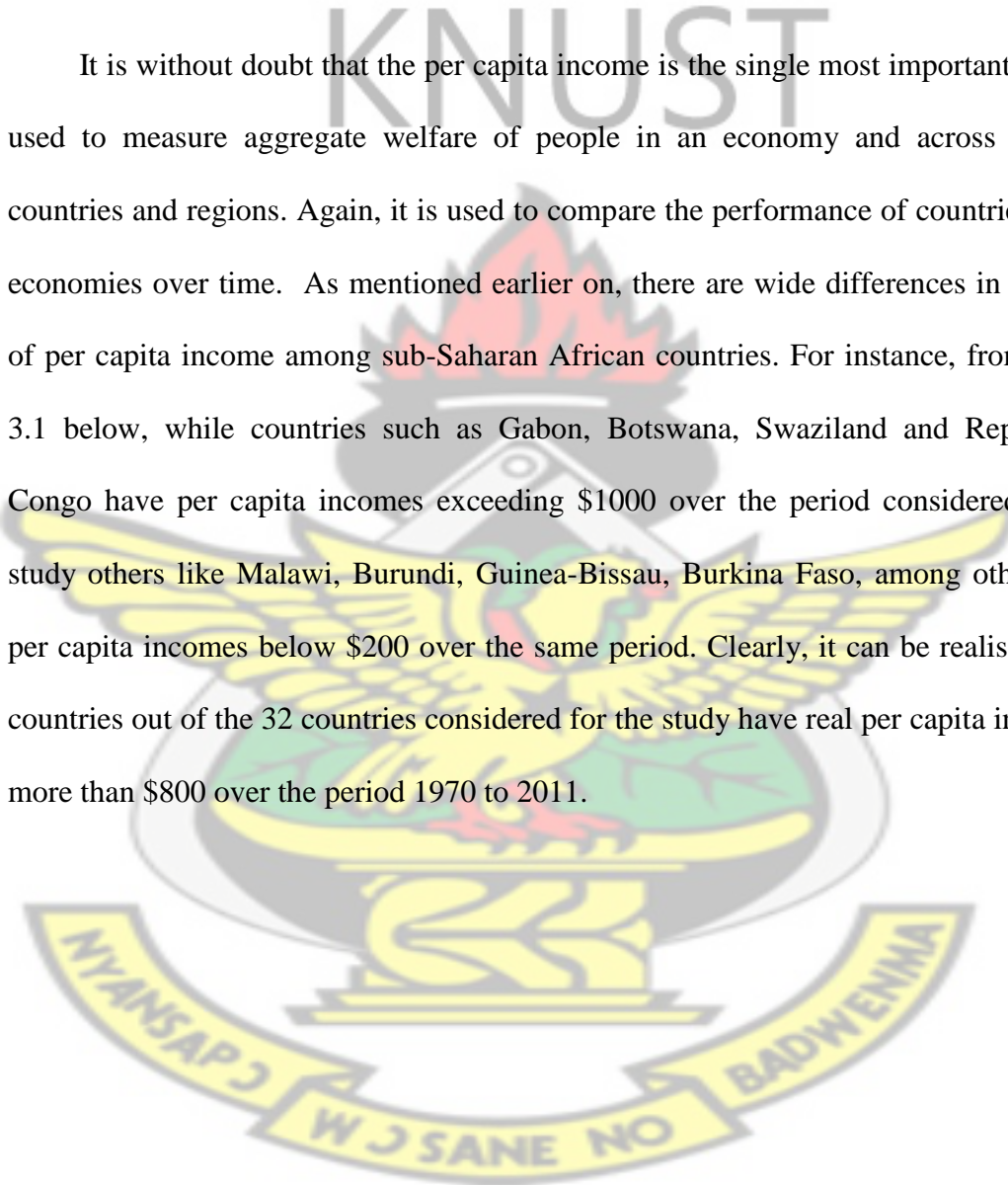
With regards to the current debt situation, the Heavily Indebted Poor Country (HIPC) initiative is still providing debt relief and assistance to the sub-region. Sponsored by the World Bank and International Monetary Fund with support from the African Development Bank, sub-Saharan African countries continue to receive benefits in the form of the multilateral debt relief initiative. Indeed, 30 sub-Saharan African countries had received partial debt relief through this initiative as of 2013 (African Development Bank, 2014)

As indicated earlier, the economic performance of sub-Saharan Africa is expected to be driven and supported by investment in infrastructure, increased production in the agricultural sector as well as vibrant services sector. Additionally, the continuous drive for economic growth is anticipated to take place through a rise in net

foreign direct investment. On the whole, sub-Saharan Africa is projected to continue to be one of the fastest growing sub-regions.

3.2 Income Differences in SSA

It is without doubt that the per capita income is the single most important variable used to measure aggregate welfare of people in an economy and across different countries and regions. Again, it is used to compare the performance of countries and/or economies over time. As mentioned earlier on, there are wide differences in the level of per capita income among sub-Saharan African countries. For instance, from Figure 3.1 below, while countries such as Gabon, Botswana, Swaziland and Republic of Congo have per capita incomes exceeding \$1000 over the period considered for the study others like Malawi, Burundi, Guinea-Bissau, Burkina Faso, among others have per capita incomes below \$200 over the same period. Clearly, it can be realised that 9 countries out of the 32 countries considered for the study have real per capita income of more than \$800 over the period 1970 to 2011.



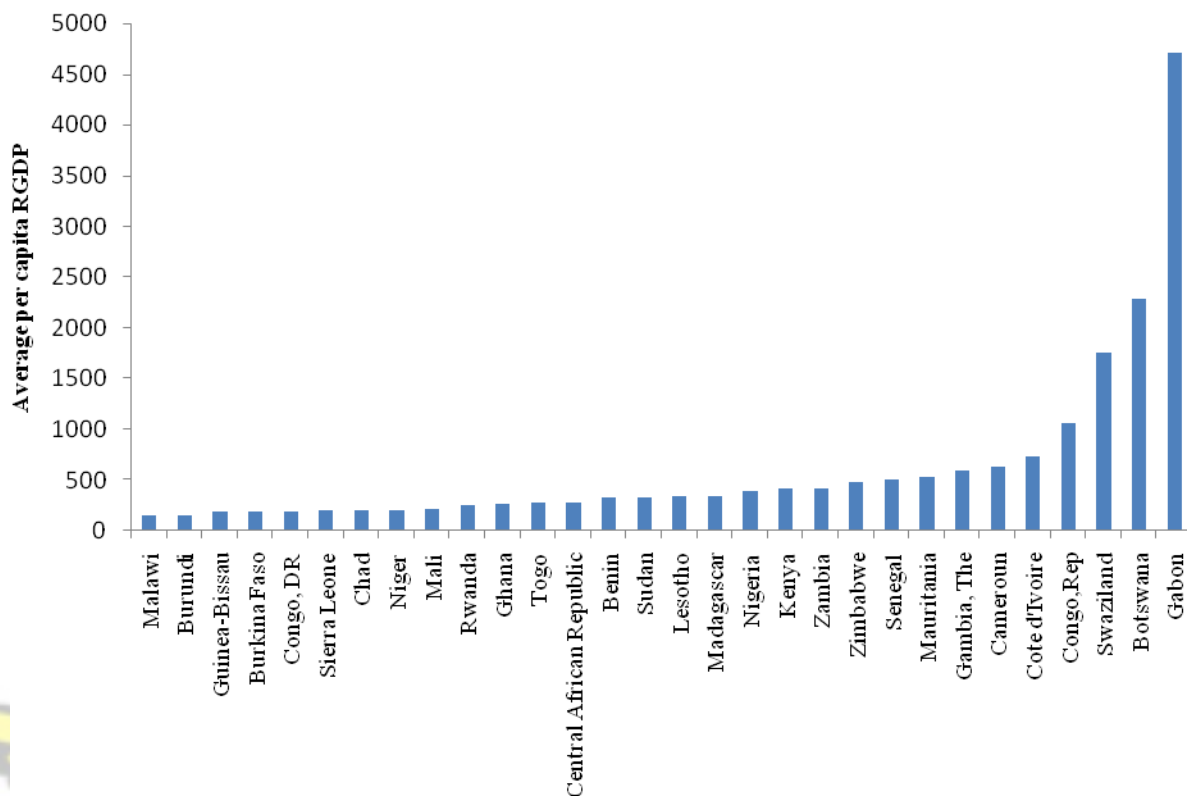


FIGURE 3.1 Average real GDP per capita among 30 sub-Saharan African countries (1970 – 2011). *Source:* Author’s construct based on data from WDI, 2014.

The facts presented above indicate the levels of income in sub-Saharan Africa are generally low. They further suggest that there are wide variations or differences in the levels of income between the top performers (e.g. Gabon and Botswana) and the other slow growing countries (e.g. Burundi, Congo DR, Chad, Niger, etc), an indication of a big gap in terms of income distribution among SSA countries.

One of the factors that account for income differences and growth in SSA is trade. As will be discussed in detail in Sub-section 3.3, external trade forms a significant proportion of the national output and income of many SSA countries. Generally, countries with large volumes of trade (and hence high ratios of trade to GDP) tend to perform better than those with low volumes of trade. For those countries with relatively large per capita incomes in SSA, the relative shares of trade in GDP are quite high and above 70%. For instance, the share of external trade in GDP for Botswana is approximately 88% while that of Nigeria stands at 75%. These compare more favourably than those attained by low income countries such as Burundi, Guinea-Bissau and Central African Republic whose relative shares of trade in GDP respectively are 46%, 48% and 34% (WDI, 2013)

Also identified as a potential source of income and growth differences among SSA countries is the inflow of foreign aid. It is an undeniable fact that the annual budgets of most sub-Saharan African countries are to some extent implemented with donor assistance. Major aid recipients in SSA include Democratic Republic of Congo, Sudan, Kenya, Ghana, Nigeria, Cote d'Ivoire, Zambia, Senegal and Burkina Faso. In spite of the numerous aid received, only a few countries (Cameroon, Ghana, Cote d'Ivoire, Zambia, Kenya and Senegal) have achieved moderate income per capita of over \$600. Other minor aid recipients such as Botswana, Gabon and Swaziland are among the high income earners in SSA (African Development Bank, 2013). Thus, aid inflow is a major factor that account for differences in income and growth in SSA. The details of how aid affects economic performance have been presented in Sub-section 3.4.

Moreover, political institutions and for that matter quality of governance have greatly contributed to income and growth differences in SSA. It is important to emphasize that there are significant differences in the nature and structure of the political systems among individual countries in the SSA sub-region. While countries such as Ghana, Botswana, Gabon, Equatorial Guinea and Zambia have enjoyed relative political stability and good governance which have fostered economic activities leading to income and growth others such as Burundi, Cote d'Ivoire, Central African Republic, Democratic Republic of Congo and Rwanda were plagued with civil conflicts and wars which disrupted economic activities resulting in adverse economic performance hence, decline in income and growth.

Among other factors that account for differences in income distribution and growth among SSA countries, natural resource endowment plays a significant role. Generally, most SSA countries are endowed with various resources which include arable land, vegetation, drainage, minerals and oil. Ghana, South Africa, Nigeria, Zambia, Equatorial Guinea, Gabon, Botswana and Angola are some examples of resource-rich countries¹ in SSA. On the other hand, countries such as Burkina Faso, Niger, Central African Republic and Ethiopia are resource-poor. Of course, the role played by resources in growth performance of these countries cannot be underestimated compared with resource-poor countries. As reported by World Bank (2013), the average GDP per capita growth rate in resource-rich countries was 2.2 times more than that in the resource-poor countries. Of the twenty-one countries currently classified as

¹ These are countries that derived more than 5% of their GDP from oil and non-oil minerals (not including forests) over the period 1980-2010 (World Bank, 2013)

middle-income in SSA, thirteen are resource-rich. Examples include South Africa, Botswana, Ghana, Gabon, Equatorial Guinea and Nigeria. In fact, Africa's recent growth situation has been largely driven by the resource-rich countries and this is projected to continue given the spate of recent discovery of minerals in the sub-region. This therefore follows that income and growth differences among SSA countries could partly be explained by the distribution of natural resources.

Another factor partly responsible for the observed differences in growth and income is demographic changes in individual countries. The rate of population growth has been quite high in Africa reaching 4.8% in 2013. The population of Africa has been projected to hit 1.4 billion if the present demographic patterns continue. In spite of this, the population of Africa is unevenly distributed as too many people live in some parts of the continent and too few people in other parts. This situation accounts for the disparity in growth performance and income. This is especially the case since population is very important in growth policy while population size affects the level of income per capita. For instance, while countries like Nigeria, Ethiopia and Cameroon have relatively large population sizes others like Equatorial Guinea, Gabon and Botswana have small population sizes.

According to a World Bank Report, per capita incomes as of 2013 were \$20,581 for Equatorial Guinea with a population of 722,254, \$11,571 for Gabon with a population of 1.7 million and \$7315 for Botswana with a population of 2.1million. Comparatively, the per capita incomes of these 3 countries are higher than those of Nigeria with a population of 178.5million and a per capita income of \$3005, Ethiopia with a population of 96.5million and a per capita income of \$505 and Cameroon with a

population of 23.7million and a per capita income of \$1328. Clearly, it follows from these analyses that those countries with smaller population will have higher incomes than those with large population, all things being equal. Thus, demographic trends in SSA countries partly explain the observed differences in income and growth.

Other factors that are responsible for income and growth differences in sub-Saharan Africa include human capital development (education and health), broad macroeconomic policies (inflation, exchange rate policy, fiscal and monetary policies) in individual countries, disparities in infrastructural development and the locations of the individual countries in the sub-region.

3.3 Trade-Growth in sub-Saharan Africa

The trade policies of many sub-Saharan African countries before independence were designed to be an integral part of the trade policies of the colonial masters. Such trade policies were formulated to promote and regulate trade to serve the interest of the colonial masters. These policies created close relationship between the colonial masters and the colonies which enabled them to take full control of the external trade of the colonies.

A significant feature of post independence trade policies in sub-Saharan Africa was that most of the countries adopted trade restrictions. That is, most countries adopted protectionist trade policies which were earlier on precipitated by the supposed need to promote and sustain domestic industrial development. Chief among them included Ghana, Nigeria, Zambia, Zimbabwe, among others. This led to a situation of import substitution and infant industry protection. The most significant policies of the

trade restriction were tariffs and quantitative restrictions. As part of the structural adjustment and reform programmes, many sub-Saharan African countries were compelled to adopt the trade liberalisation policy. Thus, a lot of sub-Saharan African countries now have essentially open economies with external trade and transactions representing a considerable percentage of their national output. Significantly, the economic performance and for that matter economic growth of several SSA countries has come to rest on the prospects of their export trade with the rest of the world.

Consequently, the ratios of international or external trade to GDP have been quite high in most SSA countries. This situation has made trade policy very important to the performance and development prospects of those countries. For instance, in Nigeria, the percentage share of international trade to GDP increased from 35 percent in 1960 to over 60 percent in the 1980s and over 75 percent in the 2000s. Other SSA countries showed related characteristics. For example, the ratio of international trade to GDP has been quite above 88% and 66% for Botswana and Zambia respectively. Around the same time, annual growth rates in GDP have been relatively high averaging between 4.23% and 6.14% for Zambia and 6.86% and 9.74% for Botswana (World Bank, 2010)

Sub-Saharan Africa's external trade though has shown some improvements, still remains far low especially when compared with other developing regions particularly the East Asia. Undeniably, African countries as a whole have not performed significantly well in trade, as can be seen from their exports, which have either stagnated or declined even in nominal terms. For instance, the average growth rate of African countries' export between 1975 and 1984 was 6.9% which even declined to an

average of 2.9% over the period between 1985 to 1990. There was however significant improvement in exports between 2000 and 2010 with an average of 6.7% and it is currently estimated to be 7.3% (World Bank, 2013). As noted earlier on, Africa's share of international trade does not compare favourably with other developing regions of the same category. For instance, African countries altogether reported approximately 20% of exports from all developing countries in 1980. This unfortunately declined to an average of about 10% in the 1990s. At least there were some considerable improvements in 2000s growing at an average of 14.6%. As of 2013, Africa's share of developing regions' external trade had reached 23.52% (WDI, 2013).

The preceding discussions show clearly that even though international trade is improving gradually and hence constitute a significant fraction of the aggregate output of SSA countries, the sub-region as a whole has contributed little to total external trade of all developing regions. Thus, despite being taunted as the fastest growing sub-region in the world in recent times, SSA's share in total global trade remains significantly low. On this note, SSA's position for a rapid growth in exports for its countries should be given the needed boost.

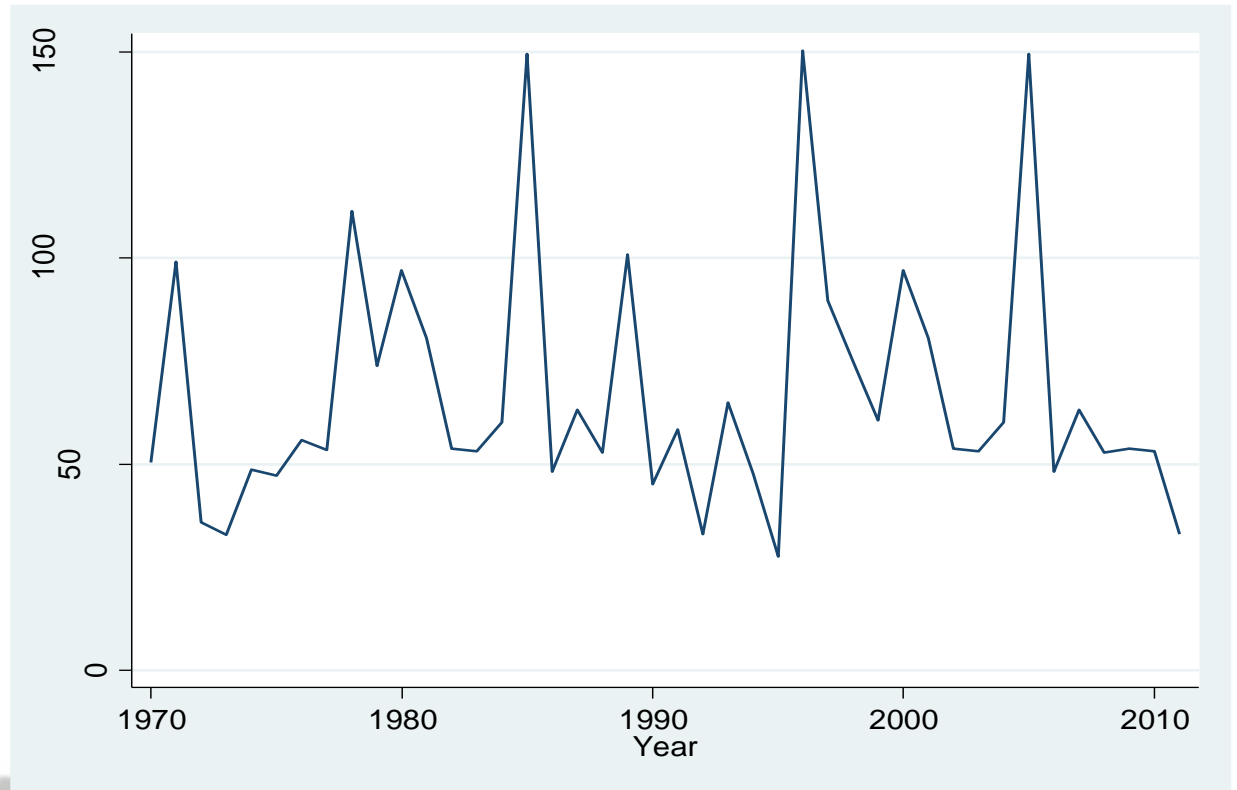
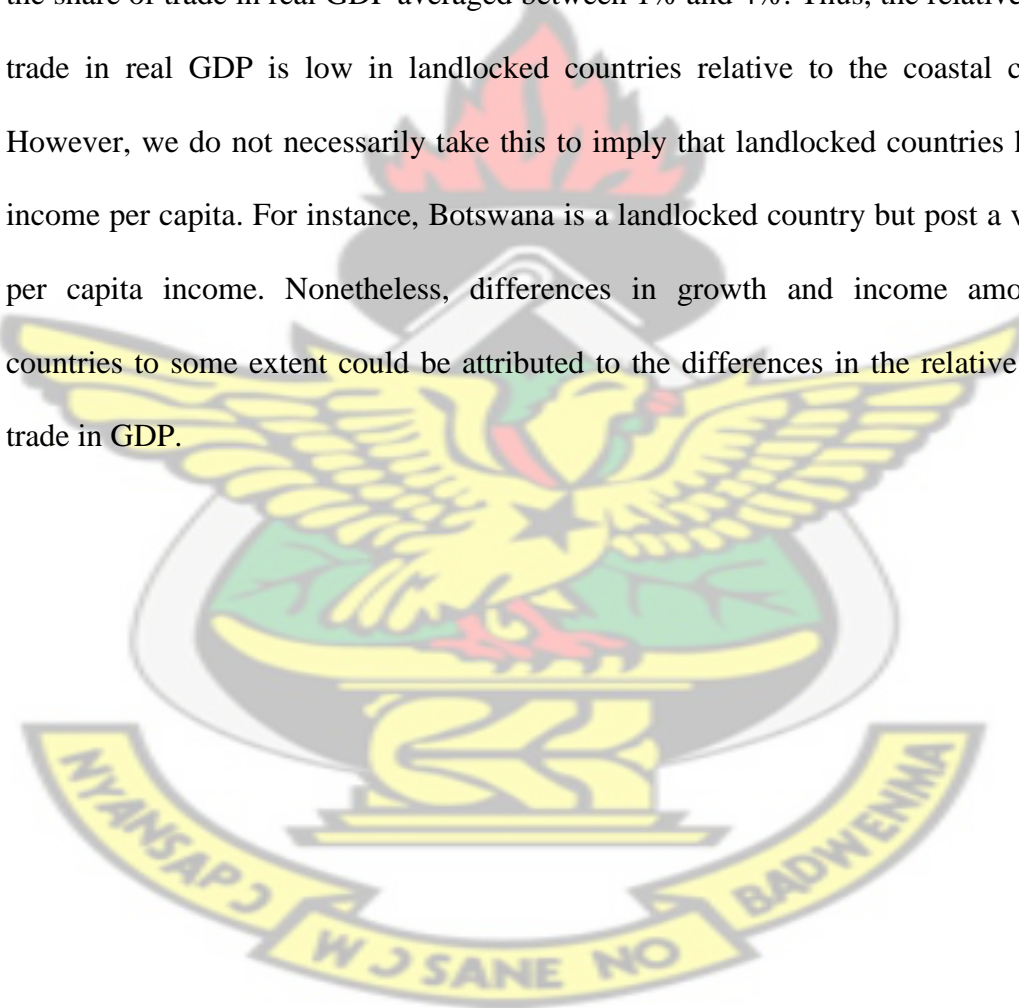


FIGURE 3.2 Trends in the share of Trade in GDP for 32 sub-Saharan African countries (1970 – 2011). *Source:* Author’s construct based on data from World Development Indicators.

Figure 3.2 above illustrates the trends in the ratio of trade to GDP for the 32 countries considered for the study over the period 1970 to 2011. Clearly, it can be illustrated that the contribution of trade to GDP and income per capita has not been consistent albeit exhibit positive trends. The share of trade in real GDP was impressive in 1970 and towards the latter part of 1980 as well as in the mid-1990s and mid-2000s. However, the contribution of trade to GDP and income per capita fell considerably in the mid-1970s as well as the early 1980s and 1990s. This was a period of stagnation among some SSA countries including Ghana, Sudan, among others.

The contribution of trade to real GDP and income per capita improved after the 1994 perhaps due to the adoption of the adjustment and reform programmes of the World Bank and International Monetary Fund during that period. The share of trade in real GDP over the study period averaged between 6% and 10% for countries such as Republic of Congo, Gabon, Mauritania, Swaziland and The Gambia compared with countries such as Rwanda, Burundi, Niger, Chad and Central African Republic where the share of trade in real GDP averaged between 1% and 4%. Thus, the relative share of trade in real GDP is low in landlocked countries relative to the coastal countries. However, we do not necessarily take this to imply that landlocked countries have low income per capita. For instance, Botswana is a landlocked country but post a very high per capita income. Nonetheless, differences in growth and income among SSA countries to some extent could be attributed to the differences in the relative share of trade in GDP.



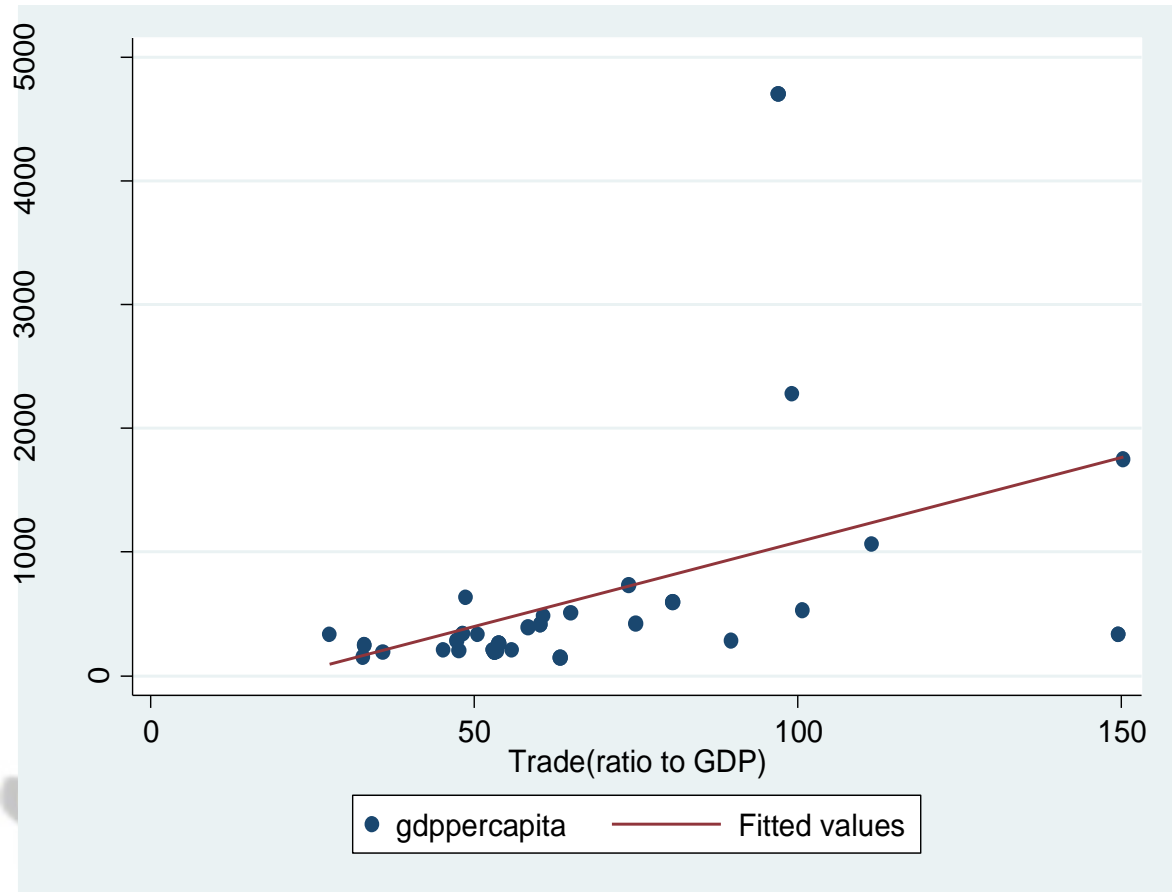


FIGURE 3.3 Real GDP per capita against Trade (ratio to GDP) for 32 sub-Saharan African countries (1970 – 2011). *Source:* Author's construct based on data from World Development Indicators.

The previous figure (Figure 3.2) depicts the trend in trade as a ratio to GDP. Figure 2.3 however, illustrates the correlation between per capita GDP and trade as a ratio to GDP. A careful observation of the graph reveals that real GDP per capita is directly related to total volume of trade as a ratio to GDP over the period under consideration. The implication of this observed relationship is that countries with high degree of trade openness are expected to achieve moderate levels of income compared with countries with considerable amount of restrictions. However, much emphasis is not placed on this results since this is only a pair of bivariate plots and the observed relationship may

change as we control for other variables. Nonetheless, it provides enough evidence to support the theoretical relationship between income levels and trade.

3.4 Aid-Growth performance in SSA

It is without doubt that many sub-Saharan African countries are major aid recipients. Significantly large percentages of the annual budgets drawn by most SSA countries are contingent on donor support. In addition to the relief aid (such as HIPC reliefs) and economic development, most foreign aids are also provided as part of the support for the adjustments and structural reform programmes as well as bilateral relationships and agreements.

Indeed, it is significant to mention that the amount of foreign aid inflows from western countries and donors to sub-Saharan Africa has been very enormous, totalling more than US\$600 billion between 1960 and 2012. This amount is seen to be equivalence of four Marshall Plans being pumped into SSA countries. In Table 2.1 below, we present the average aid received by each of the thirty-two countries considered for the study as well as their respective average income per capita and its growth rate over the period 1970-2011. As can be seen from the table, much of the aid in SSA during the period under consideration was received by Democratic Republic of Congo accounting for almost 10%. This is followed closely by Sudan with 8.2%.

Table 3.1 Aid, income per capita and growth rate of income per capita among selected SSA countries (1970 – 2011)

| <i>Rank</i> | <i>Country</i> | <i>Average aid (\$million)</i> | <i>Average income per capita (\$)</i> | <i>Average annual growth rate in income per capita (%)</i> |
|-------------|--------------------|--------------------------------|---------------------------------------|--|
| 1 | Congo, DR | 1242775714 | 193.51 | -2.6 |
| 2 | Sudan | 1171104048 | 333.10 | -0.1 |
| 3 | Kenya | 970889762 | 417.73 | 1.4 |
| 4 | Nigeria | 899899762 | 390.59 | 1.6 |
| 5 | Zambia | 847570714 | 422.26 | 0.6 |
| 6 | Ghana | 804811667 | 259.59 | 0.8 |
| 7 | Senegal | 792787857 | 507.76 | 0.3 |
| 8 | Cote d'Ivoire | 687150476 | 731.77 | -0.7 |
| 9 | Cameroun | 665129048 | 630.67 | 1.2 |
| 10. | Mali | 647256905 | 208.38 | 1.6 |
| 11 | Burkina Faso | 574857381 | 189.21 | 1.8 |
| 12 | Madagascar | 553466667 | 336.45 | -1.1 |
| 13 | Malawi | 524898095 | 148.98 | 1.2 |
| 14 | Rwanda | 507435714 | 246.65 | 1.9 |
| 15 | Niger | 491825714 | 205.90 | -1.0 |
| 16 | Zimbabwe | 396412143 | 484.52 | -1.1 |
| 17 | Mauritania | 372830476 | 532.35 | 1.2 |
| 18 | Benin | 329209524 | 333.07 | 0.6 |
| 19 | Chad | 321485238 | 205.79 | 1.0 |
| 20 | Burundi | 308759286 | 153.04 | -0.1 |
| 21 | Congo, Rep. | 276928571 | 1063.78 | 1.8 |
| 22 | Sierra Leone | 230737619 | 201.14 | 0.3 |
| 24 | Togo | 216660000 | 282.36 | 0.1 |
| 25 | Central African R. | 205839286 | 283.13 | -0.6 |
| 26 | Botswana | 179463571 | 2280.70 | 6.8 |
| 27 | Guinea-Bissau | 129586512 | 186.70 | -0.1 |
| 28 | Gabon | 125677619 | 4704.90 | 3.4 |
| 29 | Gambia, The | 95895000 | 593.81 | 0.8 |
| 30 | Swaziland | 65057381 | 1750.60 | 2.9 |

Source: Author's construct based on WDI Data (2013)

Other major aid recipients in SSA over the period include Kenya, Ghana, Zambia, Nigeria, Senegal, Cote d'Ivoire, Cameroun and Burkina Faso. Notwithstanding the enormous aid received, it was only Cote d'Ivoire, Cameroun, Senegal, Zambia and Kenya that achieved modest GDP per capita. It is significant to emphasise that though countries such as Botswana, Congo Republic, Gabon, Swaziland and The Gambia were not major aid recipients, they achieved real income per capita well above \$500.

An important revelation from Table 3.1 is that close to one-third of the selected countries achieved average negative growth in GDP per capita over the period 1970–2011, two of which were major aid recipients (Democratic Republic Congo and Sudan). Similarly, close to half of the sample countries achieved an average growth rate in GDP per capita of more than 1%. For the rest of the sample, average growth rate in GDP per capita was mild. Within the same period, there was considerable amount of aid inflow to these countries. An important implication of this analysis is that though aid could account for growth and income differences in sub-Saharan Africa, its contribution could be affected by the conditions in the recipient country since most the major aid recipients either experienced declining rates of growth or mild growth rates.

Figure 3.4 shows the trends in aid inflows and per capita GDP in sub-Saharan Africa for the period 1970 to 2011. The figure shows that aid prior to the early 1990s increased steadily. There was however a sharp decline after 1992 till after 1996 when it picked up. Then it dropped again around 2005 after which it began to rise again. The increase in aid prior to the early 1990s was because it was the period many SSA countries had just subscribed to the Structural Adjustment Programme especially between 1980 and 1990 and hence received considerable amount of aid. Indeed, inflow

of foreign aid is contingent on donor priorities as well as conditions prevailing in the donor country. This could therefore account for the rise and fall in the inflow of aid to SSA countries over the period.

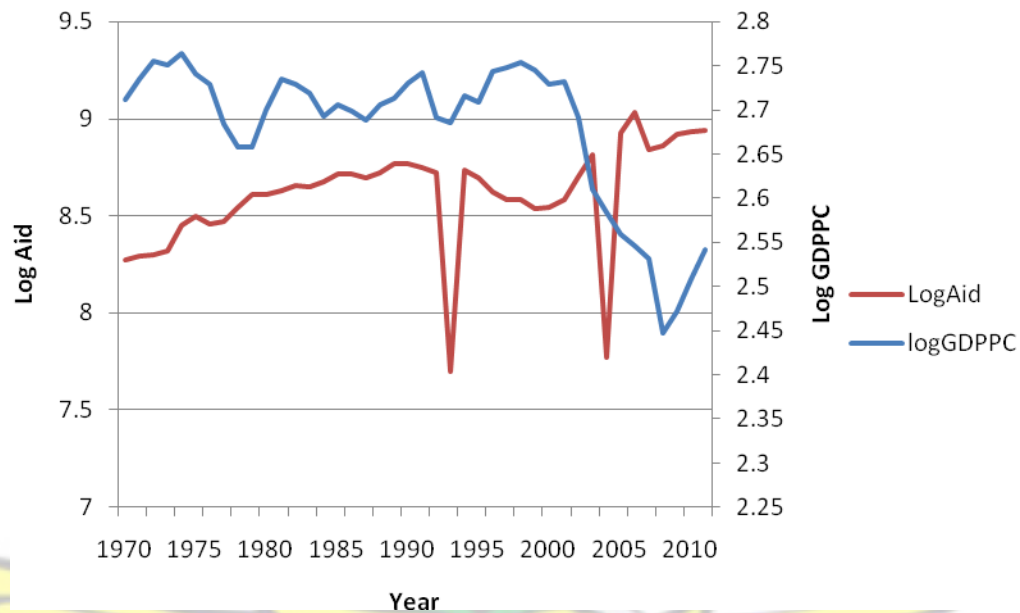
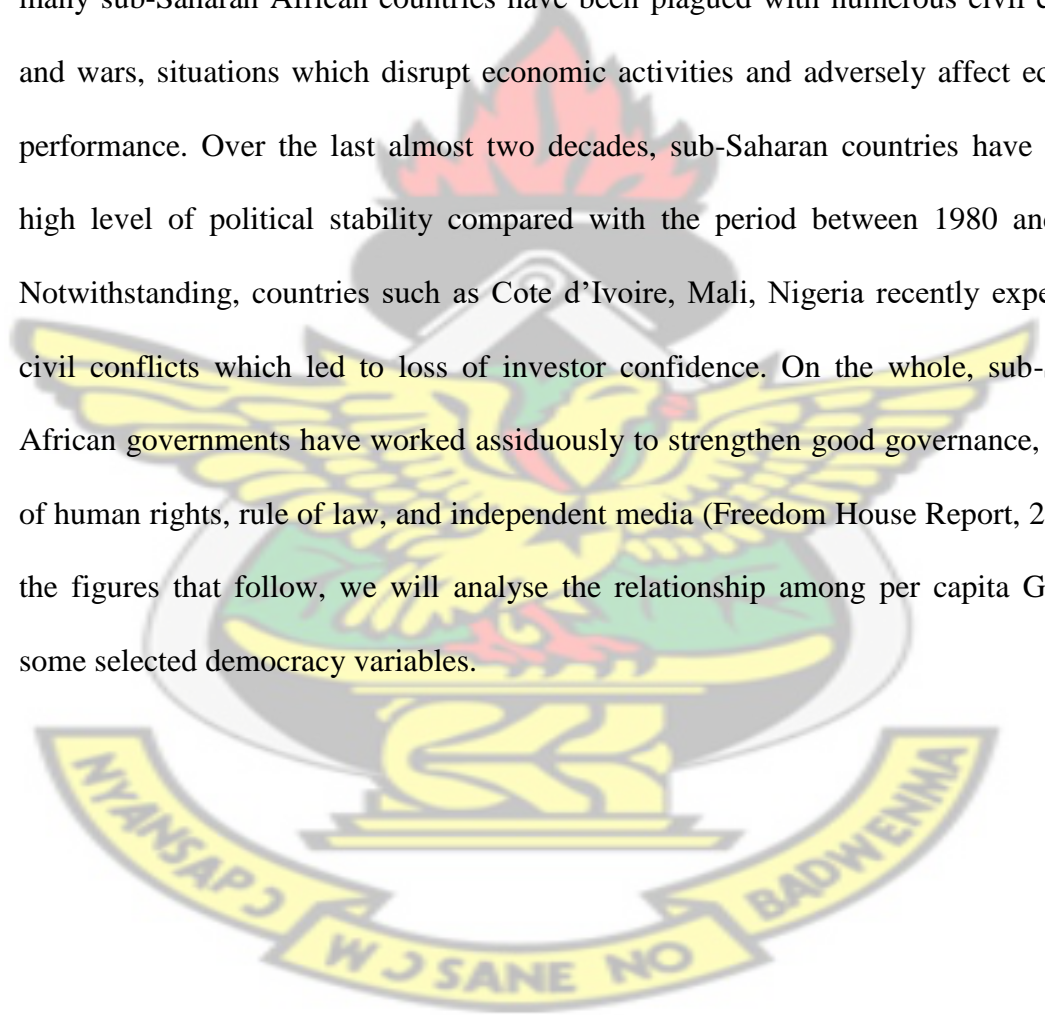


Figure 3.4: Aid inflow to sub-Saharan Africa and real GDP per capita (1970 – 2011). *Source:* Author’s construct based on data from WDI, 2014.

From the figure, just like aid GDP per capita was also quite unstable (rising and falling). The period before 1975 saw a gradual increase in per capita GDP until between 1975 and 1980 when there was a downward trend. Despite this, some periods of rising aid inflow resulted in a rise in GDP per capita especially between 1982 and 1990. Of course between 1992 and 1996 both aid and per capita GDP fell. This cannot be taken to mean a causal relationship but then there is the possibility of a statistical relationship among these two variables.

3.5 Political Institutions and growth in SSA

The role of political institution in shaping growth and income distribution in SSA leaves much to be desired especially as democracy gains root in many SSA countries. It is theorised that higher quality and hence effective institution is a key ingredient in achieving a sustained growth in any given country. Clearly, the nature and structure of political system differs markedly across all countries in sub-Saharan Africa. Indeed, many sub-Saharan African countries have been plagued with numerous civil conflicts and wars, situations which disrupt economic activities and adversely affect economic performance. Over the last almost two decades, sub-Saharan countries have enjoyed high level of political stability compared with the period between 1980 and 1995. Notwithstanding, countries such as Cote d'Ivoire, Mali, Nigeria recently experienced civil conflicts which led to loss of investor confidence. On the whole, sub-Saharan African governments have worked assiduously to strengthen good governance, defense of human rights, rule of law, and independent media (Freedom House Report, 2013). In the figures that follow, we will analyse the relationship among per capita GDP and some selected democracy variables.



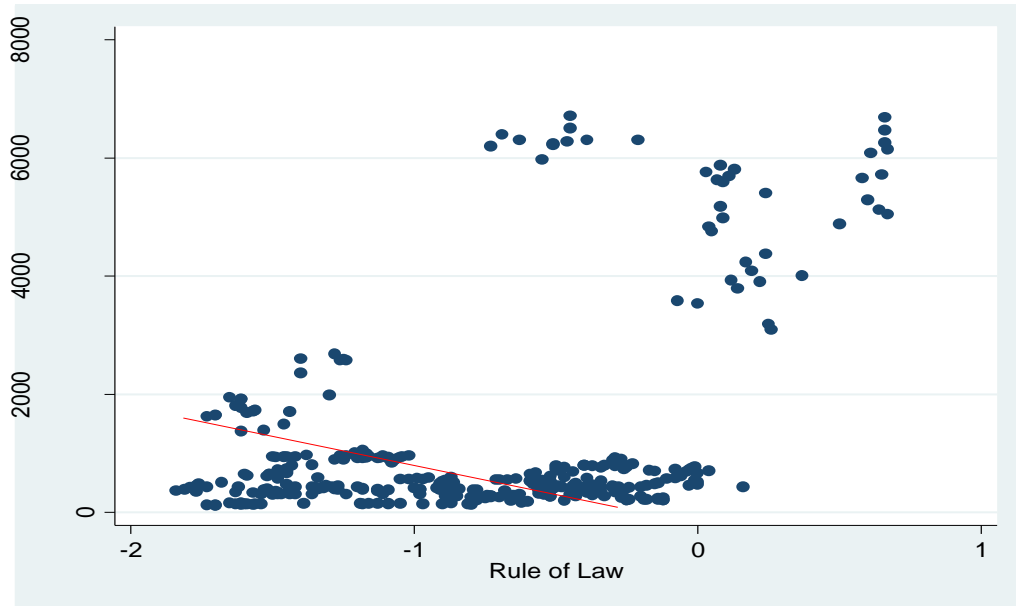


Figure 3.5 Real GDP per capita against Rule of Law

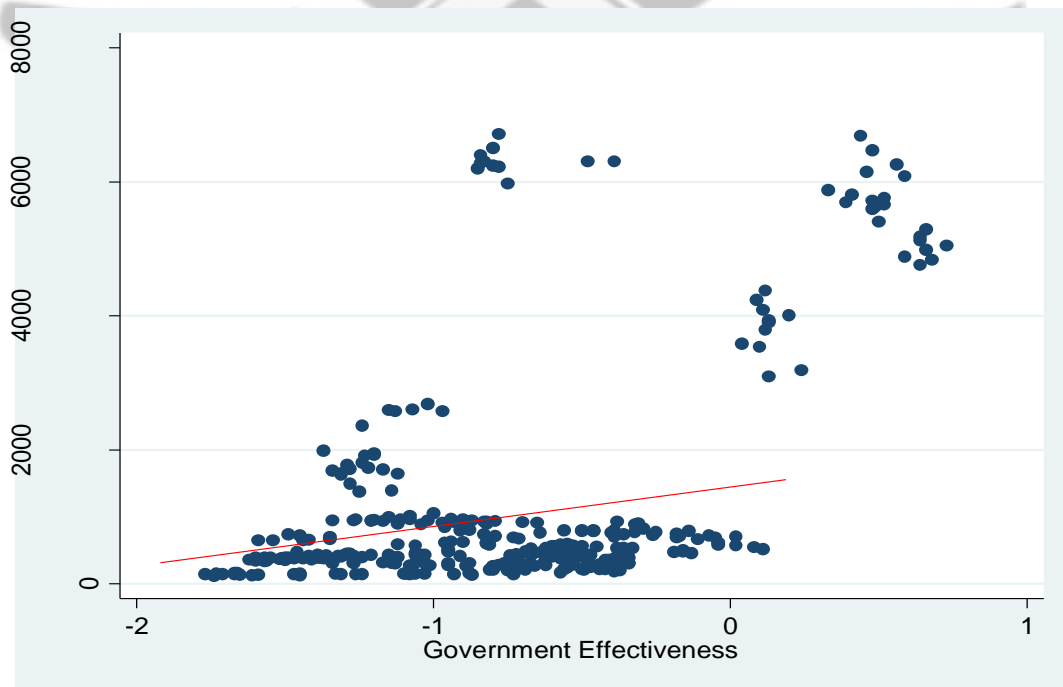


Figure 3.6 Real GDP per capita and Government Effectiveness

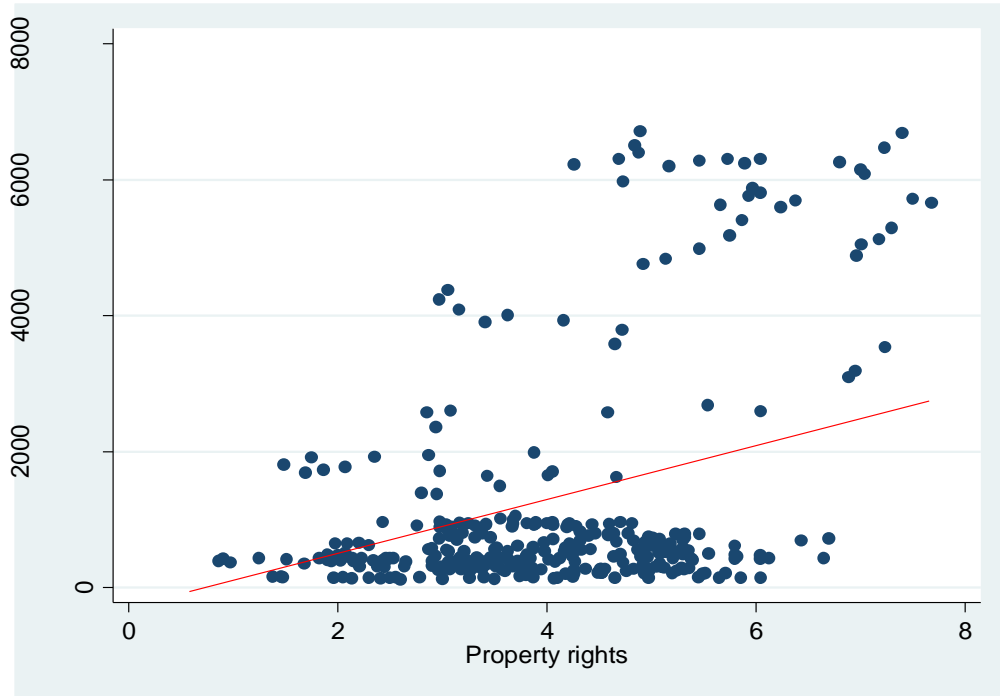


Figure 3.7 Relationship between real GDP per capita and property rights

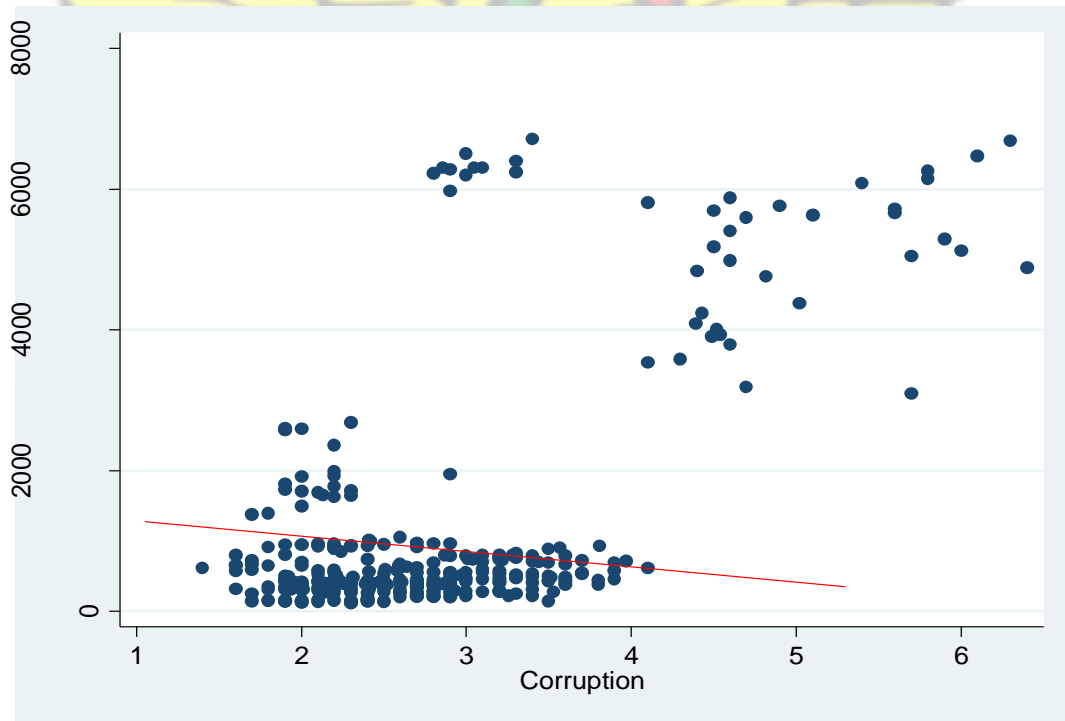


Figure 3.8 Real GDP per capita versus Corruption

Figure 3.5 shows positive correlation between real GDP per capita and rule of law. This means that effective rule of law can result in economic growth hence countries that promote rule of law can achieve a sustained increase in growth in sub-Saharan Africa. Similar analysis can be made for government effectiveness and property rights in Figures 3.6 and 3.7 respectively since government effectiveness and property rights have direct correlation with income per capita. However, corruption is inversely related to income per capita as illustrated in Figure 3.8 implying that high incidence of corruption in sub-Saharan Africa could significantly harm efforts at achieving economic growth and income.

3.6 Summary and Conclusion

Based on the evidence gathered from the analysis presented thus far together with the articles that follow and among all other things, the following stylized facts about growth and income in SSA can be summarized.

- The variations in income among SSA countries and between SSA on one hand as well as other developing regions and the developed world are quite big.
- Growth and income in SSA are susceptible to changes in the political system and the extent of governance quality.
- The extent of structural transformation is generally low in sub-Saharan Africa. The rural and semi-rural nature of the region and the overreliance on primary exports with low prices relative to huge import demand bring imbalances on the external trade which affects growth and income.

- Sluggish growth in capital accumulation across SSA due to general low savings mobilization resulting in relatively low marginal productivity of capital. Hence, reliance on foreign aid to supplement domestic capital mobilization to promote growth and income.
- Changes in demographic patterns and ethnic polarization have constrained economic growth and income.

In conclusion therefore, growth in sub-Saharan Africa has been uneven. While some countries such as Botswana, Gabon, Equatorial Guinea and Mauritania have achieved modest growth rates economic growth continue to be dismal, negative or sluggish in other parts such as Zimbabwe, Democratic Republic of Congo, Burundi and Central African Republic. Clearly, it can be realised that nine countries out of the 32 countries considered for the study accounted for approximately 75% of the sub-Saharan Africa's real per capita income over the period 1970 to 2011. Among other things, differences in the degree of trade openness, composition of international trade, differences in the amount of total aid received, differences in political structure, natural resource endowments, changes in demographic trends could account for the differences in the growth rates and income distribution across sub-Saharan Africa.

4. SUMMARIES OF APPENDED PAPERS

In this section, the three major empirical papers have been summarized. It mainly highlights the methodology, key findings and contributions to literature. Since these are summaries, it is imperative for interested readers to read the details from the appended papers.

4.1 Summary of Paper I

The impact of trade openness and foreign aid on income among developing countries has been the subject of many discussions and studies over the past few decades. The central prediction of most of the studies and for that matter literature on trade-growth and aid-growth nexuses is that trade openness and foreign aid accelerate economic performance. Within the frameworks of neoclassical and endogenous growth theories, trade openness is very crucial since it can lead to transfer of knowledge and hence technological progress. Openness to international trade stimulates technological progress by increasing domestic rivalry and competition, leading to increased innovation. Additionally, trade openness provides the avenue for latest goods to freely flow across international borders. This increases the stock of knowledge for technological innovations which can spur economic activities and improve economic performance and income (See Sakyi *et al*, 2014; Asiedu, 2013; Yanikkaya, 2003; Wacziarg, 2001; Sachs and Warner, 1997).

Apart from this, trade openness (or liberalization) particularly in developing countries comes along with inflow of aid especially since most aids are given to

countries with which the donor country has bilateral trade relationship. These aids contribute substantially to capital formation especially in developing countries where levels of savings are generally low. This will lead to a rise in income (McGillivray and Morrissey, 1998; Gyimah-Brempong and Racine, 2010; Gyimah-Brempong *et al*, 2007, Burnside and Dollar, 2000).

In the 1980s, many sub-Saharan African countries (such as Ghana, Nigeria and Kenya) subscribed to reform and adjustment programmes which sought to liberalise their economies to international trade. Since donor countries usually give aid to countries with which they have bilateral trade relationship, SSA countries have received large inflows of aid amounting to about US\$34.8 billion according to OECD (2013). Trade openness is expected to improve the efficiency and productivity of aid through transfer of knowledge and technology.

The argument presented in this paper rests on the premise that international trade makes aid more effective and efficient by enhancing the productivity of capital and investment arising from aid through transfer of knowledge and technology which is crucial for raising income levels in sub-Saharan Africa. Thus, this paper investigates the effect of trade openness and foreign aid and their interaction on income for a panel of 32 sub-Saharan African countries over the period 1970-2011.

This present study differs markedly from existing studies in two significant ways. First, it finds out the impact of the interaction between foreign aid and trade openness on growth which has long been ignored in literature related to SSA. Second, we use aggregate aid data and two measures of aid namely, aid as a percentage of GDP and aid per capita. This enables us to analyse aid-income nexus in ways not analysed by

previous studies specific to SSA. Finally, this study is based on panel data from large number of countries in SSA over a relatively longer period of time, hence the results are more general than the earlier studies.

The specified long and short run models in this paper take the following reduced form:

$$Y_{it} = f(X_{it}, AID_{it}, OPENNESS_{it}, (AID*OPENNESS)_{it}) \dots\dots\dots (1)$$

where AID_{it} is foreign aid measured by aid per capita and aid as a percentage of GDP, $OPENNESS_{it}$ is trade openness, $AID*OPENNESS_{it}$ denotes the interaction term between foreign aid and trade openness, X_{it} is a set of control variables which include foreign direct investment, capital stock, democracy and inflation.

Equation (1) was estimated using the pool mean group estimator. As a check for consistency of results, the mean group estimator was also adopted. Stationarity tests were carried out using Im-Pesaran-Shin (IPS), Levin-Li-Chu (LLC) and Cross-Sectional Augmented Dickey Fuller (CADF) tests. Panel cointegration was also performed using the Westerlund (2007) cointegration test to determine the existence of long run relationship among real GDP per capita and the explanatory variables.

The findings obtained in this paper showed that aid has significantly positive effect on income over the period under consideration which is consistent with other previous studies that conclude that aid promotes growth and income. Contrary to our expectation, trade openness rather has negative effect on income in SSA over the period considered in this paper. The paper also emphasized the important role played by foreign direct investment, capital stock and democracy in income growth in sub-Saharan Africa. From a policy perspective, the study suggests that more should be done

so that the benefits from aid inflows would result in sustained income levels. Specifically, aid can be channelled to assist small and medium scale businesses which can help to reduce poverty. Also, since the exports section of the external trade generates revenue, policies to make the export sector more competitive relative to the import sector would be more appropriate. This may be achieved by diversifying exports to add value to exports so that they attract competitive prices on the world market.

4.2 Summary of Paper II

Democracy has been found to provide an impetus for economic growth. It provides the avenue for attracting foreign direct investments, foreign aid and above all redistributes income and resources in favour of the poor and marginalised in the economy. In addition, democracy makes it possible for individuals to own property and establish businesses without any stringent restrictions. For this reason a large number of studies have found a positive and significant effect of democracy on economic growth. On the contrary, other studies have argued that democracy poses negative effect on growth and income. If democratic institutions suffer from inefficiencies in making decisions resulting in difficulty in implementing crucial policies (especially in developing countries) democracy would undermine economic performance.

This area though has attracted considerable attention over the past few decades, there is still more room for further studies. Firstly, existing studies in the literature have not taken into account the fact that democracy is a composite variable made up of several proxies and that no single or two indicators could sufficiently proxy for democracy in any given country. Notwithstanding, most of the earlier studies on

democracy-growth nexus have approached the subject by relying on polity2, political rights and civil rights as measures of democracy (see Sakyi, 2011; Drury *et al*, 2006; Roll and Talbott, 2003 and Rodrik, 2002). Perhaps, it is this situation that has produced mixed results in the extant literature. Secondly, many of the empirical works on corruption have sought to find out the sources or causes of corruption (see Andvig, 2008; Treisman, 2000) with few touching on the relationship between corruption and growth (see Mohtadi and Agarwal, 2003; Gyima-Brempong, 2002). It is against this background that this paper contributes to the existing literature by presenting evidence from a large panel of countries in sub-Saharan Africa over the period 2002–2012.

This study thus contributes significantly to literature in several ways. First, we acknowledge that no single indicator can sufficiently proxy for democracy and therefore considers several alternative proxies to measure democracy and not just one as exist in the previous studies. Secondly, we also apply the principal component analysis to reduce the dimension of the democracy indicators to avoid the potential of multicollinearity problem of including more than one proxy in a single equation. Thirdly, we also include in our specifications country specific effects to remove the impact of specific country characteristics on income that could correlate with democracy. Fourthly, we extend the basic democracy-income model to include corruption to account for the level of inefficiencies in the governance process and how it affects the levels of income. Finally, we include in our model the interaction between democracy and corruption to account for the extent to which increased democratization can reduce the incidence of corruption to spur the levels of income.

Of course, the choice of sub-Saharan Africa is necessary based on at least two reasons. In the first place, democracy has become very important in the political system of many sub-Saharan African countries since the early 1990s. The widespread adoption of democracy among SSA countries was seen to help enhance the poor economic performance that had been in place for years. Secondly, Africa is generally considered as one of the most corrupt regions in the world. A study by African Union in 2002 revealed that corruption every year costs the sub-region approximately US\$150 billion. In contrast, foreign aid and assistance inflows from western countries to sub-Saharan African region amounted to about US\$22.5 billion according to the Organization for Economic Cooperation and Development (OECD, 2008).

The model of interest in this paper which is dynamic in nature takes the following specific form:

$$y_{it} = \delta + \gamma y_{it-1} + \theta_1 DEMO_{it} + \theta_2 COR_{it} + \theta_3 (DEMO * COR_{it}) + \beta' X_{it} + \lambda_i + \varepsilon_{it} \quad (1)$$

where $i = 1, 2, 3, \dots, N$ is the cross-sectional dimension of countries, $t = 1, 2, 3, \dots, T$ represents time, y_{it} is the logarithm of real GDP per capita, y_{it-1} is the logarithm of real GDP per capita at the beginning of each period which in Solow growth analysis allows for a convergence situation across countries, $DEMO_{it}$ is the democracy variable, COR_{it} is the corruption variable, $DEMO * COR_{it}$ is the interaction between democracy and corruption, X_{it} is the set of control variables, λ_i represents the unobserved individual or country specific fixed effect, ε_{it} is the error term. As indicated previously, no single indicator can sufficiently represent democracy. We therefore use eight proxy measures of democracy in our analysis.

In estimating the income model in equation (1), we apply the principal component analysis to create four indexes from the eight proxies of democracy. The next step involves estimating the income equation using the within-mean and system GMM estimators. The results of the principal component analysis suggest that approximately 88% of the total variance in the original data are accounted for by the first four principal components.

The results from the two estimators were not significantly different in terms of the expected signs and magnitude of the coefficients. Our findings revealed that corruption has significantly negative impact on income, a situation that can be attributed to the weaknesses in the institutional set up of many sub-Saharan African countries. Secondly, the results showed that whether or not democracy has income effect depends on a particular indicator used. Thus, the overall effect of democracy on income depends on the choice of democracy indicator. This is further confirmed by the indexes created from the principal component analysis. While property rights and political stability have had positive income effects government effectiveness and rule of law have shown negative impact on income. Among the control variables, foreign direct investment and capital stock proved to have significantly positive impact on income while inflation and trade openness had negative income effects. Based on these findings, the paper came out with the following recommendations: First, governments must incorporate anticorruption measures in their development strategies which must include the private sector in the implementation of policies. Secondly, policy reforms should target programmes that seek to develop and build the capacities of judiciaries, legislatures, media and civil societies to help enforce rule of law and strengthen democratic

institutions. Finally, researchers should seriously take into account the selection of proxies when investigating the impact of democracy on economic performance.

4.3 Summary of Paper III

Economists, governments, policy makers and development partners alike have long been interested in those factors or variables that drive economic growth in developing countries generally and in particular sub-Saharan Africa. The economic performance of sub-Saharan African (SSA) countries has not only been inconsistent but also very abysmal compared with other developing countries of the same category. Many SSA countries were very promising prior to independence and the periods immediately after independence. However, from mid-1970 to the early 1990, many African countries experienced turbulence in economic performance resulting in negative growth rates. According to O'Connell and Nduru (2005) for the past four decades, in a whole, the 0.9% average per capita income growth falls short by 1.5% in relation to other developing regions, and just about 3% below that of East Asian economies. Many are the policies that Sub-Saharan African countries have pursued and continue to pursue with the objective to achieving a sustained increase in growth and also enhance general condition of living of their people. Notwithstanding, sub-Saharan African countries continue to be marginalised in term of economic growth. The question that needs to be answered then is which variables or factors drive the growth process of SSA countries? This paper thus aims at identifying the major determinants of long run economic growth in SSA over the period 1970–2012.

Clearly, a number of studies exist which have sought to find out the variables that drive economies of SSA to long term economic growth. Nonetheless, there is still a scope for further empirical investigations. A common characteristic of existing studies in growth literature is that they adopt parametric regression methodologies which assume functional specification of model prior to estimation and as a result suffer a lot of specification and estimation problems. This situation often leads to biased and inconsistent estimates resulting in wrong inferences and conclusions, thus putting the robustness of the explanatory variables in such models in doubts. It is therefore imperative to look for an alternative methodology which provides more consistent evidence on the determinants of economic growth in SSA. The contribution of this study to the extant literature relies on the use of the local linear kernel estimator, a powerful nonparametric estimator which exists nowhere in growth literature related to sub-Saharan Africa.

Though neoclassical and endogenous growth theories posit that physical capital accumulation as well as human capital and technological progress account for bulk of output growth, there is still more room to account for other explanatory variables. Following theory and earlier researchers therefore, we specify a growth model based on aggregate production function as follows:

$$Y_{it} = f(\text{HUMCAP}_{it}, \text{INV}_{it}, \text{AID}_{it}, \text{TOP}_{it}, \text{DEMO}_{it}, \text{INFL}_{it}, \text{POP}_{it}) + \mu_{it} \quad (1)$$

where $i = 1, 2, 3, \dots, N$ is the cross-sectional dimension of countries, $t = 1, 2, 3, \dots, T$ represents time, Y_{it} is the real GDP, HUMCAP_{it} is human capital (measured by gross primary school enrolment), INV_{it} is rate of investment in physical capital (Gross domestic capital formation as a ratio to GDP), AID_{it} denotes foreign aid (official

development assistance as a percentage of GDP), TOP_{it} is trade openness (measured as a sum of export and import as a ratio to GDP), $DEMO_{it}$ indicates democracy (proxy by Polity2), $INFL_{it}$ measures inflation (measured by the consumer price index), POP_{it} represents population (a proxy for labour force) and μ_{it} is the white noise.

The first step involved in nonparametric analysis is to apply consistent model specification test to test the null hypothesis of correct parametric model specification. On condition that the null hypothesis of correct specification of the parametric model is rejected, we continue to estimate the growth equation by employing the local linear kernel estimator which begins with the selection of optimal bandwidth. In the last stage, we plot the partial regression and partial gradient or partial response surfaces that measure how the log of real GDP and its response surface change in response to changes in one of the explanatory variables, when remaining variables are held constant at their respective modes/medians.

The findings obtained in this paper suggest a positive and nonlinear relationship between economic growth on one hand as well as investment in physical capital, population and democracy on the other hand. This implies that in the long run, increases in gross capital formation (proxy for investment in physical capital), population and democracy would promote economic growth in sub-Saharan Africa, all things being equal. Also, the paper finds that human capital and inflation have no significant effect on economic growth in SSA at least during the study period. Finally, we find in the study that foreign aid has negative effect on economic growth in SSA over the study period.

The findings obtained in the paper have important implications particularly for growth policy in SSA and growth empirics generally. Growth policies should thus consider expanding and improving the quality of education and enrolment especially at the higher levels through increased public spending. Also, policies should target strengthening democratic institutions to be more efficient and deepen the level of democracy to provide a more favourable political environment for investors and economic activities. For research, the results imply that researchers should be cautious in specifying the functional form of growth models related to determinants of economic growth.

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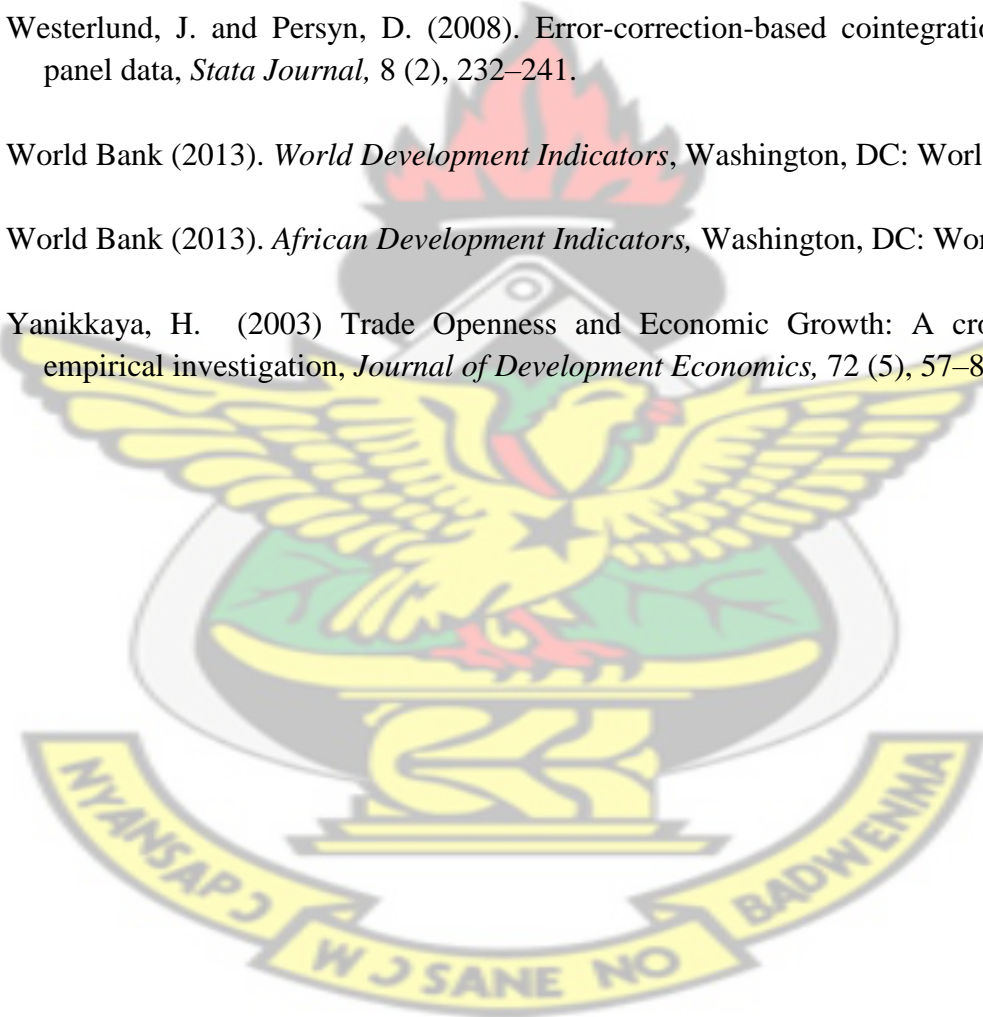
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Foreign aid, trade openness and income in sub-Saharan Africa: A panel cointegration investigation[⊗]

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Abstract

The concern of this paper was to investigate the impact of foreign aid and trade openness on income for a panel of 32 sub-Saharan African countries over the period 1970–2011 using panel cointegration techniques. The long and short run coefficients were estimated principally using the Pool Mean Group estimator. The findings obtained in this paper suggest that while foreign aid has contributed significantly to income differences within SSA over the period under consideration trade openness has been detrimental to income in SSA over the same period. Also, the combined effect of aid and trade openness has resulted in income growth. Additionally, the study emphasizes the critical role played by foreign direct investment, democracy and physical capital stock in promoting income in sub-Saharan Africa. From a policy perspective, the study suggests that more should be done so that the benefits from aid inflows would result in sustained income growth. Also, the external trade sector should be given the needed attention it deserves.

Keywords: aid, trade openness, income, panel cointegration, sub-Saharan Africa

JEL Classification: C33, F13, F35, F43, 040, 055

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1. Introduction

The impact of foreign aid and international trade in accounting for income and growth differences has been a subject of intense discussion in development literature related to sub-Saharan Africa (SSA) in recent times. This has resulted mainly from the adoption of the structural adjustments and reform programmes of the World Bank and International Monetary Fund by many SSA countries (e.g. Ghana, Nigeria, Burkina Faso, Zambia and Kenya). One feature of these programmes was that they involved large amounts of foreign aid to finance economic activities in SSA. In this regard, sub-Saharan Africa has been the largest recipient of aid with aid rising by 13.6% reaching US\$34.8 billion in real terms in 2012 (OECD, 2013).

One of the key components of the structural adjustment and reform programmes was that the countries involved had to liberalise or open up their economies to international trade. By implication therefore, countries that are more open to international trade would be expected to receive more aid than countries that are less open. Further, it is hypothesized that donor countries give more aid to countries they have bilateral trade relationship with. Therefore, an amount of foreign aid received by a country can be conditioned on the extent to which it has opened up its economy to international trade with other countries especially donors.

Apart from this, international trade has significant effect on aid. International trade is expected to improve the productivity and efficiency of aid. International trade leads to transfer of knowledge resulting in technological progress, enhances efficiency in domestic production and increases market size. If foreign aid enhances capital accumulation and consequently investment, then international trade can make aid

become more effective by enhancing the productivity of capital and investment arising from aid through transfer of knowledge and technology. If this holds, then when foreign aid is interacted with trade openness it could significantly affect economic growth. However, it is unfortunate that the interaction between aid and trade has long been ignored in literature especially. Existing studies on aid-growth nexus have only estimated the effect of foreign aid on investment and growth with some touching on how the policy environment affects aid effectiveness (For example, Gyimah-Brempong and Racine, 2010; Gyimah-Brempong *et al*, 2007, Morrissey *et al*, 2005; Hansen and Tarp, 2000; Burnside and Dollar, 2000). Similarly, trade-growth nexus studies have also sought to specifically find the impact of trade openness on economic growth (See Sakyi *et al*, 2014; Yanikkaya, 2003; Wacziarg, 2001; Sachs and Warner, 1997).

Studies that specifically focus on the effect of foreign aid and trade openness on income in one model seldom exist especially those related to SSA let alone to account for their interaction. In some cases, where they exist, one of them is used as a control variable. Further, a lot of studies in the extant literature use growth rate of income rather than the actual levels of income (see Gyimah-Brempong and Racine, 2010, Gyimah-Brempong *et al* 2007, Morrissey *et al* 2005). It is in this regard that this study contributes to the growing literature on the effect of aid and trade on income. The basic thrust of this study is thus to find the impact of the interaction between foreign aid and trade openness on income which has long been ignored in the literature related to sub-Saharan Africa.

This study makes some important contributions to supplement existing literature. Firstly, it finds out the impact of the interaction between foreign aid and trade openness

on income which has long been ignored in literature related to SSA. Secondly, we use aggregate aid data and two measures of aid namely, aid as a percentage of GDP and aid per capita. This enables us to analyse aid-income nexus in ways not analysed by previous studies specific to SSA. Third, this study is based on panel data from large number of countries in SSA over a relatively longer period of time, hence the results are more general than the earlier studies.

Our results showed that aid has significantly positive effect on income over the period under consideration which is consistent with other previous studies that conclude that aid promotes income and growth. Contrary to our expectation, trade openness rather has negative effect on income in SSA over the period considered in this paper. The paper also emphasized the important role played by foreign direct investment, capital stock and democracy in income growth in sub-Saharan Africa.

The rest of the paper is structured as follows: Section 2 provides a brief literature review while section 3 describes the empirical methodology with emphasis on the data set, model specification and estimation techniques. Section 4 discusses the empirical results. Finally, section 5 concludes the entire study.

2. Aid, trade openness and income – A brief survey

Within the frameworks of neoclassical and endogenous growth theories, trade openness is very crucial since it can lead to transfer of knowledge and hence technological progress. Openness to international trade promotes technological progress by increasing domestic rivalry and competition, leading to increased innovation. Additionally, trade openness provides the avenue for latest goods to freely flow across international

borders. This increases the stock of knowledge for technological innovations which can foster economic activities and improve economic performance and income (See Sakyi *et al*, 2014; Asiedu, 2013; Yanikkaya, 2003; Wacziarg, 2001; Sachs and Warner, 1997).

Apart from this, trade openness (or liberalization) particularly in developing countries comes along with inflow of aid especially since most aids are given to countries with which the donor country has bilateral trade relationship. These aids contribute substantially to capital formation especially in developing countries where levels of savings are generally low. This will lead to a rise in income (McGillivray and Morrissey, 1998; Gyimah-Brempong and Racine, 2010; Gyimah-Brempong *et al*, 2007, Burnside and Dollar, 2000).

Following from the above, there has been a proliferation of studies examining the relationship between aid, trade openness and income. Some of these studies have found positive relationship while others found negative relationship. For example, investigating the effect of aid on income Morrissey *et al* (2005) argue that aid affects growth through investment in physical and human capital. Using GMM estimation, they concluded that aid has significantly positive impact on income. Gyimah-Breimpong *et al* (2010) estimated the impact of aid on growth for a panel of 77 developing countries over the period 1995–2004. Applying dynamic panel data estimator, their results showed that aid has positive effect on income. Other studies that consider the effect of aid on income include Hansen and Tarp (2000), Burnside and Dollar (2000), Gomanee, *et al*. (2003), Dalgaard *et al*. (2004), and Karras (2006) who concluded that aid impacts positively on growth. However, Burnside and Dollar (2000)

and Brautigam and Knack (2004) rather obtained negative effect of foreign aid on income.

In the case of the trade-income relationship, Wacziarg (2001) examined the correlation between trade openness and GDP per capita for 57 countries over the period 1970-1989 and arrived at a conclusion that there is a significantly positive impact of trade openness on income. Also prominent in this area is Yanikkaya (2003) who investigated the effect of trade openness on growth of per capita income for 120 countries between 1970-1997 using the Generalized Method of Moment. He concluded that trade openness has significant positive impact on income growth. Other studies that conclude that trade promotes income include Sakyi *et al* (2014), Asiedu (2013), Ahmed and Anoruo (2000), Edwards (1998), Sachs and Warner (1997), Harrison (1996), Paulino (2002), among others. Nonetheless, Rodriguez and Rodrik, (1999), Vamvakidis (2002), among others have obtained contrary findings.

The preceding discussions suggest that the literature on the relationship between aid, trade openness and income have generated mixed results thereby providing more room for further investigation. It is also evident from the above that the existing studies centre on estimating separately the specific impact of aid and trade openness on income. On that note, they have clearly failed to examine the specific impact of the interaction between aid and trade openness on income. This paper therefore provides further evidence in this area by incorporating the interaction term to account for its effect on income.

3. Data and Empirical Strategy

This paper explores the impact of foreign aid and trade on openness income per capita. The panel data consist of annual observations for 30 SSA countries² for the period 1970 to 2011. Indeed, it is important to emphasise that the selection of countries was influenced by the data availability for all the variables that were considered in the study.

The data for this paper were obtained from various sources namely, World Bank's WDI Database, African Development Indicators as well as the Polity IV Project (Marshall and Gurr, 2013). The major variables of interest in the study are real GDP per capita (that is, income) as well as foreign aid and trade openness. Real GDP per capita refers to the GDP divided by mid-year population measured in constant 2000 US dollars. Foreign aid includes both official development assistance and net official assistance. In this study, two measures of aid are considered (i.e. aid per capita and aid as a percentage of GDP). Trade openness is measured as exports plus imports as a percentage of GDP. In addition to aid and trade openness, there are other control variables which include foreign direct investment, capital stock, democracy and inflation.

²Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Democratic Republic of Congo, Republic of Congo, Cote d'Ivoire, Gabon, Ghana, The Gambia, Guinea-Bissau, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Sudan, Swaziland, Togo, Zambia and Zimbabwe. The selection of countries was influenced by the availability of data for all the variables considered over the period for the study.

3.1 Model Estimation

The estimated model in this paper takes the following reduced form:

$$Y_{it} = f(X_{it}, AID_{it}, OPENNESS_{it}, (AID*OPENNESS)_{it}) \dots\dots\dots (1)$$

where AID_{it} is foreign aid measured by aid per capita and aid as a percentage of GDP, $OPENNESS_{it}$ is trade openness, $AID*OPENNESS_{it}$ denotes the interaction term between foreign aid and trade openness, X_{it} is a set of control variables.

From equation (1), the specific model is estimated as follows:

$$\log Y_{it} = \beta_i + \theta_1 AID_{it} + \theta_2 OPENNESS_{it} + \theta_3 (AID*OPENNESS)_{it} + \gamma X_{it} + \mu_{it} \dots\dots\dots (2)$$

where Y_{it} is the real GDP per capita, θ_1 , θ_2 and θ_3 are the parameters to be estimated, β_i and μ_{it} are the country-specific intercept and error term respectively. All the others have been previously defined. X_{it} includes foreign direct investment (FDI), capital stock (K), democracy (DEMO) and inflation (INFL).

3.2 Panel Unit Root Test

Unit root test is the initial step in every cointegration investigation. Two main categories of panel unit root tests are distinguished, namely first generation tests which emphasizes cross-sectional independence (e.g. Im *et al*, 2003; Levin *et al*, 2002) and second generation tests which accepts cross-sectional dependence (e.g. the Pesaran's CADF (2007) In this paper, three alternative unit root tests are considered. That is, Im *et al* (2003), Levin *et al* (2002) and CADF.

Im *et al* (2003) proposed a unit root test that is based on the average of individual series Augmented Dickey Fuller. It has been found that this test is more efficient in long run relationship analysis. This test involves estimating individual ADF regressions which then put together to carry out a panel unit root test. The underlying ADF regression model is specified as follows:

$$\Delta y_{it} = \alpha_i y_{i,t-1} + \sum_{j=1}^{p_i} \gamma_{ij} \Delta y_{it-j} + \varepsilon_{it} \quad (3)$$

According to Hall and Asteriou (2007) this test further provides for various specifications for the coefficient α_i for each of the cross-sections, variance of the error term and the lag length. The proposed test statistic (i.e. \bar{t} statistic) which is obtained by averaging the individual ADF test statistics is given as

$$\bar{t}_{NT} = \frac{1}{N} \sum_{i=1}^N t_{\alpha i} \quad \dots\dots\dots (4)$$

Like the Im *et al* (1995) test, LLC statistic tests the null hypothesis that each individual unit in the panel is nonstationary against the alternative hypothesis that all individual units of the panel are stationary. This test takes into account fixed effects, individual deterministic trends and heterogeneous autocorrelation according to Baltagi (2008). As indicated by Levin *et al* (2002) when cross-sectional dependence exists, the cross-sectional average is subtracted from the data to minimise the degree of cross-sectional dependence. The test is based on the following regression

$$\Delta y_{it} = \phi y_{i,t-1} + \sum_{L=1}^{p_i} \lambda_{iK} \Delta y_{i,t-K} + \alpha_{mi} d_{mt} + \varepsilon_{it} \quad \dots\dots\dots (5)$$

where $m = 1, 2, 3$, and d_{mt} and α_{mi} are used to indicate the vector of deterministic variables and the corresponding vector of coefficients for a particular model $m=1, 2, 3$ respectively. Levin *et al* (2002) suggest three-step procedure that implements the test, since the lag order p_i is unknown. The three-steps involves the estimation of a separate Augmented Dickey-Fuller (ADF) regression for each N , the estimation of the long run to short-run standard deviations and the estimation of the panel test statistics. This test is useful when the panel size moderate.

The CADF test as developed by Pesaran (2003) considers heterogeneous dynamic panels that are subject to serially correlated and cross sectionally dependent errors:

$$y_{it} = (1 - \rho_i)\delta_i + \delta_i y_{i(t-1)} + v_{it} \dots\dots\dots (6)$$

where δ_i denotes deterministic component.

To deal with with cross sectional dependence, Pesaran (2003) applies the test on standard unit root statistics in a cross-sectionally augmented Dickey-Fuller (CADF) regression which is augmented with the cross section averages of lagged levels and first-differences of the individual series. The resultant model is given by:

$$\Delta y_{it} = \alpha_i + b_i y_{i(t-1)} + c_i \bar{y}_{t-1} + d_i \Delta \bar{y}_t + \varepsilon_{it} \dots\dots\dots (7)$$

3.3 Panel Cointegration test

On condition that the series are stationary, we proceed to estimate the long run relationship among dependent and independent variables. To this end, this study makes use of the error-correction-based panel cointegration developed by Westerlund (2007). He proposed four tests to test for the long-run relationship that exist among the dependent variable and the independent variables. These tests are developed to test the

null hypothesis of no cointegration. Thus, if the null hypothesis of no error correction is rejected, then the null hypothesis of no cointegration is also rejected.

The error correction model proposed by Westerlund (2007) takes the following form:

$$\Delta y_{it} = \delta_i' d_t + \alpha_i (y_{i(t-1)} - \beta_i' x_{i(t-1)}) + \sum_{j=1}^{pi} \alpha_{ij} \Delta y_{i(t-j)} + \sum_{j=0}^{pi} \gamma_{ij} \Delta x_{i(t-j)} + e_{it} \dots\dots\dots (8)$$

To be able to estimate the error correction parameter α_i by ordinary least square, equation (8) is rewritten as

$$\Delta y_{it} = \delta_i' d_t + \alpha_i y_{i(t-1)} + \lambda_i' x_{i(t-1)} \sum_{j=1}^{pi} \alpha_{ij} \Delta y_{i(t-j)} + \sum_{j=0}^{pi} \gamma_{ij} \Delta x_{i(t-j)} + e_{it} \dots\dots\dots (9)$$

From equation (9), α_i estimates the speed of error-correction towards the long-run equilibrium. Reparameterizing the model makes the parameter α_i stay unaffected by imposing an arbitrary β_i .

Following from the above equations, four tests based on least squares estimate of α_i and its t -ratio for each individual i was developed by Westerlund (2007). The first two of the tests are called group mean statistics and the remaining two tests are called panel statistics.

The group mean statistics are given as:

$$G_\tau = \frac{1}{N} \sum_{i=1}^N \frac{\hat{\alpha}_i}{SE(\hat{\alpha}_i)} \dots\dots\dots (10)$$

and

$$G_\alpha = \frac{1}{N} \sum_{i=1}^N \frac{T \hat{\alpha}_i}{\hat{\alpha}_i(1)} \dots\dots\dots (11)$$

where $SE(\hat{\alpha}_i)$ is the standard error of $\hat{\alpha}_i$. G_τ and G_α statistics test the null hypothesis of $H_0: \alpha_i = 0$ for all i versus the alternative hypothesis of $H_1: \alpha_i < 0$ for at least one i . Thus, when the null hypothesis is rejected, it is an indication of the presence of cointegration for at least one cross-sectional unit in the panel.

The panel statistics on the other hand take the following form:

$$P_\tau = \frac{\hat{\alpha}}{SE(\hat{\alpha})} \dots\dots\dots (12)$$

and

$$P_\alpha = T\hat{\alpha} \dots\dots\dots (13)$$

The P_τ and P_α statistics test following hypothesis

$H_0: \alpha_i = 0$ for all i

$H_1: \alpha_i < 0$ for all i .

The rejection of the null hypothesis, H_0 implies the rejection of no cointegration for the entire panel.

3.4 Estimation of panel cointegration regression

Once the null hypothesis of no cointegration has been rejected implying the existence of cointegration relationship among the entire panel, we move on to estimate the long run cointegration parameters. Indeed, several panel cointegration regression estimations have been proposed. Pooled Mean Group Regression (PMG) proposed by Pesaran *et al* (1999), Dynamic OLS (DOLS) proposed by Kao and Chiang (2003), Fully Modified OLS (FMOLS) developed by Pedroni (2004) are just a few examples. This study however employs the PMG estimator to estimate the long run and short run coefficients. A key advantage of this estimator is that it allows the short-run

specifications to differ from country to country while it constrains the long run coefficients to be the same. To check for the robustness of the coefficients of the PMG estimator, the Mean Group (MG) is applied.

The PMG estimator proposed by Pesaran *et al* (1999) assumes an autoregressive distributed lag (ARDL) (p, q_1, \dots, q_k) dynamic panel specification of the form

$$y_{it} = \sum_{j=1}^p \lambda_{ij} y_{i,t-j} + \sum_{j=0}^q \delta_{ij}' X_{i,t-j} + \mu_i + \varepsilon_{it} \quad \dots\dots\dots (14)$$

where the number of groups $i = 1, 2, \dots, N$; the number of periods $t = 1, 2, \dots, T$; X_{it} is a $k \times 1$ vector of explanatory variables; δ_{it} are the $k \times 1$ coefficient vectors; λ_{ij} are scalars; and μ_i is the group-specific effect.

One key feature about cointegrated variables is that they are sensitive to deviation from long run equilibrium. It is therefore imperative to estimate error correction model to capture the short-run dynamics.

The resulting error correction equation is thus given in equation (15) below

$$\Delta y_{it} = \phi_i (y_{i,t-1} - \theta_i' X_{it}) + \sum_{j=1}^{p-1} \lambda_{ij}^* \Delta y_{i,t-1} + \sum_{j=0}^{q-1} \delta_{ij}^* \Delta X_{i,t-j} + \mu_i + \varepsilon_{it} \quad \dots\dots\dots (15)$$

where ϕ_i is the error correction term. ϕ_i is expected to be significantly negative.

Also of particular importance is θ_i' , which contains the long-run relationships between the variables.

From equations (2) and (15), the specific PMG regression takes the following form:

$$y_{it} = \delta_{10i} AID_{it} + \delta_{11i} AID_{i,t-1} + \delta_{20i} OPENNESS_{it} + \delta_{21i} OPENNESS_{i,t-1} + \delta_{30i} (AID * OPENNESS)_{it} + \delta_{31i} (AID * OPENNESS)_{i,t-1} + \gamma X_{it} + \lambda_i y_{i,t-1} \mu_i + \varepsilon_{it} \quad \dots\dots\dots (16)$$

Following from equation (16) above, the specific error correction reparameterisation takes the form below:

$$\Delta y_{it} = \phi_i (y_{i,t-1} - \theta_{0i} - \theta_{1i} AID_{it} - \theta_{2i} OPENNESS_{it} - \theta_{3i} (AID * OPENNESS)_{it}) + \delta_{1i} \Delta AID_{it} + \delta_{2i} \Delta OPENNESS_{it} + \delta_{3i} \Delta (AID * OPENNESS)_{it} + \gamma X_{it} + \varepsilon_{it} \dots\dots\dots (17)$$

4. Results and Discussion

The presentation and detailed discussion of empirical results from the data analysis are provided in this section.

4.1 Panel unit root tests

In order to examine the impact of foreign aid and trade openness as well as their interaction on growth in sub-Saharan Africa, the stationarity status of all the variables were determined. Besides, panel cointegration testing requires that all variables are integrated of the same order, hence the need to undertake panel unit root testing. As a result, Im-Pesaran-Shin, Levin-Lin-Chu as well as Pesaran’s CADF unit root tests were carried out. All the tests involve testing the null hypothesis of non-stationarity against the alternative hypothesis of stationarity. The results of the individual test statistics are shown in Table 1. It is significant to mention that all the tests included constant and trend terms with a lag length of one.

The results in the table clearly indicate that the levels of real GDP per capita, aid per capita, aid to GDP ratio and openness as well as their interaction terms are non-stationary and as such have unit roots. However, when the variables were first-differenced and the tests were repeated, the unit root and for that matter nonstationarity

is eliminated. This can be seen from the fact that all the panel unit root tests carried out reject the null hypothesis of nonstationarity at 1% significance level for the first difference variables. It can on the basis of this be said that the first differenced variables are integrated of order one (i.e. I(1))

Table 1 Panel unit root tests results

| Variables | Levels | | | First Difference | | |
|-------------------------|------------|------------|-------------|------------------|------------|-------------|
| | <i>IPS</i> | <i>LLC</i> | <i>CADF</i> | <i>IPS</i> | <i>LLC</i> | <i>CADF</i> |
| <i>lnGDPPC</i> | -1.863 | -2.473 | -1.930 | 22.264** | -14.205** | -17.753** |
| <i>lnAID/GDP</i> | -3.073 | -3.411 | -2.128 | -25.102** | -12.437** | -21.398** |
| <i>lnAIDPC</i> | -2.969 | -2.857 | -2.046 | -21.513** | -11.314** | -20.152 |
| <i>OPENNESS</i> | -2.884 | -3.065 | -2.240 | -24.349** | -13.007** | -18.018** |
| <i>OPENNESS*AID/GDP</i> | -2.915 | -2.822 | -2.148 | -4.637** | -4.865** | -3.427** |
| <i>OPENNESS*AIDPC</i> | -2.532 | -2.763 | -2.381 | -6.493** | -6.704** | -5.109** |
| <i>lnFDI</i> | -2.471 | -2.100 | -1.217 | 13.662** | -10.376** | -9.118** |
| <i>lnK</i> | -1.038 | -1.763 | -1.064 | -16.468** | -13.622** | -10.246** |
| <i>DEMO</i> | -1.315 | -1.244 | -1.702 | -11.006** | -8.418** | -9.727** |

** denotes the rejection of the null hypothesis of non-stationarity at 1% level of significance..

4.2 Panel Cointegration Test

Having established the stationarity status of the panel variables, the next step is to test for the panel cointegration using the first-differenced variables in equation (8). As noted earlier, the cointegration is carried out for the entire panel using Westerlund's cointegration tests.

It is worth mentioning that even though the Westerlund cointegration tests allow the time series to be unequal length, there could be existence of cross-sectional dependence across countries in the panel. In other words, when the cross-sectional correlation is present over the units, the group mean and panel statistics cease to be valid. In order to overcome such a case, Westerlund (200) proposed bootstrapping to obtain robust critical values. The robust critical values (reported as robust p -values in Table 2) were computed using 300 replications. The bootstrap option is computed to account for cross-sectional dependence.

G_{τ} and G_{α} are group mean statistics that test the null hypothesis of no cointegration for the entire panel against the alternative hypothesis of cointegration for some countries in the panel. On the other hand, P_{τ} and P_{α} are the panel statistics that test the null hypothesis of no cointegration against the alternative hypothesis of cointegration for the entire panel. The results of the four panel cointegration tests are reported in Table 2 below.

Table 2 Westerlund's Panel Cointegration Results

| <i>Panel Cointegration Tests</i> | <i>Model 1</i> | <i>Model 2</i> |
|----------------------------------|-------------------|-------------------|
| G_{τ} | -8.253***[0.002] | -11.841***[0.000] |
| G_{α} | -22.618***[0.000] | -19.324**[0.003] |
| P_{τ} | -15.401***[0.000] | -12.153***[0.001] |
| P_{α} | -18.277***[0.000] | -14.066***[0.001] |

*Note: Values in [] are the robust ρ -values. ***, ** and * show significance at 1%, 5% and 10% respectively.*

A critical look at the results in Table 2 above clearly shows that all the four test statistics reject the null hypothesis of no cointegration for the entire panel at 1% level of significance in the two models except for the group mean statistics (G_{α}) in model 2 which is significant at 5%. Further, the robust critical values obtained through bootstrapping also reject the null hypothesis of no cointegration and thus provide more reliable predictions for the cointegration test. In general therefore, it can be concluded that the variables are all cointegrated.

4.3 Panel cointegration regression

In this section, we present and discuss the results of the long and short run coefficients using the PMG estimator. As indicated in Section 2.4, the Mean Group (MG) estimator was applied to check for robustness of the estimates of the PMG estimator. Clearly, the results from Table 3 show that the MG estimator provides results that are similar to those of the PMG estimator in terms of magnitude and signs of the coefficients, thus demonstrating the robustness of the long and short run estimates.

From Table 3, both measures of aid appear positive and significant in both models (for the PMG estimator) except in the short run where *AIDPC* was negative albeit not statistically significant. Individually, a 1% rise in *AIDGDP* raises income by 0.784 and 0.539 in both the long run and short run respectively while a 1% increase in *AIDPC* leads to a 0.422 rise in income. A 1% rise in *AIDPC* leads to a 0.317 fall in income though not significant. Apart from *AIDPC* in the short run, all the other statistics are statistically significant at 1% and 5% levels. These results are consistent with a priori expectation as well as studies that find positive and significant effect of aid on income (Gyimah-Brempong *et al*, 2010; Karras, 2006; Hansen and Tarp, 2005; Morrissey *et al*, 2005; Dalgaard *et al*, 2004; Gomanee, *et al.*, 2003;). It however contradicts other studies such as Brautigman and Knack (2005), Burnside and Dollar (2000) which found negative effect of aid on income. The results obtained in this study are not surprising since individual countries (and for that matter the whole of sub-Saharan African) have received considerable amount of aid over the period under consideration due to their subscription to the adjustment and reform programmes to help accelerate income growth. Available statistics suggest that the SSA sub-region has been the largest recipient of aid with aid rising by 13.6% reaching US\$34.8billion in real terms by 2013.

Table 3 Results of the panel cointegration regression

| <i>Variables</i> | <i>Model 1</i> | | <i>Model 2</i> | |
|-------------------------------------|----------------------|----------------------|----------------------|-------------------|
| | <i>PMG</i> | <i>MG</i> | <i>PMG</i> | <i>MG</i> |
| <i>Long run coefficients</i> | | | | |
| <i>lnAID/GDP</i> | 0.784*** (0.683) | 0.531*** (0.416) | | |
| <i>lnAIDPC</i> | | | 0.422*** 0.537*** | |
| <i>lnOPENNESS</i> | -0.316** (0.240) | -0.406** (0.283) | (0.310) -0.324*** | (0.364) 0.281 |
| <i>lnOPENNESS*AID/GDP</i> | 0.226*** (0.052) | 0.214** (0.255) | (0.079) | (0.043) |
| <i>lnOPENNESS*AIDPC</i> | | | 0.276*** | 0.418** |
| <i>lnFDI</i> | 0.242*** (1.034) | 0.217*** (1.001) | (0.046) 0.236*** | (0.283) |
| <i>lnK</i> | 0.155*** (2.435) | 0.148*** (1.822) | 0.225*** (1.273) | (1.424) |
| <i>DEMO</i> | 0.062** (0.834) | 0.057** (0.701) | 0.214*** 0.113** | |
| <i>INFL</i> | -0.077*** (0.681) | -0.083*** (0.516) | (2.063) 0.070*** | (1.640) -0.052 |
| | | | (0.527) 0.067 | (0.538) - |
| | | | 0.086** (0.723) | (0.469) |

Short run coefficients

| | | | | |
|---------------------------------|----------------------------------|---------------------|----------------------------------|--------------------|
| $\Delta \ln AID/GDP$ | 0.539*** (0.264) | 0.237** (0.210) | | |
| $\Delta \ln AIDPC$ | | | 0.317 (0.345) | 0.328 (0.271) |
| $\Delta \ln OPENNESS$ | -0.152*** (0.083) | -0.043** (0.060) | -0.148*** 0.263** (0.075) | — (0.142) |
| $\Delta \ln OPENNESS * AID/GDP$ | 0.065 (0.610) | 0.037* (0.420) | | |
| $\Delta \ln OPENNESS * AIDPC$ | | | 0.073** | 0.152** |
| $\Delta \ln FDI$ | 0.136*** (0.022) | 0.104*** (0.014) | (0.008) 0.170*** | (0.062) 0.154** |
| $\Delta \ln K$ | 0.028*** (0.162) | 0.033*** (0.140) | (0.136) 0.083*** | (0.117) |
| $\Delta DEMO$ | 0.152*** (0.083) | 0.043** (0.060) | 0.010*** (0.028) | (0.086) |
| $\Delta INFL$ | -0.002*** (0.016) | 0.030 (0.226) | 0.148*** (0.075) | 0.263 (0.142) |
| EC | -0.814*** 0.818*** (0.023) | — (0.160) | -0.002** 0.015** (0.115) | — (0.074) |
| | | | -0.827*** 0.832*** (0.071) | — (0.281) |

Note: Values in () are standard errors. ***, ** and * indicate 1%, 5% and 10% levels of significance respectively. All equations include a constant term.

Generally, the levels of savings are low in SSA due to relatively high incidence of poverty. As a result capital formation is very low resulting low investment and consequently low research and development activities. However, with the rise in foreign aid inflows, it is expected that aid would augment domestic savings to improve domestic capital formation. This would result in increased level of investment and consequently income growth.

Contrary to a priori expectation, the coefficients of *OPENNESS* carry a negative sign in the long run and short run for both measures of aid. For instance, when *AIDGDP* is used as a measure of aid, a percentage increase in trade openness reduces income by 0.316 and 0.152 in the long run and short run respectively. Similarly, a percentage rise in trade openness leads income to fall by approximately 0.324 and 0.148 in both the long run and short run respectively when *AIDPC* is used. In all cases, the results are statistically significant at 1% level except in the long run in model 1 which is at 5% significance level. This suggests that openness to international trade does not enhance income in sub-Saharan Africa. Our finding is similar to studies that obtain negative relationship between trade openness and income (Example Akilou, 2013; Gries and Redlin, 2012). However, it is contrary to studies such as Sakyi (2014), Asiedu (2013), Yanikkaya (2003), among others who found positive relationship between trade openness and growth rate of income per capita.

Though trade openness is theoretically expected to promote income growth through technological transfer from technologically advanced countries, accessibility to larger and wider markets and greater levels of specialisation resulting efficiency among

domestic sectors and producers, the results rather suggest that trade openness is detrimental to income. One should however not be surprised.

As mentioned earlier, one key feature of the structural and reform programme was trade liberalization which exposed domestic sectors (or producers) to a higher degree of international competition. Unfortunately, these domestic sectors are not able to compete more favourably with their more efficient counterparts in the advanced countries mainly due to their infant nature and also because trade liberalization encourages the importation of cheaper goods. Thus they produce at a relatively higher average cost, a situation that reduces the productivity in these sectors which subsequently affects income negatively.

Secondly, the negative contribution of trade to income growth in SSA could be attributed to the unfavourable terms of trade. The exports of many SSA countries are mainly raw primary products (cocoa, minerals, timber, among others) which experience fluctuating prices while the prices of their imports which are mainly manufactured are rising, thereby creating unfavourable terms of trade. Apparently, this result is contrary to the classical argument that openness to trade resulting from comparative advantage leads to income growth. It however emphasizes the protectionist argument that trade openness has a detrimental effect on income.

Clearly, the preceding discussions show that while aid has produced positive income effects trade openness has had negative impact on income in SSA. Notwithstanding, the combined effect of trade openness and aid (shown by the interaction term) generates positive income effect. From Table 3, when trade openness is interacted with both measures of aid, the coefficients are significantly positive in

both the long run and short run at 1% and 5% levels of significance. This implies that if trade liberalization (or openness) is a conditionality for receiving aid as in the case of the structural adjustment and reform programmes in SSA and trade openness improves the productivity of aid, then obviously the interaction term would be expected to result in income growth. Hence, the results suggest that the positive income effect of aid exceeds the negative income effect of trade openness.

Since trade openness and foreign aid are not the only the factors that affect income, we included in our model foreign direct investment, capital stock, political regime and inflation as control variables. The results as reported in Table 3 are not only statistically significant but also consistent with a priori expectation and economic theory. Foreign direct investment has positive and significant relationship with real GDP per capita. This result is statistically different from zero at 1% in both specifications in the long run and short run. This implies that foreign direct investment enhances the levels of income. This is not surprising since many SSA countries in recent times have received tremendous inflows of FDI in the telecommunication sector, financial sector, among others. This is consistent with studies that find positive impact of FDI on income.

The coefficients of capital stock are significantly positive at 1% level. Thus, consistent with neoclassical school of thought, the result show that capital stock fosters economic activities which enhance income in SSA. Democracy (a proxy for political regime) was found to be an important ingredient in promoting income growth in SSA. In both estimated models, political regime was positive and statistically different from

zero at 1% except in model 1 where it was 5%. Inflation, a measure of macroeconomic instability was found to have negative effect on income.

The estimated coefficients of the error correction model (ecm) are not only highly significant at 1% level but also have the appropriate negative sign in both specifications. The coefficients of the *ecm* as shown in Table 3 reflect a very high speed of adjustment to equilibrium after a shock.

5. Conclusion and Policy Implications

The objective of this paper was to investigate the impact of foreign aid and trade openness on income for a panel of 32 sub-Saharan African countries over the period 1970–2011 using panel cointegration techniques. The long and short run estimates were estimated principally using the PMG estimator with the MG estimator being used for robustness checks.

The findings obtained in this paper suggest that while foreign aid has contributed significantly to income growth over the period under consideration trade openness has been detrimental to income growth in SSA over the same period. Also, the combined effect of aid and trade openness has resulted in income growth. Additionally, the study emphasizes the crucial role played by foreign direct investment, democracy and physical capital stock in promoting income levels in sub-Saharan Africa. Finally, the study finds that inflation is detrimental to income in SSA.

From a policy perspective, the findings obtained in this paper have considerable implications. Even though this paper has established that aid has produced positive income effect, it should not be taken to mean aid inflow to SSA has been completely

successful. Indeed, when the observed economic performance is compared with aid inflows, it can be seen that it has not. This implies that though the findings suggest that aid has brought some benefits, there is still more room for improvement for these benefits to result in sustained income levels. More specifically, aid can be channelled to assist small and medium scale businesses which can help to reduce rural and urban poverty. Notwithstanding the positive impact of aid on growth, we also recommend that sub-Saharan African countries should gradually reduce their dependence on foreign aid since such assistance are just to complement internal efforts.

Further, the results suggest that the adoption of the trade openness (or liberalisation) policy as part of the structural reforms has not helped as far as economic performance is concerned. Therefore, policies should target strengthening the external trade sector to make it more competitive. Since the exports section of the external trade generates revenue, policies to make the export sector more competitive relative to the import sector would be more appropriate. This may be achieved through diversification of exports which can be done by adding value to exports so that they attract competitive prices on the world market. Domestic expenditure on imported consumer goods could be reduced while encouraging the importation of intermediate goods and inputs that enhance domestic production.

Notwithstanding the above findings, it is significant to emphasize that our paper did not investigate the mechanisms through which aid and trade openness affect income. Secondly, It is also significant to note that aid as used in this paper refers to aggregate aid flows to SSA countries as a percentage of GDP and also per capita during the period of the study. It does not disaggregate aid into loans, grants, food aid, among

others. In much the same way, trade openness is also measured as simply the sum of export and import as a percentage of GDP. It is possible that alternative measures can produce different findings.

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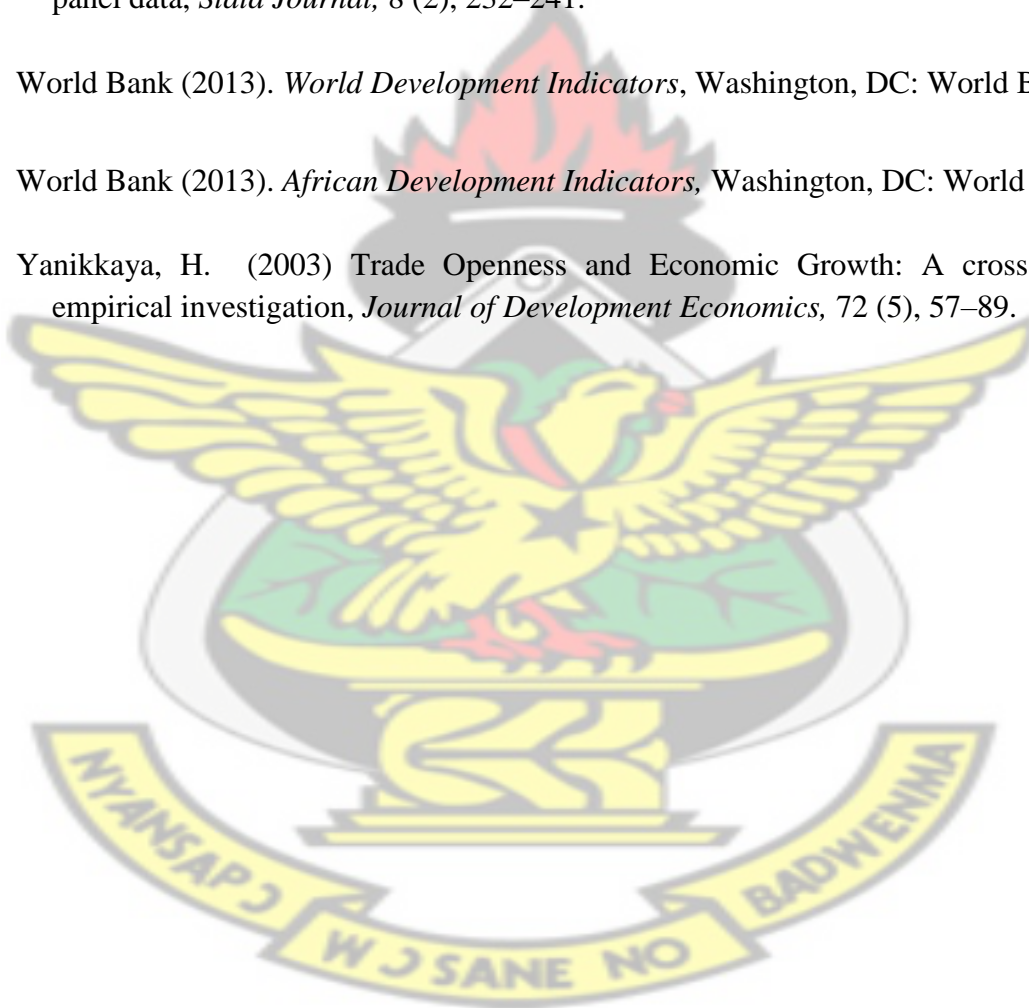
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II

Democracy, Corruption and Income: Evidence from sub-Saharan Africa[♥]

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Abstract

The objective of this paper was to investigate the effect that democracy and corruption have on income in sub-Saharan Africa. Considering eight alternative indicators of democracy, the study finds that corruption has adversely affected income in SSA. The results also showed that whether or not democracy has growth effects depends on a particular indicator used. This result is further confirmed by the indexes created from the principal component analysis. While property rights and political stability have had positive income effects rule of law and government effectiveness have shown negative impact on income. The paper therefore concludes that policy reforms should target programmes that seek to develop and build the capacities of judiciaries, legislatures, media and civil society groups to help enforce rule of law and strengthen democratic institutions. Also, researchers should seriously take into account the selection of proxies when investigating the impact of democracy on economic growth.

Keywords: Democracy, corruption, income, principal component analysis, sub-Saharan Africa

JEL Classification: C36, O4, O43, O55, P16

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1. Introduction

Under endogenous growth models, economic performance is as a result of the contribution to aggregate output from introduction of new technology as well as governance and structural reforms. Governance reforms that enhance the quality of institutions provide effective mechanisms for accelerating economic performance and transform an economy from poverty to prosperity in the long term. Obviously, one of such governance reforms is democracy. Democracy provides an impetus for economic growth and income. A more democratic institution provides one of the channels of attracting foreign direct investments, foreign aid and above all redistribution of income and resources in favour of the poor and vulnerable in the economy.

Additionally, democracy makes it possible for individuals to own property and wealth and establish businesses without any stringent restrictions. It is therefore not surprising that some existing studies have argued that democracy has a significantly positive impact on economic performance (example, Rigobon and Rodrik, 2005; Roll and Talbott, 2003; Rodrik, 2002; Sala-i-Martin, 2002). Notwithstanding, other studies obtained statistically negative relationship between democracy and economic performance (see Sakyi, 2011; Baum and Lake, 2003; Kurzman *et al.*, 2002; Helliwell, 1994).

To the extent that democracy has a significantly positive effect and fosters economic activities, democracy would have positive impact on economic performance. If democratic institutions suffer from inefficiencies in making decisions resulting in difficulty in implementing crucial policies (especially in developing countries)

democracy would undermine economic performance. Thus, research on democracy-income nexus is still far from a conclusive one. This could be due to the fact that there are several proxies for democracies and each of them affects income in different ways. Studies in the extant literature rely mainly on political right and civil liberties and Polity2 as measures of democracy (See Veiga and Aisen, 2011; Sakyi, 2011; Fosu, 2008; Roll and Talbott, 2003). It is in this regard that this study contributes to the literature. In this study, we present evidence from a large panel of countries in sub-Saharan Africa over the period 2002–2012. We also extend the basic democracy-income model to include several democracy indicators and apply the principal component analysis to reduce the dimension of the indicators. This helps reduce multicollinearity of including more than one democracy proxy in a single equation.

Indeed, for the past two and a half decades, democracy has become very important in sub-Saharan Africa. The political systems of sub-Saharan African countries have become democratised. Hitherto, democracy was almost not in existence since many obstacles undermined democratisation. As argued by Fosu (2008), the importance of democracy became apparent in sub-Saharan Africa at the beginning of 1990 as democracy was anticipated would enhance the poor economic performance that had bedeviled the sub-region for decades. On the other hand, Africa is widely considered among the most corrupt regions in the world. This situation is seen as a contributory factor to the poor economic performance and impoverishment of many countries on the continent. In fact, six out of the top ten corrupt countries in the world are found in Africa (Transparency International, 2013). A study undertaken by African Union in 2012 revealed that approximately US\$150 billion in the SSA sub-region is

lost through corruption. In contrast, foreign aid and assistance inflows from western countries to sub-Saharan African region amounted to about US\$22.5 billion according to the Organization for Economic Cooperation and Development (OECD, 2008). It is in regard that African leaders and governments have to institute measures to fight corruption rather than depending on foreign aid.

As noted earlier, while large body of studies find democracy to have positive and significant effect, others find negative effect. For example, Roll and Talbott (2003) investigated the link between democracy and gross national income per capita for between 134 and 157 countries over the period 1995–1999. Using political rights and civil liberties as measures of democracy, their study found a statistically significant positive relationship between democracy and gross national income per capita. Kaufmann *et al.* (1999) also found empirical evidence to support the positive relationship between democracy (proxied by voice and accountability) and economic growth. Adding to the already existing studies, Boko (2002) examined the link between democracy and growth for 27 African countries and concluded that democracy has a significant positive effect on growth. However, Veiga and Aisen (2011) find the relationship between democracy and income over the period 1960–2004 for 169 countries. Using, GMM estimation techniques, they found that democracy has a slightly negative impact on per capita income. Other studies that found negative effect include Baum and Lake (2003), Kurzman *et al.* (2002), Helliwell (1994) and Olson (1993).

Furthermore, studies in the extant literature have concluded that corruption adversely affect economic growth. These studies individually and collectively argue that corruption coupled with long and unnecessary bureaucratic procedures have the

tendency to drive away potential investors, donor support, among others which consequently affect growth negatively. Corruption has the tendency to restrict the success of small, medium and large scale business which limit their ability to grow and become job and income generating. It leads to higher costs while providing inferior infrastructure projects, declining economic efficiency and macroeconomic challenges (Rose-Ackerman, 1996).

According to Aidt *et al.* (2008) corruption reduces productivity growth through two mechanisms. First, corruption negatively affects innovation. Secondly, corruption reduces learning-by-doing externalities which inhibit possibilities of utilizing existing technology developed by other countries. In investigating the effect of corruption on product growth Lambsdorff (2003) concluded that corruption-growth relationship is manifested in the poor quality of the bureaucratic system. Other studies that obtained negative relationship between corruption and growth are Akcay (2006), Drury *et al* (2006), Mauro (2004), Mauro (2004), Bardhan (1997) and Mauro (1995).

The preceding discussions reveal three major conclusions. First, sub-Saharan African countries have democratized their political system since 1990 to help promote economic growth. At the same time, corruption has become prevalent in SSA which has cost the sub-region several billions of US dollars. Secondly, it reveals that the empirical evidence on the impact of democracy on income is still far from a conclusive one, a situation that can be attributed to many factors. Thirdly, it shows that corruption in a country especially in developing countries increases the levels of poverty and income inequality which inhibit the economic growth and performance of the sub-region. Given these conclusions, there is still more room for further research with respect to the

democracy-income nexus especially in sub-Saharan Africa. The isolation of the SSA sub-region from other developing regions in this study will inform a more explicit policy implication from the findings particularly as SSA countries are similar in economic characteristics.

This paper thus contributes significantly to literature in several ways. First, we acknowledge that no single indicator can sufficiently proxy for democracy and therefore considers several alternative proxies to measure democracy and not just one as exist in the previous studies. Secondly, we also apply the principal component analysis to reduce the dimension of the democracy indicators to avoid the potential of multicollinearity problem of including more than one proxy in a single equation. Thirdly, we also include in our specifications country specific effects to remove the impact of specific country characteristics on economic growth that could correlate with democracy. Fourthly, we extend the basic democracy-income model to include corruption to account for the level of inefficiencies in the governance process and how it affects income. Finally, we include in our model the interaction between democracy and corruption to account for the extent to which increased democratization can reduce the incidence of corruption to spur economic growth.

This paper in the end found that corruption has had negative and significant impact on income confirming the weaknesses in the institutional set up of many sub-Saharan African countries. Additionally, the overall effect of democracy on income depends on the choice of democracy indicator. After controlling for other macroeconomic variables, property rights and political stability were found to have statistically positive effect on income while rule of law and government effectiveness

have significantly negative effect on income. The indexes created from the principal components generated mixed results in both estimations as some have positive and others have negative effect on income.

The rest of the paper is arranged as follows: Section 2 describes the empirical methodology with emphasis on the data set, model specification and estimation techniques. The empirical results of the various estimation techniques as well as discussions are presented in detail in Section 3. The last section provides the conclusion of the study.

2. Empirical Methodology

This section describes the methodology used in this paper with emphasis on data sources and measurement as well as model specification and estimation technique.

2.1 Description of Data

This paper seeks to investigate the impact of democracy and corruption on income per capita in sub-Saharan Africa. In all, the panel data consist of 32 sub-Saharan African countries ¹over the period 2002 – 2012. In fact, it is worth emphasising that the selection of countries was influenced by data availability for all the variables that were considered in the study.

¹ Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Democratic Republic of Congo, Republic of Congo, Cote d'Ivoire, Ethiopia, Gabon, Ghana, Guinea, The Gambia, Guinea-Bissau, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Swaziland, Togo, Zambia and Zimbabwe.

The data used in the paper were selected from different sources. Real GDP per capita, gross domestic fixed capital formation, foreign direct investment, inflation and trade openness were obtained from World Bank's World Development Indicators, corruption was taken from the Transparency International's Corruption Perception Index (CPI) which ranks countries and territories based on the perceived level of corruption in their public sector. A country or territory's score indicates the perceived level of public sector corruption on a scale of 0–100, with 0 being highly corrupt and 100 being perceived as very clean.

In this paper, we consider eight (8) alternative indicators to measure democracy. All the indicators were grouped into three. The first group of indicators of democracy consists of Polity2 which was obtained from Polity IV Project². Polity2 is a continuous variable that measures the democratic quality of political regimes using polity scores; it ranges from -10 (strongly autocratic) to +10 (strongly democratic). It is worth emphasizing that Polity scores are derived from other measures such as competitiveness of executive recruitment, openness of executive recruitment, regulation and competitiveness of participation.

The second group of indicators of democracy consists of rule of law, government effectiveness, voice and accountability and political stability/no violence³. Rule of law relates to the perceptions about the extent to which agents have confidence

² See Marshall and Gurr (2013) *Polity IV project: Political regime characteristics and transitions, 1800–2012*. Center for Systemic Peace and Colorado State University. Retrieved from <http://www.systemicpeace.org/polity/polity4.htm>

³ Data on indicators in this group were obtained from Kaufmann *et al* (2013). The Worldwide Governance Indicators: A Summary of Methodology, Data and Analytical Issues. *World Bank Policy Research Working Paper No. 5430*

in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. The next indicator of democracy in this group is government effectiveness which reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Voice and accountability measure of democracy relates to the perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. The last indicator of democracy in this group is Political stability/No violence which reflects the perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism.

The last group of indicators of democracy include: (i) Property rights which is an assessment of the ability of individuals to accumulate private property, secured by clear laws that are fully enforced by the state. It thus measures the degree to which a country's laws protect private property rights and the degree to which its government enforces those laws. (ii) Investment freedom which evaluates a variety of restrictions that are typically imposed on investment. (iii) Business freedom which reflects the ability to start, operate, and close a business that represents the overall burden of

regulation as well as the efficiency of government in the regulatory process. These indices were obtained from the Index of Economic Freedom⁴.

In order to make all the indicators in the various groups comparable, all the eight indicators namely Polity2, rule of law, government effectiveness, voice and accountability, political stability/no violence, property rights, investment freedom and business freedom were converted to 0 – 10 scale with 0 representing full autocracy and 10 corresponding to full representative democracy. It is significant to mention that the first two groups of indicators measure political democracy while the third group of indicators measures economic democracy. It is also worth emphasising that these four alternative measures of democracy may be highly correlated. However, they measure different dimensions of the political and economic systems and as such it is expected that they have completely different and independent impact on level of income.

2.2 Empirical Strategy and Estimation Technique

This paper essentially finds out the impact of democracy and corruption on income in sub-Saharan Africa. Basically, this study uses dynamic panel techniques.

The specific equation to be estimated takes the following form:

$$y_{it} = \delta + \gamma y_{it-1} + \theta_1 DEMO_{it} + \theta_2 COR_{it} + \theta_3 (DEMO * COR_{it}) + \beta' X_{it} + \lambda_i + \varepsilon_{it} \dots\dots (1)$$

where $i = 1, 2, 3, \dots, N$ is the cross-sectional dimension of countries, $t = 1, 2, 3, \dots, T$ represents time, y_{it} is the logarithm of real GDP per capita (i.e. income), y_{it-1} is the

⁴ The Index of Economic Freedom was obtained from the Heritage Foundation published by Freedom House, 2013. These indicators are measured in units ranging from 0 to 100 with higher values implying full representative democracy. See www.freedomhouse.org

logarithm of real GDP per capita at the beginning of each period which in Solow growth analysis allows for a convergence situation across countries, $DEMO_{it}$ is the democracy variable, COR_{it} is the corruption variable, $DEMO * COR_{it}$ is the interaction between democracy and corruption, X_{it} is the set of control variables, λ_i represents the unobserved individual or country specific fixed effect, ε_{it} is the error term.

In this study, the key variables of interest are democracy and corruption as well as their interaction term. Democracy enhances stable political environment, fundamental civil liberties and open society; promotes property protection, business freedom, as well as contract enforcement. All these are expected to foster economic activities which translate into income. Thus, a greater democratization should therefore raise level of income. Corruption on the other hand erodes part of the proceeds obtained by investors and entrepreneurs which reduces investor confidence and hence discourages investment. It results in loss of tax revenue by government, leads to inferior public infrastructure and services. These adversely affect economic performance resulting in decline in income. In effect, corruption is anticipated to produce a negative effect on income. The inclusion of the interaction term results from the fact that a strong democracy is expected to make political institutions and for that matter the process of governance more transparent and accountable. This reduces the level of inefficiency in the allocation of resources (that is, corruption) which is expected to culminate in overall improvement in economic performance.

In addition to democracy and corruption, the model contains control variables namely, foreign direct investment, capital stock, inflation and trade openness to control for other factors which can affect income. Foreign direct investment (FDI)

complements domestic investment which is expected to increase total investment and hence increase in total output and income. The coefficient of FDI is thus expected to be positive. Capital stock (proxy by gross domestic capital formation) is expected to positively affect income since larger capital stock implies higher rates of investment which translates into higher levels of income. Inflation rate is a reflection of macroeconomic instability and therefore a higher rate of inflation is generally detrimental to economic activities because it raises the cost of borrowing which lowers the rate of capital investment. Consequently, a negative coefficient for inflation is expected. Trade openness is often considered to be conducive for economic activities. Apart from the comparative advantage theory, trade openness leads to competition, enlarges market sizes, technology transfer resulting in production efficiency. Trade openness thus produces positive income effects.

Having specified the model for the study and explained the variables contained in it, we proceed to describe the technique adopted for estimation. This study basically adopts both the within-group (WG) and system Generalized Method of Moment (GMM) estimators to estimate the model specified in equation (1). The choice of these estimators was influenced by the fact that the dataset has a short time dimension ($T = 12$) and a larger country dimension ($N = 30$). This therefore makes the use of other panel data analysis like cointegration impossible. Besides, the within-group and the system GMM estimators are capable of accounting for individual country specific effects. They are therefore used in this study to complement each other.

As noted earlier, this study uses dynamic panel data. This implies that the lagged dependent variable is likely to be correlated with the error term in the model. In such a

situation, estimating equation (1) using ordinary least square (OLS) results in inefficient and biased estimates. In order to treat this problem and use OLS to estimate the model, the within-group estimator is applied to transform equation (1) by differencing the time series means of each variable for each country.

$$y_{it} - \bar{y}_i = \gamma(y_{it-1} - \bar{y}_i) + \theta_1(DEMO_{it} - \overline{DEMO}_i) + \theta_2(COR_{it} - \overline{COR}_i) + \theta_3(DEMO * COR_{it} - \overline{DEMO * COR}_i) + \beta'(X_{it} - \bar{X}_i) + (\varepsilon_{it} - \bar{\varepsilon}_i) \dots\dots\dots (2)$$

From equation (2), though differencing the time series means of the variables eliminates the individual country-specific effects, λ_i because it does not vary with time, the correlation between $(y_{it-1} - \bar{y}_i)$ and $(\varepsilon_{it} - \bar{\varepsilon}_i)$ still remains. This again renders the within-group estimator biased and inconsistent. Thus, in order to deal with this problem, the first-differenced GMM attributable to Arrelano and Bond (1991) is used. This estimator uses lagged level of the dependent variable and other endogenous regressors as instruments for the first-differenced equation given in equation (3) below.

$$y_{it} - y_{it-1} = \gamma(y_{it-1} - y_{it-2}) + \theta_1(DEMO_{it} - DEMO_{it-1}) + \theta_2(COR_{it} - COR_{it-1}) + \theta_3(DEMO * COR_{it} - DEMO * COR_{it-1}) + \beta'(X_{it} - X_{it-1}) + (\varepsilon_{it} - \varepsilon_{it-1}) \dots\dots\dots (3)$$

Equation (3) provides consistent and efficient estimates since it is able to remove the time invariant effects and also the past values are lagged more than two periods as valid instruments. Notwithstanding, when the dependent variable is highly persistent, the Differenced GMM could be biased and inefficient. In the light of this, it becomes essential to use the system GMM which provides consistent and efficient estimates. The system GMM as proposed by Blundell and Bond (1998) is derived from estimating two

simultaneous equations, one in levels (with lagged first differences as instruments) and the other in first-differences (with lagged levels as instruments).

3. Discussion of Results

The presentation and detailed discussion of empirical results from the data analysis are provided in this section. Essentially, this study finds out how income levels in SSA are affected by the nature of governance and institutional efficiency (measured by corruption). Other key variables such as foreign direct investment, capital stock, inflation and trade openness that affect income were controlled for. The discussion of the empirical results begins with the results of the principal component analysis. It is then followed by the results of the two estimators used in the study namely, the within-mean and the system GMM.

3.1 Principal Component Analysis

This paper considers eight alternative indicators for democracy of which none can solely serve as an adequate indicator for democracy. Thus, to reduce the dimension of the democracy indicators and avoid the potential multicollinearity problem of including more than one proxy in a single equation, we apply principal component analysis to create four sub-indexes from the eight alternative indicators.

Tables 1A and 1B present the results of the principal component analysis out of which the four indexes were created. Table 1A lists the eigen values of the correlation matrix ordered from largest to smallest while Table 1B lists the associated eigen vectors

or scoring coefficients. The eigen values indicate the variances of the principal components. From Table 1A, the variance for the first principal component is 4.479 explaining 56% of the total variance. The second principal component has a variance 1.238 (also explaining 15.5% of the total variance). The third and fourth principal components explain about 9% and 7% respectively. In effect, it can be seen that 88% of the total variance in the original data are accounted for by the first four principal components. This implies that the dimension of the democracy indicators has been reduced by half while preserving 88% of the information contained in the original data. Again, it is significant to mention that all the sub-indexes created are uncorrelated (orthogonal) and as a result can be included in a single equation.

From Table 1B, using a scoring coefficient of 0.3 or higher to determine the significance of factor score, it could be seen that the first principal components denoted as DEMOIndex1 include property rights (PR), polity2 (Polity2), voice and accountability (VA), political stability and no violence (PS), government effectiveness (GE) and rule of law (RL).

Similarly, the second principal components (*DEMOIndex2*) represents investment freedom (IF) and business freedom (BF). Further, the third principal components (*DEMOIndex3*) represents polity2 (Polity2) and political stability and no violence (PS). Finally, the fourth principal components (represented by DEMOIndex4) is made up of property rights (PR), investment freedom (IF), business freedom (BF) and political stability (PS).

Table 1A: Principal Component/Correlation

| <i>Principal component</i> | <i>Eigenvalues</i> | <i>Proportion (%)</i> | <i>Cumulative (%)</i> |
|----------------------------|--------------------|-----------------------|-----------------------|
| 1 | 4.479 | 0.560 | 0.560 |
| 2 | 1.238 | 0.155 | 0.715 |
| 3 | 0.752 | 0.094 | 0.809 |
| 4 | 0.596 | 0.075 | 0.883 |
| 5 | 0.486 | 0.061 | 0.944 |
| 6 | 0.287 | 0.036 | 0.980 |
| 7 | 0.088 | 0.011 | 0.991 |
| 8 | 0.073 | 0.009 | 1.000 |

Table 1B: Eigenvectors (Scoring coefficients)

| <i>Component variable</i> | <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | <i>5</i> | <i>6</i> | <i>7</i> | <i>8</i> |
|-----------------------------|----------|----------|----------|----------|----------|----------|----------|----------|
| <i>Property rights</i> | 0.358 | -0.167 | 0.178 | 0.330 | 0.722 | 0.409 | -0.121 | 0.013 |
| <i>Investment freedom</i> | 0.185 | 0.650 | 0.297 | 0.593 | -0.308 | 0.058 | 0.066 | 0.021 |
| <i>Business freedom</i> | 0.185 | 0.686 | -0.089 | -0.522 | 0.420 | -0.185 | -0.066 | 0.013 |
| <i>Polity2</i> | 0.318 | 0.070 | -0.803 | 0.087 | -0.144 | 0.335 | 0.209 | 0.256 |
| <i>Voice & account.</i> | 0.445 | -0.073 | -0.189 | 0.022 | -0.199 | -0.125 | -0.486 | -0.684 |
| <i>Political stability</i> | 0.358 | -0.060 | 0.406 | -0.494 | -0.379 | 0.521 | -0.090 | 0.190 |
| <i>Government effect.</i> | 0.427 | -0.197 | 0.053 | 0.096 | -0.048 | -0.570 | -0.278 | 0.602 |
| <i>Rule of law</i> | 0.440 | -0.164 | 0.157 | -0.075 | 0.027 | -0.267 | 0.782 | -0.257 |

Having created the principal components, the next step is to estimate the model. The results obtained by applying the within-group estimator are shown in Table 2A.

In model 2(a) the results show that corruption has negative and significant impact on income in sub-Saharan Africa. Thus, a percentage increase in corruption results in 0.068 percent decrease in economic performance in SSA. Corruption is indeed endemic in virtually all SSA countries. The inefficiencies in the various institutions coupled with the fact that the independence and professionalism of the public and private sectors have been eroded have resulted in widespread corruption, a situation which has been disadvantageous to levels of income. This result is consistent with theoretical and empirical expectations (Aidt *et al*, 2008; Akcay, 2006; Drury *et al*, 2006; Mauro, 2004; Gyimah-Brempong, 2002)

Individually, two of the four key democracy proxies (with higher scoring coefficients) namely property rights and political stability showed positive and significant impact on income while the other two proxies (that is, rule of law and government effectiveness) showed negative and significant impact on income. One thing worth noting is that the magnitudes of these impacts were quite small.

Table 2A: Democracy, Corruption and Income: Within-group Estimation

| <i>Variable</i> | <i>(1a)</i> | <i>(2a)</i> | <i>(3a)</i> | <i>(4a)</i> | <i>(5a)</i> | <i>(6a)</i> | <i>(7a)</i> | <i>(8a)</i> |
|-----------------------------|----------------------|----------------------|----------------------|---------------------|----------------------|---------------------|----------------------|----------------------|
| <i>Log(FDI)</i> | 0.090 (6.29)*** | 0.092 (5.64)*** | 0.087 (5.44)*** | 0.091 (5.74)*** | 0.091 (5.87)*** | 0.091 (5.75)*** | 0.092 (5.77)*** | 0.092 (5.84)*** |
| <i>Log(CAP)</i> | 0.007 (3.84)*** | 0.004 (4.06)*** | 0.005 (4.82)*** | 0.007 (4.47)*** | 0.007 (4.63)*** | 0.021 (5.38)*** | 0.022 (6.15)*** | 0.017 (4.66)*** |
| <i>INFL</i> | -0.001 (-3.95)*** | -0.009 (-3.41)*** | -0.008 (-3.64)*** | -0.005 (-3.43)** | -0.001 (-3.68)*** | -0.007 (-3.57)** | -0.008 (-3.64)*** | -0.0001 (-2.37)** |
| <i>OPEN</i> | -0.002 (-1.45)* | -0.0002 (-0.97) | -0.0005 (-0.063) | -0.001 (-1.24)* | -0.0010 (-0.98) | -0.002 (-0.96) | -0.002 (-0.97) | -0.008 (-1.31)* |
| <i>COR</i> | -0.068 (-3.45)*** | | | | | | | |
| <i>PR</i> | | 0.034 (4.25)*** | | | | | | |
| <i>RL</i> | | | -0.079 (-1.69)** | | | | | |
| <i>PS</i> | | | | 0.051 (2.24)** | | | | |
| <i>GE</i> | | | | | -0.012 (-1.08)* | | | |
| <i>DEMOIndex1</i> | | | | | | 0.188 (2.84)** | 0.147 (2.63)** | 0.079 (1.34)* |
| <i>DEMOIndex2</i> | | | | | | 0.205 (2.96)*** | 0.102 (2.41)** | -0.007 (5.75)** |
| <i>DEMOIndex3</i> | | | | | | 0.021 (1.98)** | 0.365 (1.76)*** | -0.148 (-1.97) |
| <i>DEMOIndex4</i> | | | | | | -0.040 (-2.96)** | -0.499 (-3.48)** | -0.031 (-3.02)** |
| <i>Interaction</i> | 0.005 (2.01)** | -0.168 (-1.20)* | 0.006 (1.04) | -0.260 (-1.91) | 0.007 (2.58)* | 0.002 (1.02) | 0.008 (1.52) | -0.008 (-2.55) |
| <i>lnGDPC_{t-1}</i> | 0.886 (6.83)*** | 0.890 (6.87)*** | 0.892 (6.88)*** | 0.889 (6.79)*** | 0.890 (6.86)*** | 0.893 (6.91)*** | 0.891 (6.90)*** | 0.885 (6.92)*** |

***denotes significance at 1% level, ** denotes significance, 5% level, * denotes significance at 10% level.

The *t*-statistics are provided in parentheses

Dependent variable is the log of real gross domestic product per capita spanning over the period 2002-2012. Interaction refers to the interaction of corruption with property rights, rule of law, political stability, government effectiveness as well as the indexes of the first, second, third and fourth principal components.

The coefficient of property rights (PR) in model 2(a) is 0.034 and is statistically significant at 1 percent level. The coefficient of rule of law (RL) is also -0.079 and significant at 5 percent level of significance. Political stability (PS) which also showed positive impact at 5 percent significance level had a coefficient of 0.051. Government effectiveness in model 5(a) had a coefficient of -0.012 which is statistically significant at 10 percent.

Clearly, apart from government effectiveness and rule of law, the other proxies meet a priori expectations and are also consistent with theory. For example, in model 2(a), a percentage increase in property rights results in a 0.034 percentage increase in income per capita. This implies that if individuals are allowed to own properties and wealth without any restriction, it can lead to increased income. In model 3(a) one percentage point increase in rule of law reduces income per capita by 0.079 per cent. Thus, rule of law has negative significant impact on income in SSA. This result is contrary to a priori expectation as rule of law is expected to enhance economic performance and hence income. It also contradicts studies that found positive and significant effect of rule of law on income (Example, Rigobon and Rodrik, 2005). This result is however not surprising in the light of the numerous weaknesses in the institutional structure of many SSA countries. Institutions such as the judiciary and legislature are ineffective, hence rule of law is not strictly enforced. In model 4(a) increase in political stability by one percentage point will cause income per capita to increase by 0.051 per cent. This means that in a politically stable environment where there is no violence, terrorism, among others, sustained economic performance could be achieved. Violence, terrorism, conflicts, coup d'états and other forms of instabilities

create tension and insecurity in an economy which among other things, drive away current and potential investors, slow down economic activities, resulting in low economic performance. Indeed, over the period considered for the study, SSA countries had enjoyed considerable amount of political stability resulting in higher investor confidence to do businesses.

Contrary to a priori expectation, a percentage increase in government effectiveness results in a fall in income per capita by 0.012. What this means is that governments have not been effective and efficient in achieving sustained income levels in SSA. This is reflected in the low quality of policy formulation and implementation coupled with lack of commitment on the part of governments to such policies.

With respect to the indexes created from the principal component analysis, the coefficient of the index created from the first principal component (DEMOIndex1) are positive and marginally in all the three specifications especially in model 8(a). The semi-elasticity of this index are respectively 0.188, 0.147 and 0.079 in models 6(a), 7(a) and 8(a). Hence, an increase in DEMOIndex1 by 1% point raises income per capita by 0.188%, 0.147% and 0.079% in models 6(a), 7(a) and 8(a) respectively. This implies that the interactive effect of property rights, rule of law, political stability and government effectiveness produce a significant impact on income in SSA.

DEMOIndex2 which is the index created from the second principal component had positive and significant coefficients in models 6(a) and 7(a). However, in model 8(a), it has negative coefficient which is statistically significant as well. Thus, the interactive effects of the variables constituting this index yield a positive income effect in models 6(a) and 7(a) but negative impact in model 8(a). In this index, the coefficients

are 0.205, 0.102 and -0.007 in models 6(a), 7(a) and 8(a) in that order. Therefore, a one percentage point increase in DEMOIndex2 causes income per capita to rise by 0.205 per cent in model 6(a), and 0.102 per cent in model 7(a).

In much the same way, the index created from the third principal components (represented by DEMOIndex3) recorded positive and significant estimates in models 6(a) and 7(a) but negative and insignificant estimate in model 8(a). The estimated semi-elasticities are correspondingly 0.021 and 0.365 in models 6(a) and 7(a). Therefore, when DEMOIndex3 increases by one percentage point, it causes real GDP per capita to increase marginally by 0.02 (model 6(a)) and 0.365 (model 7(a)). DEMOIndex4 which represents the index created from the fourth principal components produced coefficients which were negative and statistically significant at 5% level in all three models.

The interaction terms showed positive and significant impact on income per capita in five out of the eight specifications. Thus, the positive income effects of democracy in these models outweigh the negative income effects of corruption in these specifications. However, the interaction between rule of law and corruption (in model 2(a)), government effectiveness and corruption (in model 4(a)) as well as the interaction between DEMOIndex4 and corruption (in model 8(a)) yielded negative impact on income per capita. This clearly is an indication of the extent to which corruption has engulfed government machinery and institutional structure of most sub-Saharan African hence, making them fragile and ineffective. Nonetheless, it can be said that a strong democratization could be a catalyst for reducing corruption which in turn could enhance economic performance in SSA as seen in most of the specifications.

As regards the control variables, the results are significantly consistent with economic theory and empirical literature with the exception of trade openness which persistently had negative coefficients which were not statistically significant in all specifications.

Foreign direct investment and gross domestic capital formation (a proxy for capital stock) maintained positive and statistically significant impact on real GDP per capita in SSA. However, the magnitudes of the effects (measured by the coefficients) were quite small. Inflation recorded a negative and significant impact on income per capita in all specifications as postulated in economic literature. This implies that inflation which in many macroeconomic literatures measures the extent of macroeconomic instability is injurious to economic performance in SSA. Trade openness showed a negative impact on GDP per capita, albeit not statistically significant in five out of the eight specifications.

Democracy as used in this study is a composite variable which makes it endogenous. It therefore becomes imperative to control for any possible endogeneity hence, the adoption of the System-GMM estimator in this study. The results obtained from this estimator are presented in Table 2B. The results of the Sargan test showed that the instruments were generally valid. The serial correlation tests (AR(1) and AR(2) tests) indicated that the errors in the levels were not serially correlated hence there is no significant first order serial correlation and second order serial correlation. Overall, the results obtained from this estimation are not significantly different from that of the within-mean in terms of a priori signs and expectations.

The coefficient on corruption is still negative and significant at 5% level. The results indicate that a one percentage point increase in corruption reduces real GDP per capita by 0.018 per cent. Corruption creates disincentive to invest, leads to poor public infrastructure, increases cost of production, among others. All these culminate into low economic performance which reduces income levels.

Property rights and political stability and no violence maintained their positive income effects in SSA though the effect of property rights was marginal (at 10% level of significance). Government effectiveness and rule of law still exert negative impact (at 5% significance level) on income in SSA confirming the perceived inefficiencies in the entire government set up in many SSA countries.



Table 2B: Democracy, Corruption and Income: System-GMM Estimation

| <i>Variable</i> | <i>(1b)</i> | <i>(2b)</i> | <i>(3b)</i> | <i>(4b)</i> | <i>(5b)</i> | <i>(6b)</i> | <i>(7b)</i> | <i>(8b)</i> |
|-----------------------------|----------------------|----------------------|----------------------|---------------------|----------------------|---------------------|----------------------|---------------------|
| <i>Log(FDI)</i> | 0.036 (3.31)*** | 0.040 (3.89)*** | 0.038 (2.94)** | 0.042 (4.14)*** | 0.039 (3.18)*** | 0.047 (3.30)*** | 0.042 (3.08)*** | 0.028 (2.83)** |
| <i>Log(CAP)</i> | 0.002 (4.03)*** | 0.003 (5.29)*** | 0.003 (5.73)*** | 0.002 (4.16)*** | 0.013 (5.84)*** | 0.009 (4.96)*** | 0.010 (5.13)*** | 0.005 (5.62)*** |
| <i>INFL</i> | -0.012 (-2.43)*** | -0.015 (-1.75)*** | -0.009 (-1.87)*** | -0.012 (-2.27)** | -0.002 (-1.13)*** | -0.006 (-1.73)** | -0.007 (-1.02)*** | -0.005 (-1.02)** |
| <i>OPEN</i> | -0.002 (-1.49)* | 0.001 (1.02) | 0.002 (1.68)* | 0.003 (1.86)** | 0.002 (1.34)* | 0.008 (1.79)* | -0.006 (-1.91) | -0.003 (-1.82)* |
| <i>COR</i> | -0.018 (-1.99)** | | | | | | | |
| <i>PR</i> | | 0.071 (1.96)* | | | | | | |
| <i>RL</i> | | | -0.037 (-3.25)*** | | | | | |
| <i>PS</i> | | | | 0.032 (3.98)*** | | | | |
| <i>GE</i> | | | | | -0.186 (-2.64)** | | | |
| <i>DEMOIndex1</i> | | | | | | 0.012 (3.44)** | 0.094 (2.86)** | 0.047 (1.93)* |
| <i>DEMOIndex2</i> | | | | | | 0.030 (2.61)** | 0.039 (1.97)* | 0.056 (1.88)* |
| <i>DEMOIndex3</i> | | | | | | 0.040 (1.24)** | -0.011 (-3.39)*** | -0.080 (-2.47)** |
| <i>DEMOIndex4</i> | | | | | | 0.011 (1.82)* | 0.046 (1.19) | 0.058 (1.75)* |
| <i>Interaction</i> | 0.015 (1.93)* | -0.064 (-1.76)* | 0.017 (3.43)*** | -0.028 (-2.15)** | 0.011 (1.76)* | -0.012 (-1.04) | -0.008 (-0.98) | 0.020 (1.08) |
| <i>lnGDPC_{t-1}</i> | 0.926 (7.21)*** | 0.928 (7.25)*** | 0.953 (7.41)*** | 0.951 (7.41)*** | 0.958 (7.43)*** | 0.962 (7.49)*** | 0.950 (7.38)*** | 0.947 (7.37)*** |
| <i>OIR</i> | 18.32 [1.00] | 16.27 [1.00] | 22.06 [1.00] | 19.63 [1.00] | 17.41 [1.00] | 25.71 [1.00] | 21.04 [1.00] | 25.20 [1.00] |
| <i>AR(1)</i> | -1.34 [0.196] | -1.34 [0.195] | -1.34 [0.196] | -1.35 [0.195] | -1.35 [0.195] | -1.35 [0.195] | -1.34 [0.196] | -1.35 [0.195] |

***denotes significance at 1% level, ** denotes significance at 5% level, * denotes significance at 10% level.

Values in () and [] are the *t*-statistics and probability values respectively.

Dependent variable is the log of real gross domestic product per capita spanning over the period 2002-2012. Interaction refers to the interaction of corruption with property rights, rule of law, political stability, government effectiveness as well as the indexes of the first, second, third and fourth principal components.

Considering the indexes created from the principal components, DEMOIndex1, DEMOIndex2 and DEMOIndex4 all showed marginally positive impact on income in all three specifications. DEMOIndex3 affects income negatively in models 7(b) and 8(b) while it had positive effect in model 6(b). The impact of the interaction between rule of law, government effectiveness, DEMOIndex2, DEMOIndex3 and corruption on income was negative. On the other hand, the coefficient on the interaction between property rights, political stability, DEMOIndex1 and DEMOIndex4 was positive.

Among the control variables, foreign direct investment and capital still had positive and significant impact on income in SSA in all specifications. Once again, the magnitude of their effect is still small. Inflation also continues to negatively affect income in all the models. Trade openness alternates in signs and impact depending on a particular specification.

4. Conclusion and Policy implications

This study aimed at investigating the impact of democracy and corruption on income for a panel of 32 countries in sub-Saharan Africa. The study made use of within-group and system GMM estimators which are both panel approaches to estimation.

The study recognized that democracy is a composite variable and as a result considered eight alternative indicators (proxies) for democracy. The use of the principal component analysis was highly prominent to reduce the dimension of the various indicators of democracy to four as all the eight indicators cannot enter a single equation. The results of the principal component analysis show that approximately

88.3% of the total variance in the original data is accounted for by the first four principal components. Corruption had negative and significant impact on income. The results further show that whether or not democracy has income effect depends on a particular indicator used. Thus, the overall effect of democracy on income depends on the choice of democracy indicator. This is further confirmed by the indexes created from the principal component analysis. While property rights and political stability have had positive income effects government effectiveness and rule of law have shown negative impact on income. Among the control variables, foreign direct investment and capital stock have contributed significantly to income while inflation has been detrimental to income.

The results and for that matter the findings mentioned above have important policy and research implications. Governments must incorporate anticorruption measures in their development strategies. Such measures should include the private sector in the implementation of anti-corruption strategies. Also, businesses must also endeavour to eliminate corruption in their transactions, by keeping bribery out of the procurement and bidding processes while reducing extortion. Public opinion as well as community members' involvement must support anticorruption strategies to create an environment where corruption is not accepted or condoned. Again, policy reforms should target programmes that seek to develop and build the capacities of judiciaries, legislatures, media and civil societies to help enforce rule of law and strengthen democratic institutions. Furthermore, governments and policy makers in SSA must seek to reduce macroeconomic instability by targeting relatively low inflation rates that promote economic growth.

Finally, for research, the results obtained in this study suggest that one should seriously take into account the selection of proxies when investigating the impact of democracy on economic performance.

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Appendix: Descriptive Statistics of Variables

| <i>Variable</i> | <i>Mean</i> | <i>Standard Dev.</i> | <i>Minimum</i> | <i>Maximum</i> |
|-----------------------------|-------------|----------------------|----------------|----------------|
| <i>Property rights</i> | 4.030 | 1.347 | 0.86 | 7.68 |
| <i>Investment freedom</i> | 5.179 | 4.085 | 0 | 48.79 |
| <i>Business freedom</i> | 9.153 | 12.821 | 2.34 | 57.3 |
| <i>Polity2</i> | 2.240 | 4.560 | -5 | 9 |
| <i>Voice & Account.</i> | -0.606 | 0.623 | -1.73 | 0.73 |
| <i>Political stability</i> | -0.598 | 0.885 | -2.51 | 1.19 |
| <i>Government Effect.</i> | -0.739 | 0.552 | -1.77 | 0.73 |
| <i>Rule of Law</i> | -0.762 | 0.612 | -1.84 | 0.67 |
| <i>Corruption</i> | 2.816 | 0.930 | 1.4 | 6.4 |
| <i>FDI</i> | 4.220 | 5.394 | 6.043 | 46.494 |
| <i>Capital</i> | 20.062 | 7.604 | 2.000 | 59.723 |
| <i>Inflation</i> | 370.557 | 2918.364 | -8.975 | 26419.62 |
| <i>Trade Openness</i> | 75.101 | 31.976 | 21.674 | 209.874 |

III

A nonparametric approach to estimating growth determinants in sub-Saharan Africa^{*}

Michael Kwame Asiedu^{*}

Abstract

This paper provides a contribution to the growth empirics in sub-Saharan Africa with a focus on identifying the major determinants of long run economic growth among SSA countries. Being aware of the overwhelming dominance of parametric regression methodology in the extant literature and its associated numerous setbacks, we specifically employ the local linear kernel estimator which does not assume any functional form for the underlying growth model. At the end of the study, the findings suggest that there is a positive and nonlinear relationship between economic growth on one hand as well as investment in physical capital, population and democracy on the other hand. Again, while we find that human capital and inflation have no significant effect on economic growth over the study period, foreign aid was found to have negative effect on economic growth in SSA. The findings obtained in the paper have important implications for growth policy in SSA. Growth policies should thus consider population control, expanding and improving the quality of education and enrolment especially at the higher levels and strengthen democratic institutions. For research, the findings imply that researchers should be cautious in specifying the functional form of growth models when investigating the determinants of economic growth.

Keywords: Bandwidth, economic growth, local linear kernel regression, nonparametric, sub-Saharan Africa

JEL Classification: C13, C14, O40, O55

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1. Introduction

Economic growth is one of the key indicators of economic performance of any given country and region. Thus, interest in factors that determine economic growth of countries and regions has attracted considerable amount of attention in both theoretical and empirical growth literature especially after the publication Robert Solow's paper in 1956. Using different conceptual and methodological frameworks, these studies have come out with several set of variables that determine economic growth. Notwithstanding, the search for factors that explain economic growth among countries still continues. A popular feature of studies in empirical growth literature is the dominance of parametric methods based on linear specifications of growth models. Parametric methods assume functional forms for the specified models which may or may not be correct. Thus, estimators used in these models provide efficient and consistent results under very strict assumptions and/or conditions, a situation that affects the robustness of the estimates. As a result, the findings are usually contradictory which eventually adversely affects the inferences and conclusion drawn. For instance, while Sala-i-Martin (2004), Mankiw *et al* (1994) and Barro (1991) found positive impact of human capital on economic growth others such as Krueger and Lindahl (2001) Pritchett (2001) and Topel (1999) found negative relationship between human capital and economic growth. In much the same way, trade openness has been found to accelerate growth by Sakyi *et al* (2014), Yanikkaya (2003) and Wacziarg (2001) but others like Vamvakidis (2002) as well as Rodriguez and Rodrik (1999) concluded that trade openness has significant negative growth effects.

This study thus contributes to the growing literature on determinants of economic growth by applying the nonparametric regression method (specifically the local linear kernel estimator) which does not impose any structure on the data or specify any functional relationship prior to estimation. Through this approach, the supposed factors that drive the growth process of sub-Saharan African countries would be identified. Besides, to the best of our knowledge, nonparametric methodology has not been utilised in growth literature specifically related to sub-Saharan Africa. In addition, we also consider large number of sub-Saharan African countries covering relatively longer period of time.

It is without doubt that sub-Saharan African countries lag behind their counterparts in North America, Western Europe as well as Japan in terms of aggregate standard of living and infrastructural development. Indeed real per capita income in the United Kingdom, United States, Germany and Japan are more than 20 times those in sub-Saharan Africa (Romer, 2006, Sala-i-Martin and Barro, 2009, among others). While some countries like South Korea, Turkey and Israel appear to be making transition to membership in the group of relatively wealthy nations others including many in sub-Saharan Africa have had difficulty in obtaining positive growth rates of real income per capita. For this reason, the main focus of many governments of sub-Saharan African countries since independence from colonialism has been to find alternative ways of speeding up the rate of growth of aggregate output which will consequently lead to a decline in the high incidence of poverty which shows that 47.2% of the population live on less than \$1.90 a day according to the 2014 World Bank Report. This is clearly exemplified in the many reformed programmes and policies they

have pursued over the years and continue to pursue. These notwithstanding, the rate of economic growth and per capita income in sub-Saharan African countries have been quite sluggish currently averaging about 4.31 percent. The big question that is begging to be answered then is which variables or factors drive the growth process of SSA countries?

The economic performance of sub-Saharan African countries has not only been inconsistent but also very abysmal compared with other developing countries of the same category. For instance, while annual GDP growth rate and per capita income in SSA as at 2014 stood at 4.31% and \$1431 respectively the annual GDP growth rate and per capita income in East Asia over the same period respectively stood at 6.83% and \$6221 (World Bank, 2015). Many SSA countries show great potentials prior to independence and the periods immediately after independence. However, the following two decades presented some obstacles to many sub-Saharan African countries which resulted in stagnation or decline in economic performance. Since 1990s a lot of SSA countries (Example, Ghana, Cote d'Ivoire, Tanzania, Mauritius, Equatorial Guinea, Gabon and Botswana) have exhibited a modest recovery. Yet levels of economic performance remain quite below the immediate post independence era. In a whole, the 0.9% average per capita income growth falls short by 1.5% in relation to other developing regions, and just about 3% below that of East Asian Economies and the high performing African (Botswana and Mauritius).

In view of the enormous emphasis placed on economic growth and its resulting measure of aggregate economic welfare, it becomes imperative to understand those variables that determine and drive the growth process of SSA countries. Many of the

earlier studies on the growth covariates in SSA have adopted parametric regression methodologies to test specific dimensions or magnitudes of several variables (See Ndambiri, 2012; Sakyi, 2011; Gyimah-Brempong *et al* 2010; Basu *et al*, 2005; Fosu and Ndungu, 1999; Sachs and Warner, 1997) The results of many of the existing panel data studies face estimation challenges. For instance, the problem of unit root, cross-country dependence, cross-country heterogeneity, among others are often more difficult to address. Besides, most of the estimators used in parametric regression analysis are efficient and provide consistent estimates under strict assumptions and/or conditions, a situation that can affect the results and hence the conclusions drawn.

In order to circumvent the setbacks of the parametric methods identified above, we estimate our specified growth model nonparametrically using the Local Linear Kernel Estimator (LLKE) proposed by Li and Racine (2004). There are some benefits that can be derived from applying this estimator. Firstly, this estimator naturally takes care of interactions and nonlinearities among all the regressors as it jointly models the relationship among all the regressors. Secondly, among the class of nonparametric estimators, the local linear estimator has been found to be among the best boundary-correction methods. Finally, as argued by Li and Racine (2004), the resulting nonparametric estimator can have a convergence rate that is arbitrary close to the parametric rate when the underlying relationship is almost linear.

This study makes significant contributions to the literature. First, to the best of our knowledge, this is the only study that considers the nonparametric methodology and for that matter LLKE to investigate the determinants of economic growth in sub-Saharan Africa. Second, this study considers panel data from a large number of sub-

Saharan African countries covering relatively longer period of time which makes the results more general than the earlier studies. Finally, we include in this study a large number of regressors so that the key factors that affect long run economic growth in SSA can be determined.

Eventually, the findings obtained in this study suggest that there is a positive and nonlinear relationship between economic growth on one hand as well as investment in physical capital, population and democracy on the other hand. We also find that human capital and inflation have no significant effect on economic growth in SSA at least over the period considered for the study. The relationship between trade openness and real GDP though is nonlinear, it is a bit difficult to describe as it becomes negative after some threshold level and turns back to positive after a certain threshold value. Finally, we find in the study that foreign aid has negative effect on economic growth in SSA over the study period.

The rest of the paper is organised as follows: Section 2 provides an empirical review of growth determinants. Section 3 presents the description of the data and estimation techniques uadopted in the study. Section 4 discusses the empirical results while Section 4 provides the conclusion and policy implications of the study.

2. Determinants of economic growth: An empirical survey

Clearly, two major theories dominate growth literature which discuss the role of various factors that determine economic growth among countries and regions. These theories are the neoclassical growth theory and endogenous growth theory. The neoclassical growth theory was developed by Robert Solow (1956) and highlights investment in

physical capital as the major source of economic growth. This theory views technological progress as exogenously determined. One key prediction of the neoclassical growth models has to do with convergence. Those models predict that if a group of countries have the same steady state, then all things being equal, the poor countries in the group would grow faster than the rich countries.

The second theory is the endogenous growth theory pioneered by Romer (1986) and Lucas (1988). This theory emphasises the importance of human capital (knowledge) as well as invention and innovation (technological progress) in growth process. According to this theory, research and development activities are the key drivers of knowledge and technological progress. Further, knowledge and technology exhibit increasing returns which drive the process of economic growth. New growth theory predicts that there will be no convergence due to increasing returns to scale.

In addition to the neoclassical and endogenous growth theories, other theories have emerged which have offered useful insights into the contributions of non-economic factors such as institutions, legal and political systems, socio-cultural and geographical factors. These theories have been championed by Gallup *et al.* (1999), Kaufmann *et al.* (1999), Brunetti (1997), Knack and Keefer (1997), North (1990), Matthews (1986) and Granovetter (1985).

Following from these theoretical developments, a wide range of empirical studies have flourished. Empirical studies in growth literature have come in two forms. The first form of studies generally focuses on convergence and/or divergence. That is, whether differences in aggregate economies over time would converge at equilibrium

(See Mathur, 2005; Polanec, 2004; Barro and Sala-i-Martin, 1992; Barro, 1991; DeLong, 1988; Baumol, 1986).

The second form of studies which is the focus of many recent growth literature has sought to investigate the variables underlying economic growth. These studies have identified varied factors that explain the observed differences in economic growth across countries and regions over time using diverse methodologies (For example, Lucas, 1988; Romer, 1990; Barro, 1991; Summers and Heston, 1991; Mankiw, Romer and Weil, 1992; Sachs and Warner, 1997; Barro and Sala-i-Martin, 2004; Lensink and Morrissey, 2006).

In both endogenous growth models and extensions of the neoclassical models, human capital has been identified as a very important variable that explains differences in growth across countries. Proxy by levels of school enrolments, literacy rate, teacher-pupil ratio, among others, human capital concerns the technical know-how and skills acquired by the population through education and other forms of training. Barro (1991) examined the relationship between human capital (using gross primary and secondary school enrolment rates) and growth rate of per capita GDP) from 1960 to 1980 for a number of countries and concluded that both gross primary and secondary school enrolment rates have positive and significant effects on rates of economic growth. Using a larger and seemingly better dataset, Sala-i-Martin (2004) concluded that human capital (proxy by male education) has positive correlation with growth while female education was insignificant. Other studies by Kyriacou (1991), Mankiw, Romer and Weil (1994), Benhabib and Spiegel (1994) all concluded that human capital enhances economic growth. Notwithstanding, other authors like Levine and Renelt (1992),

Krueger and Lindahl (2001) and Pritchett (2001) have found contrary results and therefore questioned human capital as a growth covariate.

Another variable that has received tremendous attention as a principal determinant of economic growth in literature is trade openness. Apart from the comparative advantage theory, international trade obviously enhances efficiency in domestic markets, transfer of technology and provides the opportunity for the importation of capital and intermediate goods required for economic growth. This situation has led many economists to conclude that openness to international trade accelerates economic growth and development (Edwards 1992, 1998; Sachs and Warner, 1997; Wacziarg, 2001; Yanikkaya, 2003). Nonetheless, several other authors have obtained contrary findings (e.g., Levine and Renelt, 1992; Rodriguez and Rodrik, 1999; Vamvakidis, 2002).

Investment in physical capital stock has also been identified in literature as an important variable that promotes growth. Certainly, both the neoclassical and endogenous growth theories emphasise the significant role of investment in economic growth. Many of the studies found in the growth literature argue and conclude that investment in physical capital stock is the most fundamental variable that determines economic growth (See Lichtenberg, 1992; Levine and Renelt, 1992; Mankiw *et al.*, 1992; Easterly, 1997; Barro and Sala-i-Martin, 2004; Artelaris *et al.*, 2007).

Elsewhere in growth literature democracy has also been discovered to be a significant determinant of economic growth. A more democratic institution provides the avenue for attracting foreign direct investments, foreign aid and above all redistributes

income and resources in favour of the poor and marginalised in the economy. Additionally, democracy makes it possible for individuals to own property and establish businesses without any stringent restrictions. Thus, some existing studies have argued that democracy has a positive and significant impact on economic performance (see Rigobon and Rodrik, 2005; Roll and Talbott, 2003; Rodrik, 2002; Sala-i-Martin, 2002). Notwithstanding, other studies have obtained statistically negative relationship between democracy and growth (see Sakyi, 2011; Baum and Lake, 2003; Kurzman *et al.*, 2002; Helliwell, 1994).

One variable in literature that has been emphasized an important determinant of economic growth is foreign aid. Aid enhances savings and capital mobilization. Besides, aid raises the ability to import intermediate goods and provides the conduit technological transfer which enhances the marginal productivity of capital in a domestic economy. Thus, aid contributes substantially to economic growth and income (see Gyimah-Brempong *et al.*, 2007; Morrissey *et al.*, 2005; Hansen and Tarp, 2000). However, some other studies found negative effect of aid on growth (for instance, Brautigam and Knack, 2004; Jensen and Paldam, 2003).

Within the endogenous growth models, Research and Development (R&D) has been highlighted as an important source of economic growth. Research and Development activities result in inventions and innovations which lead to technological progress. This brings about the introduction of new and superior products which spur productivity growth and consequently economic growth. Other studies have empirically confirmed this assertion (e.g. Lichtenberg, 1992; Ulku, 2004; Artelaris *et al.*, 2007).

The prevailing macroeconomic conditions as well as the economic policy stance of the government have also been emphasised as important determinants of economic growth. Generally, a relatively more stable macroeconomic conditions reduce risks and uncertainties associated with investment and hence provide a conducive environment for growth. Conversely, a macroeconomic instability resulting from high inflation tend to harmfully affect economic growth. Also, good economic policies resulting in improved infrastructures, investment in human capital and efficient institutions can spur economic growth. Barro and Sala-i-Martin (1995), Easterly and Rebelo (1993), Fisher (1993), Barro (1991, 1998), Grier and Tullock (1989) and Kormendi and Meguire (1985) have all concluded that macroeconomic conditions and economic policies play a significant role in economic growth.

3. Empirical Methodology

This section describes the methodology used in this paper with emphasis on data sources and measurement as well as model specification and estimation technique.

3.1 Data Sources and Definition of Variables

This study aims at identifying those variables that drive the economies of Sub-Saharan African countries to economic growth. The study covers the period 1970 to 2012 and considers a panel data for 32 Sub-Saharan African countries¹. These countries were considered on the basis of data availability for the variables used in the study.

¹ Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Chad, Democratic Republic of Congo, Republic of Congo, Cote d'Ivoire, Gabon, Ghana, The Gambia, Guinea-Bissau, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, South Africa, Sudan, Swaziland, Togo, Uganda, Zambia and Zimbabwe.

Data were drawn from several sources including the World Bank's WDI Database, the African Development Indicators Database and Polity IV Project. Real gross domestic product, investment in physical capital and trade openness were obtained from the WDI Database; human capital, foreign aid, inflation and population were taken from the African Development Indicators; data on democracy were obtained from the Polity IV project (Marshall and Gurr, 2013).

Real GDP is the monetary value of goods and services produced within the borders of an economy during a given year. It is measured using 2000 constant prices. Human capital concerns the technical know-how as well as skills and training acquired by the population. It is proxy by education measured here by gross primary school enrolment. Gross domestic capital formation as a percentage of GDP (a measure of gross domestic investment) captures the share of capital stock in promoting long run economic growth. AID here includes both official development assistance and net official assistance measured as a percentage of GDP. Trade openness considers the extent to which the economies of SSA countries are opened to international trade. Measured as a sum of export and import as a ratio to GDP, trade openness captures the role of external trade in economic growth. Democracy captures the impact of the political regime on economic growth. It is proxy by Polity2 (developed by Marshall and Gurr, 2013) which is a continuous variable that measures the democratic quality of political regimes using polity scores ranging from -10 (strongly autocratic) to +10 (strongly democratic). Inflation reflects the annual percentage change in the general price levels in the economy. Measured here by the consumer price index, inflation

reflects the macroeconomic conditions in the economy. Population includes all residents in a country regardless of their citizenship and it is used as a proxy for labour force and country size.

3.2 Model Specification and Method of Estimation

In this study, we investigate the factors that determine the growth process of sub-Saharan African countries in the long run. Theoretically, the neoclassical and endogenous growth models predict that investments in physical and human capital as well as technological progress are capable of explaining bulk of the differences in economic growth across countries. Nonetheless, there is still more room to account for other explanatory variables that explain changes in productivity and output growth among economies.

We therefore follow theory and earlier researchers and specify a growth model based on aggregate production function. In this specification, we see economic growth as dependent on human capital (Sala-i-Martin, 2004; Mankiw *et al*, 1994; Barro, 1991; Romer, 1990), investment in physical capital (Artelaris *et al.*, 2007; Barro and Sala-i-Martin, 2004; Levine and Renelt, 1992), foreign aid (Gyimah-Brempong *et al*, 2007; Morrissey *et al*, 2005; Hansen and Tarp, 2000). Several other studies also stress the significance of trade openness in economic performance (Yanikkaya, 2003; Sachs and Warner, 1997; Wacziarg, 2001). Other regressors in the model include democracy (Rigobon and Rodrik, 2005; Roll and Talbott, 2003; Sala-i-Martin, 2002; Kaufmann *et al.* 1999), macroeconomic conditions (Barro, 1998; Barro and Sala-i-Martin, 1995; Fisher, 1993) and population (Siddique and Iqbal, 2005; Harrison 1996).

The growth equation to be estimated in this paper therefore takes the following general form:

$$Y_{it} = f(\text{HUMCAP}_{it}, \text{INV}_{it}, \text{AID}_{it}, \text{TOP}_{it}, \text{DEMO}_{it}, \text{INFL}_{it}, \text{POP}_{it}) + \mu_{it} \dots\dots\dots (1)$$

Where $i = 1, 2, 3, \dots, N$ is the cross-sectional dimension of countries, $t = 1, 2, 3, \dots, T$ represents time, Y_{it} is the real GDP, HUMCAP_{it} is human capital, INV_{it} is rate of investment in physical capital, AID_{it} denotes foreign aid, TOP_{it} is trade openness, DEMO_{it} indicates democracy, INFL_{it} measures inflation, POP_{it} represents population and μ_{it} is the white noise.

3.2.1 Nonparametric Regression Technique

A peculiar feature of this study on economic growth in SSA is that it employs the nonparametric regression method which is expected to yield more robust and efficient results. As indicated earlier on, one major argument often advanced in favour of nonparametric methods is the incorrect functional specification of parametric models which sometimes results in wrong inferences (Li and Racine, 2004). Thus, in an attempt to circumvent this weakness of the parametric method, Hsiao, Li and Racine (2007) consistent model specification test is applied in estimating the growth equation specified in (1) by employing the local linear kernel estimator (LLKE). LLKE is preferred in many nonparametric analyses because it is known to be among the best boundary-correction methods so far. According to Li and Racine (2004, 2007) as cited in Adu (2012), when the underlying relationship is somewhat linear, the resulting nonparametric estimator can have a convergence rate that is arbitrarily close to the

parametric rate. In addition, parametric specifications fail to capture possible interaction and nonlinearities which local linear kernel estimator does.

The estimation of the growth model in equation (1) involves three main steps. The first step involves evaluating the usual parametric specification by applying a consistent model specification test for correct parametric specification. This test is used to test the null hypothesis that the parametric model is specified appropriately. The null hypothesis takes the following form:

$$H_0 : P[E(Y_{it}|X_{it}) = m(X_{it}, \alpha)] = 1 \quad \dots\dots\dots (2)$$

where $m(\cdot)$ is a known function (the assumed parametric regression model) with α being $q \times 1$ vector of unknown parameters.

The above null hypothesis is tested against the following alternative hypothesis:

$$H_1 : P[E(Y_{it}|X_{it}) = m(X_{it}, \alpha)] < 1 \quad \dots\dots\dots (3)$$

Both hypotheses are tested by employing a statistical test which is based on the outcome of correct specification. This demands that the residuals satisfy $E[E(\varepsilon_{it}|X_{it})^2] = 0$ on condition that there is correct model specification. $E(\varepsilon_{it}|X_{it})$ is consistently estimated using nonparametric methods. By the law of iterated expectations, $E[\varepsilon_{it} E(\varepsilon_{it}|X_{it})]$, a density weighted version is employed for the purpose of testing provided by $J = E[\varepsilon_{it} E(\varepsilon_{it}|X_{it}) f(X_{it})]$, where $\varepsilon_{it} = Y_{it} - m(X_{it}, \alpha)$ and $f(X_{it})$ is a joint probability density function. The reason for employing density weighting is to avoid the presence of a random denominator. Indeed, $E[E(\varepsilon_{it}|X_{it})^2 f(X_{it})] \geq 0$ and $J = 0$ on condition that the stated null hypothesis in

equation (2) is true. Hence, J provides a suitable statistic for testing both hypotheses.

Thus, the statistic is computed as follows:

$$J_{(N \times T)} = \frac{1}{N} \sum_{i=1}^n \sum_{t=1}^T \hat{\varepsilon}_{it} \hat{E}_{-it}(\varepsilon_{it} | X_{it}) \hat{f}_{-it}(X_{it}) \dots \dots \dots (4)$$

where $\hat{\varepsilon}_{it} = Y_{it} - m(X_{it}, \hat{\alpha})$ is the residual derived by applying the parametric null model, $\hat{\alpha}$ is \sqrt{N} consistent estimator of α under the null hypothesis of correct specification and $\hat{E}_{-it}(\varepsilon_{it} | X_{it}) \hat{f}_{-it}(X_{it})$ is a leave-one-out kernel estimator of $E(Y_{it} | X_{it}) f(X_{it})$.

Suppose the null hypothesis of correct specification of the parametric model is not accepted, implying misspecification of the parametric model, the next step then will be to estimate equation (1) using nonparametric methods. Specifically, this is done using the cross-validated local linear nonparametric estimator.

In the second stage, the growth equation in (1) is modelled in nonparametric form. To do this, we rewrite the model as

$$Y_{it} = g(x_{it}^c, x_{it}^d) + \varepsilon_{it}, \quad i = 1, 2, \dots, N; t = 1, 2, 3, \dots, T \dots \dots \dots (5)$$

where $x_{it}^c \in R^q$ is a set of continuous (a subset of X_{it}) regressors of dimension q and $x_{it}^d \in S \times S \times \dots \times S$ is a set of discrete (a subset of X_{it}) regressors of dimension r . The unknown conditional expectation $g(\cdot)$ and its derivatives cannot be observed but can be estimated by employing nonparametric methods. This defined as

$$g(x_{it}^c, x_{it}^d): \beta(x^c def \nabla g(x^c, x^d) \equiv \partial g(x^c, x^d) / \partial x^c \text{ where } \nabla g(\cdot) \text{ is a } q \times 1 \text{ vector.}$$

Define $\delta(x^c, x^d) = g(x^c, x^d), \beta(x^c)'$ is a $(q+1) \times 1$ vector-valued function whose first component is $g(x^c, x^d)$ and whose remaining q components are the first derivative of $g(x^c, x^d)$ with respect to x^c . Taking a Taylor series expansion of $g(x^c, x^d)$ at x_j^c , we obtain

$$g(x_{it}^c, x_{it}^d) = g(x_{jt}^c, x_{it}^d) + (x_{it}^c - x_{jt}^c) \beta(x_{jt}^c) + R_{ijt}$$

where $R_{ijt} = g(x_{it}^c, x_{it}^d) - g(x_{jt}^c, x_{it}^d) - (x_{it}^c - x_{jt}^c) \beta(x_{jt}^c)$

Thus, we rewrite equation (5) in the following form:

$$Y_{it} = g(x_{jt}^c, x_{it}^d) + (x_{it}^c - x_{jt}^c)' \nabla g(x_{jt}^c, x_{it}^d) + R_{ijt} + \varepsilon_{it} \dots \dots \dots (6)$$

$$= (1, (x_{it}^c - x_{jt}^c)') \delta g(x_{jt}^c, x_{it}^d) + R_{ijt} + \varepsilon_{it}$$

Equation (6) above is therefore estimated using the local linear kernel estimator.

Applying this estimator requires optimal bandwidth selection. To do this, least-square cross-validation is used to choose the optimal bandwidth. Estimating the optimal bandwidth is analogous to the minimization of the error sum of squares in parametric regression analysis. But a leave-one-out method is used in the cross-validation function to avoid over fitting. A leave-one-out local linear kernel estimator of $\delta(x_{it}^c, x_{it}^d)$ is derived through a kernel weighted regression of Y_{it} on $(1, (x_{it}^c - x_{jt}^c)')$ and x_{it}^d .

This estimator is given as

$$g_{-i}(x_{it}^c, x_{it}^d) = e_1' \hat{\delta}_{-i}(x_{it}^c, x_{it}^d) \dots \dots \dots (7)$$

where e_1 is a $(q+1) \times 1$ vector, whose first element is 1 and the rest being zero. Optimal bandwidth (h, λ) is then chosen to minimise the least-squares cross-validation function given as

$$CV(h, \lambda) = \sum_{i=1}^N \sum_{t=1}^T [Y_{it} - \hat{g}_{-i}(x_{it}^c, x_{it}^d)]^2 \dots\dots\dots (8)$$

where $\hat{g}_{-i}(x_{it}^c, x_{it}^d)$ is defined in equation (7). The resultant bandwidth vector is represented by (h, λ) .

After deriving the correct bandwidth vector, $\delta(x_{it}^c, x_{it}^d)$ is estimated by

$$\begin{aligned} \hat{\delta}(x_{it}^c, x_{it}^d) &= \begin{pmatrix} \hat{g}(x_{it}^c, x_{it}^d) \\ \hat{\beta}(x_{jt}^c) \end{pmatrix} \\ &= \left[\sum_{i=1}^N W_{\hat{h}ix} \begin{pmatrix} 1 & (x_i^c - x_j^c)' \\ x_i^c - x_j^c & (x_i^c - x_j^c)(x_i^c - x_j^c)' \end{pmatrix} L_{\lambda ij}(x_i^d, x_j^d, \lambda) \right]^{-1} \times \\ &\quad \sum_{j=1}^N W_{\hat{h}ix} \begin{pmatrix} 1 \\ x_i^c - x_j^c \end{pmatrix} L_{\lambda ij}(x_i^d, x_j^d, \lambda) Y_{it} \end{aligned}$$

where $W_{\hat{h}ix}$ is a product kernel for continuous data and $L_{\lambda ij}$ is a product kernel for discrete data.

The last step involves plotting the partial regression and partial gradient or partial response surfaces that measure how the log of real GDP and its response surface change in response to changes in one of the explanatory variables, holding all other variables constant at their modes/medians.

4. Discussion of Empirical Results

In this section, the empirical results arising from the data analysis are presented and discussed thoroughly. The analysis begins with the consistent model specification test whose results are presented in Table 1 below. The consistent model specification test tests the null hypothesis of correct specification of the parametric model. The results of the test clearly indicate that the null hypothesis of correct specification is rejected at 0.1% level of significance.

Table 1: Consistent Model Specification Test

| Consistent Model Specification Test | |
|--|-------------------------|
| Parametric null model: $\ln(\text{formula} = \log(RGDP) \sim \log(INV) + \log(POP) + \log(HUMCAP) + TOP + INFL + DEMO + \log(AID), x = \text{TRUE}, y = \text{TRUE})$ | |
| Test Statistic 'Jn': | 16.29412 [2.22e-16] *** |
| <i>Signifiant codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1. Number of regressors: 7. IID Bootstrap (399 replications). Null of correct specification is rejected at the 0.1% level. Value in [] indicates p-value.</i> | |

Having rejected the null hypothesis of correct specification of the parametric model, the next step is to estimate the nonparametric regression which begins with the bandwidth estimates as well as the respective scale factors for all the explanatory variables. The results are presented in Table 2 below.

Table 2: Estimated Bandwidth and Nonparametric Regression

| Regression Type: Local-Linear Fixed | | Bandwidth Type: |
|---|--------------|-------------------------------------|
| Bandwidth Selection Method: Expected Kullback-Leibler Cross-Validation | | |
| Formula: $\log(\text{RGDP}) \sim \log(\text{INV}) + \log(\text{POP}) + \log(\text{HUMCAP}) + \text{TOP} + \text{INFL} + \text{DEMO} + \log(\text{AID}) + \text{ordered}(\text{YEAR}) + \text{factor}(\text{ID})$ | | |
| Variable | Bandwidth | Scale Factor |
| log(INV) | 16.80334 | 20.20503 |
| log(POP) | 0.7920637 | 1.461415 |
| log(HUMCAP) | 13.276527 | 16.85965 |
| TOP | 1.0732 | 4.346432 |
| INFL | 281.6479 | 68.77627 |
| DEMO | 0.380059 | 1.420599 |
| log(AID) | 13.72032 | 30.3864 |
| Ordered(YEAR) 1 | 0.8429146 | Lambda Max: |
| Factor(ID) | 0.0003064388 | Lambda Max: 1 |
| $R^2 = 0.9895478$ | | Residual Standard Error: 0.02874646 |
| Objective Function Value: -4.355896 (achieved on multistart 5). Number of Continuous Explanatory Variables: 7. Continuous Kernel Type: Second-Order Gaussian. Number of observations: 1333. Number of ordered categorical variables: 1. Number of unordered categorical variables: 1. Unordered Categorical Kernel Type: Li and Racine. Ordered Categorical Kernel Type: Li and Racine. Estimation time: 32,254 seconds | | |

The relative values (or sizes) of the bandwidth estimates show whether there is linear or nonlinear relationship between real GDP and the explanatory variables. Relatively larger bandwidth estimates for a regressor(s) suggest a linear relationship between real GDP and those regressors. Thus, as the relationship becomes linear the

resulting nonparametric estimator converges to the parametric estimator on the coefficient on that variable. Conversely, relatively smaller bandwidth estimates is an indication of nonlinear relationship between real GDP and the regressors.

The results from the table clearly indicate that with the exception of log of population (log(POP)), trade openness, democracy and the two categorical variables (the time index and country index) all the other variables have relatively large bandwidth estimates. As can be seen from the table, log(POP), TOP and DEMO have bandwidth estimates of approximately 0.792, 1.073 and 0.380 respectively which are close to zero. This means that the correlation among real GDP and trade openness, population, trade openness and democracy is nonlinear. The rest of the explanatory variables namely investment (INV), human capital (HUMCAP), inflation (INFL) and foreign aid (AID) have somewhat linear relationships with real GDP by virtue of the large sizes of their bandwidth estimates. The underlying relationships (linearity and nonlinearity) between real GDP and the various explanatory variables become more apparent when we consider the plots of partial regression and partial gradients as shown in Figures 1 and 2.

Following from the estimated bandwidths of the explanatory variables, we estimate the local linear kernel regression whose results are also reported alongside the bandwidth estimates in Table 2. As can be seen from the table, the nonparametric regression model provides a good fit of the data. This is evidenced in the relatively large *R-squared* value of 0.9895478 and a low residual standard error of 0.02874646. The implication is that the selected explanatory variables namely, investment, population, human capital, trade openness, inflation, democracy and foreign aid

account for approximately 98.95% of the observed variations in real GDP in SSA over the period under consideration.

In order to have a clearer understanding of the nature of the relationship between real GDP and the explanatory variables, we consider the partial gradients and partial regression plots. These are graphs that measure how the dependent variable (log of real GDP) and its response surface change if there is a change in any of the explanatory variables, when remaining variables are held constant at their respective modes/medians. They also provide estimates of the LLKE for the growth equation used in the study. All the figures plotted contain 95% variability bands. While Figure 1 shows the plots of the partial regression Figure 2 shows the plots of partial gradients.

The plot in Figure 1 shows that the relationship between real GDP and investment in physical capital is positive and linear. This means that as investment in physical capital increases real GDP also increases in SSA. As can be seen from Figure 2, the partial response surface of real GDP with respect to investment is constant confirming that the relationship is not only positive but also linear. This result is consistent with the expectation of neoclassical growth theory as well as many studies in the empirical literature (See Lichtenberg, 1992; Levine and Renelt, 1992; Mankiw *et al.*, 1992; Easterly, 1997; Barro and Sala-i-Martin, 2004; Artelaris *et al.*, 2007). Thus, investment contributes significantly to economic growth as it adds to the capital stock of a country and also replaces the reduction in the value of capital goods (i.e. depreciation). This increases the marginal productivity of capital culminating in growth.

The partial regression plots in Figure 1 suggest a positive relationship between real GDP and population. The plots in Figure 2 show that the relationship among population and real GDP is nonlinear with a response rate of between 1 and 1.05. As the plot shows, real GDP initially increases with increasing population but falls with increasing population beyond some level. This means that beyond a certain level, population could have negative effect on economic growth. This results is consistent with Siddique and Iqbal (2005) and Harrison (1996) who also found positive relationship between population and GDP growth. A rise in population not only increases the market size and raises aggregate demand but also adds to the total labour force which go to enhance productivity and output growth. However, beyond certain level population could have negative effect on economic growth as increasing population is associated with unemployment, increased congestion, urban slums and poor sanitation especially in developing regions like SSA.

As can be seen from Figures 1 and 2, the relationship among economic growth and human capital is not only linear but also constant. This result clearly suggests that economic growth in SSA does not vary with human capital (measured in this study by gross primary school enrolment). This could probably mean that primary or basic education is not enough to provide the needed skills and trainings to improve the efficiency and marginal productivity of the population to contribute significantly to growth. This finding however contradicts other previous studies that found significant relationship between human capital and economic growth (See Sala-i-Martin, 2004; Krueger and Lindahl, 2001; Pritchett, 2001; Mankiw *et al*, 1994)

The relationship between real GDP and trade openness is a little bit difficult to describe. From the respective partial regression plots and partial gradient in Figures 1 and 2, it appears that the relationship becomes negative after some threshold level and turns back to positive after a certain threshold value. Notwithstanding, it is clear that the relationship is nonlinear. The implication of this is that the nature of the relationship (whether positive or negative) between trade and real GDP depends on the extent to which the economy is opened to international trade.

From the partial plots in Figures 1 and 2, the relationship between economic growth and inflation does not appear to be consistent. For most levels of inflation the relationship is constant. However, beyond certain threshold value real GDP falls and rises after a certain threshold level. This means that inflation did not significantly have any relationship with economic growth at least over most of the period under consideration. Thus, inflation has no significant effect on economic growth over the study period. Thus, the findings obtained in this study contract most of the existence studies on the relationship between inflation and economic growth (Example, Asiedu, 2013; Adu, 2012; Fisher, 1993)

Figure 1: Partial regression plots

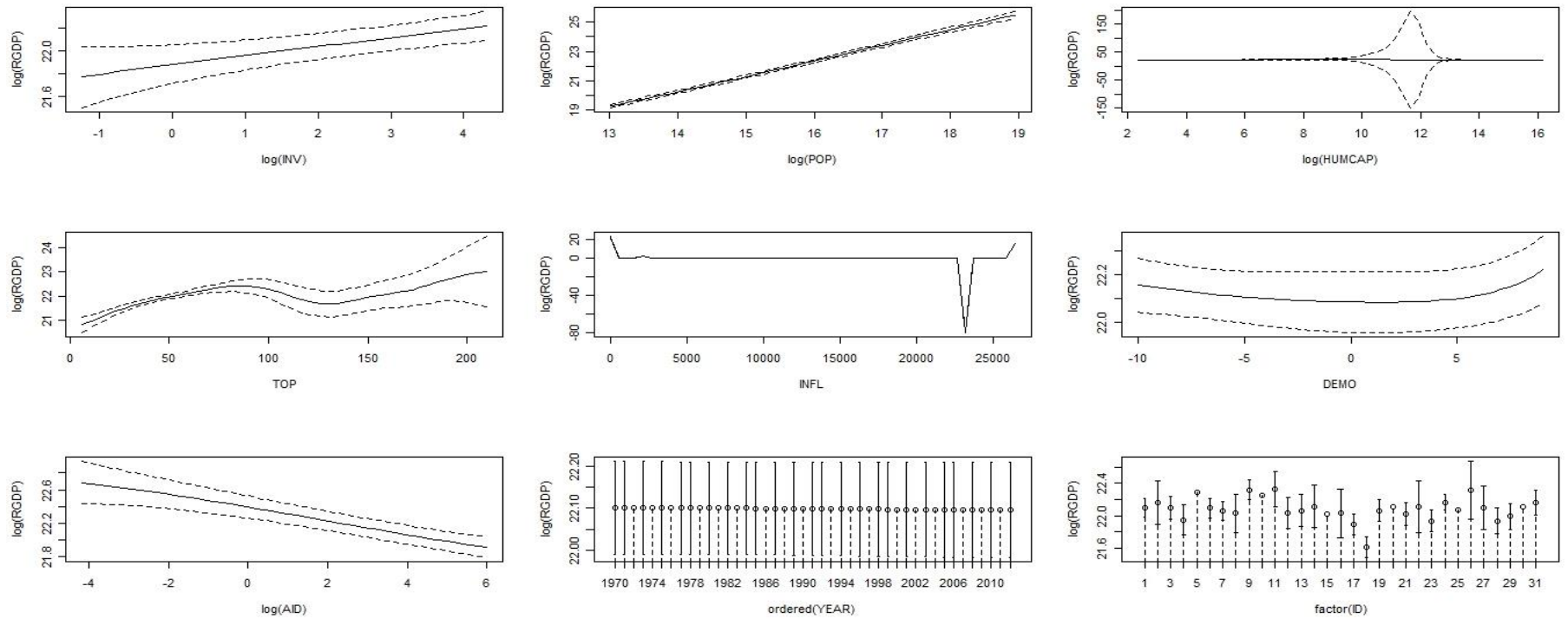
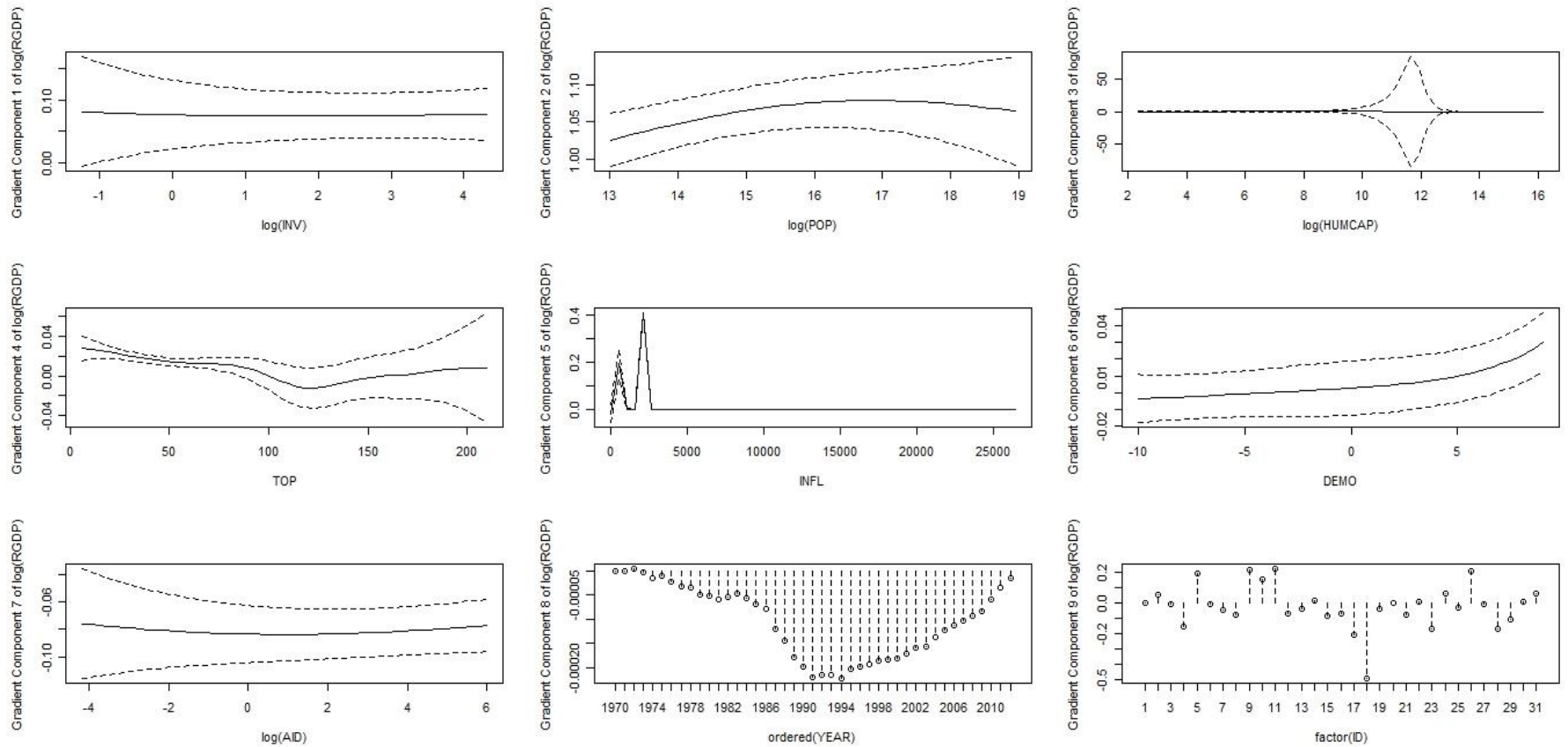


Figure 2: Plots of partial gradients



Further, the relationship between economic growth and democracy is not only positive but also nonlinear as shown in Figures 1 and 2. Clearly, the partial regression plot and partial response surface indicate that increased levels of democracy are associated with rising levels of economic growth. This result is consistent with theoretical expectations and many empirical studies that have found positive relationship between democracy and economic growth (see Jalles, 2010; Rigobon and Rodrik, 2005; Roll and Talbott, 2003; Rodrik, 2002; Sala-i-Martin, 2002). Indeed, over the last two and a half decades, sub-Saharan African countries have witnessed a remarkable improvement in democratic governance which has provided a conducive environment for economic activities to thrive on and this is expected to improve economic performance.

Measured as official development assistance as a percentage of GDP, the log of foreign aid ($\log(\text{AID})$) exhibits a negative and linear relationship with real GDP. As the plot of partial regression in Figure 1 shows economic growth reduces with increasing aid inflows. The partial response surface in Figure 2 also shows that the relationship is almost linear implying that with time, increasing aid inflows will have no significant effect on economic growth in SSA. This result appear to be consistent with earlier studies such as Ndambiri *et al* (2012), Djakov *et al* (2006), Heckelman and Knack (2005), Easterly (2003), Collier and Hoeffler (2007).

5. Conclusion and Policy Implications

This study provides a contribution to the growth empirics in sub-Saharan Africa. It was conducted principally to identify those variables that contribute to long run economic

growth among SSA countries. Mention must be made that large body of studies on the determinants of economic growth are found in the extant literature. However, these studies often adopt parametric regression methodology which assumes functional form for the specified model, a situation that has resulted in inefficient and inconsistent estimates leading to wrong inferences and conclusions due to functional misspecification. The search for an alternative methodology that circumvents the setbacks of the parametric analysis and provides more robust results remains important in growth empirics, hence this study. Thus, this study utilizes the nonparametric methodology to estimate the determinants of economic growth in sub-Saharan Africa over the period 1970 to 2012. The contribution of this study to the extant literature relies on the use of the local linear kernel estimator, a powerful nonparametric estimator which exists nowhere in growth literature related to sub-Saharan Africa.

Eventually, the findings of the study suggest that there is a positive and nonlinear relationship between real GDP on one hand as well as investment in physical capital, population and democracy on the other hand. This implies that in the long run, increases in gross capital formation (proxy for investment in physical capital), population and democracy would promote economic growth in sub-Saharan Africa, all things being equal. We also find that human capital and inflation have no significant effect on economic growth in SSA at least over the period considered for the study. Finally, we find in the study that foreign aid has negative effect on economic growth in SSA over the study period.

The findings highlighted above have important implications for growth policy in SSA in particular and growth empirics generally. An important finding of this study

is the significant role population (a proxy for labour force and country size) plays in the growth process of SSA countries. However, as already discussed in Section 4, population beyond certain threshold becomes detrimental to growth. Therefore, population control programmes should be intensified especially in the rural settings. Another interesting finding was the relationship between human capital (measured by gross primary school enrolment) and real GDP. The implication is that basic/primary education cannot provide the needed skills and training for manpower development to promote economic growth. Government policy should thus focus on expanding and improving the quality of education and enrolment especially at the higher levels through increased public spending on education. Furthermore, policies should also target strengthening democratic institutions to be more efficient and deepen the level of democracy to provide a more favourable political environment for investors and economic activities in general. This can be done by targeting programmes that seek to develop and build the capacities of judiciaries, legislatures, media, civil society groups and other state institutions. Finally, in the area of research, the results obtained in this study imply that researchers should at all times be cautious in specifying the functional form of growth models when investigating the determinants of economic growth.

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