DETERMINANTS OF ECONOMIC GROWTH IN SUB-SAHARAN AFRICA: A Panel Data Approach

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DETERMINANTS OF ECONOMIC GROWTH IN SUB-SAHARAN AFRICA:
A Panel Data Approach

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ABSTRACT

Based on a panel data of 19 Sub Saharan countries for the years 1982-2000, this study explores the determinants of economic growth in the region. Given that economic growth is essentially seen as a dynamic phenomenon, the study employs the Generalized Method of Moments (GMM) to account for the factors that influence the growth of economies in the region. The study results indicate that physical capital formation, a vibrant export sector and human capital formation significantly contribute to the economic growth among sub-Saharan countries. However, government expenditure, nominal discount rate and foreign aid significantly lead to negative economic growth. As found out in the study, it is recommended that relevant policies be formulated to promote those sectors that enhance economic growth in the region.

Keywords: *economic growth, sub Saharan Africa, dynamic panel data, GMM methodology.*

1. INTRODUCTION

Africa is the world's poorest continent (Basu *et al.,* 2005). The economic and social situation in sub-Saharan Africa remains fragile and vulnerable to domestic and external shocks (Ulku, 2004). Investment remains subdued, limiting efforts to diversify economic structures and boost growth (Nkurunziza and Bates, 2004). Furthermore, a number of countries have only recently emerged from civil wars that have severely set back their development efforts while in other parts of the continent, new armed conflicts have erupted (Basu *et al.,* 2005). These conflicts and other adverse factors, notably poor weather conditions and deterioration in the terms of trade, have led to loss in economic momentum in the region over the last two decades (Ulku, 2004; Nkurunziza and Bates, 2004; Basu *et al.,* 2005).

Sub-Saharan African countries therefore face major challenges like raising economic growth, reducing poverty and their economic integration into the world economy. Economic growth rates are still not high enough (Nkurunziza and Bates, 2004) to make a real dent in the pervasive poverty and enable these countries to catch up with other developing nations. An empirical study by Basu et al (2005) suggest that what is needed is a sustained and a substantial increase in real per capita GDP growth rates in these countries, coupled with significant improvements in social conditions.

This paper is about an empirical analysis of the factors affecting economic growth in sub-Saharan Africa. It takes a panel data approach for the period 1982–2000 over a sample of 19 countries. The empirical work involves the estimation of a dynamic panel data growth equation to identify the key determinants of per capita real GDP growth. Based on the analysis, the paper attempts to determine which factors appear to have been most effective in terms of increasing economic growth and suggests the key elements of a policy framework that could promote sustainable economic growth in Sub-Saharan Africa.

2. LITERATURE REVIEW – Determinants of economic growth

The development of economic growth literature can be classified into two frameworks, which involve the application of economic theory to growth estimations. The first framework addresses the issue of `convergence' which relates to whether contemporary differences in aggregate economies converge to an equilibrium over time. The second framework concerns the identification of growth determinants which explain the observed differences in growth among countries. This paper focuses on the second framework where growth covariates are identified, with special reference to sub Saharan Africa.

A wide range of studies have investigated the factors underlying economic growth. Using differing conceptual and methodological viewpoints, these studies have placed emphasis on a different set of explanatory parameters and offered various insights to the sources of economic growth (Lichtenberg, 1992; Ulku, 2004; Lensink and Morrissey, 2006). Investment is the most fundamental determinant of economic growth (Artelaris *et al.,* 2007) identified in the literature. The importance attached to investment has led to an enormous amount of empirical studies examining the relationship between investment and economic growth (Artelaris *et al.,* 2007).

Human capital is another important source of growth (Barro and Sala-i-Martin, 1995). It principally refers to the workers' acquisition of skills and know-how through education and training. Majority of studies (Barro and Sala-i-Martin, 1995; Brunetti *et al,* 1998, Hanushek and Kimko, 2000) have measured the quality of human capital using proxies related to education like school-enrolment rates, tests of mathematics and scientific skills among others. Evidence from empirical studies suggests that educated population is key determinant of economic growth.

Research and development (R&D) is another important determinant of economic growth. It plays a major role in economic progress by way of increasing productivity and growth (Artelaris *et al.,* 2007) since the increased use of technology enables introduction of new and superior products and processes. This role has been stressed by various endogenous growth models with the strong relation between R&D and economic growth being empirically affirmed by many studies (Lichtenberg, 1992; Ulku, 2004).

Economic policies and macroeconomic conditions have also attracted much attention as determinants of economic performance. This is because they can set the framework within which economic growth takes place (Barro and Sala-i-Martin, 1995). Economic policies can influence several aspects of an economy through investment in human capital and infrastructure, improvement of political and legal institutions. In addition, a stable macroeconomic environment may favour growth through the reduction of uncertainty, whereas macroeconomic instability may have a negative impact on growth through its effects on productivity and investment. Several macroeconomic factors with impact on growth identified in the literature include inflation, fiscal policy, budget deficits and tax burdens (Fischer, 1993).

Openness to trade has also been used extensively in the economic growth literature as a major determinant of growth performance (Artelaris *et al.,* 2007). Openness affects economic growth through several channels such as exploitation of comparative advantage, technology transfer and diffusion of knowledge, increasing scale economies and exposure to competition. Openness is usually measured by the ratio of exports to GDP (Dollar and Kraay, 2000). It has been found that economies that are more open to trade and capital flows have higher GDP per capita and grow faster.

Foreign Direct Investment (FDI) has recently played a crucial role of internationalizing economic activity and as a primary source of technology transfer and economic growth. The empirical literature examining the impact of FDI on growth has provided more-or-less consistent findings affirming a significant positive link between the two (Lensink and Morrissey, 2006).

Another important source of growth highlighted in the literature is the institutional framework. Rodrik (2000) highlights five key institutions (property rights, regulatory institutions, institutions for macroeconomic stabilization, institutions for social insurance and institutions of conflict management), which not only exert

direct influence on economic growth, but also affect other determinants of growth such as the physical and human capital, investment, technical changes and the economic growth processes.

3. METHODOLOGY AND ANALYSIS

3.1 Data sources

Annual data for the study were obtained from the World Development Indicators Online of the World Bank (2003) and the Penn World Tables (PWT) (2003). The time variant data covered the period 1982 to 2000 from which a panel was compiled on 19 African countries. A number of countries which could have been part of the sample were omitted due to lack of sufficient data on some of the variables under investigation. The countries forming the sample are listed in the appendix.

3.2 Economic and econometric model specification

This paper considered an augmented growth model by Solow as adopted from Seetanah (2011). The model considers the conventional sources of economic growth namely physical capital formation (PKFGDP), government expenditure (GGEGDP), exports of goods and services (XGDP), nominal discount rate (NDR), human capital (LR) and foreign aid (AID). The model takes the following reduced form:

$$Y = f(YLAG, PKF, GGE, X, NDR, LR, AID) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

Where Y is the Difference of the log of GDP per capita ($lnY_{it} - lnY_{it-1}$), $YLAG$ is the log of GDP per capita lagged by 1 to represent initial level income, PKF is the log of ratio of gross physical capital formation to GDP, GGE is the log of ratio of final consumption expenditure of general government to GDP, X is the log of ratio of exports of goods and services to GDP, NDR is the log of nominal discount rate, LR is the log of literacy rate and AID is the log of foreign aid as a ratio to GDP. As such, the econometric model specification can be written as:

$$y_{it} = \phi_0 + \phi_1 ylag_{it} + \phi_2 pkf_{it} + \phi_3 gge_{it} + \phi_4 x_{it} + \phi_5 ndr_{it} + \phi_6 lr_{it} + \phi_7 aid_{it} + u_{it} \dots\dots(2)$$

Where i denotes the different sub Saharan countries in the sample, and t denotes the time dimension. The small letters denotes the natural logarithm of the variables implying a double log-linear specification for ease of interpretation (that is in percentage terms).

But, first of all, the study applied the Im, Pesaran, and Shin (1995) panel unit root tests, on the dependent and independent variables. Im et al. (1995) developed a panel unit root test for the joint null hypothesis that every time series in the panel is non-stationary. This approach is based on the average of individual series ADF test and has a standard normal distribution once adjusted in a particular manner. Results of this test which applied on our time series in levels rejected a unit root in favor of stationarity at the 5 percent significance level for each variable. It was therefore concluded to be safe to continue with the panel data estimates of the above econometric specifications (see Table 1 below).

Table 1. Panel Unit Root Tests on Levels of Variables

Variable	IPS statistics
y	-3.800
ylag	-3.720
pkf	-3.453
gge	-2.594
x	-3.649
ndr	-3.726
lr	-3.619
aid	-2.976

The variables are in natural logarithmic forms. The IPS test statistic has a N (0, 1) distribution under the null of non-stationarity. Large negative values indicate stationarity (Canning, 1999).

3.3 Dynamic Panel Data Regression and GMM Methodology

However, despite the afore mentioned results, there might still be the possibility of the loss of dynamic information even in panel data framework as the dependent variable may have something to do with explaining itself as well (Levine *et al.,* 2000). To incorporate dynamics into the model, equation (2) above is rewritten as an autoregressive one model (AR (1)), that is:

$$y_{it} - y_{it-1} = \alpha_t + V y_{it-1} + \beta x_{it} + u_i + \varepsilon_{it} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3)$$

where y_{it} is the logarithm of real per capita GDP, $y_{it} - y_{it-1}$ is the rate of per capita income growth, y_{it-1} is the initial level of per capita income, x_{it} represents a vector of explanatory variables, u_{it} is an unobserved country specific and time invariant effect, ε_{it} is the error term and the subscripts i and t represent country and time period respectively. α_t refers to the period specific intercept terms to capture changes common to all countries. Equivalently, Equation (3) can be written as:

$$y_{it} = \alpha_t + (V + 1) y_{it-1} + \beta x_{it} + u_i + \varepsilon_{it} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (4)$$

The above can also be written in first differences which eliminate the country specific and time-invariant component, u_i as:

$$\Delta y_{it} = \Delta \alpha_t + (V + 1)\Delta y_{it-1} + \beta \Delta x_{it} + \Delta \varepsilon_{it} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (5)$$

To overcome the problem of endogeneity, as y_{t-1} might be endogenous to the error terms through ε_{it-1}, the use of the GMM estimators (Arellano and Bond, 1991, 1995) is thus made. The first step GMM estimator is used as it has been shown to result in more reliable inferences (Blundell and Bond, 1998). STATA v.11 Econometric Software was used to obtain the Arellano-Bond dynamic panel estimates of the linear model (5) described above. The results from estimating Equation (5) using the GMM estimator are contained in Table 2 below.

4. RESULTS AND DISCUSSION

The consistency of the model estimation depends on whether or not the lagged values of the endogenous and exogenous variables are valid instruments in our regression. As such, a Hausman test was used to test for the strict exogeneity of all regressors in the model and hence the appropriateness of our model. In addition a Wald test of joint significance was also carried out. The model in question passed both tests. At 5% level, the value of the Hausman statistic is less than the critical, implying that we accept the null hypothesis of strict exogeneity. The Wald test also passes the test of joint significance at 1%.

The study found that physical capital formation was an important positive determinant of economic growth among economies in sub Saharan Africa. A one-unit change in the level of physical capital was likely to increase growth in GDP by 3.3% (p<0.01). This is in line with findings by Artelaris *et al.* (2007) who noted that physical capital formation was a fundamental determinant of economic growth.

Human capital development through improved literacy rates also had a positive effect on GDP growth in the sense that a one unit rise in literacy rate was likely to improve GDP performance by 35.9% (p<0.01). Barro and Sala-i-Martin (1995), Brunetti *et al.* (1998) and Hanushek and Kimko (2000) also measured the quality of human capital using proxies related to education like school-enrolment rates, tests of mathematics and scientific skills among others. The empirical evidence from the studies seems to agree with the results from this study that human capital development is a key determinant of economic growth.

In addition, the export sector was also found to be an important determinant of GDP growth since every one unit increase in the exports had a probability of increasing GDP growth by 2.5% (p<0.1). Dollar and Kraay (2000) also found out that economies that are more open to trade and capital flows have higher GDP per capita and grew faster.

However, the study found out that government expenditure had an inverse effect on the GDP growth. A one unit-unit increase in the size of government expenditure was likely to reduce GDP growth among the sub

Saharan countries by 8.8% (p<0.01). In addition, the study further established that nominal discount rates also had a negative impact on economic growth because a unit increase in the discounting rates had a probability of dropping the GDP growth rate by 1.9% (p<0.05). As Fischer (1993) notes, there are certain macroeconomic factors which may have adverse impact on the growth of the GDP depending on the prevailing economic situation, namely, inflation and how it is controlled using the fiscal policy.

Contrary to the expectations, foreign aid was found to have a negative contribution to economic growth sub Saharan Africa such that every unit increase in the foreign aid was likely to decline GDP growth by 7.7% (p<0.05). This is probably because foreign aid neither internationalized economic activities nor facilitated technology transfer in Sub Saharan Africa, which would lead to economic growth. This finding is contrary to the results from a study by Lensink and Morrissey (2006) who observe a positive link between economic growth and foreign aid.

With respect to the initial level of GDP (the YLAG), the study found that it had a negative effect on the growth of GDP in the subsequent years. An increase in the initial level of GDP was likely to lower GDP growth by 29.2% (p<0.01). The expectation was that subsequent GDP growth would directly depend on the GDP level of the previous years. The result could be due to the fact that most Sub Saharan economies are agrarian where agricultural output and the prevailing prices in any one year influences future output and prices and hence GDP growth. The econometric results together with the diagnosis tests are further presented in Table 2. below.

Table 2. Results of a Dynamic Panel Data Estimation of Economic Growth in Sub Saharan Africa for the period 1982–2000

Variable	Coefficient	Standard error	z-value	p-value
Constant	0.718***	0.155	4.64	0.000
Y_{t-1}	-0.160***	0.047	-3.40	0.001
ylag	-0.292***	0.025	-11.8	0.000
pkf	0.033***	0.012	2.74	0.006
gge	-0.086***	0.017	-5.03	0.000
x	0.025**	0.013	1.83	0.067
ndr	-0.019**	0.008	-2.51	0.012
lr	0.359***	0.056	6.37	0.000
aid	-0.077**	0.033	-2.32	0.021
Diagnosis tests				
Wald test	216.98			
Hausman test	59.14			

At 5% level, the value of the Hausman statistic is less than the critical, implying that we accept the null hypothesis of strict exogeneity. The Wald test passes the test of joint significance at 1% level. Also note that * Significant at 10%.; ** Significant at 5%.; *** Significant at 1%.

5. CONCLUSION AND POLICY RECOMMENDATIONS

This paper attempted to account for the possibility of dynamics in the GDP growth from a sample of countries in the sub-Saharan Africa through the use of dynamic panel data framework, namely the Generalized Methods of Moments (GMM) method.

The results have revealed that human capital development is an important determinant of economic growth in sub Saharan Africa. This implies that governments in the region should prioritize skill development among the people if at all they are to realize any meaningful GDP growth.

Physical capital formation is another important factor that was found to influence economic growth in the sub Saharan Africa. Thus, it is necessary for countries in the region to have a policy framework that capital formation processes for eventual GDP growth.

Since export trade was also found to have a positive impact on GDP growth, it is of essence that governments in SSA to promote the export sector. However, they should maintain an optimal level of government expenditure since it was found in the study to a bad effect on GDP growth.

Countries in the region should also consider not receiving foreign aid since the study found that it had an inverse and therefore an adverse effect on GDP growth. Finally, policy makers in the region should allow the market forces to fix the rates of return on invested capital as this was likely to help the rates of discount work in favour of GDP growth in the region.

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APPENDIX 1

Variable Description

- **Y** is the Difference of the log of GDP per capita ($\ln Y_{it} - \ln Y_{it-1}$).
- **YLAG** is the log of GDP per capita lagged by 1 to represent initial level income.
- **PKF** is the log of ratio of gross physical capital formation to GDP.
- **GGE** is the log of ratio of final consumption expenditure of general government to GDP.
- **X** is the log of ratio of exports of goods and services to GDP.
- **NDR** is the log of nominal discount rate.
- **LR** is the log of literacy rate.
- **AID** is the log of foreign aid as a ratio to GDP.

APPENDIX 2

List of countries included in the sample Country

COUNTRY	ABBREVIATION
Benin	BEN
Botswana	BOT
Burundi	BUR
Cameroon	CAM
Central African Republic	CAR
Ghana	GHA
Kenya	KEN
Lesotho	LES
Malawi	MLW
Mali	MAL
Mozambique	MOZ
Nigeria	NGA
Rwanda	RWA
Senegal	ZAR
South Africa	RSA
Swaziland	SWD
Togo	TOG
Zambia	ZMB
Zimbabwe	ZWE