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Institutional Quality Differences Explaining Growth Differences between Sub-Saharan Africa and East Asia

By

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"Institutional Quality Differences Explaining Growth Differences between Sub-Saharan Africa and East Asia."

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Eba Amanuel

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List of Acronyms

DIF-GMM: Difference Generalized Method of Moments

GDP: Gross Domestic Product

GMM: Generalized Method of Moments

OLS: Ordinary Least Square

SSA: Sub-Saharan Africa

SYS-GMM: System Generalized Method of Moments

WG: Within Group

Abstract

The economic performance of most of the Sub-Saharan countries is not satisfactory as compared to that of East Asian countries. The issue of economic growth has been the concern of economists with the intent of answering the question as to why there are differences in the growth rates across countries. The impact of quality of institutions on economic performance is the subject of much debate among economists recently.
Many researches that have analyzed the factors causing difference in the rates of economic growth have found factors such as quality of institutions, geographical location, integration in international trade and culture among other things to explain the observed differences in per-capita income. While some studies like Sachs and Warner assign the prominent role to Geography, others concentrate on different factors such as institutions and integrations for causing the difference in economic performance among regions and countries.

This paper develops a case that differences in the quality of institutions is one of the fundamental cause of differences in growth between SSA countries and some East Asian countries. The Arellano-Bond (1991) and Arellano-Bover (1995) linear generalized method of moments (GMM) is used to estimate the neoclassical growth model Solow Augmented with institution to asses the impact of institutional quality difference on growth difference.

The result of this study suggest that gross capital formation, population growth, geography and the quality of institutions are the major factors causing differences in growth rates. Mainly the study concludes that improvement in the quality of institution by the same amount in the two regions under consideration has a higher impact on growth for SSA countries than the East Asian countries considered. Thus the SSA countries should also concentrate on building social infrastructure which is equivalent to improving institutional quality to encourage productive behavior for registering higher economic growth.

Chapter one

Introduction

1.1 Statement Of The Problem

The growth performance of most of the sub-Saharan Africa (SSA) countries compared to that of the East Asian countries has been very low for the last couple of decades. The literatures on growth show that the growth performance of most SSA, are worse than that of the other regions of the world. The countries that are found in this region are growing slower in terms of real Gross domestic product (GDP) per capita than counties found elsewhere (Paap et al, 2005). During the 1980s the GDP per capita in the continent fell by 1.5 percent point average which is lower than the average of all low income developing countries. This decline in the GDP per capita is even accelerated to 1.8 percent point average during the 1990-98 periods (Collier and Gunning, 1999).

In contrast, economic growth rate in most East Asian countries continues to be higher than other regions even though the growth rates are smaller for this region from 2005 onwards compared to the previous periods (Khasnobis and Bari, 2007). According to DGregorio and Lee (1999), as reported in Khasnobis and Bari, (2007), the growth of output per worker for East Asian countries on average for the period between 1960 and 1994 was about 4.2 percent while that of Africa is only about 0.3 percent showing that there is a divergence in economic performance of the two regions even though they used to have relatively similar performance at older times.

The question is, "why do East Asian countries have shown remarkable economic growth and development performance while Sub-Saharan Africa countries still remain poor?" Answering this question, among other things requires identifying the major growth determinants that contribute to this difference in economic performance.

There are lots of reasons given in various studies as to why regions in Sub-Saharan Africa have shown poor performance in economic growth and East Asian counties experienced remarkable performance. Among the several explanations of the poor economic performance of Sub-Saharan Africa, the low level of investment is the major one. Gross fixed capital formation has declined in Africa, from a total of $76.3 billion in 1980 to $58.9 billion in 1999. Aggregate savings are low because of low per capita incomes, low exports/GDP ratios, high and variable inflation rates, low interest rates, and poor financial intermediation, relatively high aid flows. These higher aid flows are negatively correlated with domestic savings in some countries. High birth rates which increase the proportion of the population under 15 do also explain the poor performance of SSA countries. This shows that there is an enormous gap in terms of economic growth between Sub- Saharan African countries and the rest of the world. (Collier and Gunning, 1999)

Another factor that has become popular in recent years, in explaining the growth divergence among different regions of the world, is the quality of institution. According to North (1990), Institutions are the rule of the game in a society or, more formally, are the humanly devised constraints that shape human interaction. In consequence they structure incentives in human exchange, whether political, social or economic. The most important word in this definition of institution is "constraint". The policies that those in power device without constraint on them are not institution but electoral rules but constitutions can be good examples of institution. Edward L Glaeser et al (2004), have identified that those constraints should be of permanent feature and temporary or transitory constraints would not necessarily bind and may be changed by those who do not like them therefore they are not regarded as institutions. Thus according to Edward L Glaeser et al, legal systems or electoral rules look more like " institutions" when they are actually used over time permanently.

The study on the role of institution for growth is found in the work of Adam Smith (1776) and in more recent works of Oslon (1982), Scully (1988), North (1990), Barro (1996), Baro and Sala-i-Martin (1995), Landes (1998), Hall and Jones (1999), and Acemoglu, Johnson, and Robinson (2001,2002), Easterly and Levine (2003) though it was only given marginal attention.(Gwartney and Lawson 2003). There are numerous studies that investigate the role of institution in determining the cross country differences in economic performance of which, Abdiweli M. (2003), Gwartney, Holcombe and Lawson (2004), Boulhol (2004), and Paap, Franses and Dojk (2005), could me mentioned as examples. This study compared to the above mentioned studies concentrates on the issue of the role of institutional differences in explaining growth differences between Sub-Saharan Africa and some of the East Asian countries using different kind of model estimation namely system generalized method of moments.

1.2 Objectives Of The Study

Generally, there are three objectives that this paper tries to investigate in the comparative analysis of the growth experience of Sub-Saharan Africa and East Asian countries.
These three objectives are:

I. To focus on the relationship between institutional quality and investment and analyze how institutional quality influences growth through its impact on investment.
II. To assess the importance of the quality of institutional difference explaining the difference in the per capita growth, and
III. To assess the importance of other growth determinants that are included in the model in explaining this growth difference.

1.3 Methodology

In order to meet the objectives, descriptive as well as econometric analysis will be employed in the paper. In various cross-country growth comparison studies, it has been identified that quality of institutions or better governance matters for having higher per capita income. For example studies by Kaufman, Kraay and Zoido-Lobaton (1996), Hall and Jones (1999), Easterly and Levine (2002), Acemoglu, Johnson and Robinson(2001), used instrumental variable regression approach to deal with the identification problem involved. Acemoglu, Johnson and Robinson (2001) used mortality rates of colonial settlers as an instrument for institutional quality in colonized areas. Their argument for using mortality rates as an instrument is that colonizers erected strong institutions to protect property rights and maintain rule of law in areas where there are few health hazards while in other areas they concentrated on extracting resources very quickly leaving behind very poor institutions. Hall and Jones (1999) used the fraction of population speaking English and western European languages as an instrument for institutional quality.

Using instrumental variable approach has an advantage of minimizing the endogeneity problem but also has got some limitations. First this approach provides policy makers with little guidance about how to change institutions in the present time period. Second, Djankov et al. (2003) argue that even if mortality risk or indigenous population density shaped the European settlement decisions, it is not clear that what the Europeans brought with them is themselves and therefore their know-how and human capital. This point is in contrast with Acemoglu, Johnson and Robinson (2001, 2002) who argue that the mortality of European settlers in the countries they colonized shaped their decision to settle or not and when they settle they brought with them the effective European institutions, and where they did not settle they instituted system of arbitrary rule and expropriation of local population. This shows that there is a debate about the fact that one can infer from European settlement patterns that the asset being transplanted is institutions. The fact that settlement patterns affect economic growth through channels different from institutions makes settler mortality rate and density of local population invalid instruments because it means that they are correlated with the error term (Glaeser et al, 2004). In line with the above argument Diamond (1997), argue that, what the European brought with them is not only human capital and institutions, they brought "guns, germs, and steel" among other things rendering correlation of the instruments with the error term again. There are common problems with estimating growth regressions besides the problems that are mentioned above. First the right hand side variables are typically endogenous and measured with error and secondly there is a problem of omitted variable bias which implies that least square parameter estimates are biased since the omitted variable is correlated with one the regressors, the initial level of income (Bond et al. 2001). Because of the above problems with using instrumental variable regression approach, this study uses a different method that accounts for the endogeniety problem and that avoids all the above problems.

In an attempt to make comparative analysis of growth experience of the two regions in relation to institutional quality difference and other sets of explanatory variables, and in studying the cross regional differences in growth and examining the extent to which this difference is attributed to institutional quality difference, the study employs the classical growth model of Solow augmented with institutions. Then this growth model is estimated by a method that should allow for endogeneity, measurement error and omitted variables.

In order to address the problems that is common in the empirical growth research, a relevant estimator was developed by Holtz-Eakin, Newey an Rosen (1988), and Arellno and Bond (1991) which is through first-differenced generalized method of moments estimators (GMM), applied to dynamic panel data models. The main concept of this method is to transform the basic growth regression equation to a dynamic panel data model by taking the first differences to remove the unobserved fixed country specific effects and instrumenting the right hand side differenced variables with levels of the series lagged two periods or more.

Bond (2001), and Roodman (2006) argue that the above method has important advantages over simple cross section regression and other estimation techniques for dynamic panel data models. First the parameter estimates will no longer be biased because of the existence of unobserved time invariant country specific effects (they are removed by first differencing), second in models that include endogenous explanatory variables such as ours and in the presence of measurement errors, the method allows parameters to be estimated consistently.

Though difference GMM has all the above advantages, there are some problems that are also associated with this technique of estimation. First when the time series is persistent and when the time under consideration is small[1] the estimator from this method is poorly behaved. And secondly when the lagged levels of any series are only weakly correlated with subsequent first differences the GMM estimator has been found to have poor finite sample properties. Under such scenario, Blundell and Bond (2001) have suggested another kind of GMM estimator; system GMM estimator which better fits growth regressions by exploiting additional assumption about the initial condition. In line with the above reasoning to use the dynamic panel data model (system GMM), this particular study applies this technique of estimation to the model specified in the third chapter.

The variables included in the model are, institutional quality index, Real per capita Gross domestic product, investment, life expectancy at birth (as a measure of human capital) and geographical measures that are very important in explaining income disparity across nations. Political rights and civil liberties components of country ratings from the Economic Freedom of the World (EFW) are used as indicators of institutional quality. Another measure that is constructed by kaufman et al, (2006), containing indices on rule of law, control of corruption, voice and accountability, political stability, government effectiveness and regulatory quality is available but since it is only available for only short period of time the former one is used in this study.

[1] In this study, averages of the variables over three years period is considered to avoid cyclical movement in the GDP series, resulting in only having nine periods.

The coefficient estimates are then reported against the explanatory variables selected and emphasis will be given on the marginal contribution of each of the variables involved in explaining the difference in the growth for the two groups. This exercise will show how the difference in a certain explanatory variable between the two regions explains the growth rate differential.

1.4 Significance of the Study

Previous research has established the importance of the quality of institution along with other determinants of growth such as trade and geography in explaining the cross country income growth differential. Even though there are studies focusing on the importance of institutions explaining the growth of Sub-Saharan Africa and East Asian countries separately, no comparison was made between the two sets of countries regarding this issue. This study tries to compare the impact of the difference in the quality of institution on growth differential between Sub-Saharan Africa and some selected East Asian countries. In addition, earlier studies that focused on the impact of institutional quality on growth used either cross section Ordinary least squares or other static panel data models which are not appropriate when dealing with growth regressions. In making such comparison, this study used more appropriate method of estimation namely system GMM that would enable us to get consistent parameter estimates to address the methodological problems that some of the previous researches have suffered.

1.5 Limitations of the Study

This study uses data from 43 African countries and 9 East Asian countries in deriving its result. Some African countries are excluded from the study due to the unavailability of data. Life expectancy at birth is used as a proxy for human capital due to the unavailability of better proxies such as secondary school enrollment ratio or public expenditure for health service for the selected countries. Even though there is more comprehensive measure of the quality of institution which is based on hundreds of individual indicators that is provided by World Governance research project, due to the availability of this data for only one decade, data from economic freedom the world index which is available for longer time span is used to measure the quality of institution for the purpose of conducting this study.

1.5 Organization of the Study

This thesis is organized into five chapters: chapter one presents introduction of the area of concern, chapter two reviews related literature, data source and description, model specification and method of estimation are presented in the third chapter and the fourth chapter deals with descriptive and econometric analysis. Finally chapter five is the summary and conclusion of the paper.

Chapter Two

Review of the Literature

2.1 Determinants of Growth Divergence and Growth Models

The income level of countries that are found in different parts of the world today varies to a great extent. Different growth theories or models attribute the growth divergence between countries to different determinants of growth among which are differences in human and physical capital, natural resources, geography, institutions, politics and developmental stage.

The Neoclassical growth models of Solow (1956, 1957), Cass (1965) and Koopmans(1965) were the advocates of absolute convergence hypothesis whereby the low income countries having low level of physical capital will accumulate physical capital and catch up with the rich countries as time goes by basing their prediction on the assumption of exogenously determined technology. In these models cross-country differences in factor accumulation are due either to differences in saving rates, preferences, or other exogenous parameters such as total factor productivity growth.

Despite the fact that the Neo-classical growth models predicted and emphasized absolute convergence, the existing fact shows us that there is increasing divergence between these two groups of countries (Ali, Abdiweli M, 2003). There are also other problems that are associated with the neoclassical growth models. The first one is related to the assumption of perfect competition and the assumption of exogenously determined technology. According to Romer (1990), firms invest if they have some monopoly power and differentiate their product by innovation consequently having market power over their price. This power over their prices will be an incentive for them to further innovate which is the cause of sustained growth challenging the absolute convergence hypothesis and the assumption of perfect competition. The other problem that the neoclassical growth models have is that, they consider capital that is included in the production function to be composed of only physical capital. Lucas (1988) argued that capital is not composed of only physical capital but also human capital which is not subject to decreasing return. Therefore countries having high human capital stock tend to grow faster. The avoidance of human capital in neoclassical growth models has the effect of creating a bias in the coefficient of population and saving in growth regressions because human capital is highly correlated with saving and population.

Following the neo classical growth models, then came the endogenous growth models of Mankiw (1992), Barro (1996), Levine and Renelt (1992), Romer (1986), Lucas (1988) with conditional convergence hypothesis, where countries converge to different steady state based on their condition or what they refer to as steady state parameters. Among the steady state parameters are mentioned, propensity to save, investment, human capital, population growth and different government policies, which helped them wind their hypothesis by concluding that there are different steady state levels for different countries.

Thus various empirical studies like Levine and Renelt (1992), Mankiw et al. (1992), Barro(1996), Barro and Sala-i-Martine (1992) indicate that unlike the neoclassical growth models which are advocate of absolute convergence hypothesis, countries converge to different steady states. Among the steady state parameters in this conditional convergence hypothesis is included the quality of institution explaining the difference in economic growth. The quality of institution can be the major source of economic growth differential among nations. Clague et al (1996), North (1990; 1991), Murphy et al., (1991), Hall and Jones (1997) all agree on the fact that the quality of institution differ from one country to another and one political regime to another and even within the same kind of political regime and this difference have a substantial impact on the growth performance of countries. (Ali, Abdiweli M, 2003)

However these endogenous growth models themselves were not recognized as explaining the growth difference between regions in recent empirical work on growth.

Many studies like Mankiw et al (1992) and Romer (1990) share the idea that endogenous growth models are not as such very different from the standard neoclassical growth models except for the inclusion of human capital and agree to the fact that neoclassical growth models are the best tool if their problems are well accounted for. Additionally Pritchett (1997), as reported in Boulhol (2004), has outlined that the conditional convergence hypothesis just as the absolute convergence hypothesis, has been more and more difficult to reconcile with the global divergence in income. As Acemoglu, Johnson and Robinson (2004) put it, the explanation for income differences by endogenous growth models is similar to that of the older theories. It is mentioned in the study that even thought these traditional theories are vibrant in economics and have provided many insights about the mechanics of economic growth; they have been unable to provide fundamental explanation for economic growth. Neither of the two theories can account for the fact that developing countries except for some are falling further behind that the developed countries.

2.2 Factors Accounting For Difference in Growth Rate of Countries.

Generally there are different strands of thought which account for the difference between the income levels and growth rates of different countries. The first one assigns the prominent role in explaining this difference to geography. Geography determines the climate, natural endowments, transport cost, extent of diffusion of technology from more advanced areas and also plays a major role in the disease burden. Therefore geography has an impact on agricultural productivity and the quality of human resources. This line of thought is shared by Fared Diamond and Jeffrey Sachs (Gwartney et al ,2004).

There are at least three main version of this hypothesis each emphasizing different routs for how geography affects prosperity. Fist, climate may be an important determinant of work effort, incentives, or even productivity. Acemoglu et al 2004, noted that this idea dates back to the famous French philosopher, Montesquieu ([1748], 1989), who wrote in his classic book The spirit of the Laws: “The heat of the climate can be so excessive that the body will be absolutely without strength. So, prostration will pass even to the spirit; no curiosity, no noble enterprise, no generous sentiment; inclinations will all be passive there; laziness there will be happiness,” and “people are ... more vigorous in cold climates. The inhabitants of warm countries are, like old men, timorous; the people in the cold countries are, like young men, brave”. Second geography affects prosperity through determining the technology available to a society, especially in agriculture. This view is pointed out and advocated by Sachs who stated that, “By the start of the era of modern economic growth, if not much earlier, temperate- zone technologies were more productive than tropical-zone technologies” (Sachs, 2001). The third view relates poverty and underdevelopment to the “disease burden”. The incidence and the burden of infectious diseases are higher in the tropical areas than in the temperate zones (Sachs, 2000). The prevalence of malaria in the Sub-Sharan Africa countries killing millions of children every year reduces the annual growth rate of sub-sharan African economies by more than 1.3 percent a year. (Bloom and Sachs, 1998)

The second line of thought is the integration view which gives attention to the role of international trade in explaining this difference. This view asserts that participation to the global economy through trade fosters convergence between the poor countries and the rich ones and thus countries having less participation in the world trade are detached and would not be able to benefit from the advantages of the international trade (Gwartney et al ,2004).

The third line of thought points out that the fundamental explanation for economic growth emphasizes the idea that different societies have different culture, because of different shared experiences or different religions. Culture plays a role in determining the economic performance of countries. It determines the views, preferences and beliefs of individuals and societies, all playing a significant role in determining economic performance of countries (Acemoglu et al, 2004).

As noted in the same study, scholars, have argued that the origins of western economic dominance is particular set of beliefs that they have about the world and how it could be transformed by human endeavor which is linked to religious (cultural) differences. Culture influences growth not only through religion, there has also been arguments that, there is something special about particular cultural endowments, usually linked to particular nation states. Societies may become dysfunctional in the sense that they adopt a system of beliefs or ways or operating which do not promote the success of a society. Banfield (1958) as noted in Acemoglu et al 2002, argued the poverty of southern Italy was due to the fact that people had adopted a culture where they only trust individual from their own families and refuse to cooperate with or trust anyone else which is simply the lack of social capital.

The fourth line of thought focuses on institutions (the role of property rights and the rule of law). This view gives credit to the rules of the game in a society and their ability to create appropriate incentives for desirable economic behavior. In the regression of economic growth on geography, institution and integration (trade), only geography is found to be exogenous while the other two (institution and trade) are endogenous (causality running from both these determinants to income and from income to them) determinants. So after controlling for the complex causality of these determinants of income by using instrumental variable approach it was found that when controlling for institution integration has no positive impact on income and geography at best has a weak impact directly even though they both have strong indirect impact through institution (Rodrik and Subramanian, 2003). The hypothesis that differences in institutions are the basic cause for difference in economic growth is based on the notion that it is the way that humans interact and decide to organize their societies that determines whether or not they prosper. Some ways of organizing societies encourage people to innovate, to take risks, to save for the future, to find better ways of doing things, to learn and educate themselves, solve problems of collective action and provide public goods, others do not"(Acemoglu, Johnson and Robinson, 2002). All these facts show that, institutional quality differences are among the factors that play roles in explaining the difference in the income level and growth rate of GDP between countries.

2.3 Institution and Growth

Boulhol (2004), after showing that technology differences play an important role in a cross country growth pattern, gives emphasis to the role of institutions for total productivity level and growth rates and for technology diffusion.

The study mentions that growth literature does not pay enough attention to heterogeneity in technology except for few studies like Hall and Jones (1996, 1999), Klenow and Rodriquez –Clare (1997). This particular study by using a detailed data base on institution found out that technology diffusion impacts economic growth and catching up is conditional on the quality of appropriate institution. It has also shown that institutions matter for technological efficiency and long run Total factor productivity growth differences which also contributes for cross country growth differences. According to the study, institutions inter into growth equation in three different channels, the level of technological efficiency, the progress of technological efficiency and possibly the speed of technology diffusion.

Other studies like Knack and keefer (1995) and Mauro as cited in Abdiweli M Ali and Crain (2002), and Gwartney et al (2004) agree on the idea that institutions that protect property rights have positive and significant effect on growth. And by using direct but subjective measures of institutional quality such as the rule of law, enforceability of contracts, risk of expropriating private property, the quality of the bureaucracy and the prevalence of governmental corruption, Abdiweli M Ali and Crain (2002), have found out that institutional quality differences are one of the major determinants of cross country growth differences.

Gwartney et al (2004) discussed the past literature in economic growth and stats that there are three explanations for differences in income levels and growth rates: the production function approach of Solow (1958), the institutional approach represented by the work of North (1990) and Landes (1998), and the geographic and location approach of Sachs (2003). After discussing this, they have pointed out that the production function approach leaves out one important factor if it does not account for institutional differences across countries. This is because institutional quality has been found to exert a major impact on the level of inputs (capital and labor) that are used in the production function approach. Therefore they have found out that institution affects both the level and the growth of GDP directly through increasing productivity of physical and human capital and indirectly through their level effect on the inputs (labor and capital) used in the production function approach. In the study they regressed both the level and growth of GDP per capita on the measure of institutional quality they considered (Economic Freedom of the World (EFW)[2] rating), on geographic and location variables and variables that they thought are major determinants of growth. These variables include, residuals of human capital per worker and physical capital per worker that they got after regressing these variables on EFW rating and geographic variables to disentangle the level of physical and human capital that are explained by EFW rating. (To get both the direct and indirect impact of institutional quality differences on income levels). The study has managed to go beyond the historical consensus that only inputs matters for growth and has found out that institutional differences as measured by EFW ratings have major impact on cross country differences in both income levels and long term growth rates

2.4 Institution as a Crucial Determinant Growth of Income and Income Differential

In human interaction for instance regarding production and exchange there is great deal of uncertainty that human beings have to deal with. These uncertainties arise mainly because of the costliness of information and the information asymmetry problem which is a very essential part of the cost of transaction. The resource of the economy devoted to or consumed in transacting are of considerable magnitude and growing (North, 1996). And transaction costs are part of the cost of production. So the total cost of production consists of not only costs of inputs like labor, capital, and land that are needed to transform the

[2] The EFW index is an outgrowth of a series of conferences sponsored by the Fraser Institute of Vancouver, British Columbia during 1986-1994. The EFW annual report is now published by a network of institutes in 59 different countries.

physical attribute of the good, but also transacting costs defining, protecting, and enforcing the property rights to goods (the right to use, the right to derive income from the use of, the right to exclude, and the right to exchange). And only in the absence of this transaction cost is that the neoclassical paradigm gives an allocative result, with positive transaction cost, resource allocations are altered by property rights structure. Property rights are the rights individuals appropriate over their own labor and the goods and services they possess. Appropriation is a function of legal rules, organizational forms, enforcement, and norms of behavior -that is, the institutional framework (North, 1996). "The major role of institutions in a society is to reduce uncertainty by establishing a stable (but not necessarily efficient) structure to human interaction" (North, 1996).

Rodrik (1999) emphasizes the importance of private initiatives and incentives to invest in risky ventures and businesses in determining the difference in the economic growth rates of different countries. These initiatives and incentives in a certain economy are shaped by the institutional structure and the absence of adequate institutions will make these incentives not to work. So according to him in order for market to function well, they have to be backed by non market institutions. Market and non market institutions are therefore complements not substitutes. In the study he argued that social arrangements like a clearly delineated system of property rights, a regulatory apparatus, anticompetitive behavior, and moral hazard, a moderately cohesive society exhibiting trust and social cooperation, social and political institutions that mitigate risk and manage social conflicts, the role of law and clean government, are taken for granted by economists. But these factors are absent in some poor economies and are very important in complementing the market in order to bring about desirable growth of the economy of any country. In every society's history or in underdeveloped world today incentives have favored predation over production or "taking" instead of "making" (North 1990, Usher 1987).

The private return to redistributive effort is generally higher than the private return to production in cases where social and legal mechanisms for enforcing contracts and property rights are weak or absent. The existing consensus among developmental and physical attribute of the good, but also transacting costs defining, protecting, and enforcing the property rights to goods (the right to use, the right to derive income from the use of, the right to exclude, and the right to exchange). And only in the absence of this transaction cost is that the neoclassical paradigm gives an allocative result, with positive transaction cost, resource allocations are altered by property rights structure. Property rights are the rights individuals appropriate over their own labor and the goods and services they possess. Appropriation is a function of legal rules, organizational forms, enforcement, and norms of behavior -that is, the institutional framework (North, 1996). "The major role of institutions in a society is to reduce uncertainty by establishing a stable (but not necessarily efficient) structure to human interaction" (North, 1996).

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The private return to redistributive effort is generally higher than the private return to production in cases where social and legal mechanisms for enforcing contracts and property rights are weak or absent. The existing consensus among developmental and growth economist views good governance as pre-requisite to sustained increase in standard of living. The difference between developmental success and failure according to this view is that, it is a function of whether incentives in a given society steer wealth maximizing individuals towards producing new wealth or toward diverting it from others. Social norms that are very important for facilitating interpersonal trust are other factors besides legal mechanisms for enforcing contracts and protecting property rights that determine the relative payoffs of production and predation. This norms (social institutions) where they are effective, reduce uncertainty and transaction cost, enhance the efficiency of exchange, encourage specialization and investment in ideas, human capital and physical capital (knack, 2002).

Rodrick 1999, identified and defined five types of institutions that permit markets to work adequately which are:

A. The institution of property rights
B. regulatory institutions
C. institutions for macroeconomic stabilization
D. institutions for social insurance,
E. institutions of conflict management

A. The Institution of Property Rights

Roderick 1999, argued that secure and stable property rights structure have been playing major role in the rise of the west and the onset of modern economic growth.

Firms or individuals will have an incentive to accumulate and innovate if they have monopoly power over their price and have adequate control over the return to asset they own (Romer, 1990).

Property right even thought they differ from one part of the world to another, they must confer control rights and formal property rights do not contribute much to growth if they do not contain control rights (Rodrick 1999).

B. Regulatory Institutions

After mentioning several reasons for market failures Rodrik 1999 emphasized the role of regulatory institutions in addressing the consequences of market failures. It argued that the experience in East Asia- i.e the fact that financial liberalization and capital account opening led to financial crises due to inadequate prudential regulation and supervision entails that market freedom requires regulation.

Due to coordination failure and capital market imperfection strategic government intervention may often be required to get out of low level traps and encourage desirable private investment responses. (stigliz and Hoff 1999).

C. Institutions for Macro Economic Stabilization

Since the time of Keynes people have come to an understanding that capitalist economies are not necessarily self stabilizing. Keynes and Keynesian in general were concerned about the "shortfall" in Aggregate Demand which slows the economy and makes it an economy characterized by high level of unemployment. And the transmission of the instability of financial market to the real economy has been stressed more recently. Most world economies have learned that it is necessary to acquire fiscal and monetary institutions that perform stabilizing functions, the most important of these institutions being the lender of last resort specifically the central bank which guars against self fulfilling banking crisis.

On the other hand it is also found that there is a sense in policy circles that fiscal and monetary institutions that are found particularly in Latin America have added to macro economic instability instead of reducing it by following pro-cyclical rather than anti-cyclical policies. So some countries have given up on domestic lender of the last resort altogether by replacing their central bank with currency board (Hausmann and Gavin 1996). This debate illustrates the obvious fact that institutions needed by a country are not independent of that country's history.

B. Regulatory Institutions

After mentioning several reasons for market failures Rodrik 1999 emphasized the role of regulatory institutions in addressing the consequences of market failures. It argued that the experience in East Asia- i.e the fact that financial liberalization and capital account opening led to financial crises due to inadequate prudential regulation and supervision entails that market freedom requires regulation.

Due to coordination failure and capital market imperfection strategic government intervention may often be required to get out of low level traps and encourage desirable private investment responses. (stigliz and Hoff 1999).

C. Institutions for Macro Economic Stabilization

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D. Institutions for Social Insurance

In modern market economy, risk to income and employment is pervasive and movement up and down in the income scale is frequent. Even though transition to modern economy frees individuals from their traditional entanglements, the kin group, the church, and the village hierarchy, it uproots them from their traditional support system and risk sharing institutions.

Social insurance legitimizes a market economy because it renders it compatible with social stability and social cohesion. But the existing experience of Western Europe and United States engenders a number of social and economic costs. This is one of the reasons why developing countries such as those found in Latin America have not ȧdopted institutions of social insurance. In Latin America the reforms that took place after the debt crises was aimed at enhancing the scope of the market and reining in that of government. Privatization, deregulation, and trade liberalization all entailed restructuring of the economy and greater risk of job loss, at least in the short run. The retrenchment of the public sector meant reduced opportunities for relatively safe public employment. Financial liberalization could be counted upon to generate volatility in the economic environment. Greater capital mobility implied the shifting of idiosyncratic country risk from mobile capital to immobile labor. So the economic insecurity generated by the debt crises is only augmented by the market oriented reforms that were adopted without instituting complementary programs of social insurance.

He argued that the point is not any more the question of whether institutions matter or not but rather to identify which types of institutions matter and the ways of acquiring them. It is also mentioned in the paper that building of institutions can be thought of as a form of technology transfer that allows increased productivity.

Good institutions are viewed as establishing incentive structure that reduce uncertainty and promotes efficiency, hence contributing to strong economic performance. (Growth and institution)

In addition to focusing on the importance of some particular institutions namely those that protect property rights and ensure that contracts are enforced which are market creating institutions, Rodrk and Subramanian have identified other institutions that are required to get long term economic development. These institutions are institutions to sustain the growth momentum, build resilience to shocks, and facilitate socially acceptable burden sharing in response to such shocks which are referred to as market regulating, market stabilizing and market legitimizing respectively (Rodrik and Subramanian 2003).

Chapter Three

Model Specification and Method of Estimation

In this chapter, model that captures the role that institutional quality plays in cross country income growth differential and investment differential is developed and estimation technique of the model is selected.

3.1 Model specification

This paper attempts to explore the role of institutional variables accounting for differences in investment rates and growth across the two groups of countries in light of the theories that suggest their importance. To this end an attempt is made to link the quality of institution and, investment rate and economic growth using an augmented Solow growth model. Particularly the study tries to incorporate institutional quality index in the growth model employed.

Economic growth could follow from the enhancement of a nation's technology, that is from increases of total factor productivity in standard growth accounting exercise, or that arises from increases in a nation's factor stocks. This latter group would include standard factors of production, such as labor and capital as well as human capital. The rate of their accumulation is directly affected by what is referred to as ancillary variables which among other factors includes institutional quality (Benhabib and Spiegel, 1997).

Since there are a number of theories suggesting that ancillary variables which also include institutional variables influence economic growth through their impact on factor accumulation (investment), it would make sense to test their effects directly on investment rates (Benhabib and Spiegel, 1997). There is a strong consensus that solid institutional framework is necessary for investment. Private investors will be reluctant to invest in risky ventures if there is no strong property right structure and if they are not well protected for the reason that they fear their returns may be appropriated by others. In addition institutions provide foundation for the operation of capital markets. (Gwartney et al, 2006).

Even though several studies have explored the impact of institutional quality on growth, most of them investigated this impact based on the framework that also includes investment rate as one of independent variables.[3] But as mentioned above one of the channels through which institutional quality affects growth is through its impact on investment therefore exploring the impact of institutional quality based on the above framework underestimates the impact of strong institutional quality on economic growth. Few other studies like Dawson (1998), Gwartney et al. (2004), Cole (2003), have examined the impact of institutional quality on investment. Dawson (1998) has found that economic freedom (measure of institutional quality) has a direct and indirect impact on growth through enhanced investment.

To this end, this paper first makes use of a model that estimates the impact of institutional quality on investment and then passes to the growth model. Therefore one possible way of capturing the impact of institutional quality on investment is to regress the variant of the following general function. This function is a simple function that is going to be used just to capture the effect of institution on investment.

$$\text{Investment} = f\,(\text{initial level of institution, institutional quality}) \qquad (3.1)$$

The growth model that this study makes use of is a version of neo-classical growth model. This is because Neo-Classical growth models augmented with the necessary tools are the best to study economic growth. The general form of the model can be characterized as:

$$\mathbf{y}_{it} = F(y_t, h_t\, Z_{(t)}) \qquad (3.2)$$

Where $\mathbf{y}_{it}$ is country y's per capita growth rate of GDP in period t, y_t is initial real GDP per capita, and h_t is initial human capital per person. The variable Z represents a vector of

[3] Examples could be Gwartney et al.1999, Scully 2002, Acemoglu et al. 2001, Easton and Walker 1997, Kaufmann and Kraay 2002, Abdiweli M. and Crain 2002.

other variables such as measure of institutional quality and environmental variables.

Then we set out a Solow growth model that is selected as an appropriate growth model to be estimated. Growth in real GDP per capita is explained by the standard determinants of growth as in the Solow growth model that is augmented with measure of institutional variable. The growth equation that is estimated assumes the following form.

$$\Delta y_{it} = \gamma_t + (\alpha - 1)y_{i,t-1} + x'_{it}\beta + \varphi I_{it} + \eta_i + v_{it} \text{ for } i = 1, \ldots, N \text{ and } t = 2, \ldots, T \qquad (3.3)$$

Where Δyit is the log difference in per capita GDP over three years period, $y_{i,t-1}$ is the logarithm of per capita GDP at the start of that period, this variable is included in log form to capture the empirically observed income-convergence effect on growth, where poorer countries tend to grow faster than richer countries. x_{it} is a vector of characteristics measured during, or at the start of, the period. The variables included in the vector of x_{it} vary depending on the kind of empirical neo-classical models employed. In the original Solow model it includes variables such as investment rate and population growth rate plus 0.05 which combines the effects of common exogenous rate of technical change and common depreciation rate[4], whereas the augmented version also included measure of human capital such as secondary school enrollment or life expectancy. The vector Xit also includes geographical factors that are also very important in explaining income disparity across nations.[5] γ_t is the term capturing the period specific intercept capturing for example productivity changes that are common to all countries. The other terms η_i and v_{it} capture the unobserved time invariant country specific effect and error term which is composed of all unexplained portion by the model respectively. I_{it} is a measure of institutional quality of a country i at time t. A simple arithmetic mean of the political rights and civil liberties components of country ratings from the Economic Freedom of the World (EFW) are used

[4] Bond, 2001, MRW,1992, Nkurunziza and Bates, 2003 all have added 0.05 to the population growth rate to capture the common effect of technological change and depreciation rate because of the fact that technological advancement or change and rate of depreciation are less likely to vary across countries.

[5] Gallup et al. (1998), McCarthy et al. (2000), Rodrik and subraminian 2003, Sachs (2003), and Gwartney et al. (2004) have all emphasized the importance of geographical variables in explaining the difference in income between countries.

as indicators of institutional quality. The Economic Freedom of the World rating is a comprehensive measure composed of 38 components that are designed to measure the degree to which a nation's institutions and policies support voluntary exchange, the protection of property rights, open markets and minimal regulation of economic activity (Gwartney et, al. 2006). An alternative measure of institutional quality based on hundreds of individual indicator variables and a variety of sources is provided by the Worldwide Governance Indicators (WGI) research project. These indicators measure six dimensions of governance: voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, rule of law, and control of corruption (Kaufmann et al., 2007). This alternative reports the six dimensions separately and thus makes the use of any one dimension possible. But the former measure of institutional quality index is employed in this paper because of the availability of longer time span data.

The above equation (equation 3.3) can be re-written in the following form:

$$y_{it} = \gamma_t + \alpha y_{i,t-1} + x'_{it}\beta + \varphi I_{it} + \eta_i + v_{it} \text{ for } i = 1, \ldots, N \text{ and } t = 2, \ldots, T. \quad (3.4)$$

The above specification of the growth model is then estimated in the following ways.
First we estimate the above equation (equation 3.4) by OLS, but instead of using the direct measurement of quality of institution we use two different alternatives to capture both the direct and the indirect impact through investment, of institutional quality on growth. The first one is inserting the fitted values from the regression of equation (3.1) above as the predicted value of investment along with other independent variables that are mentioned. This method will estimate the indirect impact of institutions through investment.

The second alternative is to estimate equation (3.4) by substituting the residuals from the regression of equation (3.1) for the investment rate. The residuals from the regression of equation (3.1) represent a variation in investment rate across countries that are not correlated with the measure of institutional quality. Using this residuals help us capture the variation in investment rate across countries that is correlated with the institutional measure difference by the coefficient of institutional quality measure. Therefore the coefficient of this last regression captures both the direct effect (through increasing the efficiency of resource use) and the indirect effect (through the attraction of high level of investment.

But as will be discussed in the following sections (section 3.2), applying OLS to such kind of growth models yields inconsistent estimates. Therefore measure of institutional quality will be directly used as one of the independent variables along with the measure of investment and other control variables. This method nets out the impact of investment on GDP growth, even though it undermines the impact of institutions on growth because it only captures the direct impact of institutions on growth (as a result of its effect on the efficiency of resource use) not accounting for the indirect impact that institution has on growth through increment in the quantity of investment. But this kind of problem is well accounted for in the estimation technique applied in this study. All the above regressions will be reproduced by using data from only sub Saharan African countries that are found at a lower level of GDP rank. This will help us explore the difference in the impact of institution on growth between sub Saharan Africa countries and the entire set of countries.

3.2 The Major Estimation Techniques and Tests

Different empirical growth models have used different sets of data for their analysis. Panel data techniques present major advantages over standard time-series or cross-sectional approaches, by combining their identifying features. Among the benefits of panel data for instance is first that there are larger number of data points available, increasing therefore the degrees of freedom and reducing the colinearity among explanatory variables, which would increase the efficiency of parameter estimates. The other advantage is that constructing and testing more complicated behavioral models is allowed by panel data than purely cross-sectional or time series data (Buhai, 2003). In addition dynamic models from observations at a single point in time cannot be estimated and single cross-section surveys rarely provide sufficient information about earlier time periods for dynamic relationships to be investigated (Bond, 2002).

There are well known problems that arise when estimating growth regressions. In growth regressions most of the explanatory variables are endogenous and measured with error. There is also a problem of omitted variable bias. One variable that should be included in a conditional convergence regression, the initial level of efficiency, is not observed. This will imply that least squares parameter estimates are biased, since the omitted variable is correlated with one of the regressors, the initial level of income. (Bond et al, 2001)
This particular study relies on panel data set because of this advantages that panel data has over both pure cross sectional and time serious data sets.

In the growth model specified above (equation 3.4), it is well known that ordinary least square (OLS) estimates of the initial GDP level coefficients and other endogenous variables are biased upwards in the presence of individual time invariant country specific effects (η_i) in short panels. Assuming the individual effects (η_i) as being stochastic[6] and disturbances (v_{it}) are serially uncorrelated, the ordinary least square (OLS) estimators of (α, β and φ) are inconsistent since the explanatory variables are correlated with the error ($\eta_i + v_{it}$) due to the presence of individual effects.

The within group estimator transforms the above equation (equation 3.4) to eliminate η_i thereby eliminating the source of inconsistency. It transforms the equation by expressing the original observation as the first difference of equation 3.4:

$$\Delta y_{it} = \gamma_t + (\alpha-1)y_{i,t-1} + \Delta x'_{it}\beta + \varphi\Delta I_{it} + \Delta v_{it} \text{ for } i = 1, ..., N \text{ and } t = 2, ..., T. \qquad (3.5)$$

Since the mean value of the individual effect is itself, it is removed from the transformed equation. However for panels with small time periods the transformation induces a non-negligible correlation between the transformed dependent variable and the transformed error term (Bond 2002, and Roodman 2006).. The within group estimator, which introduces all realizations of the v_{it} series into the transformed error term, is only consistent in large N, fixed T panels if all the right- hand variables are strictly exogenous and standard results for

[6] It implies that they are necessarily correlated with the lagged dependent variable.

omitted variables bias indicate that, at least in large samples, the within group estimator is biased downwards (ibid).

The fact that the OLS estimates are biased upwards and that the within group estimates are downwards might indicate that, the candidate consistent estimator will lie between the two estimates or at least not be significantly higher than the former or significantly lower that the latter (Bond 2002). Therefore the candidate estimator must give a consistent estimate of the parameters required in the presence of independent variables that are not strictly exogenous (meaning they are correlated with the past and the current realizations of the error), with fixed effects, heteroskedasticity and autocorrelation within individuals, and in situations where there are "small T and large N" panels.

The difference GMM estimator is designed for panel analysis in cases where the data generating process are dynamic, there are arbitrary distributed fixed individual effects, endogenous regressors, idiosyncratic disturbances having individual-specific patterns of heteroskedasticity and serial correlation and the number of time periods of available data (T) are small, (Roodman, 2006). In the difference GMM estimator the parameter estimates will no longer be biased by the presence of unobserved country-specific component and the use of instrumental variable allows for consistent estimates of parameters in models having endogenous right hand side variables and in the presence of measurement error (Bond. et, al. 2001).

In the empirical growth model with unobserved individual-specific effect and endogenous regressors such as ours (eq. 3.4), first differenced GMM approach assumes that $\eta_i + v_{it}$ has standard error component structure

$$E[\eta_i] = 0,\ E[v_{it}] = 0,\quad E[\eta_i\, v_{it}] = 0,\ \text{ for } i = 1, \ldots, N \text{ and } t = 2, \ldots, T \text{ and}$$

the errors are serially uncorrelated

$$E[v_{it}\, v_{is}] = 0,\ \text{ for } i = 1, \ldots, N \text{ and } s \neq t$$

And that initial conditions y_{i1} are predetermined

$$E[y_{i1}\, v_{it}] = 0, \text{ for } i = 1, \ldots, N \text{ and } t = 2, \ldots, T$$

All these assumption imply the following moment restrictions

$$E[y_{i,t-s} \Delta\, v_{it}] = 0 \text{ for } t = 3, \ldots, T \text{ and } s \geq 2$$

These moment restriction which are exploited by first differenced GMM imply that lagged levels of observations dated t − 2 and earlier can serve as instruments for the equations in first-differences yielding consistent estimates of the parameters.

However when the time series are persistent and the number of time series observation is small, first differenced GMM estimator is also poorly behaved because under this condition lagged levels of the variables are only week instruments for subsequent first differences. In empirical growth models output is a persistent series and most studies use serious of averages of output over some years to avoid modeling cyclical dynamics rendering small number of time periods to be investigated (ibid)[7]. When instrumental variables are weak, large finite sample biases can occur.

Under such circumstances, System GMM estimator that is suggested by Arellano and Bover (1995), and Blundell and Bond (1998), exploits additional assumption about initial conditions to obtain moment conditions that remain informative even in the presence of series that are persistent like output in our study.

The additional moment condition that Blundell and Bond consider is:

$$E[\eta_i \Delta\, y_{i,2}] = 0 \text{ for } i = 1, \ldots, N$$

This yields additional moment condition,

$$E[v_{it} \Delta\, y_{i,t-1}] = 0 \text{ for } i = 1, \ldots, N \text{ and } t = 3, \ldots, T$$

The moment condition allows for the use of lagged first-differences of the series as instruments for equations in levels (equation 3.4)

[7] This study has taken 3 years average of the variables in line with the above argument

Thus the system GMM combines two sets of equations, equation (3.4) above which is equation in levels and the first difference of it (equation 3.5) using lagged first-differences and lagged levels respectively as instruments. The fact that the above assumption requires the first-differences are not correlated with individual specific effects permits lagged first differences to be used as instruments in the levels equation (Bond et al., 2001; Roodman, 2006).

Therefore the above growth model is estimated by system GMM method because this method best suits the circumstance to get best estimates of the parameters. For the purpose of evaluating the outcome of this method, the growth model specified above is also estimated using the first difference GMM approach, the ordinary least square (OLS) approach and the within group estimator.

The Sargan/Hansen test for joint validity of the instruments is standard after GMM estimation (Roodman, 2006). In line with this, the Sargan test for the null hypothesis of valid specification is used to test whether the internally generated instruments are valid or not. The Arellano-Bond test for autocorrelation aside from the fixed effects is valid for any GMM regression on Panel data (ibid). This test along with wald test for joint significance of the dependent variables and the normal t, Z and F statistics are presented in the econometric analysis part. Time dummies are also included in the regression because the Arellano-Bond test for autocorrelation and the robust estimates of the coefficient standard errors assume no correlation across individuals in the idiosyncratic disturbances and time dummies make this assumption more likely to hold.

3.3 Sample Selection and Sources of the Data

This study offers some explanation to the source of Africa's slow economic growth and investigates whether the impact of institutional quality on economic growth for the continent is different from some of the East Asian countries considered. In its comparative analysis the research focuses on Sub-Sharan African countries and some fast growing developing economies.

The countries that are included in the study are Sub-Sharan Africa countries for which all the necessary data could be found along with countries which are rated as the seven fastest-developing countries outside of Africa[8] (East Asian countries) in Sachs and Warner including India, Japan and New Zealand. Countries in the African continent for which data could not be found for some of the important variables and countries which do not have any data are left out from the sample. The countries included in the study are presented in the annex.

The major source of the data used for this study is World development indicators (WDI) 2007. Data on real GDP, Gross capital formation (GCF), life expectancy at birth serving as a proxy for human capital, population growth rate are all taken from this source. Life expectancy at birth is chosen as a proxy for human capital because other better proxies like secondary school enrollment ratio is not available for the whole period under investigation. Data on a measure of institutional quality is taken from Freedom house, freedom in the world country rating from 1972 to 2006. There are some studies that have identified the vital role that geography plays for economic growth[9]. Gwartney et. al (2004), has emphasized the importance of geographic-locational factors in determining variation in income and growth across countries. These factors include tropical climate associated with the prevalence of disease and the effect of hot and humid climate on productivity, access to oceanic ports having effect on cost of international transaction, and distance from the world

[8] Hong Kong, South Korea, Malaysia, Indonesia, Singapore, Taiwan, and Thailand

[9] Studies like Mccarthy et al.2000, Saches 2003, Gwartney et al. 2004 have studies the impact of geographical variables on economic growth.

major trade centers having an impact once again on international transaction. Gwartney et al. (2004) have elucidated that there is no inconsistency on the impact of these variables on economic growth and the fact that they reinforce each other. Countries that are geographically isolated from world markets will face higher costs for any kind of international activities. There is high cost of shipment for countries which are landlocked compared to countries which have ocean ports, because of the fact that they must pay road transport costs in addition to sea freight costs at least across one international boundary Sachs and Warner (1997). In line with the above reasoning, this study makes use of land locked dummy variable to capture the disadvantage of being land locked country as a proxy for the effect of geography on economic growth. The data on this variable is taken from World development indicator (WDI, 2007). All these data are then averaged over three years starting from the year 1980 to 2005 giving us nine sub periods[10]. This method is used to overcome problems from, limited source of data, to reduce business cycle fluctuation influence, to accommodate convergence analysis given yearly time spans are too short (Islam 1995).

[10] The nine considered periods are 1980-1983, 1983-1986, 1986-1989, 1989-1992, 1992-1995, 1995-1998, 1998-2001, 2001-2004, and 2004-2005.

Chapter four

Data Analysis and Description of Variables

This chapter is organized in to two sections. Section one tries to describe the variables that are used in the study to explain economic growth of the cross section of countries and makes comparative analysis of the magnitude of the variables between Sub-Sharan Africa and East Asian countries. The next section is composed of econometric analysis of the role of institutional difference in economic growth difference.

4.1 Data Description and Variables Used To Explain Growth Differential

4.1.1 Variable Description

The variables that are included in the study as control variables in finding the institutional impact on growth are in line with the Solow growth models. They are basic variables that are found to be helpful in explaining cross-country growth in recent decades.

One of the variables included in the regression is Gross capital formation which is formerly referred to as gross domestic investment. It consists of outlays on additions to land improvements; plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings and plus net changes to the level of inventories.[11] This variable is used as a proxy of investment rate of countries. The other variable that is considered in the study is life expectancy. Life expectancy at birth indicates the number of years a new born infant would live if prevailing patterns of mortality at the time of its birth were to stay the same throughout its life. This variable serves as a proxy for the level of human capital of a country. Other better proxies for human capital such as rate of

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

enrollment in secondary school, the expenditure on health and education sector could not be used because of the unavailability of the data for these variables in continuous bases. The third variable considered in the study is population growth rate[12] of the countries. This variable is considered in most researches as one of the determinant of economic growth of countries. One other variable is the landlocked dummy variable as a proxy for geographical variable. The measure of institutional quality used in this research is the Economic Freedom of the World (EFW) index that is constructed by Gwartney and Lawson. These country ratings of the Freedom House are based on five areas of about twenty-three components (some of these with sub-items) and the index ranges from 1 (the best) to 7 (the worst). The areas are: government size; legal structure and security of property rights; access to sound money; freedom to trade internationally; and regulation of credit, labor, and business (Gwartney et al., 2004). The choice of this measure of institutional quality over the comprehensive measure of institutional quality that is constructed by Kaufman et al. (1999, 2000, and 2006) is justified by the availability of longer time span data for the former one. The kaufman indicators of institutional quality are based on subjective perception of residents, entrepreneurs, foreign investors, and the civic society and they are grouped in to six indicators which are voice and accountability, political instability, government effectiveness, regulatory quality, control of corruption an rule of law. But as mentioned above the data on these latter indicators of institutional quality are available only for the years starting from 1996 to 2006 and the data from the freedom house is available since 1970. So for the purpose of this particular study, the data on the institutional quality from the former source is utilized.

4.1.2 Data Presentation and Description.

The two groups of countries (countries found in SSA and the rest of them), had a slight difference in the level of GDP in the initial period under investigation. But after two decades and half there is an enormous gap in the GDP level. The following table shows

[12] Annual population growth rate. Population is based on the de facto definition of population, which counts all residents regardless of legal status or citizenship--except for refugees not permanently settled in the country of asylum, who are generally considered part of the population of the country of origin.

some basis fact about Sub-Saharan Africa and compares Africa with East Asian countries that are chosen for the purpose of this study. The table compares the mean values of the variables for SSA with the rest of the countries.

Table 4.1: Comparison of Africa with other fast developing East Asian countries

	SSA	East Asian countries under investigation
GDP per capita, PPP (constant 2000 international $) in 1980	2288.692	6648.588
Average annual growth rate of GDP per capita, from 1980- 2005	0.368006	3.98546
Average value of Life expectancy at birth	48.64458	69.81378
Population growth rate	2.493451	1.392242
Fraction of countries in tropical climate	0.89	0.45
Average Gross capital formation 1980-2005(% of GDP)	19.83	27.53
Institutional quality index	5.353395	3.526455

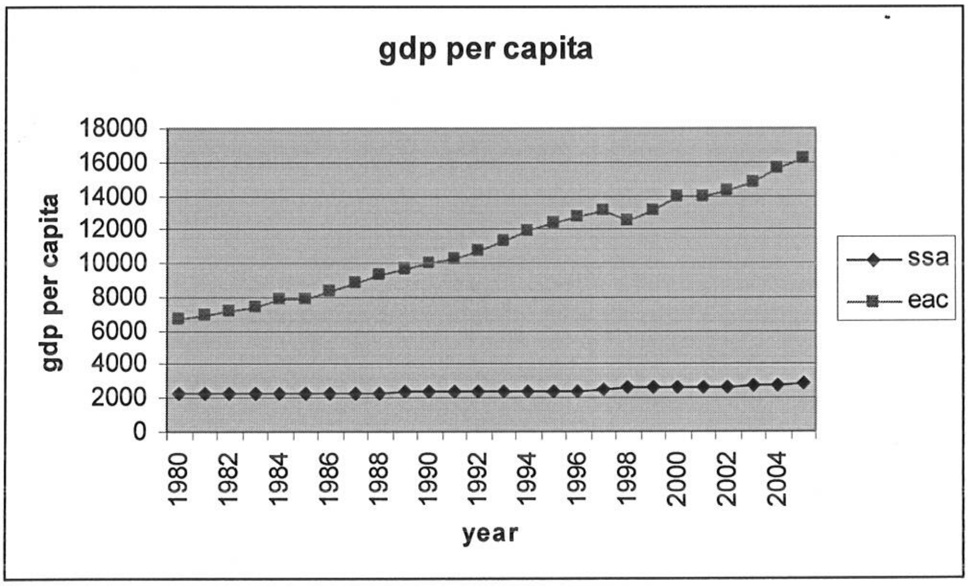
Source: constructed based on the data from World development indicator and freedom house; Freedom of the world country rating.

As can be seen from the above table, the average per capita GDP of countries that are not in SSA from the sample was about 3 times as large as that of the average of countries in the SSA in the year 1980. This difference in per capita GDP has even widened recently. For example in the year 2005 (the last year of the periods under analysis) the per capita GDP of the countries outside SSA is about 16203.68 which is 6 times as high as the level of per capita GDP (2659.997) for the same period for countries found in SSA. Higher income levels are the result of higher past rates of growth. The difference in the level of GDP between the two groups is explained by the huge difference in the average annual growth rate of GDP per capita from the year 1980 to 2005. Sub-Saharan Africa growth (measured as annual average change in GDP per capita averaged over the countries) is about 0.36 % per year over the 25 years period under investigation while the growth in the other countries averaged about 3.9%. As a result of this African countries today are poorer than the rest of the developing world. The performance of African countries in terms of the other variables is also worse than the rest of the countries. The average life expectancy of the regions is lower than developing countries outside Africa. This may be due to several reasons among which could be lower income, lack of health institutions, and climate factors that make the countries more vulnerable to endemic infectious disease. Africa also has larger proportion of the population in tropical climates. Because the incidence of infectious diseases are higher in the tropical areas than in the temperate zones which is one of the source of low productivity, African countries tend to grow more slowly that the other countries considered.

Africa has also performed worse in the rest of the variables which is also depicted in the table above. The institutional quality index is worse for African countries when compared to the other set of countries.

Despite the fact that there is a little improvement in macroeconomic conditions of SSA countries relative to older times (for example the growth rate of GDP per capita has increased in recent decades), SSA countries continue to face large and persistent income gaps relative to the other set of countries in the sample. The difference in the pattern of growth rates between the SSA countries and the some of the East Asian countries considered is displayed in figure 4.1 below.

Figure 4.1: GDP per capita for Sub-Saharan Africa countries and some selected East Asian countries



Source: constructed based on the data from the world development indicators, WDI (2007)

4.1.3. Some simple correlation between institution and economic performance

Table 4.2: Correlation between economic performance and measure of institution[13]

Variable	Average annual growth of GDP[14]	Growth volatility[15]	Average GDP level[16]	EFW rating[17]
Average annual growth of GDP	1.0000			
Growth volatility	-0.2090	1.0000		
Average GDP level	0.4580	-0.3587	1.0000	
EFW rating	-0.4525	0.5621	-0.5857	1.0000

Sources: world development indicators, World Bank 2007, Freedom house, freedom in the world country rating 1972-2005.

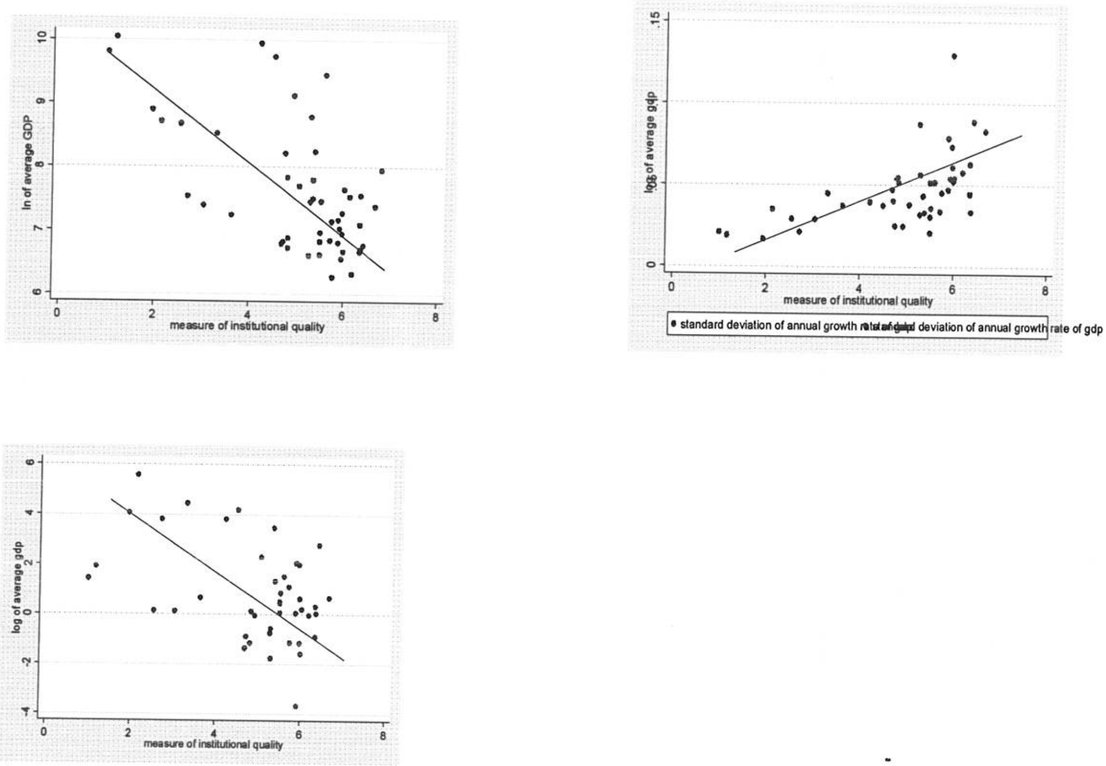
[13] The correlation are significant at 10 percent level
[14] Average annual growth rate of GDP per capita for the sample countries for the period 1980-2005
[15] Standard deviation of annual growth rate of real GDP per capita for the period 1980-2005
[16] Average value of real GDP per capita for the period under analysis
[17] Economic freedom of the world index constructed by Gwartney and Lawson.

The measure of institutional quality appears to be correlated with the measures of economic performance of countries. Since the measure of institutional quality employed in this study measured as 1(the smallest value) being the best institutional quality level and 7 being the worst, the negative signs of the correlation between measure of institutional quality with annual growth of GDP and Average GDP level indicates that institutional quality is positively related to the above two measures of economic performance. The same holds true for the correlations between growth volatility and the measure of institutional quality. Fig 4.2 below illustrates that the measure of institutional quality is positively related to cross country differences in measure of economic performance such as average GDP growth rate and level of average GDP over the period 1980- 2005 for the sample countries. Generally high income countries tend to have stronger institutional quality index and conversely countries where institutional quality is week tend to have poorer economic performance.

The above association between institutional quality and different measures of economic performance tells as nothing more than what it says. The questiorr of, whether stronger institutional quality enhances growth and economic performance, or stronger economic performance induce institutional change[18] still remains unanswered. In order to account for the problem of the direction of causality and identify the exogenous contribution of institution to the different performance of countries in the sample, more econometric technique is needed. The next section is thus devoted in identifying the contribution of institutional difference towards economic growth difference by using an appropriate technique.

18(for example; as countries grow they can afford to strengthen their institutional settings)

Figure 4.2: Associations between measures of economic performance and measure of institutional quality index.



Source: constructed based on data from world development indicators and economic freedom of the word index.

4.2 Econometric Analyses

In this section an attempt is made to find the role that difference in the quality of institution has on the difference in the growth rate of countries using different econometric techniques. The econometric techniques are those that are briefly discussed in the last chapter. The first part uses Ordinary least square approach, but it tries to solve the problem (which is discussed in the previous chapter) of estimating the impact of institution within the framework of models that also include the investment rate as explanatory variable. If investment rate happen to influence institution, this models will underestimate the growth-enhancing effects of better institutions[19]. So the first part will make an attempt using two different techniques[20] to isolate the independent effects of institutions on growth. This part will make comparison of the estimates of using the only African data with the estimates of using the data from the overall sample. But using OLS in such regressions results in estimates which are not consistent and the above methods will be appropriate if institutions are assumed to have exogenous influence on the economy. The next part deals with different estimation technique (namely GMM technique) that also accounts for the endogeneity problem of institutions.

4.2.1 The Role of Institutional Quality Difference through Investment.

Table 4.1 presents OLS results showing the effect of institutional quality as measured by the average of political rights and civil liberties components of country rating from economic freedom of the world index, on investment and GDP growth. The table presents three different kinds of regressions that are also reproduced for an only African data to examine whether there is a different impact of the independent variables on the GDP growth between the two data sets.

The first regression examines the impact of institutions on the measure of investment employed in the study. In this regression the dependent variable is gross capital formation for the period 1980 to 2005 which is composed of 9 periods at three years intervals. The independent variables are the initial EFW measure for each period and the EFW measure for the period. In this model only 4 percent of variation in investment for the 52 countries is explained by the independent variables employed. Among the independent variables, the average quality of institution has the expected sign and is significant at the commonly accepted level, but the measure of initial value of institutional quality which has

[19] Studies like Dawson (1998), Gwartney et al. (2004), Cole (2003) have examined the relationship between investment and institutional quality as measure by EFW and have found that there is indeed a relationship between the two and that economic freedom influences growth through its impact on investment.

[20] The fist technique is to insert the fitted value of investment from the regression of investment on institutional quality in to the growth model and the second one is using residuals from this equation as explanatory variable in the growth model.

insignificant impact on cross country variation in investment. Even though the measure of initial value of institution is included and priori expected to have significant impact

Table 4.3: Regression result of investment and growth equations for the Whole Sample.

Independent variables	Dependent variables		
	Gross capital formation	Average annual growth rate of GDP per capita	Average annual growth rate of GDP per capita
	Regression 1	Regression 2	Regression 3
Initial GDP level for each period		0.2682583	-0.0741103
Population growth		0.9652064***	-.5735586***
Life expectancy		-0.5972187**	1.855921***
Landlocked dummy		-0.0431089**	-0.1128815
Institutional measure (EFW)	1.267703**		1.005293**
Initial EFW rating	-0.9660032		-0.4485298
Fitted value of investment		1.974506***	
Residual from regression 1			0.2122366***
Constant	17.50055***	3.212623	6.571146
R^2	0.0416	0.2336	0.5716
Adjusted R^2	0.0371	0.2242	0.5642
Number of observation	429	417	417

'*', '**', and '***' show the significance of the corresponding variable at 10%, 5% and 1% level respectively because institution at the beginning of the period may have a positive influence of subsequent investment, from the data on hand, it has insignificant impact on investment. Rather it is the average EFW measure of the period that is significant in explaining the variation in the investment rate between countries. The coefficient of 1.26 the measure of institutional quality for each period tells us that a one unit increase in the combined average rating of political rights and civil liberties is associated with a 1.26 percentage point increase in investment.

In order to examine the impact of higher levels of investment associated with better institutions, on the GDP growth, one of the alternatives that are mentioned in the last chapter is to insert the fitted value from the first regression into the growth equation (the growth model). In this second regression the dependent variable is growth rate of GDP per capita over the period 1980-2005 averaged over three years intervals. And the independent variables are predicted value of investment from the first regression along with initial GDP per capita for each period, population growth rate, life expectancy (as a proxy for human capital) and landlocked dummy as a proxy for the effect of geography on economic growth. All the independent variables except the initial GDP are significant and have the expected signs. Initial GDP has unexpected positive sign but it is also found to be insignificant. From the second regression, one can see that a one unit increase in "fitted" investment is associated with an increase of 1.974 percentage points in the GDP growth rate. So as we saw from the first regression a one unit change in the EFW rating is associated with 1.26 percentage point increase in the investment rate, therefore a one unit change in EFW rating is associated with 2.48[21] percentage point increase in the long term GDP growth rate. This is a large change when compared to the average GDP growth rate of countries in the data (3.631968).

Another alternative that helps us to capture the indirect impact of institution through investment is using the residuals from regression one and substituting it for the investment variable in the growth equation. The residuals from the regression of equation (1) represent

[21] This is the product of the coefficients from regression one and regression two.

a variation in investment rate across countries that are not correlated with the measure of institutional quality. Using this residuals help us capture the variation in investment rate across countries that is correlated with the institutional measure difference by the coefficient of institutional quality. Thus the EFW coefficients in this last equation capture both the direct and indirect impact of institution on GDP growth rate. In this regression unlike the above one (where we have to multiply the coefficients from two regressions to get the total impact), the coefficient of EFW rating tells us both the direct and the indirect impact of institution on GDP growth rate. In this model the measure of institutional quality is significant and a one unit change in the EFW rating is associated with 1.00 percentage point increase in the GDP growth rate.

After considering countries only from SSA, (Table 4.2) the results that we got are very similar to the regression results for the whole data set. In comparison of the estimates of the coefficient of the fitted value of investment, we find that the coefficient for the only SSA dataset is slightly lower than that of the whole dataset. But the estimates of the second regression (including residual from regression number one in the growth model), we find that the estimates of the coefficient of institutional variable is slightly higher for SSA dataset. The explanatory power of the growth equation is a little higher for the only African data set in both of the cases. So the above results show that the difference between African countries and the fast developing countries included in the dataset is not important when considering the impact of institutions on economic growth. And improvement in institutional quality can at least have as much effect for Africa as for the other countries.

When we come to explaining the impact of other variables in the model, we have found that initial value of GDP in all the above regressions have insignificant impact on the growth rate of GDP. This does not comply with the convergence hypothesis that low income countries tend to grow more rapidly than higher income countries holding institutional quality and the other variables constant given the data at hand. The measure of the geographical variable employed (landlocked dummy) is insignificant in almost all the regressions and sometimes have unexpected result for some of the regressions. Life expectancy exerts a significant positive impact on GDP growth in the regressions for the second estimation technique showing a strong positive effect of investment on human capital on economic growth.

Table 4.4: Regression result of investment and growth equations for the Sub-Saharan African dataset.

Independent variables	Dependent variables		
	Gross capital formation	Average annual growth rate of GDP per capita	Average annual growth rate of GDP per capita
	Regression 1	Regression 2	Regression 3
Initial GDP level for each period		-0.078002	-0.2931785
Population growth		0.9845255**	-0.4112009***
Life expectancy		1.134176	2.588398***
Landlocked dummy		-0.3462602	-0.2978653
Institutional measure (EFW)	1.267703**		1.103713**
Initial EFW rating	-0.9660032		-0.484879
Fitted value of investment		1.936084***	
Residual from regression 1			0.2076396***
Constant	17.50055***	-1.290251	3.792025
R^2	0.0416	0.2132	0.5079
Adjusted R^2	0.0371	0.2019	0.4980
Number of observation	342	354	354

'*', '**', and '***' show the significance of the corresponding variable at 10%, 5% and 1% level respectively.

4.2.2: Institution versus Economic Growth: A More Appropriate Estimation Technique (GMM Estimation Results)

While the above methods help us solve the problem of undermining the role of institutions in models including both investment rate and institutional measure, the estimates of such models could be inconsistent in the presence of individual specific time invariant variables and some endogenous variables. There is also an issue about the direction of causation. It may be that higher growth leads to better institutions or, that causation runs both ways. In addition in growth models such as ours there could be other explanatory variables which are endogenous and in the presence of such endogenous variables the OLS estimate might once again be inconsistent. There might also be some omitted variables which could be correlated with some of the regressors rendering OLS parameter estimates biased. One way of addressing these problems is applying difference and system generalized methods of moment to dynamic data model such as ours. The GMM approach treats the explanatory variables as endogenous and generates internal instruments for endogenous variables and estimates will no longer be biased because of any omitted variables that are constant through time, (Bond.et.al, 2001).

The following table summarizes the result of applying different estimation techniques to the model that is presented in the third chapter (equation 3.4). The results show the effect of institutional quality, as measured by the EFW rating, and other variables which serve as control variables on GDP growth.

In all the regressions the dependent variable is average annual growth rate of real GDP during 1980-2005 averaged over three year intervals. The independent variables are, dependent variable lagged one period, real GDP per-capita at the start of each period, logarithm of population growth rate augmented with 0.05 to capture the common rate of technological innovation and depreciation, logarithm of life expectancy at birth serving as a proxy for human capital, gross capital formation (proxy for investment), landlocked dummy serving as a proxy for geographical variable, and institutional quality as measured by the EFW rating.

The first three columns of the table present the result of applying OLS, within groups and first difference GMM estimators respectively to the model. The final column shows us the result from applying more appropriate system GMM estimator. In the first column (OLS regression), lagged value of GDP growth, gross capital formation and institutional quality index appear to significantly explain economic growth while the other variables have insignificant impact at commonly accepted levels. In the OLS model, only 28 percent of the variation in growth is explained by the variables included in the model. The variable of focus (institutional quality index) has a positive significant impact on growth in the OLS estimation technique. According to the OLS estimation, a one unit increase in institutional quality is associated with 0.25 percentage point increase in the real GDP per-capita growth. The square of institutional variable tells us that this impact of institutional quality is diminishing for higher levels of institution, but it is insignificant.

The other estimation technique (the fixed effect) model which is believed to solve the problem of individual specific time invariant effect exhibits what follows. While lagged value of the dependent variable and a measure of institutional quality loose their significance retaining their signs, the variable gross capital formation is still significant at 99% level of significance when compared to the estimates from OLS. Other two variables namely initial level of GDP and population growth, have now turned out to be significantly explaining growth.

But loss of significance of institutional variable and lagged value of dependent variable in the within estimator might be due to the correlation between some omitted time invariant individual variable and the lagged dependent variable which remains to be a concern even after transformation of the equation as a deviation form in panels having small T.

Table 4.5: Regression result of the growth model using different estimation techniques the whole Sample

Dependent variable is the growth rate of real GDP per-capita					
Independent variables	OLS		WG	DIF-GMM	SYS-GMM
Lagged dep variable	.2431599***		-.0832133	-.1059483	.0302873
Initial GDP of the period	-8.85e-06		-.0000494*	-.9814541**	-6.596392***
gross capital formation	.0248435***		.0371943***	.0224773***	.203015***
Population growth	.1227606		.3188732**	.3744777**	1.07488*
Life expectancy	-.2509364		-.1972142	-.3875873	-.852863
Institutional quality	.2522467**		.2055862	.5083921*	1.745134**
Land locked dummy	-.0216219		-.320242	-	-9.573455***
Institutiaonal quality squared	-.0275735*		-.0194274	-.0638601*	-.212283
Constant	1.216863		1.337859	.1288688***	54.15776***
R2	0.2883	Within R2	0.2793		
Adjusted R2	0.2507	Between R2	0.0799		
		Overall R2	0.1500		
Numberof observations	320		320	223	372
Sargan/hansan test				0.0001	0.1401
Ac test of order 1				0.0000	0.0027
Ac test of order 2				0.7847	0.5392

Notes:

- 'WG' is fixed effect or within group estimation.
- The figures reported for the sargan test and difference sargan tests are the p-values of for the null hypothesis, valid specification. Difference sargan tests the additional instruments used by system GMM estimator.
- '*', '**', and '***' show the significance of the corresponding variable at 10%, 5% and 1% level respectively.
- Time dummies are included in all the estimation technique
- AC test for order 1 and 2 is Arellano-Bond test that average autocovariance in residuals of order 1 and 2 are 0.

The ordinary least square (OLS) estimator of the coefficients of the lagged dependent variable and some of the endogenous variables is inconsistent due to the presence of individual effects. In the presence of positive correlation between the lagged dependent variable and the permanent country effect, omitting unobserved time invariant country specific effects in a dynamic panel data model will cause OLS level estimates to be biased upward and inconsistent. Standard results for omitted variable bias indicate that, at least in large samples, the OLS levels estimator is biased upwards (Bond, 2002).

The within group estimator eliminates this sort of inconsistency by transforming the equation but it is also inconsistent. (This is discussed in the last chapter). In fact these two estimates are biased in opposite direction.

First difference GMM estimation technique is also applied to the model which is usually believed to suit such circumstances. But the difference GMM estimate of the coefficient on the lagged value of the dependent variable (-0.1059483) lies below the corresponding within groups estimate (-0.0832133) which itself is likely to be seriously biased downwards in a short panel like ours.

In addition, even though the Arellano-bond test for Autocovariances of order l and 2 are in harmony with the application of difference GMM, (the auto covariance that is detected in the first order residual vanishes in the second order residual), the Sargan test statistic (withp value of 0.0001) tells us to reject the null hypothesis of over identification even at 1% level of significance violating the validity of the instruments used.

Table 4.6: Regression result of the growth model using different estimation techniques for Sub-Saharan Africa Sample.

Dependent variable is the growth rate of real GDP per-capita					
Independent variables	OLS		WG	DIF-GMM	SYS-GMM
Lagged dep variable	.1885647***		-.0937743	-.1163293	.0625154
Initial GDP of the period	-.0000159		-.0000931	-1.05578**	-7.878814***
gross capital formation	.0213823***		.0391557***	.0224938**	.1917314***
Population growth	.0557257		.3323006*	.5665185**	1.382493**
Life expectancy	.0166828		.0479609	-1.438678	-4.310745
Institutional quality	-.0963097		.041882	.3332725	1.011526*
Land locked dummy	.0588657		-.3252944	-	-10.8994***
Institutiaonal quality squared	.020545		.0031799	-.0419103	-.1732813
Constant	.8383365		.5453881	.1305655***	77.88611***
R2	0.2799	Within R2	0.3023		
Adjusted R2	0.2331	Between R2	0.0461		
		Overall R2	0.1361		
Numberof observations	263		263	183	316
Sargan/hansan test				0.0011	0.1270
Ac test of order 1				0.0000	0.0014
Ac test of order 2				0.8437	0.4155

Notes for table 4.3 is also applicable for this table

In the only African dataset, institutional quality is found to exert an insignificant impact on growth in all of the three estimation techniques (OLS, within groups and DIF-GMM). The only variable that appears to be significantly explaining GDP growth is gross capital formation which is used as a proxy for investment.

Initial level of GDP is found to be negative and significant in the DIF-GMM estimator for both cases. (for the whole dataset and for only African sample). This result is in sharp contrast with the result from the earlier regressions and agrees with convergence hypothesis that holding other variables constant, low income countries tend to grow more rapidly than those with higher initial income levels. The coefficient estimates of life expectancy at birth which serves as a proxy for human capital is insignificant for all the cases and sometimes has unexpected sign. Comparison of estimates derived by DIF-GMM indicates that, while the impact of initial level of GDP, gross capital formation, and population growth on GDP growth is significant, similar and slightly higher in only African dataset than for the entire set of countries, the impact of institutional quality has turned out to be insignificant for the only African dataset. This result shows us that improvement in institutional quality has not yield the same significant effect in terms of GDP growth for Sub-Saharan African countries as it has for the entire set of countries.

The weakness of difference GMM estimation technique also works for the estimation that used the only African dataset. The difference GMM estimate of the coefficient of the lagged value of the dependent variable (-0.1163293) lies below the within groups estimate of the corresponding coefficient, (-0.0937743) suggesting once again the possibility of serious finite sample bias here. Given the time series property of output (GDP), there is a suspect that this serious finite sample bias is associated with weak instruments.

The sargan test of overidentification and the Arellano-bond test for autocovariances also tell us basically the same thing as the above one. Even if there is autocovariance of first order it disappears in the second order. But the sargan test of overidentification with p value of (0.0011) tells us to reject the null hypothesis of overidentification.

Therefore as mentioned above, the result of the DIF-GMM estimation is inconsistent and biased in situation like this. When the time series is persistent and the number of time series observation is small the estimator from this method is poorly behaved. This occurs when the lagged levels of the series are only weakly correlated with subsequent first differences so that the instruments available for the first differenced equation are weak. And the result of System GMM estimator that is suggested by Arellano and Bover (1995) and Blundell and Bond (1998) that provides more consistent estimate is presented in the final column of both tables (tables 4.3 and 4.4).

In evaluating the performance of the System GMM estimator, just like the above case (DIF-GMM), the bias observed in the pooled OLS and the within group estimator is used as a reference to define an approximate upper and lower bound for the autoregressive parameter. Thus the coefficient of the lagged dependent variable in the System GMM (0.0302873) lies between the corresponding coefficients of the pooled OLS (0.2431599) and of the within group estimate (-0.0832133). This fact is also true for the estimation result of the only African dataset. The system GMM estimate, (0.0625154) for this variable, lies between the pooled OLS result (0.1885647) and the within group estimator (-0.0937743) for an only African dataset.

Moreover, the high p values (0.1401 and 0.1270[22]) of Sargan test of over-identifying restriction under the null hypothesis of the validity of instruments, suggest in both cases that we cannot reject the null hypothesis and the instruments used in the model are appropriate.

In addition, the test in the System GMM for first order autocorrelation in the first differenced residual, rejects the null hypothesis while tests for the second order

[22] These figures are for the overall sample and for an only African data set respectively.

autocorrelation fails to reject the null hypothesis of no autocorrelation as required. Looking to the coefficients of the model under this estimation technique, all the variables that entered in to the equation as explanatory variables are significant except for life expectancy at birth which serves as a proxy for human capital. The estimated coefficient of this variable is insignificant in all the estimation methods and has unexpected negative sign. Hence this variable does not explain the growth differential between the two regions.

The coefficient of the initial level of GDP was persistently negative and highly significant supporting conditional convergence hypothesis between rich and poor countries. This implies that, holding institutional quality, investment, human capital, population growth rate constant, low income countries tend to grow more rapidly than those with hither initial income levels.

Gross capital formation which is used as a proxy for investment rate of countries was significant at 99% level in all the regressions indicating that higher level of investment enhances economic growth. Comparison of the estimates of the impact of gross capital formation between the two groups tells us that gross capital formation is one of the factors explaining the growth differential between the two groups. This validates the existing theory that countries level of investment is one of the determinants of its economic growth. The basic neoclassical growth model of Solow (1956) and Swan (1956) predicts that one of the key determinants of growth is the investment rate. Countries that grow quickly are countries that invest a substantial fraction of their GDP and countries that fail to grow are those that fail to invest. Of course there are other investment theories suggesting that it is not the overall level of investment that matters but the quality and the efficiency of investment. Doppelhoffer et al.(2002) found that public investment is one of the robust determinant of growth and it is in fact negatively correlated with growth because of the inefficiency that are associated with public investment (because like all public expenditures, it has to be financed by distortionary taxes) outweighs their positive return.

The landlocked dummy variable (used as a proxy for geographical impact on growth) was significant and negative for the System GMM estimator in both cases. This result is consistent with the view of Sachs and Warner that countries which are isolated from world markets (land locked countries) face higher costs for any kind of international activities just because they don't have ocean ports. Besides, there is a well-established literature on the effects of geography (including the influence of location) on development[23]. This impact of lack of oceanic ports on economic growth measured by annual percentage growth rate of GDP is slightly higher for African countries than for the entire set of countries. The set of countries that are included in the study and that are outside Africa do have oceanic ports, this fact suggest that countries that lack such oceanic ports in Africa (16 countries in the dataset which is about 37 percent of the countries included in the dataset) have a disadvantageous geographical location and it contributes to the poor economic outcomes in those parts of Africa.

Coming to the variable of focus (institutional quality), the impact of institutional quality on economic growth was positive and significant for the overall sample and for the only African dataset. Given the data at hand this result shows that, this outcome is not new and it validates a previously held hypothesis that, institutional quality as measured by the EFW index exerts a major impact on income differences and long-term growth rate.

Comparison of the estimates derived from the two groups, tells us that there is difference in the estimates of the impact of institutional quality on growth (1.745134 for African dataset and 1.011526 for the overall sample). The impact is higher for African countries than for the entire set of countries. This result shows that institutional quality has been providing at least as much benefit in terms of GDP growth for African countries as for the other set of countries[24]. This result is also supported by the negative coefficient of the square of institutional variable indicating that the effect of institutional quality on growth is lower for

[23] See, for example, Macfarlan et al. (2001), Sachs and Warner (2001), Diamond (1997), Gwartney et al. (2004).
[24] It should be noted here that the EFW index is an ordinal index and that the change in this index from one point to another say from 7 to 6 is not the same improvement as a change from 3 to 2.

countries having higher GDP. The result shows us that the difference in economic growth rate and thereby per-capita income between sets of countries found in African and the overall sample is partly explained by the difference in the measure of institutional quality. Even though the measure of institutional quality is an ordinal scale thereby making it difficult to compare the effect of moving from an average EFW index of the SSA countries to the average EFW index of East Asian countries, it is obvious from the above result that one of the factors contributing to the difference between the economic performance of SSA countries from the other set of countries is the quality of institution as measured by the EFW index.

In general, the above analysis using the Solow growth model augmented with human capital and measure of institutional quality help us to see the effect of variables included in the model on economic growth and it reveals the following. The cross country variation in economic growth and the difference in economic growth between the two regions under investigation is explained by the difference in the level of Gross capital formation, initial level of GDP, population growth, geography (as proxied by landlocked dummy), and last but not least the level of institutional quality.

The measure of institutional quality employed in this study (EFW index) is closely related to what Hall and Jones (1999) as cited in Gwartney et al. (2004) refer to as "social infrastructure". They claim that this social infrastructure is present when a country encourage productive behaviors like accumulation of skills or the development of new goods and production and discourage predatory activities such as rent seeking, corruption, and theft. SSA countries do not have sufficient social structure which can be seen from the lower average EFW index of these countries compared to the East Asian countries. The result that we got from the above analysis tells us that Africa's slow economic growth compared to the East Asian growth is partially explained by poor institutional structure.

According to the result, if African countries improve their institutional structures, it would be possible for them to register higher economic growth and they have a better chance to improve their institutional structure by simply mimicking the institutional structure of countries that have better institutional quality.

Chapter Five

Summary and Conclusion

This paper has reviewed what Sub-Saharan countries economic growth looks like on average, how it is related to the growth experience of some selected East Asian countries and study if institutions have part in explaining the difference between the two regions.

The growth experience of Sub-Saharan Africa countries has not beet satisfactory up until very recently. In contrast, East Asian countries have shown a remarkable economic growth for the past decades. There are some reasons that are mentioned in the paper that cause the difference in the economic performance of the two regions. One of the factors that also gained attention recently in explaining the growth differential of countries is the quality of institutions.

A well established literature has found that institutions matter for growth. The paper has used two methods in exploring the impact of those factors in explaining the growth differential. Models that include both investment rate and measures of institutional quality as explanatory variables will ignore the indirect impact of institution on growth through investment and therefore underestimate the role of institutions explaining growth. In order to account for this problem therefore, the first method used OLS approach but use two different techniques (as discussed in section 4.2.1) to isolate the independent effect of institutions. And we have found that the impact of institutional quality on growth is higher for the only SSA sample than for the overall sample. This may be due to the fact that most of the SSA countries in the study have poor institutional quality as measured by the EFW rating compared to the other countries in the study making the impact higher. This result is justified by the negative coefficient of the square of institutional quality variable in all of the regressions made. Second we have used a more appropriate GMM estimation technique in trying to address the weakness of other studies that used other methodologies like Ordinary least squares, random and fixed effects panel estimations to growth models.

The first regression illuminates the impact of institution on investment as measured by gross capital formation. Countries that have higher quality of institution, as measured by the EFW index attract higher level of investment. The result that we got confirms this hypothesis.

The result presented for the two methods are almost comparable and they indicate that the cross country difference as well as the regional difference in the quality of institution as measured by the EFW index exerts a major impact in income and growth differences.

The factors that have contributed to higher growth in East Asia, but in which SSA has been lagging behind (or been in a disadvantageous position), include gross capital formation, population growth, geography (as proxied by landlockedness) and the quality of institutions which are very important in determining the growth performance of the two regions. One factor, life expectancy at birth which is used to proxy human capital is found to have an insignificant impact in explaining the growth differential.

Sub-Saharan Africa countries lack adequate social structure that encourages productive behaviors like accumulation of skills, development of new goods and production, and discourages predatory activities like corruption, rent seeking and theft. Compared to these countries East Asian countries are found at a better position benefiting from the better social infrastructure

The major concern of this paper, Institutional quality has been more important in determining growth, in SSA subgroup than for the entire sample. The coefficient estimate of this variable in the OLS regression and System GMM approach is higher for the only African sample indicating that if Sub-Saharan Africa countries improve their poor institutional structures, the impact in terms of securing higher level of economic growth would be higher than what the East Asian countries benefit if they improve their institutional quality by the same amount. Thus the Sub-Saharan countries should divert some of their efforts and go beyond factors which economists have reached some kind of consensus on, contributing to a higher economic growth[25] and build up the social infrastructure (institutional quality) that encourage productive behavior for registering higher economic growth.

[25] Factors like checking population growth, technological innovation, and investment in different factors of production.

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ANNEX A

TABLE A1: List of Countries in the Sample of the Study

Angola
Benin
Botswana
Burkina Faso
Burundi
Cameroon
Cape Verde
Central African Republic
Chad
Congo, Dem. Rep.
Congo, Rep.
Cote d'Ivoire
Equatorial Guinea
Ethiopia
Gabon
Gambia, The
Ghana
Guinea
Guinea-Bissau
Kenya
Lesotho
Madagascar
Malawi
Mali
Mauritania
Mauritius
Mozambique
Namibia
Niger
Nigeria
Rwanda
Sao Tome and Principe
Senegal
Seychelles
Sierra Leone
South Africa
Sudan
Swaziland
Tanzania
Togo
Uganda
Zambia
Zimbabwe
Hong Kong, China
Japan
Korea, Dem. Rep.
Korea, Rep.
Singapore
India
Indonesia
New Zealand
Thailand

Table A2: Description of the Variables Used In the Study

Variable	Description
Growth rate of GDP per capita	Annual percentage change in real GDP per capita, three years average
$Dependent_{t-1}$	Growth rate of GDP per capita lagged one period
Initial condition	Real GDP per capita at the start of each period
Population growth	Annual percentage change in total population
Human capital	Life expectancy at birth in years
Investment	Gross capital formation/ gross domestic investment
Geographical variable	Land locked dummy variable
Institutional quality	The average of political rights and civil liberties measures of the freedom house, each measured on a 1-7 scale.

ANNEX B

Table B1: Correlation between Institutional Measure and Economic Performance

	lngdpg	avgdp	stdgdpg	inst
Lngdpg	1.0000			
stdgdpg	-0.2090	1.0000	1.0000	
avgdp	0.4580	-0.3587	1.0000	
inst	-0.4525	0.5621	-0.5857	1.0000

Table B2: OLS Regression result of investment and growth equations.

Table B2.1 Linear Regression of Investment Equation for All the Countries in the Dataset

```
regress grosscapitalformationasapercenta instiscalechanged initialinstscalechanged

      Source |       SS       df       MS              Number of obs =     429
-------------+------------------------------           F(  2,   426) =    9.26
       Model |  1865.51616     2  932.758078           Prob > F      =  0.0001
    Residual |  42928.8861   426  100.772033           R-squared     =  0.0416
-------------+------------------------------           Adj R-squared =  0.0371
       Total |  44794.4023   428  104.659818           Root MSE      =  10.039

------------------------------------------------------------------------------
grosscapit~a |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
instiscale~d |   1.267703   1.062276     2.13   0.033     .1797477    4.355659
initialins~d |  -.9660032    1.01377    -0.95   0.341    -2.958617    1.026611
       _cons |   17.50055   1.050163    16.66   0.000      15.4364    19.56469
```

Table B2.2 Linear Regression of Solow Growth Equation with Fitted Value of Investment from Regression in Table B2.1 for the entire Dataset

```
regress gdpgrowthfromwdi initialgdp lnofpop lnoflife lldummy fitinvest

      Source |       SS       df       MS              Number of obs =     425
-------------+------------------------------           F(  5,   419) =    2.21
       Model |  1756.29200     5  351.258411           Prob > F      =  0.0520
    Residual |  5762.08100   419   13.751986           R-squared     =  0.2336
-------------+------------------------------           Adj R-squared =  0.2242
       Total |   7518.3731   424   17.732012           Root MSE      =  4.1811

------------------------------------------------------------------------------
gdpgrowthf~i |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  initialgdp |   .2682583   .0000497     1.09   0.275    -.0000434    .0001521
     lnofpop |   .9652064   .3971202     2.42   0.006     .1807617    1.741954
    lnoflife |  -.5972187  1.318599     0.33    0.073    -2.151681    3.032104
     lldummy |  -.0431089   .4648903    -0.59   0.056    -1.187848    .6397673
   fitinvest |  1.974506    .1185001     1.70   0.009    -.0318227    .4340348
       _cons |  3.212623    5.203399    -0.61   0.543    -13.39529    7.060748
-------------+----------------------------------------------------------------
```

Table B2.3 Linear Regression of Solow Growth Equation with Fitted Value of Investment from Regression In Table B2.1 For the SSA dataset

```
by ssa, sort : regress gdpgrowthfromwdi initialgdp lnofpop lnoflife lldummy
fitinvest


ssa = 1

      Source |       SS       df       MS              Number of obs =     354
-------------+------------------------------           F(  5,   356) =    2.05
       Model |  286.580300     5  57.3160663           Prob > F      =  0.0711
    Residual |  6602.36913   356  18.5459821           R-squared     =  0.0416
-------------+------------------------------           Adj R-squared =  0.0371
       Total |  6888.94977   361  19.0829634           Root MSE      =   4.337

------------------------------------------------------------------------------
gdpgrowthf~i |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  initialgdp |   -.078002   .0001208     1.06   0.291    -.0001099    .0003654
     lnofpop |   .9845255   .4789854     1.86   0.063    -.0502271    1.833766
    lnoflife |   1.134176    1.91281     0.78   0.436    -2.271445     5.25221
     lldummy |   -.346260     .50491     0.31   0.760     -.838717    1.147245
   fitinvest |   1.936084   .1395008     1.56   0.120    -.0567714    .4919272
       _cons |   -1.29025   7.186531    -1.12   0.265    -22.15487    6.111912
```

Table B2.4 OLS regression of Solow Growth Equation with the residual from the investment equation for the entire dataset

```
regress lnofinitialgdp gdpgrowthfromwdi  lnofpop lnoflife lldummy
instiscalechanged initialinstscalechanged resid

    Source |       SS       df       MS              Number of obs =     417
-------------+------------------------------           F(  7,   409) =   77.95
       Model |  243.055694     7   34.722242           Prob > F      =  0.0000
    Residual |  182.197145   409  .445469793           R-squared     =  0.5716
-------------+------------------------------           Adj R-squared =  0.5642
       Total |  425.252839   416   1.0222424           Root MSE      =  .66744

------------------------------------------------------------------------------
lnofinitia~p |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
gdpgrowthf~i |  -.0741103    .009053    -0.27   0.784     -.020281    .0153116
     lnofpop |  -.5735586   .0587414    -9.76   0.000    -.6890313   -.4580859
    lnoflife |   1.855921   .2094416     8.86   0.000     1.444204    2.267637
     lldummy |  -.1128815    .074073    -3.64   0.654    -.4154931   -.1242706
instiscale~d |   1.005293   .0738657     2.79   0.066      .060887    .3512947
initialins~d | -.04485298   .0682787    -0.50   0.615    -.1685662    .0998757
       resid |   .2122366     .00387     4.41   0.000     .0094718     .024687
       _cons |   6.571146   .8040152     0.41   0.684    -1.253456     1.90758
------------------------------------------------------------------------------
```

Table B2.5 OLS regression of Solow Growth Equation with the residual from Investment equation for the SSA dataset

```
by ssa, sort: regress lnofinitialgdp gdpgrowthfromwdi  lnofpop lnoflife
lldummy insticalechanged initialinstscalechanged resid

ssa = 1

      Source |       SS       df       MS              Number of obs =     354
-------------+------------------------------           F(  7,   346) =   51.02
       Model |  104.139742     7  14.877106           Prob > F      =  0.0000
    Residual |  100.882286   346   .2915673           R-squared     =  0.5079
-------------+------------------------------           Adj R-squared =  0.4980
       Total |  205.022028   353  .580798946           Root MSE      =  .53997

------------------------------------------------------------------------------
lnofinitia~p |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
gdpgrowthf~i | -.02931785   .0075597    -0.77   0.443    -.0206759    .0090617
     lnofpop |  -.4112009   .0573096    -7.18   0.000    -.5239199    -.298482
    lnoflife |   2.588398   .2167435    11.94   0.000     2.162097    3.014699
     lldummy |  -.2978653   .0633415    -0.90   0.368     -.181696    .0674696
instiscale~d |   1.103713   .0628962     1.00   0.059    -.0609472    .1864668
initialins~d |  -0.484879   .0563768     0.26   0.794    -.0961703    .1255986
       resid |  .02076396   .0033013     3.23   0.061     .0041543    .0171408
       _cons |  -2.586886   .8337161    -3.10   0.002    -4.226676   -.9470966
------------------------------------------------------------------------------
```

Table B3: Growth Regression Results of the Solow Model Using Within Group, Difference and System GMM Methods.

Table B3.1 OLS regression results of the growth model for the entire dataset

reg lngdpg lngdpglag initialgdp grosscapitalformationasapercenta lnofpop lnoflife instiscalechanged lldummy inst2 d1 d2 d3 d4 d5 d6 d7 d8

Source	SS	df	MS
Model	60.5677772	16	3.78548608
Residual	149.537306	303	.493522463
Total	210.105083	319	.658636625

Number of obs =	320
F(16, 303) =	7.67
Prob > F =	0.0000
R-squared =	0.2883
Adj R-squared =	0.2507
Root MSE =	.70251

lngdpg	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdpglag	.2431599	.0539697	4.51	0.000	.136957	.3493628
initialgdp	-8.85e-06	9.20e-06	-0.96	0.337	-.000027	9.25e-06
grosscapit~a	.0248435	.0042178	5.89	0.000	.0165436	.0331434
lnofpop	.1227606	.0884201	1.39	0.166	-.0512346	.2967558
lnoflife	-.2509364	.2520371	-1.00	0.320	-.7469011	.2450284
instiscale~d	.2522467	.1226674	2.06	0.041	.0108588	.4936345
lldummy	-.0216219	.0915931	-0.24	0.814	-.201861	.1586171
inst2	-.0275735	.015869	-1.74	0.083	-.058801	.0036539
d1	-.5833278	.1705994	-3.42	0.001	-.9190374	-.2476182
d2	-.3873822	.1732385	-2.24	0.026	-.728285	-.0464793
d3	-.195646	.1682179	-1.16	0.246	-.5266692	.1353773
d4	-.5150215	.1629125	-3.16	0.002	-.8356045	-.1944384
d5	-.8276431	.1673619	-4.95	0.000	-1.156982	-.4983044
d6	.0016878	.1636437	0.01	0.992	-.3203343	.3237098
d7	-.4086614	.1572315	-2.60	0.010	-.7180654	-.0992574
d8	-.2396326	.1622425	-1.48	0.141	-.5588972	.079632
_cons	1.216863	.9694861	1.26	0.210	-.6909155	3.124641

Table B3.2 OLS regression results of the growth model for the SSA dataset

```
by  ssa, sort: reg lngdpg  lngdpglag initialgdp  grosscapitalformationasapercenta
lnofpop lnoflife instiscalechanged  lldummy inst2 d1 d2 d3 d4 d5 d6 d7 d8
ssa = 1

      Source |       SS       df       MS              Number of obs =     263
-------------+------------------------------           F( 16,   246) =    5.98
       Model |  49.8598735    16  3.11624209           Prob > F      =  0.0000
    Residual |  128.248121   246  .521333824           R-squared     =  0.2799
-------------+------------------------------           Adj R-squared =  0.2331
       Total |  178.107994   262  .679801505           Root MSE      =  .72203

------------------------------------------------------------------------------
      lngdpg |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   lngdpglag |   .1885647   .0615433     3.06   0.002     .0673457    .3097837
  initialgdp |  -.0000159   .0000225    -0.70   0.482    -.0000602    .0000285
grosscapit~a |   .0213823   .0045678     4.68   0.000     .0123854    .0303793
     lnofpop |   .0557257   .1158351     0.48   0.631    -.1724293    .2838807
    lnoflife |   .0166828   .4036759     0.04   0.967    -.7784192    .8117847
instiscale~d |  -.0963097   .1637564    -0.59   0.557    -.4188532    .2262338
     lldummy |   .0588657   .1016458     0.58   0.563    -.1413414    .2590727
       inst2 |    .020545   .0225738     0.91   0.364    -.0239175    .0650076
          d1 |  -.6303498   .1979215    -3.18   0.002    -1.020187   -.2405129
          d2 |  -.4315438   .2061155    -2.09   0.037    -.8375201   -.0255675
          d3 |  -.2639694    .199151    -1.33   0.186    -.6562281    .1282892
          d4 |  -.6007008   .1871704    -3.21   0.002    -.9693617   -.2320399
          d5 |  -.9384846   .1952185    -4.81   0.000    -1.322998   -.5539717
          d6 |   .0962782   .1884436     0.51   0.610    -.2748905     .467447
          d7 |  -.2843898   .1757102    -1.62   0.107    -.6304781    .0616986
          d8 |  -.1899281   .1841818    -1.03   0.303    -.5527026    .1728464
       _cons |   .8383365   1.528494     0.55   0.584    -2.172268    3.848941
------------------------------------------------------------------------------
```

Table B3.3 Within group regression results of the growth model for the entire dataset

```
xtreg  lngdpg  lngdpglag initialgdp  grosscapitalformationasapercenta
lnofpop lnoflife instiscalechanged lldummy inst2 d1 d2 d3 d4 d5 d6 d7 d8,
fe

Fixed-effects (within) regression               Number of obs      =       320
Group variable (i): countrycode                 Number of groups   =        50

R-sq:  within  = 0.2793                         Obs per group: min =         2
       between = 0.0799                                        avg =       6.4
       overall = 0.1500                                        max =         9

                                                F(16,254)          =      6.15
corr(u_i, Xb)  = -0.4284                        Prob > F           =    0.0000

------------------------------------------------------------------------------
      lngdpg |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   lngdpglag |  -.0832133   .0598543    -1.39   0.166    -.2010872    .0346607
  initialgdp |  -.0000494   .0000255    -1.94   0.054    -.0000996    8.71e-07
grosscapit~a |   .0371943   .0063692     5.84   0.000     .0246511    .0497375
     lnofpop |   .3188732   .1328801     2.40   0.017     .0571861    .5805603
    lnoflife |  -.1972142   .3283201    -0.60   0.549    -.8437906    .4493622
instiscale~d |   .2055862   .2080933     0.99   0.324    -.2042219    .6153942
     lldummy |   -.320242   .7259294    -0.44   0.659    -1.749849    1.109365
       inst2 |  -.0194274   .0296578    -0.66   0.513    -.0778339     .038979
          d1 |  -.5705481   .1773218    -3.22   0.001    -.9197564   -.2213399
          d2 |  -.4876122    .177858    -2.74   0.007    -.8378763    -.137348
          d3 |   -.320462   .1744889    -1.84   0.067    -.6640914    .0231673
          d4 |  -.5109762   .1655427    -3.09   0.002    -.8369874    -.184965
          d5 |  -.9082765   .1703446    -5.33   0.000    -1.243744   -.5728087
          d6 |  -.1878024   .1561198    -1.20   0.230    -.4952566    .1196518
          d7 |  -.3327788   .1464892    -2.27   0.024    -.6212669   -.0442906
          d8 |  -.2165617   .1521104    -1.42   0.156    -.5161201    .0829966
       _cons |   1.337859    1.35789     0.99   0.325    -1.336298    4.012015
-------------+----------------------------------------------------------------
     sigma_u |  .55274634
     sigma_e |  .63225387
         rho |  .43320574   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(49, 254) =     2.45             Prob > F = 0.0000
```

Table B3.4 Within group regression results of the growth model for the SSA dataset

```
by  ssa, sort:  xtreg  lngdpg  lngdpglag initialgdp
grosscapitalformationasapercenta lnofpop lnoflife instiscalechanged
lldummy inst2 d1 d2 d3 d4 d5 d6 d7 d8, fe
-> ssa = 1

Fixed-effects (within) regression               Number of obs      =       263
Group variable (i): countrycode                 Number of groups   =        43

R-sq:  within  = 0.3023                         Obs per group: min =         2
       between = 0.0461                                        avg =       6.1
       overall = 0.1361                                        max =         9

                                                F(16,204)          =      5.53
corr(u_i, Xb)  = -0.4592                        Prob > F           =    0.0000

------------------------------------------------------------------------------
      lngdpg |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
   lngdpglag |  -.0937743   .0662312    -1.42   0.158    -.2243597    .0368112
  initialgdp |  -.0000931   .0000678    -1.37   0.171    -.0002268    .0000406
grosscapit~a |   .0391557   .0070694     5.54   0.000     .0252172    .0530942
     lnofpop |   .3323006   .1959407     1.70   0.091     -.054028    .7186293
    lnoflife |   .0479609   .7233944     0.07   0.947    -1.378328    1.474249
instiscale~d |    .041882   .2396941     0.17   0.861    -.4307135    .5144775
     lldummy |  -.3252944   .7591816    -0.43   0.669    -1.822143    1.171554
       inst2 |   .0031799    .035385     0.09   0.928    -.0665874    .0729472
          d1 |  -.5354043   .2012723    -2.66   0.008    -.9322449   -.1385636
          d2 |  -.4541928     .20761    -2.19   0.030    -.8635293   -.0448563
          d3 |  -.3222861   .2057504    -1.57   0.119     -.727956    .0833838
          d4 |  -.5499298   .1936359    -2.84   0.005    -.9317141   -.1681455
          d5 |  -1.006004   .2032518    -4.95   0.000    -1.406748   -.6052606
          d6 |  -.1054254   .1843119    -0.57   0.568     -.468826    .2579751
          d7 |  -.2246653   .1689724    -1.33   0.185    -.5578217     .108491
          d8 |   -.117669   .1793388    -0.66   0.512    -.4712644    .2359264
       _cons |   .5453881   2.806894     0.19   0.846    -4.988854     6.07963
-------------+----------------------------------------------------------------
     sigma_u |  .57667676
     sigma_e |  .65727038
         rho |  .43496377   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(42, 204) =     2.21             Prob > F = 0.0001
```

Table B3.5 Difference GMM estimation results of the growth model for the entire dataset

```
xtabond lngdpg lnofinitialgdp grosscapitalformationasapercenta lnofpop lnoflife
instiscalechanged inst2 lldummy d1 d2 d3 d4 d5 d6 d7 d8, lags(1) maxldep(3)
maxlags(3) artests(2)
note: d1 dropped due to collinearity
note: d2 dropped due to collinearity

Arellano-Bond dynamic panel-data estimation      Number of obs      =       223
Group variable (i): countrycode                  Number of groups   =        49

                                                 Wald chi2(13)      =     69.91

Time variable (t): period                        Obs per group: min =         1
                                                                avg =   4.55102
                                                                max =         7

One-step results
------------------------------------------------------------------------------
    D.lngdpg |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lngdpg |
         LD. |  -.1059483   .0735302    -1.44   0.150    -.2500649    .0381683
lnofinitia~p |
         D1. |  -.9814541   .4337887    -2.26   0.024    -1.831664   -.1312438
grosscapit~a |
         D1. |   .0224773   .0084387     2.66   0.008     .0059378    .0390169
     lnofpop |
         D1. |   .3744777   .1726037     2.17   0.030     .0361807    .7127746
    lnoflife |
         D1. |  -.3875873   .3970476    -0.98   0.329    -1.165786    .3906116
instiscale~d |
         D1. |   .5083921   .2827725     1.80   0.072    -.0458318    1.062616
       inst2 |
         D1. |  -.0638601   .0388651    -1.64   0.100    -.1400343    .0123141
     lldummy |
         D1. |  (dropped)
          d3 |
         D1. |   .1586858   .1421743     1.12   0.264    -.1199706    .4373423
          d4 |
         D1. |  -.1536887   .1426878    -1.08   0.281    -.4333516    .1259743
          d5 |
         D1. |  -.6728788   .1457566    -4.62   0.000    -.9585564   -.3872012
          d6 |
         D1. |   -.097292   .1351009    -0.72   0.471    -.3620848    .1675009
          d7 |
         D1. |   -.257866   .1246622    -2.07   0.039    -.5021994   -.0135327
          d8 |
         D1. |  -.1688322   .1388117    -1.22   0.224    -.4408982    .1032338
       _cons |   .1288688    .042364     3.04   0.002      .045837    .2119007
------------------------------------------------------------------------------
Sargan test of over-identifying restrictions:
         chi2(17) =    49.15         Prob > chi2 = 0.0001

Arellano-Bond test that average autocovariance in residuals of order 1 is 0:
         H0: no autocorrelation   z =  -4.68   Pr > z = 0.0000
Arellano-Bond test that average autocovariance in residuals of order 2 is 0:
         H0: no autocorrelation   z =   0.27   Pr > z = 0.7847
```

Table B3.6 Difference GMM estimation results of the growth model for the SSA dataset

```
by  ssa, sort:  xtabond lngdpg lnofinitialgdp
grosscapitalformationasapercenta lnofpop lnoflife instiscalechanged inst2
lldummy d1 d2 d3 d4 d5 d6 d7 d8, lags(1) maxldep(3) maxlags(3) artests(2)

-> ssa = 1
note: d1 dropped due to collinearity
note: d2 dropped due to collinearity

Arellano-Bond dynamic panel-data estimation     Number of obs      =       183
Group variable (i): countrycode                 Number of groups   =        42

                                                Wald chi2(13)      =     66.16

Time variable (t): period                       Obs per group: min =         1
                                                               avg =  4.357143
One-step results                                               max =         7
------------------------------------------------------------------------------
    D.lngdpg |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lngdpg |
         LD. |  -.1163293   .0754804    -1.54   0.123    -.2642681    .0316095
lnofinitia~p |
         D1. |   -1.05578   .5141078    -2.05   0.040    -2.063413    -.048147
grosscapit~a |
         D1. |   .0224938   .0088649     2.54   0.011     .0051188    .0398687
     lnofpop |
         D1. |   .5665185   .2502044     2.26   0.024     .0761269     1.05691
    lnoflife |
         D1. |  -1.438678   1.065484    -1.35   0.177    -3.526989    .6496336
instiscale~d |
         D1. |   .3332725   .3077204     1.08   0.279    -.2698484    .9363934
       inst2 |
         D1. |  -.0419103   .0435626    -0.96   0.336    -.1272914    .0434707
     lldummy |
         D1. |  (dropped)
          d3 |
         D1. |   .1441159   .1679661     0.86   0.391    -.1850917    .4733235
          d4 |
         D1. |  -.2356936   .1663458    -1.42   0.157    -.5617255    .0903382
          d5 |
         D1. |  -.8300303   .1736988    -4.78   0.000    -1.170474   -.4895869
          d6 |
         D1. |   -.091343   .1564015    -0.58   0.559    -.3978844    .2151983
          d7 |
         D1. |  -.2409371   .1426722    -1.69   0.091    -.5205695    .0386952
          d8 |
         D1. |  -.0217402   .1635314    -0.13   0.894    -.3422558    .2987754
       _cons |   .1305655   .0441768     2.96   0.003     .0439805    .2171505
------------------------------------------------------------------------------
Sargan test of over-identifying restrictions:
        chi2(17)  =    40.55          Prob > chi2 = 0.0011

Arellano-Bond test that average autocovariance in residuals of order 1 is 0:
        H0: no autocorrelation    z =  -4.10   Pr > z = 0.0000
Arellano-Bond test that average autocovariance in residuals of order 2 is 0:
        H0: no autocorrelation    z =   0.20   Pr > z = 0.8437
```

Table B3.7 System GMM estimation results of the growth model for the entire dataset

```
xtdpdsys lngdpg lnofinitialgdp lnofpop lnoflife grosscapitalformationasapercenta
instiscalechanged lldummy inst2 d1 d2 d3 d4 d5 d6 d7 d8, lags(1) maxldep(3) maxla
> gs(3) artests(2)
note: d1 dropped because of collinearity

System dynamic panel-data estimation            Number of obs        =       372
Group variable: countrycode                     Number of groups     =        50
Time variable: period

                                                Obs per group:   min =         4
                                                                 avg =      7.44
                                                                 max =         8

Number of instruments =     39                  Wald chi2(15)        =    176.29
                                                Prob > chi2          =    0.0000
One-step results
------------------------------------------------------------------------------
D.lngdpg          Coef.    Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lngdpg
         L1. |   .0302873   .0499933     0.61   0.545    -.0676979    .1282724
lnofinitia~p |  -6.596392   1.072177    -6.15   0.000    -8.697821   -4.494964
     lnofpop |    1.07488   .5561301     1.93   0.053     -.015115    2.164875
    lnoflife |   -.852863   1.925265    -0.44   0.658    -4.626313    2.920587
grosscapit~a |    .203015   .0367195     5.53   0.000     .1310461    .2749838
instiscale~d |   1.745134   1.179012     1.48   0.039    -.5656864    4.055955
     lldummy |  -9.573455   2.850521    -3.36   0.001    -15.16037   -3.986536
       inst2 |   -.212283   .1704143    -1.25   0.213     -.546289     .121723
          d2 |  -2.978527   .7436506    -4.01   0.000    -4.436056   -1.520999
          d3 |  -1.499723   .7627886    -1.97   0.049    -2.994761   -.0046852
          d4 |  -2.134752   .6978391    -3.06   0.002    -3.502491   -.7670124
          d5 |  -3.905798   .6942849    -5.63   0.000    -5.266572   -2.545025
          d6 |  -.9693128   .6587018    -1.47   0.141    -2.260345     .321719
          d7 |  -2.808708   .5853377    -4.80   0.000    -3.955948   -1.661467
          d8 |   -1.26464   .6111352    -2.07   0.039    -2.462443   -.0668368
       _cons |   54.15776   10.74873     5.04   0.000     33.09064    75.22488
------------------------------------------------------------------------------
Instruments for differenced equation
        GMM-type: L(2/4).lngdpg
        Standard: D.lnofinitialgdp D.lnofpop D.lnoflife
                  D.grosscapitalformationasapercenta D.instiscalechanged
D.lldummy
                  D.inst2 D.d1 D.d2 D.d3 D.d4 D.d5 D.d6 D.d7 D.d8
Instruments for level equation
        GMM-type: LD.lngdpg
        Standard: _cons
estat sargan
Sargan test of overidentifying restrictions
        H0: overidentifying restrictions are valid

        chi2(23)     =  30.33053
        Prob > chi2  =    0.1401
Arellano-Bond test for zero autocorrelation in first-differenced errors
  +-----------------------+
  |Order |  z     Prob > z|
  |------+----------------|
  |   1  |-3.0023  0.0027 |
  |   2  |-.61402  0.5392 |
  +-----------------------+
   H0: no autocorrelation
```

Table B3.8 System GMM estimation results of the growth model for the SSA dataset

```
by ssa, sort : xtdpdsys lngdpg lnofinitialgdp lnofpop lnoflife
grosscapitalformationasapercenta instiscalechanged lldummy inst2 d1 d2 d3
d4 d5 d6 d7 d8, lags(1) maxldep(3) maxlags(3) artests(2)
-> ssa = 1
note: d1 dropped because of collinearity
System dynamic panel-data estimation            Number of obs        =        316
Group variable: countrycode                     Number of groups     =         43
Time variable: period
                                                Obs per group:   min =          4
                                                                 avg =   7.348837
                                                                 max =          8
Number of instruments =      39                 Wald chi2(15)        =     159.09
                                                Prob > chi2          =     0.0000
One-step results
```

lngdpg	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lngdpg						
L1.	.0625154	.0538268	1.16	0.245	-.0429831	.1680139
lnofinitia~p	-7.878814	1.419549	-5.55	0.000	-10.66108	-5.096549
lnofpop	1.382493	.6673552	2.07	0.038	.0745005	2.690485
lnoflife	-4.310745	3.883023	-1.11	0.267	-11.92133	3.299841
grosscapit~a	.1917314	.0400229	4.79	0.000	.113288	.2701749
instiscale~d	1.011526	1.362492	0.74	0.058	-1.658909	3.681961
lldummy	-10.8994	3.20471	-3.40	0.001	-17.18051	-4.618282
inst2	-.1732813	.1977605	-0.88	0.381	-.5608849	.2143222
d2	-2.874515	.9376991	-3.07	0.002	-4.712371	-1.036658
d3	-1.693016	.9890601	-1.71	0.087	-3.631538	.2455061
d4	-2.495011	.908323	-2.75	0.006	-4.275292	-.7147307
d5	-4.70294	.9214476	-5.10	0.000	-6.508944	-2.896935
d6	-.5990983	.786597	-0.76	0.446	-2.1408	.9426035
d7	-2.70183	.6711756	-4.03	0.000	-4.017309	-1.38635
d8	-1.067694	.7160731	-1.49	0.136	-2.471172	.3357834
_cons	77.88611	16.91315	4.61	0.000	44.73695	111.0353

```
Instruments for differenced equation
        GMM-type: L(2/4).lngdpg
        Standard: D.lnofinitialgdp D.lnofpop D.lnoflife
                  D.grosscapitalformationasapercenta D.instiscalechanged
D.lldummy
                  D.inst2 D.d1 D.d2 D.d3 D.d4 D.d5 D.d6 D.d7 D.d8
Instruments for level equation
        GMM-type: LD.lngdpg
        Standard: _cons
estat sargan
Sargan test of overidentifying restrictions
        H0: overidentifying restrictions are valid
         chi2(23)     =  30.83107
        Prob > chi2  =    0.1270
Arellano-Bond test for zero autocorrelation in first-differenced errors
```

Order	z	Prob > z
1	-3.1878	0.0014
2	-.81426	0.4155

H0: no autocorrelation

Table B3.8 System GMM estimation results of the growth model for the SSA dataset

```
by ssa, sort : xtdpdsys lngdpg lnofinitialgdp lnofpop lnoflife
grosscapitalformationasapercenta instiscalechanged lldummy inst2 d1 d2 d3
d4 d5 d6 d7 d8, lags(1) maxldep(3) maxlags(3) artests(2)
-> ssa = 1
note: d1 dropped because of collinearity
System dynamic panel-data estimation          Number of obs      =       316
Group variable: countrycode                   Number of groups   =        43
Time variable: period
                                              Obs per group:   min =         4
                                                               avg =  7.348837
                                                               max =         8
Number of instruments =     39                Wald chi2(15)      =    159.09
                                              Prob > chi2        =    0.0000
One-step results
------------------------------------------------------------------------------
      lngdpg |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lngdpg |
         L1. |   .0625154   .0538268     1.16   0.245    -.0429831    .1680139
lnofinitia~p |  -7.878814   1.419549    -5.55   0.000    -10.66108   -5.096549
     lnofpop |   1.382493   .6673552     2.07   0.038     .0745005    2.690485
    lnoflife |  -4.310745   3.883023    -1.11   0.267    -11.92133    3.299841
grosscapit~a |   .1917314   .0400229     4.79   0.000      .113288    .2701749
instiscale~d |   1.011526   1.362492     0.74   0.058    -1.658909    3.681961
     lldummy |   -10.8994    3.20471    -3.40   0.001    -17.18051   -4.618282
       inst2 |  -.1732813   .1977605    -0.88   0.381    -.5608849    .2143222
          d2 |  -2.874515   .9376991    -3.07   0.002    -4.712371   -1.036658
          d3 |  -1.693016   .9890601    -1.71   0.087    -3.631538    .2455061
          d4 |  -2.495011    .908323    -2.75   0.006    -4.275292   -.7147307
          d5 |   -4.70294   .9214476    -5.10   0.000    -6.508944   -2.896935
          d6 |  -.5990983    .786597    -0.76   0.446      -2.1408    .9426035
          d7 |   -2.70183   .6711756    -4.03   0.000    -4.017309    -1.38635
          d8 |  -1.067694   .7160731    -1.49   0.136    -2.471172    .3357834
       _cons |   77.88611   16.91315     4.61   0.000     44.73695    111.0353
------------------------------------------------------------------------------
Instruments for differenced equation
        GMM-type: L(2/4).lngdpg
        Standard: D.lnofinitialgdp D.lnofpop D.lnoflife
                  D.grosscapitalformationasapercenta D.instiscalechanged
D.lldummy
                  D.inst2 D.d1 D.d2 D.d3 D.d4 D.d5 D.d6 D.d7 D.d8
Instruments for level equation
        GMM-type: LD.lngdpg
        Standard: _cons
estat sargan
Sargan test of overidentifying restrictions
        H0: overidentifying restrictions are valid
         chi2(23)     =  30.83107
        Prob > chi2  =     0.1270
Arellano-Bond test for zero autocorrelation in first-differenced errors
  +-----------------------+
  |Order |  z     Prob > z|
  |------+----------------|
  |   1  |-3.1878  0.0014 |
  |   2  |-.81426  0.4155 |
  +-----------------------+
H0: no autocorrelation
```

Declaration

I, the undersigned, declare that this thesis is my original work and has not been presented for a degree in any other university, and that all source of materials used for the thesis have been duly acknowledged.

The examiners' comments have been dully incorporated.

Declared by:

Name: Eba Amanuel

Signature:

Date: 29-01-2009

Confirmed by Advisor:

Name: Girma Estiphanos

Signature:

Date: Jan. 29/2009

Place and date of submission: ______________________.