MODELING AFRICA'S ECONOMIC GROWTH

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ABSTRACT

This study investigated Africa's economic growth over the period 1996 to 2010, deriving its motivation from the theoretical and empirical literature on the subject. Factors peculiar to the continent such as conflicts, policy distortions, weak institutions, export reliance and low productivity growth were accommodated. Departure from the conventional model specification occurred in the areas of exclusion of some traditional factors and the emergence of new entries. The methodology consisted of both a static and a dynamic panel data analyses of fifteen countries distributed across the different regions of the continent. Some remarkable results were obtained.

INTRODUCTION

Over the last decades, economic growth and its determinants have been of great importance in both theoretical and applied studies. This is due to much importance of economic growth itself. The first steps towards developing the theories of economic growth were taken in the 1930's and early 1940's. All these theories have been directed to the two central questions: why growth rates across countries are different and what factors cause this difference? This difference manifests itself in different standards of living and quality of life in all over the world. In some economies, the level of investment and the productivity is low; the workers face little change in their standards of living and the growth rate and level of development are low; whereas in some other countries, these indices are high enough.

Africa's poor economic performance has been widely studied. Within the empirical growth literature, considerable attention has been paid to slow growth performance in Africa. In average term, the growth rate in Africa hardly surpassed 2% while East and the Pacific countries had over 5% and Latin America experienced growth rate above 2%n (Easterly and Levine, 1997). Large body of studies points to a diverse set of potential causes of Africa's growth tragedy, ranging from bad policies, to poor education, political instability and inadequate infrastructure, but prominent among the cause is low factor productivity growth (see Ndulu and O'Connell, 1999; Ndulu and O'Connell, 2009, Berthelemy and Söderling, 2001; Hoeffler, 2002 and Fosu, 2002). This literature has improved our understanding of African growth tragedy. However, it fails to guide us directly to the factors behind the low productivity growth observed in Africa.

This study did not directly approach the issue of determinants of productivity growth in Africa; rather, it provided quantitative estimates of the extent to which observed productivity

growth accounted for the growth performance of the continent. In so doing, it specified a growth model derived from economic theory but somewhat departed from the approach common to the literature. The rest of the paper is organized as follows. In section II, an overview of growth theory is presented succeeding in a following subsection, a review of the empirical growth literature as applied to Africa. Section III specified the empirical model employed in the study while, section IV dealt with the results and their interpretations. The final section provided some concluding remarks.

THE GROWTH LITERATURE

Overview

Classical economists, such as Smith (1991), Malthus (1798), Richardo and Eck (1817) and much later Ramsey (1928),Young (1928), Schumpeter (1934) and Knight (1944) provided many of the basic ingredients that appear in modern theories of economic growth. The main studies begin on these basic ingredients and focuses on the contributions in the neoclassical tradition since the late 1950s. From a chronological viewpoint, the starting point for modern theory growth theory is the classic article of Ramsey (1928). Ramsey's treatment of household optimization over time goes far beyond its application to growth theory. Between Ramsey and late 1950s, Harrod (1939) and Domar (1946) attempted to integrate Keynesian analysis with elements of economic growth. They used production function with little substitutability among the inputs to argue that the capitalist system is inherently unstable.

The next and more important contributions of modern growth theory have been the works of Solow (1956) and Swan (1956). The fundamental features of the Solow-Swan neoclassical production function are the assumptions of constant returns to scale, diminishing returns to each input and some positive and smooth elasticity of substitution between the inputs. The Solow-Swan production function is applied along with a constant saving rate rule in order to generate a simple general equilibrium model of the economy. A key prediction of these neoclassical growth models which has been frequently applied as an empirical hypothesis is conditional convergence, in the sense that the lower the starting level of per capita GDP, compare to the long-run or steady state position, the faster the growth rate. This is due to the assumption of diminishing returns to capital.

In the late of 1950s and 1960s, the neoclassical growth theorists came to recognize the deficiencies in the past models. In order to overcome this, these theories tend to assume that technological progress occurred in an exogenous manner. This assumption would permit a positive constant per capita long term growth rate, while retaining the prediction of conditional convergence.

Cass (1965) and Koopmans (1965) applied Ramsey's analysis of consumer optimization to the neoclassical growth model in order to make adequate preparation for an endogenous determination of the saving rate. This extension tends to preserve the hypothesis of conditional convergence, while allowing for strong transitional dynamics. Due to the lack of relevance and empirical supporting evidence, growth theory effectively came to the end as an active research

field by the early 1970s. The years after the mid-1980, have witnessed a boom in research on economic growth theory, beginning with the work of Romer (1986) and Lucas (1988).

Selected Growth Studies Related to Africa

In the process of explaining Africa's growth problem, the World Bank has assembled a large database on many dimensions of Africa's development experience. Over the last decade, a growing number of development specialists have examined these data to better understand the statistical determinants of Africa's growth performance. The first study in this regard, by Easterly and Levine (1997), seeks explanations for the factors ascertaining the growth tragedy in Africa. The second study, by Radelet, Sachs and Lee (1997), analyzes the factors that have contributed to differences in growth rates between a sample of Asian and African countries.

The third, by Sachs and Warner (1997), attempts to measure the "sources of slow growth" in Africa. The fourth, by Block (1998), asks whether African countries "grow differently" from those in other regions. The fifth study, by Calamitsis, Basu and Ghura (1999), identifies empirically the main factors fostering adjustment and growth in Sub Saharan Africa (SSA). In the sixth study, Fosu (1999) explicitly notes that Africa's poor performance is the result of internal and external factors. Confining his attention to external factors, Fosu assembles evidence showing that Africa's exports have been determined exogenously and that exports have driven income growth. The final study by Easterly (1999) searches for reasons for the poor performance of developing countries in general. Easterly concludes that growth in developing countries had been systematically reduced by shocks that spilled over from developed countries.

These studies overlap in obvious ways. Taken together they help us identify many of the important factors that have affected economic growth in Africa. Since all of the studies rely on standard single equation growth regressions, their principal value is to highlight potentially fruitful associations between the explanatory variables and economic growth. Easterly and Levine derive a model of long term growth to analyze the variables that are directly and indirectly related to growth performance in Africa. They derive their basic equation from a model of long-term growth. The variables included in the equation are initial income, human capital, financial depth, black market exchange rate premium, central government surplus and several dummies relating to Africa's peculiarities.

Reviewing their results, Easterly and Levine concluded that the poor growth was strongly associated with (1) low schooling, (2) political instability, (3) under-developed financial systems, (4), distorted foreign exchange markets, as measured by the black market premium, (5), high government deficits, (6), low infrastructure, (7), ethnic fractionalization, and, (8), spillovers from neighbors that magnify (1) – (7).

The study by Radelet, Sachs and Lee (1997) examines cross-country differences in rates of growth between Africa and Asia. Their estimates highlight the relative importance for growth of efficient bureaucracy and institutions, good macroeconomic management, and strategies that enhance productivity. Using a growth accounting exercise for the period 1965 to 1990, the authors explain a significant portion of the difference in average annual growth rates under two headings, "policy variables" and "demography." The policy variables are (a) government savings

rate; (b) openness; and (c) institutions. The aggregate nature of their analysis confounds the effects of specific policy variables.

The statistical significance of the variable "institutions" points to the complex web of decisions, policies, and actions that enhance the efficiency of public bureaucracies, improve the competence of public sector administrators, promote effective implementation of policies and programs, maintain accountability, and enhance governance. The significance of the "government savings rate" is evidence of policies, decisions, and administrative actions that ensure governments conduct their affairs in ways that avoid (or overcome) distortions. The most common distortions that undermine growth in Africa are deficit financing, the rapid accumulation of domestic and foreign debt, ill-advised attempts to fix the exchange rate and interest rates, and interventions that hinder financial development. The variable "openness" represents policies and actions that enhance international competitiveness, promote sustained increases in total factor productivity, and encourage public and private investments that raise the level of output over time.

These results are suggestive. For example, using the estimated coefficients as a guide, there appears to be a direct link between economic growth (defined as sustained increases in real output per capita) and development (defined as generalized improvements in welfare). This is reflected in the significance of the demographic variable "life expectancy," an outcome consistent with a growing body of evidence suggesting that there is no trade-off between rapid growth and poverty reduction. On average, African countries have had exceedingly low growth rates, accompanied by increased poverty and welfare regression. By contrast, rapid growth in Asia has been accompanied by widespread poverty reduction and improving welfare.

In the work of Sachs and Warner (1997) the emphasis is on trade openness. They consider a sample of 74 countries in a cross-country regression for per capita growth between 1965 and 1990. They find that access to the sea, life expectancy, government savings, institutional quality and a growing population share of working age persons have a significant and positive influence on growth. Their results also show that resource endowments and a tropical climate impede growth. Sachs and Warner interpret their findings as evidence that growth in Africa is not different from growth elsewhere. The main reasons why African countries have grown slowly are that they are landlocked, predominantly tropical, have weak institutions, and have maintained counterproductive policies. The latter are evident in persistent budget deficits and commercial policies that close off African economies to international competition.

In the fourth study, Block (1998) inquires "Does Sub-Saharan Africa Grow Differently?" Seeking to move beyond analyses that treat SSA "primarily as a dummy variable in a single reduced-form growth regression", Block considers whether in Africa, the "mechanisms of economic growth operate differently". He does that using an "augmented reduced form" growth regression. The model is augmented by specifying separate equations for some explanatory variables in the growth regression. Block's growth regression includes initial per capita income, life expectancy at birth, a dummy for landlockedness, a political risk index, the growth rate of the net barter terms of trade, the Sachs-Warner index of openness, the overall budget deficit including grants, the difference between the population growth rate and the growth rate of the economically active population, real investment, and the growth rate of the population.

Block's results offer little that is new. Like Sachs and Warner, he concludes that countries in SSA do not grow differently from countries elsewhere. He does find, however, that

the factors influencing growth are weaker in SSA. He also finds that their effects have been undercut through inappropriate policies and institutional barriers. Block concludes that weak institutions and poor policies in SSA have been far more costly in terms of growth than in other regions.

Calamitsis, Basu and Ghura (1999) study begins with the optimistic view that some African countries are "on the move". They caution, however, that the social and economic situation in most African countries remains "fragile". For policy makers, the challenge is to focus on growth and poverty alleviation, and "integrate [Africa] fully into the world economy". The authors' goal is to determine the empirical impact of adjustment on economic growth (measured as the change in real per capita income). They use the results to suggest the types of changes needed to stimulate growth and reduce poverty.

Their growth regression includes initial income, population growth, ratios of private and government investment to GDP, index of human capital, dummy for sustained IMF programs, rate of inflation, standard deviation of inflation, central government budget deficit (excluding grants), change in real effective exchange rate, rate of export growth, percentage change in external terms of trade, index of political freedom, dummy for war, and series of country and time specific dummies. Expecting simultaneity bias due to endogenous regressors to be a problem, they run a number of tests.

Concluding that the tests show no such bias, they turn to their results. These show that private investment is a more robust determinant of growth than government investment. Human capital has a positive but not significant effect on income growth. And population growth has a major negative effect. The estimated coefficients of the budget deficit and real exchange rate are negative and that of export growth is positive. An interesting finding is that inflation has the correct (negative) sign but is not statistically significant. The authors also find that sustained implementation of IMF programs leads to an increase in per capita income growth.

Fosu (1999) study begins with the assertion that Africa's "uneven" growth performance has resulted from both internal and external factors. His analysis, however, focuses on the importance of external factors. In particular, he concentrates on questions related to "openness". Acknowledging that openness and the growth of exports are not the same, he nonetheless frames his analysis in terms of a growth accounting approach that defines income as a function of capital, labor, and exports. After some manipulation (logarithmic differentiation and several substitutions), Fosu derives the equation he estimates. It relates the growth of real income to the growth of labor, the ratio of investment to income, the growth of exports, and a term (the ratio of exports to non-exports) designed to measure the "externality" effects of trade. This equation is then estimated for a cross-section of African countries for the periods 1960-70 and 1970-80.

The results show that exports are positively related to the growth of income and that the coefficient is statistically significant. Fosu also concludes that external shocks, the real exchange rate, foreign aid, and debt were important determinants of growth. He suggests that debt had a threshold effect. Below a particular threshold of gross domestic investment to GDP, the level of debt raises the rate of growth; above the threshold, debt lowers the rate of growth. Fosu examines the endogeneity of exports and the direction of causation between growth and exports. He concludes that exports were exogenous and that causation ran from exports to income. There are

now several studies that reach the opposite conclusions (Rodrik 1998; Summers 1999; Frankel and Romer 1999).

Another study of Easterly (1999) titled "The Lost Decades: Explaining Developing Countries' Stagnation 1980-1998" begins with the observation that there was no change in the median per capita income in developing countries during the 1980s and 1990s. This contrasted with an increase of 2.5 percent recorded for the period 1960 to 1979. Easterly examines whether the loss of growth was the result of "(1) good policies that did not achieve desired results, (2) bad economic policies, or (3) some third factor like shocks?" Based on his evidence – cross-country regressions and comparison of turning points that relate events in the rich countries to those in the developing countries – he argues that the most likely explanation was point (3). The principal shock he finds was the "growth slowdown in the industrial world". This conclusion would resonate widely in African capitals. African leaders have persistently argued that their countries could not grow because of the impact of periodic shocks that originate outside Africa.

Englebert (2000) uses a very parsimonious empirical framework to consider per capita growth from 1960 to 1992 with a sample of 99 developing countries. His empirical model of growth includes only five significant variables: a lagged dependent variable, state legitimacy index, a developmental capacity index (modified to be orthogonal to state legitimacy), an East Asian dummy (which positively affects growth) and a tropical climate index. He provides a strong motivation for the relevance of this state legitimacy variable for explaining slow growth in African countries, but his econometric results are not very convincing due to the suspected omitted variable bias.

Englebert finds that the African dummy becomes an insignificant regressor when he includes a dummy for the historical legitimacy of the state. The state legitimacy variable is highly significant in his regressions, with a coefficient that is relatively stable around 0.02. Englebert shows that the significance of the African dummy is very sensitive to the inclusion of the state legitimacy variable: when this variable is included, the t-statistic on the coefficient of the African dummy turns insignificant. He also shows that legitimate states are more likely to have high scores on a range of indicators of institutional stability, good governance and prudent policymaking, including variables such as trade openness, the depth of the financial sectors, foreign indebtedness, enforceability of contracts, the risk of expropriation and civil liberties.

Most recent research on Africa's growth has been empirical. Generally, empirical estimation were based on augmented Solow growth model equation of the rate of output growth on the following variables, entering individually or in combination (i) a measure of the initial level of output and the initial level of technology to capture the impact of initial conditions; (ii) the [exogenous] rate of technological change to account for productivity changes; (iii) the savings rate to capture capital accumulation; (iv) the growth rate of the work force; (v) the rate of depreciation of capital; (vi) the share of capital in output; and, (vii) the rate of convergence to the steady-state (Barro and Sala-i-Martin, 1995). This specification is directly derived from a production function.

A number of empirical studies have found that the Solow growth model fails to explain Africa's economic growth. An "African dummy" has been found to be large and significant in cross-section studies, suggesting that Africa's growth responds to variables different from those explaining it elsewhere (Barro and Lee, 2010; Easterly and Levine, 1997). Other studies, as noted by Collier and Gunning (1999), eliminated the dummy "though to an extent by transferring the puzzle elsewhere". This is the case with Sachs and Warner (1997) for example, who do not

find a significant African dummy but instead find a significant "tropics dummy". Both specification and estimation techniques could explain the significance of the African dummy.

Most researchers have responded to the puzzle of the Africa dummy by re-specifying the growth model and adding variables thought to capture missing factors not explained by the textbook Solow model. First, some studies endogenize the savings variable by including in the model the policy variables influencing savings. These include the black market premium, the rate of inflation and the rate of the budget deficit. Even sociological variables such as ethnic fractionalization have been considered important in explaining the Africa's dummy (see Easterly and Levine, 1997). Sachs and Warner (1997) added geographical variables to the list and found a significant tropical dummy. More generally, some studies have also introduced political variables in growth models to explain better the growth process (see for instance Barro and Lee, 1993; Alesina et al., 1996; and Easterly and Levine, 1997). Hoeffler (2002) is among the few who responded to the debate over the African dummy from an econometric perspective. In her methodologically detailed study, Hoeffler found that the significance of the African dummy was due to estimation problems.

All the studies cited above used either cross section OLS or fixed effect panel approaches to estimate the growth model. However, it is simple to show that these methods are flawed when estimating dynamic panel data models. Hoeffler presents five models using five different estimation techniques. She finds that when the appropriate method of estimation is used, the African dummy is no more significant even when the model is restricted to the basic Solow model without adding any more variables. She therefore concludes that growth in Africa is explained by the same fundamental production function factors used in the Solow model.

Underlying the controversy is the complexity of the growth process. Most studies claiming to have explained growth account for just a small proportion of the variation in the rate of growth. This cannot be otherwise because growth has its country or regional idiosyncratic determinants. Whether these are so important that they invalidate the main pattern given by the basic variables of the Solow model is an empirical question. An important but rarely adopted approach to explaining growth, probably due to its high cost, remains the 'case study' approach. It is only through case study analysis that the predictions of cross-country models can be confronted with country 'realities' to determine their robustness.

THE EMPIRICAL MODEL

As revealed generally by the literature in the preceding section, modern real sector or optimal growth analysis recognizes the contributions of the real sector and its development policies, financial sector policies and performance, and, exogenous developments, to the growth process. Typical of the impulses from the real sector and related policies are the supply of labor input and the associated manpower development policy/program, and, process and product development policies. Governments contribute to manpower development policy and general human capital development through education and health programs and their related expenditures and also direct the growth process through economy-wide policies causing far reaching changes in many sectors. The quality of institutions falls into this latter category. From

the finance stable, short run growth drivers contributing to enhanced quality of investments through improved efficiency of available capital inputs, are supplied. In short, no key part of the economy is left out in the growth permutation.

Exogenous factors or events do set limits to growth; such limits could range in duration from short term to long term, the latter often engenders policies causing structural change as an escape from the penalizing factor or factors. The short term factors/events could include strife, religious/communal disturbances, drought causing famine and output drop and policy regime change with high initial adjustment costs. The long-term exogenous factors/events could take the form of population growth, technological change, deterioration in a country's terms of trade which may result from fall in the demand for export sales as a result of say, prolonged recession in the economies of foreign buyers or a permanent change in the taste of foreign buyers. While some of the short-term factors could be expected to adjust themselves hence calling for only short-term stabilization policies, the long-term factors would necessitate structural change policies [either to absorb – accommodation - or offset the exogenous or long-run shift factor] of the type mentioned above.

Aggregating these factors and re-arranging, the growth model to be estimated in this study is in the first instance specified as a panel data set of fifteen African countries such that:

1. $$GDP = f(K, L, INST, CNFL, PMP, RIR, INFL, DEBT, POPG, OPEN, TOT, TFPG, GDP_t)$$

(+) (+) (+) (-) (-) (+) (+/-) (+/-) (-) (+) (+) (+) (+)

Where, GDP is per capita real gross domestic product, K is capital input, L is labor input, INST is quality of institutions, CNFL is conflicts, PMERP is parallel market exchange rate premium, RIR is real interest rate, INFL is inflation rate, DEBT is overall debt exposure, POPG is population growth, TOT is external terms of trade, reflecting both domestic and foreign demands, TFPG is total factor productivity growth and GDP_t is trend nominal GDP. The signs underneath the variables denote a priori expectations.

In relation to the overview given in the introductory segment of this section, TFPG absorbs directly most of the governmental efforts in the real sector as it is directly influenced by the national system of innovations (NSI) encapsulating technological change (an exogenous and long-run factor) and other policies raising factor productivity in both the short and long runs. Such other policies include relative prices such as, exchange rate and interest rate which however are also designed to eliminate distortions in their relevant markets and thus could constitute independent sources of short run growth. This justified their separate inclusion in the model(In this study, exchange rate policy was to be proxy by the parallel market exchange rate premium (PMERP) which is generally believed to capture more aptly, the disequilibrium in the foreign exchange market. However, widespread data unavailability precluded its use; the real effective exchange rate was accordingly substituted. While, it could still be an effective indicator of policy distortion, it may not capture the direct effect of corruption discussed in the paper.).

TFPG would also be influenced (as per NSI) by schooling at all levels and other training and health programs hence, unlike other growth models, such factors are not viewed in this study

as independent sources of growth. Trend GDP is included as an exogenous variable capturing technological change in the sense of being the sole driver of consumers' surplus which reflects growth in the welfare sense (Ogun, 2012a).

An exogenous factor – strife, comprising of religious and communal disturbances, which is widespread in Africa, is represented by conflicts (CNFL).

In most studies of growth, corrupt practices are often emphasized/specified as short run determinant (see e.g. Mo, 2001; Mauro, 1995; 2004,). In the present study, the most significant impact of corruption is narrowed to that on TFPG where it exerts long run effect (see e.g. Ogun, 2012b). Accordingly, its direct growth effect was limited to the short run and reflected in the parallel market exchange rate premium serving as the incentive for 'round tripping' and other sharp practices in the financial and public sectors (see e.g. Ogun 2012c).

Debt (including fiscal deficit), inflation and openness represent the other policy factors (that is, quality of management) in the model, noting however, that, openness is a long run variable.

To some extent, both inflation and terms of trade would reflect the effect of weather condition with terms of trade also capturing the effect of taste.

In log expression, equation (1) becomes:

$$LogGDP = \alpha_0 + \alpha_1 LogK + \alpha_2 LogL + \alpha_3 LogINST + \alpha_4 LogCNFL + \alpha_5 LogPMERP + \alpha_6 LogRIR + \alpha_7 LogINFL + \alpha_8 LogDEBT + \alpha_9 LogPOPG + \alpha_{10} LogOPEN + \alpha_{11} LogTOT + \alpha_{12} LogTFPG + \alpha_{13} GDP_t + \mu_t \quad (2)$$

Where, the variables and the related partials are as earlier defined. An alternative specification in which a variable, $\frac{M2}{P}$, denoting real money balances (with expected positive effect on growth) is substituted for inflation appears as below (The alternated variables, that is, real money balances and inflation could not be contained in the same equation for obvious reason of mutlicollinearity – sustained inflation being a monetary phenomenon.).

$$LogGDP = \beta_0 + \beta_1 LogK + \beta_2 LogL + \beta_3 LogINST + \beta_4 LogCNFL + \beta_5 LogPMERP + \beta_6 LogRIR + \beta_7 \frac{M2}{P} + \beta_8 LogDEBT + \beta_9 LogPOPG + \beta_{10} LogOPEN + \beta_{11} LogTOT + \beta_{12} LogTFPG + \beta_{13} LogGDP_t + \varepsilon_t \quad (3)$$

The variables in the model and the relevant proxies are described below.

GDP = gross domestic product per capita;

K = capital stock defined as the sum of gross capital formation and personal consumption;

L = labor force defined as total annual employment;

INST = quality of institutions proxy by two indices, government effectiveness and regulatory quality. Both indices were obtained from the World Government Indicators (WGI) produced by Kaufmann, Kraay and Mastruzzi (2010). As

indicated by the authors, government effectiveness index reflects perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Also, they described regulatory quality index as reflecting perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development.

CNFL = social conflicts/strife proxy by an index of political stability and absence of violence and also obtained from WGI. According to the proponents, this index reflects perceptions of the likelihood that the government would be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism.

PMERP = parallel market exchange rate premium proxy by real effective exchange rate;

RIR = real interest rate;

INFL = inflation defined as log difference of consumer price index;

M2/P = real money balances;

DEBT = the dollar value of the sum of total indebtedness – external and internal debt;

POPG = population growth;

OPEN = degree of openness conventionally represented as the ratio of the sum of exports and imports to gross domestic product (GDP);

TOT = terms of trade – relative price of exports and imports;

TFPG = total factor productivity growth defined as the change (percentage) in the sum of the ratio of gross national output (GNP) to total employment and the ratio of GNP to capital;

GDP_t = trend GDP generated as the fitted value of a regression of nominal GDP on time.

There is no particular yardstick employed in choosing the sample; the sample however reflects the different regions on the continent. The countries in the sample are: South Africa, Botswana, Mauritius, Kenya, Tanzania, Uganda, Democratic Republic of Congo, Gabon, Central African Republic, Nigeria, Ghana, Senegal, Egypt, Algeria and Tunisia.

THE RESULTS AND THEIR INTERPRETATIONS

As noted in the preceding section, both inflation and real money balances were interchanged in the estimation. Results were produced for the alternative specifications under a static model expressed in two forms: a log level specification and a log differenced dependent variable with log level explanatory variables. Also, three types of estimation results were produced: pooled (OLS), fixed effects and random effects. Under the static model, the Hausman statistics were significant suggesting a preference for the fixed effects approach. Nonetheless, the random effect estimates are retained for possible comparison. Besides the static model, dynamic panel estimations were also conducted. Still alternating real money balances and inflation, results were produced for differenced generalized method of moments (DIF-GMM) and system GMM (SYS-GMM).

The study covered the period 1996 to 2010. This scope imposed restrictions on the application of panel unit root and panel cointegration methodologies which would have signified the type of time-defined relationships that existed between the dependent and some independent variables in the model. However, as the trend of applications in the empirical literature suggests, these methodologies are of little significance when dealing with dynamic panel analysis. Nonetheless, an unorthodox way of inferring long-run relationship involving the static regression of theoretically identified steady-state variables on the dependent variable was explored. Unconventional, it at least gives an indication of the possibility of long-run relationships that might hold under the specifications.

Apart from data on political stability, government effectiveness and regulatory quality whose source has been reported, all the data employed in the study are from the World Development Indicators (2011) of the World Bank (The data set employed in the study is available from the author upon request).

The result of the static model corresponding to inflation in the list of explanatory variables is presented below.

Table 1. GDP Equation Considering Inflation

Static Model : GDP equation considering Inflation

Variable	Pooled (lngdp)	Fixed Effect (lngdp)	Random Effect (lngdp)		Pooled (D.lngdp)	Fixed Effect (D.lngdp)	Random Effect (D.lngdp)
Lnk	*0.3631***	*-0.044*	*0.3631718****		*0.0013*	*0.1047*	*0.0013*
Lnl	*-0.3461****	*0.7218****	*-0.3461252****		*-0.005*	*-0.451*	*-0.005*
Rir	*-3E-05*	*0.0013****	*-3E-05*		*0.0003*	*0.0001*	*0.0003*
Lnreer	*0.0323*	*-0.052*	*0.0323*		*0.0347*	*0.0457*	*0.0347*
Inflation	*-0.0075****	*-4E-04*	*-0.0075****		*-5E-04*	*-6E-04*	*-5E-04*
Lndebt	*-0.0679***	*-0.0353****	*-0.0679054***		*0.0116*	*0.0217*	*0.0116*
Lnpopg	*0.1120***	*0.0739***	*0.1120635***		*0.0223*	*-0.048*	*0.0223*
Tot	*4E-12*	*1.46E-11****	*4E-12*		*-6E-12*	*-1.16E-11***	*-6E-12*
Lntfpg	*0.8077****	*0.6478****	*0.8077****		*0.0019*	*0.063*	*0.0019*
Openness	*-8E-09*	*6.51E-9***	*-8E-09*		*4E-10*	*-2E-09*	*4E-10*
Polstab	*-0.068*	*-0.015*	*-0.068*		*-0.022*	*0.0037*	*-0.022*
Goveff	*-0.1725***	*0.0086*	*-0.1725957****		*-0.04*	*0.0436*	*-0.04*
Regqu	*0.1202***	*0.1000****	*0.1202***		*0.0644**	*0.0071*	*0.0644***
Lnfitted	*0.4987***	*-0.6136**	*0.4987***		*0.3585***	*0.7655*	*0.3585****
_cons	*-8.7305****	*-6.06***	*-8.7305****		*-3.0266***	*-2.346*	*-3.0266****
R-squared	*0.9984*	*0.0905*	*0.9984*		*0.4818*	*0.1494*	*0.4818*
F-stat	*1438.20****	*127.36****			*1.86**	*1.01*	
Hausman		*53.57****				*7.12*	

Note: here and in all tables ***, **, and, * denote significance at 1%, 5% and 10% respectively
Source: Computed

In table 1, variables such as real interest rate, terms of trade, openness, political stability, government effectiveness and regulatory quality were not entered in log due to their very small

values hence were entered in level. Under the OLS estimates, variables k, reer, infl, debt, tot, tfpg, polstab, regqu and fitted gdp entered with the correct sign and with the exception of polstab, all were significant at either 1 or 5 per cent. Notably, both inflation and debt generated adverse effect on gdp; rir, popg, a measure of institutional quality, goveff, l and openness were wrongly signed with the middle three highly significant. However, another measure of institutional quality, regqu, conformed to a priori expectation. The adjusted coefficient of multiple determination suggests that the explanatory variables accounted for over 99 per cent of the movements in the GDP.

With the fixed effects, variables k, reer, popg, fitted gdp bear the wrong sign with the last two significant at 5 percent. Rir and openness were now correctly signed and significant. However, only about 9 per cent of the variations in the GDP were explained by the independent variables. The results of the random effects are practically the same with the OLS estimates.

Comparatively, the case of the static model with differenced dependent variable while the independent variables remained at level was generally poor.

The static model estimates corresponding to real balances are presented in table 2.

Static Model : GDP equation considering m2/cpi						
Variable	**Pooled (lngdp)**	**Fixed Effect (lngdp)**	**Random Effect (lngdp)**	**Pooled (D.lngdp)**	**Fixed Effect (D.lngdp)**	**Random Effect (D.lngdp)**
lnk	*0.2893****	*-0.035*	*0.2893859****	*-3E-04*	*0.0944*	*-3E-04*
lnl	*-0.4184****	*0.4725226**	*-0.4184****	*-0.001*	*-0.208*	*-0.001*
rir	*0.0002*	*0.00115****	*0.0002*	*0.0003*	*0.0004*	*0.0003*
lnreer	*0.1280**	*-0.024*	*0.1280**	*0.041*	*0.0227*	*0.041*
m2cpi	*8.43E-12****	*2.36E-12***	*8.43E12****	*4E-14*	*-2E-12*	*4E-14*
lndebt	*0.0333**	*-0.018*	*0.0333**	*0.0122*	*0.0078*	*0.0122*
lnpopg	*-0.1460016****	*0.046*	*-0.1460****	*0.018*	*-0.02*	*0.018*
tot	*-4E-12*	*1.19E-11****	*-4E-12*	*-6E-12*	*-0.1E-11***	*-6E-12*
lntfpg	*0.6824697****	*0.6558965****	*0.6824697****	*0.0029*	*0.0317*	*0.0029*
openness	*-9.51****	*3E-09*	*-9.51E-11****	*2E-11*	*2E-10*	*2E-11*
polstab	*0.0141*	*-0.01*	*0.0141*	*-0.02*	*0.0068*	*-0.02*
goveff	*0.0361*	*-0.002*	*0.0361*	*-0.04*	*0.0356*	*-0.04*
regqu	*0.046*	*0.1056****	*0.046*	*0.0627**	*0.0193*	*0.0627**
lnfitted	*0.102*	*-0.361*	*0.102*	*0.3472***	*0.5664*	*0.3472***
_cons	*-3.5212***	*-4.7741***	*-3.5212****	*-3.0058***	*-3.674*	*-3.0058***
R-squared	*0.9993*	*0.1713*	*0.9995*	*0.4803*		
F-stat	*4472.40****	*155.57****		*1.85***		
Hausman		*128.65****			*9.12*	

Source: Computed

In Table 2, real balances joined the list of variables entered in level. With the OLS estimates, labor force, debt, terms of trade, openness and political stability (conflicts) were incorrectly signed. Contrarily, capital stock, real interest rate, real effective exchange rate, real money balances, population growth, total productivity growth, government effectiveness, regulatory quality and fitted gdp entered with the correct signs; capital stock, real money balances, population growth and total factor productivity growth were highly significant. The

fixed effects estimates appeared to follow the trend of the OLS with noticeable differences in the relative performances of real effective exchange rate, debt, terms of trade, openness and regulatory quality. The random effects estimates were not significantly different from the OLS. Again, the static model results corresponding to the differenced dependent variable and level independent variables were generally poor.

As indicated earlier, an attempt was made at assessing the pattern of long-run relations that may hold in the model by including only the theoretically defined long-run variables in a static model. The first set of results corresponding to level expression is presented below.

Table 3. Static Model I Considering Long-run Variables

Static Model: lngdp			
Variable	**Pooled**	**Fixed Effect**	**Random Effect**
lntfpg	*0.8389****	*0.8718****	*0.7606****
totr	*-1.08E-10****	*0.2E-11*	*-0.8E-13*
openness	*-3.11E-9****	*-9.31E-11**	*-1.55E-10***
lnfitted	*1.7714****	*0.4436****	*0.5437****
_cons	*-16.1152****	*-7.1389****	*-6.8751****
R-squared	*0.8916*	*0.7896*	*0.7955*
F-stat	*337.12****	*706.48****	
Hausman		*-27.31*	

Source: Computed

The results suggest that only two variables may play important long-run roles in the set of countries involved. These are, total factor productivity growth and fitted gdp. Terms of trade and openness are incorrectly signed even though significant hence, may not be credible long-run factors in the relevant countries.

The results of the differenced dependent variable are as follows.

Table 4. Static Model II Considering Long-run Variables

Static Model: D.lngdp			
D.lngdp	**Pooled**	**Fixed Effect**	Random Effect
lntfpg	*0.0054****	*0.0108*	*0.0047*
Tot	*-0.1E-11*	*0.2E-11*	*0.2E-12*
Openness	*0.4E-10*	*1.34E-9****	*2E-10*
lnfitted	*0.0492*	*-0.032*	*0.0197*
_cons	*-0.4133**	*0.0999*	*-0.193*
R-squared	*0.0755*	*0.0363*	*0.0649*
F-stat	*3.10***	*2.25**	
Hausman		*11.06****	

Source: Computed

With a highly significant Hausman statistic, the favored fixed effects estimates appear to suggest the possibility of openness being relevant in long-run growth consideration in the sample of countries.

With respect to the dynamic panels, the inflation and real balances interchange were also observed under the two GMM estimations, DIF-GMM (a) and SYS-GMM (b). The results corresponding to inflation are as presented below.

Table 5. Dynamic Model With Inflation

Variable	Inf[a](lngpd)	Inf[b](Ingdp)	inf[a](D.lngpd)	Inf[b](D.Ingdp)
Lngdp(-1)	*0.1937*	*0.4326****	*-0.531*	*-0.102*
lnk	*0.0148*	*0.2078****	*0.2238*	*0.0265*
lnl	*0.4097*	*-0.2391****	*-3.3592****	*-0.042*
rir	*0.0002*	*0.0014*	*0.0001*	*-0.002*
lnreer	*-0.044*	*0.0118*	*-0.007*	*0.0461*
inflation	*0.0002*	*0.0002*	*0.0012*	*0.0002*
lndebt	*-0.017*	*0.002*	*0.0095*	*0.0232*
lnpopg	*0.0544*	*0.0576*	*0.021*	*0.0863*
tot	*7E-12*	*-6E-12*	*-0.337E-10****	*-7E-12*
lntfpg	*0.5140****	*0.4078****	*0.5228***	*-0.045*
openness	*5E-09*	*-1E-09*	*-7E-09*	*2E-09*
polstab	*-0.01*	*0.0003*	*-0.009*	*-0.014*
goveff	*0.0451*	*-0.002*	*-0.055*	*0.0594*
regqu	*0.0055*	*-0.016*	*-0.01*	*-0.067*
lnfitted	*-0.275*	*0.3244*	*4.668907****	*0.1844*
_cons	*-5.075*	*-4.7144***	*6.004*	*-1.436*
Wald	*243.86****	*15505.81****	*19.41*	*9.71*
Sargan Test	*9.405856*	*10.0644*	*9.6471*	*11.0271*
Sargan Prob > chi2	*0.6679*	*0.9857*	*0.6469*	*0.9623*

Source: Computed

Under DIF-GMM, only four variables appeared to enter with the wrong sign viz: real effective exchange rate, inflation, population growth and fitted gdp. Of the remaining, total factor productivity growth was highly significant. The variable maintained this performance under SYS-GMM with initial GDP (lagged GDP), capital stock and labor force entering the significance list. With the differenced dependent variable, only total factor productivity growth and fitted gdp were credibly significant under DIF-GMM while no variable significance was recorded under SYS-GMM. Generally, the Sargan test statistics were insignificant suggesting some degree of appropriateness of the model especially as regards the choice of instruments.

With real balances, the results are as follow.

Table 6. Dynamic Model With Real Balances

Variable	m2cp[a](lngpd)	m2cpi[b](lngdp)	m2cpi[a](D.lngpd)	m2cpi[b](D.lngdp)
lngdp(-1)	*0.0561*	*0.3498328***	*-0.491*	*-0.251*
lnk	*0.0039*	*0.2244137****	*0.2042*	*0.0785*
lnl	*0.1576*	*-0.283 9584****	*-2.963223***	*-0.047*
rir	*0.0006*	*0.0015*	*-8E-05*	*-0.002*
lnreer	*-0.034*	*0.0226*	*-0.038*	*-0.014*
m2/cpi	*0.31E-11**	*0.2E-11*	*-0.1E-11*	*-0.4E-11*
lndebt	*-0.005*	*0.0084*	*0.0027*	*0.0007*
lnpopg	*0.0032*	*0.0115*	*0.0412*	*0.2373***
totr	*0.8E-11*	*-0.5E-11*	*-0.308E-10***	*-0.101E-10**
lntfpg	*0.7082****	*0.4608****	*0.432*	*-0.03*
openness	*0.1E-08*	*-0.2E-08*	*-0.4E-08*	*0.5E-08*
polstab	*-0.015*	*-0.007*	*-0.017*	*-0.009*
goveff	*0.0541*	*0.0143*	*-0.049*	*0.0146*
regqu	*0.0357*	*-0.006*	*-0.018*	*-0.111*
lnfitted	*0.0181*	*0.3116*	*4.2198***	*0.2448*
_cons	*-4.781*	*-4. 5381***	*4.9832*	*-2.588*
Wald	*132.24*	*16165.79****	*17.95*	*13.33*
Sargan Test	*8.8419*	*16165.79*	*9.4967*	*10.6490*
Sargan Prob > chi2	*0.7164*	*0.9854*	*0.6600*	*0.9692*

Source: Computed

Under DIF-GMM and with all variables in level, real balances and total factor productivity growth were significant. With SYS-GMM, total factor productivity growth, initial GDP, capital stock and labor force were significant. When the dependent variable was differenced one period, only the fitted gdp was credibly significant under DIF-GMM while no such equivalence was recorded under SYS-GMM.

An attempt was made to ascertain at different levels, the extent and direction of convergence in the models. First, unconditional convergence was tested with only the lag of the dependent variable in the equation. The outcome is reported below in table 7.

Table 7. Testing for Unconditional Convergence

```
      Source |       SS       df       MS              Number of obs =     210
-------------+------------------------------           F(  1,   208) =    4.81
       Model |   .00396965     1   .00396965           Prob > F      =  0.0294
    Residual |   .17159079   208  .000824956           R-squared     =  0.0226
-------------+------------------------------           Adj R-squared =  0.0179
       Total |   .17556044   209  .000840002           Root MSE      =  .02872

------------------------------------------------------------------------------
     D.lngdp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lngdp |   .0035749   .0016297     2.19   0.029     .0003621    .0067878
       _cons |  -.0042303   .0111896    -0.38   0.706    -.0262897    .0178292
------------------------------------------------------------------------------
```

Source: Computed

The coefficient of lagged GDP is about 0.0036 with ($p<0.05$) suggesting that there is divergence among the African countries. High growing countries tend to grow more.

The case of conditional convergence was examined at various levels, first, with inflation and other explanatory variables minus fitted gdp and real balances. The outcome of the experiment is as follows.

Table 8. Conditional Convergence Considering Inflation without Fitted GDP

```
      Source |       SS       df       MS              Number of obs =      43
-------------+------------------------------           F( 14,    28) =    1.16
       Model |  .013641373    14  .000974384           Prob > F      =  0.3541
    Residual |  .023482704    28  .000838668           R-squared     =  0.3675
-------------+------------------------------           Adj R-squared =  0.0512
       Total |  .037124077    42  .000883907           Root MSE      =  .02896

------------------------------------------------------------------------------
     D.lngdp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lngdp |   .0819009   .0929553     0.88   0.386    -.1085094    .2723113
         lnk |  -.0231872   .0350922    -0.66   0.514    -.0950703    .0486959
         lnl |   .0311281   .0462769     0.67   0.507    -.0636657     .125922
         rir |   .0000729   .0006139     0.12   0.906    -.0011847    .0013305
      lnreer |   .0270976   .0712945     0.38   0.707    -.1189426    .1731379
   inflation |   .0009257   .0020656     0.45   0.658    -.0033056    .0051569
      lndebt |  -.0013652   .0149034    -0.09   0.928    -.0318934     .029163
      lnpopg |   .0072716   .0292881     0.25   0.806    -.0527225    .0672656
        totr |  -1.52e-12   3.75e-12    -0.40   0.689    -9.19e-12    6.16e-12
      lntfpg |  -.0598544   .0783267    -0.76   0.451    -.2202993    .1005906
    openness |   1.46e-09   3.44e-09     0.43   0.674    -5.59e-09    8.52e-09
     polstab |  -.0052472   .0314227    -0.17   0.869    -.0696137    .0591192
      goveff |  -.0232771   .0473818    -0.49   0.627    -.1203344    .0737802
       regqu |   .0372632   .0340522     1.09   0.283    -.0324896    .1070159
       _cons |   .1035367   .8195697     0.13   0.900    -1.575276    1.782349
------------------------------------------------------------------------------
```

Source: Computed

The coefficient of lagged GDP is positive and insignificant suggesting divergence.

With the inclusion of fitted gdp, the outcome is shown below in Table 9.

Table 9. Conditional Convergence Considering Inflation with Fitted GDP

Source	SS	df	MS		
Model	.017887777	15	.001192518	Number of obs	43
Residual	.0192363	27	.000712456	F(15, 27)	1.67
Total	.037124077	42	.000883907	Prob > F	0.1185
				R-squared	0.4818
				Adj R-squared	0.1940
				Root MSE	.02669

D.lngdp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdp	-.0055571	.0928637	-0.06	0.953	-.1960976	.1849834
lnk	.0032752	.034112	0.10	0.924	-.0667168	.0732672
lnl	-.0062124	.0453123	-0.14	0.892	-.0991855	.0867607
rir	.0003379	.0005762	0.59	0.562	-.0008443	.0015201
lnreer	.0346559	.0657842	0.53	0.603	-.1003221	.1696339
inflation	-.0005774	.002001	-0.29	0.775	-.004683	.0035282
lndebt	.0113645	.0146926	0.77	0.446	-.0187822	.0415112
lnpopg	.0228226	.0277359	0.82	0.418	-.0340867	.0797319
totr	-5.78e-12	3.87e-12	-1.49	0.147	-1.37e-11	2.16e-12
lntfpg	.0063449	.0771172	0.08	0.935	-.1518865	.1645762
openness	3.32e-10	3.21e-09	0.10	0.918	-6.25e-09	6.91e-09
polstab	-.0224599	.0298077	-0.75	0.458	-.0836203	.0387005
goveff	-.041263	.0442883	-0.93	0.360	-.1321351	.0496091
regqu	.0648355	.0333557	1.94	0.062	-.0036046	.1332757
lnfitted	.361983	.1482711	2.44	0.021	.0577559	.6662101
_cons	-3.083619	1.508277	-2.04	0.051	-6.178348	.0111092

Source: Computed.

The coefficient on lagged GDP is negative but insignificant suggesting convergence.

Under the real balances, the estimates without the inclusion of the fitted gdp are reported in the table below.

Table 10. Conditional Convergence with M2/CPI but without Fitted GDP

```
     Source |       SS       df       MS              Number of obs =      43
------------+------------------------------           F( 14,    28) =    1.15
      Model |  .013556478    14   .00096832           Prob > F      =  0.3620
   Residual |  .023567599    28    .0008417           R-squared     =  0.3652
------------+------------------------------           Adj R-squared =  0.0478
      Total |  .037124077    42  .000883907           Root MSE      =  .02901

------------------------------------------------------------------------------
     D.lngdp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lngdp |   .0121392   .2173026     0.06   0.956    -.4329851    .4572634
         lnk |  -.0004366   .0641482    -0.01   0.995    -.1318381     .130965
         lnl |  -.0058439   .0977292    -0.06   0.953     -.206033    .1943451
         rir |   .0000873   .0006173     0.14   0.889    -.0011771    .0013517
      lnreer |   .0222634   .0698735     0.32   0.752     -.120866    .1653929
       m2cpi |   6.15e-13   1.95e-12     0.32   0.755    -3.38e-12    4.61e-12
      lndebt |   .0008097   .0190099     0.04   0.966    -.0381303    .0397498
      lnpopg |   .0032357   .0411593     0.08   0.938    -.0810753    .0875468
        totr |  -1.22e-12   3.65e-12    -0.34   0.740    -8.70e-12    6.26e-12
      lntfpg |  -.0164345   .1492374    -0.11   0.913    -.3221336    .2892646
    openness |   1.57e-09   3.56e-09     0.44   0.662    -5.72e-09    8.86e-09
     polstab |   -.007193   .0308788    -0.23   0.817    -.0704453    .0560592
      goveff |  -.0147617   .0545215    -0.27   0.789    -.1264439    .0969204
       regqu |   .0361485   .0348496     1.04   0.308    -.0352377    .1075346
       _cons |   .0790603   .8829818     0.09   0.929    -1.729646    1.887767
------------------------------------------------------------------------------
```

Source: Computed

The result clearly suggests divergence among the countries in the sample.

Finally, the exercise involving real balances and fitted gdp yields the following outcome.

Table 11. Conditional Convergence with M2/CPI and Fitted GDP

```
      Source |       SS       df       MS              Number of obs =      43
-------------+------------------------------           F( 15,    27) =    1.66
       Model |  .017832305    15   .00118882           Prob > F      =  0.1211
    Residual |  .019291772    27   .00071451           R-squared     =  0.4803
-------------+------------------------------           Adj R-squared =  0.1916
       Total |  .037124077    42  .000883907           Root MSE      =  .02673

------------------------------------------------------------------------------
     D.lngdp |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
       lngdp |  -.0112334     .20044    -0.06   0.956    -.4225023    .4000356
         lnk |   .0029432   .0591192     0.05   0.961    -.1183593    .1242458
         lnl |  -.0056572    .090043    -0.06   0.950    -.1904101    .1790957
         rir |   .0003322   .0005775     0.58   0.570    -.0008527     .001517
      lnreer |    .041981   .0648807     0.65   0.523    -.0911432    .1751052
       m2cpi |   1.33e-13   1.81e-12     0.07   0.942    -3.58e-12    3.84e-12
      lndebt |   .0126712   .0181736     0.70   0.492    -.0246179    .0499604
      lnpopg |   .0166897   .0383189     0.44   0.667    -.0619343    .0953137
        totr |  -5.89e-12   3.87e-12    -1.52   0.140    -1.38e-11    2.05e-12
      lntfpg |   .0105124   .1379407     0.08   0.940    -.2725186    .2935434
```

openness	-9.39e-11	3.35e-09	-0.03	0.978	-6.97e-09	6.78e-09
polstab	-.0193043	.0288778	-0.67	0.509	-.0785566	.039948
goveff	-.0387616	.0511825	-0.76	0.455	-.1437795	.0662563
regqu	.0624867	.0338658	1.85	0.076	-.0070002	.1319735
lnfitted	.3476795	.1421259	2.45	0.021	.0560612	.6392978
_cons	-3.040245	1.512541	-2.01	0.055	-6.143722	.0632332

Source: Computed

The result clearly suggests convergence.

CONCLUDING OBSERVATION

The results of the analyses in this paper generally supported the established view in the literature on the importance of capital abundance, labor supply, institutions, factor productivity and real balances in the growth process of African countries. Inflation, policy distortions, conflicts and debt (total) were negative influences. The test on institutions accepted the alternative hypothesis of reduced institutional weaknesses improving economic growth.

The performance of total productivity growth was unexpected and could in the first instance be interpreted as suggesting a departure from the standard view of a declining productivity growth calling forth explanation(s) perhaps, in the manner of its computation in this study. An eclectic interpretation which is consistent with the established view in the literature would underscore its unparalleled importance in the growth process as underwritten by its remarkable performance in this study. This therefore throws a challenge at African governments on the state of their national system of innovations. Clearly, an essential ingredient to achieving continuous improvement in productivity growth is the need to raise further, the promotion of an enhanced national system of innovations.

The generally poor performance of terms of trade in the results may be a reflection of the reality of the composition of African trade being mostly primary exports and finished goods import with well-known adverse price movements. Thus, an accelerated program of transition from primary to secondary goods production and export would be growth beneficial.

The evidence on convergence was mixed; unconditional convergence proposition was not supported but conditional convergence was obtained only with the presence of fitted gdp signifying the importance of rapid technological progress in African countries' desire to catch up with the more advanced economies.

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