# Determinants of the recent growth surge in Africa: what changed since mid-1990s?

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**Abstract**

Growth performance of African countries since their independence in the late 1950s until mid-1990s is qualified by many scholars as a tragedy. Geography, ethnic fractionalization, conflicts and wars, bad policies, predatory elites, and many other phenomena were the factors presumed to explain the poor or catastrophic growth performance of the bulk of African countries. Fortunately, a revival of the economic growth in the majority of African countries is observed since mid-1990s. Identification of the factors that are instrumental of this growth's surge is of prime importance for policy makers. It is so because growth is the condition, even not sufficient one, to poverty reduction and improvement of standards of life in Africa. In spite of the structural differences between African countries, many factors affect their economies in the same manner. One major result of our paper is that contrary to what is the common belief in the 1970s, 1980s and the first half of the 1990s, investment was positively linked to growth in African countries in the period 2000-2009.

## 1. Introduction

Since the end of the 1950s and the independence of its countries, Africa as a whole underwent a major disillusion. During the first half of the 20th century, Africa outperformed [1] Asia (Collier and Gunning, 1999). Compared to its performance in the first half of the 20th century, the growth performance improved in African countries in the period 1960-1973. "In 1970, the real per capita GDP was 30% higher in SSA[2] excluding South Africa compared to Southeast Asia" (Stein, 2008, p. 1). This picture changed dramatically in the period from 1973 to mid-1990s due especially to terms of trade shocks, conflicts and political instability, and reinforcement of the dictatorships among others. Growth in Africa deteriorated if we compare the continent with its past performance or the performance of Asia's countries since mid-1970s. Therefore, over the period spanning from 1970s until mid-1990s "Africa's economies first flattered and then started to decline" (Collier and Gunning, 1999, p. 3).

This pattern continues until mid-1990s. Since then, a new cycle has emerged. Indeed, since "mid-1990s, average African growth accelerated" (Collier and Gunning, 1999, p. 19). This growth recovery created hopes for a brighter Africa's future compared to the past. Many scholars and institutions share this feeling [3] (Broadberry and Gardner, 2013; The Economist, 2011; Rodrik, 2014). There are available indirect indices that the prosperity of Africans, measured by real consumption derived from the consumed basket of goods and services and the quality of life, performed well since mid-1990 (Young, 2012)[4].

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[1] "In the 1960s, most African countries were richer than their Asian counterparts, and their stronger natural resource base led many to believe that Africa's economic potential was superior to overpopulated Asia's" (Babatunde, 2012, p. 143). This was also the conviction of G. Myrdal (1968).

[2] SSA is Sub-Saharan African.

[3] The Economist published two optimistic special reports on Africa. The first is entitled "Africa rising" published December 3, 2011. The second is entitled "Aspiring Africa" published March 2, 2013. Compare these two reports with its report "The hopeless continent" published Mai 13, 2000.

[4] "Demographic and Health Survey data on the consumption of consumer durables and housing, children's health and mortality, the schooling of youth and the allocation of women's time between marriage and childbirth and market activity, indicate that since 1990 real material consumption in sub-Saharan Africa has been rising at a rate three and half to four times that recorded by international data sources such as the PWT and UN, and on par with the growth taking place in other regions of the world" (Young, 2012, p. 42). PWT and UN mean the Penn World Tables and the United Nations respectively.

Researchers were unable to agree on the reasons explaining the mediocre/poor growth performance of African countries in the post-independence era over the period 1974 to 1995. Many factors are candidate to explain this situation. Geography, ethnic fractionalization, poor endowment, predatory elites, and bad public policies in the areas of physical and human capital accumulation were the main proposed explanations of the insufficiency of African growth.

Over the period spanning from 1965 to 1990, growth rate of the real per capita GDP in many African countries was nil or worse negative (Easterly and Levine, 1997). Table 1 gives an idea about growth rates of the real GDP and of real per capita GDP of Africa and other regions. This table shows that over the period 1980-2009 the GDP's average growth rate of African countries is higher than that of the World and practically equal to the growth rate of the MENA region. The highest real GDP's growth rates are recorded in China and in Asia-developing countries. Over the same period, growth rate of the real per capita GDP in Africa is lower than that of the World's average. The highest real per capita GDP growth rate was recorded in China and in Asia's developing countries.

As depicted in **Figure 1**, three phases are distinguishable in the growth's evolution of the real per capita GDP (constant 2005 US dollars) in Africa: growth during 1960-1975, decline during 1976-1995, and recovery during 1996-2013. There was a continuous divergence between the World's real GDP per capita and Africa's during all periods and between China's real per capita GDP and Africa's during the 20 last years. Remark that, the real per capita GDP in Africa was higher than that of China over the period 1960-1995 (figure 1).

**Table 1. Average growth rates of real GDP and of real per capita GDP**

|  | 1980-1989 | | 1990-1999 | | 2000-2009 | | 1980-2009 | |
|---|---|---|---|---|---|---|---|---|
|  | $g\%^{(1)}$ | $g_y\%^{(2)}$ | $g\%$ | $g_y\%$ | $g\%$ | $g_y\%$ | $g\%$ | $g_y\%$ |
| **Africa** | 2.94 | 0.10 | 3.34 | 0.91 | *4.83* | 2.37 | 3.74 | 1.17 |
| **World** | 3.07 | 1.29 | 2.67 | 1.15 | *2.61* | 1.37 | 2.78 | 1.27 |
| **MENA [3]-All Countries** | 1.20 | -1.87 | 4.22 | 1.96 | *4.95* | 2.88 | 3.45 | 0.99 |
| **ESP [4]-All Countries** | 5.08 | 3.46 | 3.47 | 2.21 | *3.82* | 3.01 | 4.12 | 2.89 |
| **ESP-Developing Countries** | 7.91 | 6.15 | 7.96 | 6.57 | *8.79* | 7.89 | 8.22 | 6.87 |
| **China** | 10.09 | 8.52 | 9.64 | 8.41 | *10.21* | 9.54 | 9.98 | 8.83 |
| **South Africa** | 2.24 | -0.26 | 1.39 | -0.80 | *3.66* | 2.04 | 2.43 | 0.33 |

<u>**Source**</u>: Calculated using WDI, 2015. *(1)* **g** is growth rate of the real *GDP* (2005 US dollars). *(2)* **g**$_y$ is growth rate of the real per capita *GDP* [per capita *GDP*=GDP (constant 2005 US$)/total population]. *(3)* MENA is Middle East and North Africa. *(4)* ESP is East Asia and Pacific.

This paper searches to explore the stylized facts characterizing the recent growth surge in Africa. The objective is, therefore, to identify the regularities and the indices that may best inform us about the main growth drivers or constraints in Africa. Mainly, this paper focuses on ten sets of growth factors (Table 2, annex).

Analysis in this paper focuses on the period 1980-2009 broken into three sub-periods 1980-1989, 1990-1999 and 2000-2009. However, the simulated model in this paper is estimated only for the last sub-period because the data are available, for the bulk of African countries, only in this sub-period.
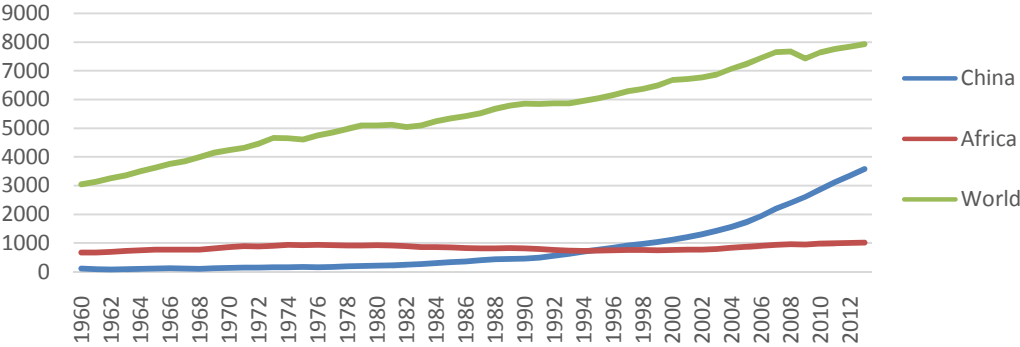


**Figure 1. Real per capita GDP (constant 2005 US$)- 1960-2013**
**Source**: Elaborated using WDI data set, 2015.

The structure of this paper is as follows. The second section reviews a sample of literature that focus on the determinants of growth in African countries over the post-independence era. The third section is a description of the economic growth experience of African countries. The fourth section is devoted to present and discuss some econometric results. The fifth section serves to conclude.

## 2. Growth in Africa: from the tragedy to the odyssey

There is a growing literature exploring factors behind Africa's tragic growth performance since the independence of the bulk of its countries in the 1950s and especially in the period 1975-1995. The available literature focused, in its first wave in the late 1990s, on the factors behind Africa's growth tragedy over the period spanning from mid-1970s to mid-1990s. The second wave of

literature explored the drivers/triggers of Africa's growth revival since mid-1990s. Here we summarize a sample of empirical research about the growth experience of Africa.

Easterly and Levine (1997) attempted to understand how no economic variables, such as ethnic fractionalization, command economic performance directly and indirectly through their impact on the nature and quality of public policies. The two authors used averaged data for the periods 1960s, 1970s, and 1980s. They documented that standard growth factors such as "low school attainment, political instability, poorly developed financial systems, large black market exchange rate premiums, large government deficits, and inadequate infrastructure… account for about two-fifths of the growth differential between countries of Sub-Saharan Africa and fast-growing East Asia" (Easterly and Levine, 1997, p. 1205). The authors focused on how ethnic fractionalization is related to bad policies presumed to be the main element that hinder the accumulation of factors and be at the origin of the growth gap in Sub-Saharan Africa compared to East Asia. For the authors, ethnic diversity is associated to bad public policies and hence is strongly, albeit indirectly, linked to growth performance in Sub-Saharan countries.

Bloom and Sachs (1998) explored the factors that are at the root of the long-run growth decline in African countries. They showed that "African per capita income growth averaged 1.5 percent in the 1960s, 0.8 percent in the 1970s, and -1.2 percent in 1980s. Output per capita continued to decline from 1990 to 1996 at a rate of 0.9 percent per year" (Bloom and Sachs, 1998, p. 208). They invoked six sets of factors to explain Africa's catastrophic economic performance: external conditions, heavy dependence on a small number of primary exports, internal politics, economic policies, demographic change, and social conditions. The authors concluded that Africa's poor growth is mainly due to its geography and demography.

In its review of the literature that answered the question: why has Africa grown slowly?, Collier and Gunning (1999) distinguish four classes of factors. These four classes are: *(1)* domestic exogenous factors such as geography and soil's quality, *(2)* domestic policies, politics, and institutions such as political freedom and bureaucracy, *(3)* external exogenous factors such as volatility of terms of trade and accessibility of foreign markets, and *(4)* external policies such as exchange rate and trade policies (Collier and Gunning, 1999, table 2, p. 7).

According to these authors, "the binding constraint upon Africa's growth may have been externally oriented policies in the past" (Collier and Gunning, 1999, p. 20).

The earlier papers, that explored the determinants of growth with data about African economies, found that being an African country is frequently associated with low growth performance (Barro, 1991 and Mauro, 1995). Englebert (2000) undertook a thorough exploration "which purports to solve the mystery of the AFRICA dummy" (p. 1822). His main hypothesis is that the lack of legitimacy of many post-independence African states constraints elites to adopt policies "which retard or hinder growth" (p. 1822). He constructed an index to discriminate between legitimate and non-legitimate countries. " 'State legitimacy' is quantified with a variable that differentiates endogenous from imported statehood with the idea that political institutions which evolve endogenously into a society, as a result of domestic social interactions or in opposition to neighbouring societies, are presumed historically legitimate from a societal point of view. This dummy variable takes the value 1 when a state is historically legitimate, 0 otherwise" (p. 1827). He concluded that the real impediments of growth in Africa countries are rooted in its polity. Furthermore, when the measure of the legitimacy of the state is introduced, the Africa's dummy ceased to be significant.

Using an augmented Solow model, Hoeffler (2002) searched to explain the African growth experience. The author's objective is to examine the validity of the conclusion of authors such as Barro (1991) and Levine and Renelt (1992) who found that an Africa dummy is negatively and significantly linked to growth in African countries. Using a generalized method of moments (GMM) estimator, Hoeffler reported "that there is no systematic unobserved difference between African and non-African countries. Hence, rather than concentrating research efforts on the analysis of a spurious Africa dummy, it may be more worthwhile to focus on the continent's low investment ratios and high population growth rates, which we found to be sufficient to explain Africa's low growth rates" (Hoeffler, 2002, p. 156).

Knutsen (2009) analysed the links between democratization and growth performance in Sub-Saharan Africa. The author focused on the negative economic impact of dictatorial regimes when they operate in an environment

characterized by weak state institutions. "The empirical analysis shows that democracy most likely contributes to higher growth rates in Sub-Saharan Africa, and that democracy has a larger positive effect on growth in Africa than globally. Moreover, statistical analyses, both on African and global samples, show that democracy has a particularly positive effect in countries with weak state institutions" (Knutsen, 2009, p. 1). This author found that ethnic fractionalization is negatively correlated with growth as in Easterly and Levine (1997). Contrary to what the convergence hypothesis predicts, it appears that growth is positively linked to initial level of income in Sub-Saharan Africa. Regressions show that the largeness of a country and its political stability are positively linked to its growth.

Diop, Dufrénot and Sanon (2010) explored the links between governance and institutional characteristics of ECOWAS[5] countries and their growth rate of per capita GDP/income during the period 1995-2004. As we signalled in the introduction, this period is important because in the mid-1990s, Africa's growth recovered from its long-run decline since mid-1970s. For this, they test β-convergence[6] using a panel data model. The set of growth rate determinants includes the quality of governance and institutions and a bundle of usual variables for control. The data are annual and cover the period 1995-2004. Authors' results show negative relationship "between the growth rate of per capita GDP and variables reflecting the rule of law, government effectiveness, property rights, accountability, regulatory burden" (Diop et al., 2010, p. 272).

Mckinsey Global Institute (2010) prepared a report entitled "Lions on the move: the progress and potential of African economies" in order to explore the causes of the surge of growth since late 1990s. In this report, it appears that the surge of growth is not dependant on commodities price boom over the period 2000-2008. The factors that are the real causes of the recovery of growth in African economies are better investment climate, prudent macroeconomic policies, and less political conflicts in many countries. The report identified three undergoing trends that are contributing to sustain growth in African

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[5] ECOWAS countries are: Benin, Burkina Faso, Cape Verde, Côte d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Mali, Niger, Nigeria, Senegal, Sierra Leone, and Togo.

[6] This concept is referred to, among others, Barro (1984), Barro (1991), Barro and Sala-i-Martin (1991, 1992). Beta-convergence or "regression toward the mean" occurs when "a poor economy tends to grow faster than a rich one, so that the poor country tends to catch up to the rich one in terms of levels of per capita income" (Barro and Sala-i-Martin, 2003, p. 462).

countries. They are "Africa's evolving global economic ties, its growing access to international capital, and the emergence of an urban African consumer" (p. 14).

Tsangarides (2012) focused on factors that are most likely to sustain or end a growth spell in African economies. He used, as an investigation tool, the Bayesian Model Averaging techniques/methods for proportional hazards models. Growth spells are "sustained growth episodes between growth accelerations and decelerations" (Tsangarides, 2012, p. 1). The author's objective is to link "the probability that growth spells will end to the various determinants including exogenous shocks, human capital, macroeconomic and socio-political factors" (Tsangarides, 2012, p. 16). By this, the author searched to isolate the factors that are most likely to contribute to the end of a growth spell. The point of his exercise is to determine the correlates of growth spells/surges and ends. Operationally, the author adopted the same definition of Berg, Ostry, and Zettelmeyer (BOZ, 2012) of a growth spell. Indeed, complete growth spells are "period of time that *(i)* begin with a growth up-break followed by a period of at least a 2 percent average per capita income growth; and *(ii)* end with a growth down-break followed by a period of less than 2 percent average per capita income growth" (Tsangarides, 2012, p. 7). The authors' main results are that investment in human and physical capital, trade and openness, and droughts are the major variables that influence growth surges in Africa (Tsangarides, 2012, p. 16).

Working on a sample of 19 Sub-Saharan African (SSA) countries representing 72% of SSA population and using a data set covering the period 1960-2000, Fosu (2013) explored the links of a healthy political regime with growth, total factor productivity (TFP), and factor accumulation. As a fundamental concept[7], the author used "policy syndromes" that are: "'state control', 'adverse redistribution', 'suboptimal inter-temporal resource allocation', and 'state breakdown', with the absence of the above syndromes referred to as 'syndrome-free'" (Fosu, 2013, p. 4). The main patterns of growth of the region show that "per capita growth rate moves rather well with TFP growth, compared with its movement with either physical or human capital

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[7] Fosu (2013) paper refers strongly to the African Economic Research Consortium growth project. This project assumes that "policy syndromes" are strongly linked to the mediocre growth experience of African countries especially in the 1970s, 1980s, and the first half of the 1990s.

accumulation. The contribution of education seems particularly uniform over time and seems unrelated to the evolution of growth" (Fosu, 2013, p. 3).

Mijiyawa (2013) focused on the period 1995-2005. During this period, a revival of growth in Africa was observed. A Mijiyawa conducted multivariate growth regressions *à la Barro* and found that physical capital accumulation, volume of credit issued to the private sector, effectiveness of the government, extent of exports, and share of manufacturing activities in GDP are linked significantly and positively to growth. The author conducted a robustness check of his results by introducing measures of ethnic and language diversity, a dummy to take account of the non-access to the sea of a country, and an index measuring the extent of the tropical climate in a country. The author documented no change of the sign and significance of the five variables that he initially detected to be growth enhancing factors (Mijiyawa, 2013, p. 9).

M. Ghazanchyan and J. Stotsky (2013) explored the determinants of the growth surge over the period 1999-2011 for a sample of 42 Sub-Saharan African countries. The authors use cross-section and time series data and employ different econometric techniques. The main results of the authors are that "the recent African growth experience has been varied and that capital accumulation has boosted growth but that the relationship is not as strong or clear as might be expected. Evidence for the positive effect of the private investment is largely limited to oil exporters, where its main impulse may be on the demand side. Some evidence is found for a positive effect of public investment in the non-oil countries... Some limited evidence is found for a positive impact of more flexible foreign exchange regimes. The change in the real effective exchange rate and current account liberalization do not appear to be strong determinants of growth or their effect does not clearly emerge at this aggregate level of data" (p. 20).

## 3. Descriptive patterns of growth in Africa

Growth rates in Africa deteriorated sharply in the 1970s and in the 1980s. Fortunately, since mid-1990s a slight improvement of Africa's growth rate is observed, but not as bright as what is observed in Asian countries. In the first decade of the millennium, a more robust recovery started pushing many observers to consider that Africa is in the onset of an era of sustainable high

growth. Table 3 reports the growth performances of Africa over the sub-periods 1980-1989, 1990-1999, and 2000-2009.

**Table 3. Overall average growth rates in Africa, in %**

|  | 1980-1989 | 1990-1999 | 2000-2009 | 1980-2009 |
|---|---|---|---|---|
| **Average growth rate of g** | 2.94 | 3.34 | 4.83 | 3.74 |
| **Standard deviation of g** | 5.84 | 11.76 | 6.26 | 8.45 |
| **Maximum of g** | 23.60 | 149.97[1] | 63.38[1] | 149.97 |
| **Minimum of g** | -26.67 | -51.03[2] | -32.83 | -51.03 |

**Source**: WDI, 2015. *(1)* These rates were recorded in Equatorial Guinea. *(2)* This rate was recorded in Liberia.

The mean of a set of numerical magnitudes is commonly used to resume their statistical distribution. In reality, the mean is a good measure of the central tendency only in symmetrical concentrated distributions. In our paper, it is not the case because the growth rates of African countries are neither symmetrical nor concentrated around their mean. Table 4 provides the distribution of the average growth rate of African countries over the sub-periods 1980-1989, 1990-1999, 2000-2009, and 1980-2009 over 5 modalities. The fifth modality includes countries for which data is not available.

Table 4 shows that *(1)* the bulk of countries recorded an average growth rate between 0% and 5% over the period 1980-2009; *(2)* among these countries recording a growth rate between 0 and 5%, a kernel of 18 countries recorded systematically a growth rate in this range (i.e. [0, 5[) during the three sub-periods. These countries are Algeria, Benin, Cameroon, Central African Republic, Comoros, Gabon, Guinea-Bissau, Kenya, Lesotho, Madagascar, Malawi, Morocco, Namibia, Niger, Senegal, Seychelles, South Africa and Togo. They represent 34.6% of Africa countries; *(3)* the cases of Zimbabwe and Equatorial Guinea are particular. Zimbabwe is the only country that recorded a negative growth rate during sub-period 2000-2009. Its growth rate is on a continuous degradation from class [5, 10[ during the first sub-period down to class [0, 5[ during the second sub-period, and down to class [-5, 0[ during the last sub-period. In contrast, Equatorial Guinea recorded the highest growth rate during the sub-periods 1990-1999 and 2000-2009. Its growth rate jumped from class [0, 5[ during the first sub-period to class [10, +[ during second and third sub-periods.

**Table 4. Distribution of countries according to the average growth rate of their real GDP**

| Classes | 1980-1989 | | 1990-1999 | | 2000-2009 | | 1980-2009 | |
|---|---|---|---|---|---|---|---|---|
| | $n_i$ | $f_i$ (%) | $n_i$ | $f_i$(%) | $n_i$ | $f_i$(%) | $n_i$ | $f_i$(%) |
| [-05, 00[ | 3 | 6 | 6 | 12 | 1 | 2 | 1 | 2 |
| [00, 05[ | 37 | 71 | 34 | 65 | 31 | 59 | 41 | 79 |
| [05, 10[ | 6 | 11 | 7 | 13 | 16 | 31 | 9 | 17 |
| [10, +[ | 1 | 2 | 2 | 4 | 3 | 6 | 1 | 2 |
| NA* | 5 | 10 | 3 | 6 | 1 | 2 | 0 | 0 |
| Total of Countries | 52 | 100 | 52 | 100 | 52 | 100 | 52 | 100 |

**Source**: our elaboration, * No Available data

## 4. Methodology and results

Many factors could be attributed a positive or a negative role in economic growth. Furthermore, we can distinguish between large and marginal effects factors. We can classify growth factors into broad families. Our objective in this paper is to explain the average growth performance of African countries by a bundle of factors that are most likely to explain their growth performance and, therefore, to detect the most relevant variables in the process of growth in these economies during the period 2000-2009. We introduce the factors that empirical literature on growth revealed to be the most important. We will run the following equation[8]:

$$g_i = \beta_0 + \beta_1 Y_{IC} + \beta_2 X_1 \ldots + \beta_k X_k + \varepsilon_i = \boldsymbol{\beta X} + \varepsilon$$

Here $X_1$, $X_2 \ldots X_k$ are explanatory variables and $Y_{IC}$ is the initial real per capita income introduced to take account of the convergence hypothesis. Table 5 in annex presents definitions, notation, and broad families of these variables. The vector of parameters is $\beta$. The econometric study is devised so as to explore multiple specifications of the growth rate function.

Growth depends on numerous factors. It is possible to enumerate a half hundreds of factors[9] that are likely to explain growth performance of a country. In this paper, we want to explore the most influential factors commanding growth in Africa. Indeed, as proposed by the proponents of the growth diagnostic approach (Hausmann, Rodrik, and Velasco, 2005), it is an interesting and fruitful methodology to identify primarily the most binding obstacles in Africa. Remark also that a factor $X_i$ may be linked to growth directly or

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[8] We also run an equation with the real per capita GDP as endogenous variable.

[9] We can distinguish factors depending on being triggers, or enablers, or supporters, or engines, or hinderers, or boosters, or stimulators. Another classification may separate contributing factors and mediating factors. One of the most used classifications is proximate vs. fundamental or root factors of growth.

indirectly. What is important for us is the magnitude of the influence of those factors on the growth performance of African countries. The consequence of the use of this methodology is to roll out/exclude factors that impact positively or negatively but marginally the economy's growth rate.

It is important to signal that we are aware of the limits of our methodology. Certainly, running the growth equation 1 to identify the variables that are at average the most relevant for growth in Africa in a given period is misleading because of the absence of homogeneity of African economies. In fact, these economies are heterogeneous, i.e. they do not have the same production function, they do not adopt the same policies, and they do not operate under the same structural conditions. The relevance of our results stems from their usefulness to determine the list of variables that are to take account in any strategy designed to enhance growth in Africa.

We regress the growth rate of real GDP, noted g, and the growth rate of real per capita GDP, noted $g_y$, for 48 African countries on different regressors. Libya, Somalia, South Sudan and 'Sao Tome and Principe' are excluded because their data are not available. Only results of 9 regressions are presented in annex (Table 6 and Table 7). For both models, we keep the same exogenous variables to allow comparison. Table 6 presents results of simulating equation 1 where the growth rate of real GDP, noted g, is the endogenous variable. Table 7 provides results of simulating equation 1 with the growth rate of real per capita GDP, noted $g_y$, as the endogenous variable. Table 8 and Table 9 (in Annex) provide results of equation 1 after excluding Botswana from our 48 countries sample. The idea behind this is to compare our results with the results of Devarajan, Easterly, and Pack (2001).

In all models presented in annex (Table 6 and Table 7), we observe that the set of explanatory variables that have the expected sign remains unchanged. We can highlight four of our results. The first result is that investment and governance and institutional variables are linked positively, albeit sometimes insignificantly, to growth in Africa. This result is similar to result of M. Ghazanchyan and J. Stotsky (2013). Recall also that A. Mijiyawa (2003) introduced, among others, similar exogenous factors in his study of the Africa's drivers of growth over the period 1995-2005. He found that the measure physical capital accumulation and the measure of the effectiveness of

government are linked significantly and positively to growth. Our results concord with Mijiyawa's only in the case of investment rate.

The second result is that the real interest rate (*r*) affects negatively and systematically growth in Africa. This result is concordant with the results of authors mentioned above who observed that the price of capital goods in terms of the price of consumption goods is higher in African countries. Indeed, Artadi and Sala-i-Martin (2003) recorded evidence on how higher is the price of capital goods in Africa (p. 10 and figure 13).

The third result is the positive impact of most variables measuring institutional capital on economic growth especially the positive and significant coefficient attached to regulatory quality variable (*ICR*). This result is so important in the African context. Indeed, what African countries need is primarily a sound and healthy environment or climate of investment and the human and institutional capabilities to implement reforms.

The fourth result is the robustness, the positivity, and the significance of the coefficient attached to the investment rate in the models of the growth rate of the real GDP and the growth rate of the real per capita GDP. This result deserves deep investigation because sound research proved that during the pre-growth revival in Africa, investment in Africa is not low but inefficient (Devarajan et al., 2001). Indeed, Devarajan et al. (2001) widely documented that over the period 1970-1997 the African economies suffered more from a low return of investment than from a low investment *per se*. The authors were aware of the fact that African countries invest a lower rate of their GDP but convincingly argue that this may be a rational response of economic agents to the low return of investment. The main argument of the authors is that private and public investments are loosely linked to growth when Botswana is excluded from their sample. They found that "... a combination of factors, all of which occurred simultaneously" (p. 23) may explain the weak impact of investment on growth in Africa. They concluded that "the solution lies in addressing this set of factors simultaneously" (p. 23). We think that their result ceased to be valid since mid-1995. Indeed, we check the robustness of this result by excluding Botswana, as do Devarajan and al. (2001), from our sample (Table 8 and Table 9).

Investment is necessary for growth (Levine and Renelt, 1992). It is more central for African countries that are in the first stages of economic development

based on the accumulation of physical capital such as bridges, roads, ports, and schools. Contrary to Devarajan et al. (2001), we think that many factors, that in the 1970s, the 1980s, and the first half of the 1990s prevented investment from producing its full effects on growth, were removed since mid-1990s as evidenced by the strong links that we find between investment and growth in the period 2000-2009 (Tables 6, 7, 8, and 9 in annex). This observation is also shared by Artadi and Sala-i-Martin (2003) who asserted that private investment recorded a growing trend in Africa during the 1990s and this "may be one of the reasons behind the slight increase in growth rates of the second half of the decade and the first two years of the new century" (p. 9).

## 5. Concluding remarks

Research on episodes of economic growth surges and declines (outbreaks and down-breaks) show that the sources of an increase of the rate of growth in a country are not the same factors that cause a reversal (Tsangarides, 2012). For African countries, known by their fragility and by the no-durability of growth rather than by the absence of periods of high growth rates, it is necessary to take account of factors that initiate growth, of factors that sustain growth, and those factors that stop growth. This warning is so important because in many situations we have observed dramatic and sudden reversals of growth periods due to wars, political instability, or unwise economic policies. The objective of African policy-makers must be to make the current growth surge in Africa persistent and a real and lasting take-off rather than a one-time event.

Many authors interested to the causes of the tragedy of growth in Africa proposed that the nature and quality of institutions are at the root of this tragedy (Englebert, 2001). Later research corroborated this conjecture. In accordance with development economics literature, that digs deeper into the fundamental determinants of growth and development, it appears that African economies suffered and continue to suffer from the low quality of institutions that translates into bad governance, produces inefficient policies, and contributes to the design of reverse incentives.

The survey and inspection of post-independence growth experience of African countries provide useful results about triggers, impediments, and trajectory of growth in this so diverse continent. It appears that African countries inefficiency and lacks of proximate factors of growth are due to the absence of

deep growth factors that may provide adequate incentives to accumulate and use resources efficiently. These deep factors are institutions that shape incentives, decisions, and policies (Acemoglu and Robinson, 2012). In Africa, it is widely accepted that lack of adequate institutions is the ultimate explanation of Sub-Saharan African countries low growth performance. The creation and making of the post-independence state shaped its legitimacy and thus the policies that its rulers adopted. The future research on the development shortfalls in Africa should concentrate on the factors that shape institutions, determines state legitimacy and elites' incentives as proposed by authors such as D. Acemoglu and J. Robinson (2012).

Current growth prospects in Africa are brilliant. The continent may improve its performance by accumulating physical and human capital, (re)allocating inputs to the most productive uses, increasing efficiency through imitating best practices in productive activities and public sector decision-making. Physical accumulation of capital may be a promising road in Africa because econometric results provide evidence that investment is positively linked to growth.

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**Table 2. Classification of growth factors**

| Growth Factors Taxonomy | Variable 1 | Variable 2 | Variable 3 | Variable 4 | Variable 5 |
|---|---|---|---|---|---|
| 1. **Tangible reproducible Capital** | Rate of investment | K/Y | Physical infrastructure availability | | |
| 2. **Human Capital** | Average number of years of schooling | secondary school enrolment rate | Life expectancy at birth | | |
| 3. **Governance and Institutional capital** | Index of democracy | Index of corruption | Quality of bureaucracy | Rule of law (Bolt) | |
| 4. **Social capital** | Index of social confidence | Crimes frequency | Ethnic heterogeneity | | |
| 5. **Macroeconomic management** | Inflation | Government deficit | Current account deficit | Public debt (debt service in GNI- %) | Black market exchange rate premium |
| 6. **Sectoral structure of the economy** | Manufacturing VAM/GDP | Agricultural VAA/GDP | Rate of urbanization | | |
| 7. **Openness** | (M+X)/GDP | M/GDP | X/GDP | | |
| 8. **Geography (natural capital)** | Water availability | Coastal borders | Forest density | Natural products as % of X | |
| 9. **Financial Sector** | Financial deepening | Real interest rate | | | |
| 10. **Initial conditions** | Real per capita GDP in the beginning of the period | | | | |

**Source**: Our elaboration

**Table 5. Definitions and notation of the variables**

| Description | Notation | Details (unit)[*] |
|---|---|---|
| **Real GDP** | $Y$ | Total GDP at 2005 $ (number) |
| **Total population** | $N$ | Total of people residing in a country |
| **Real GDP growth rate** | $g$ | Growth rate of the real GDP at 2005US$ (%) |
| **Real per capita GDP growth rate** | $g_v$ | Growth rate of the real GDP per capita at 2005US$ (%) |
| **Tangible reproducible Capital 1** | $Inv$ | Rate of investment is the ratio of gross capital formation plus the net change in the level of inventories to GDP (%) |
| **Tangible reproducible Capital 2** | $roads$ | Availability of roads is the share of paved roads in percent in total roads (%) |
| **Human capital 1** | $hcp$ | Primary completion rate (%) |
| **Human capital 2** | $hcs$ | Secondary enrolment rate (%) |
| **Human capital 3** | $hclife$ | Life expectancy at birth: the number of years a new born is expected to live, (number) |
| **Human capital 4** | $hclt$ | Literacy rate of adult total (% of people ages 15 and above) |
| **Governance and Institutional capital 1** | $icv$ | Voice and Accountability "Reflects perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically motivated violence and terrorism". |
| **Governance and Institutional capital 2** | $icr$ | Regulatory Quality "*Reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development*". |
| **Governance and Institutional capital 3** | $icp$ | Political Stability and Absence of Violence/Terrorism "Reflects perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism". |
| **Governance and Institutional capital 4** | $icg$ | Government Effectiveness is "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". |
| **Governance and Institutional capital 5** | $icl$ | Rule of Law is "the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence". |
| **Governance and Institutional capital 6** | $icc$ | Control of Corruption "Reflects perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests". |
| **Macroeconomic management 1** | $inf$ | The growth rate of GDP's implicit deflator (GDP at current price/GDP at constant price, the two variables are at local currency) (%) |
| **Macroeconomic management 2** | $fdservice$ | Foreign debt service/GNI (%) |
| **Sectoral structure of the economy 1** | $industry$ | Share of industry in GDP measured by the ratio of industry's value added to total GDP (%) |
| **Sectoral structure of the economy 2** | $agri$ | Share of agriculture in GDP measured by the ratio of agriculture's value added to total GDP (%) |
| **Urbanization rate** | $u$ | Share of the population of urban areas in total population (%) |
| **Economic openness 1** | $openXM$ | (X+M)/ GDP, (%) |
| **Economic openness 2** | $openX$ | X/GDP, (%) |
| **Economic openness 3** | $openM$ | M/GDP, (%) |
| **Natural capital (geography) 1** | $ncf$ | Forest density % is = Forest Area/total area |
| **Natural capital (geography) 2** | $ncw$ | Water availability (% of population with access to water services) |
| **Natural capital (geography) 3** | $ncrent$ | Total natural resources rents (% of GDP) |
| **Financial Sector 1** | $r$ | Real interest rate |
| **Financial Sector 2** | $DCPS$ | Financial sector deepening measured by domestic credit to the private sector/GDP (%) |
| **Terms of trade** | $Terms$ | Relative price of African countries exportation to the price of their imported products (%) |

**(\*)** Source of all variables is the WDI, 2015 excluding the variables that measure governance and institutional capital, their source is the Worldwide Governance Indicators, 2014. The WGI which is one of the most carefully constructed and most widely used indicator (Maurseth, 2008) aims at aggregating existing sources about governance to construct new and more reliable composite indicators. It shows the estimated governance scores ranging between approximately -2.5 and 2.5 and the percentile rank of ranging from 0 (lowest) to 100 (highest) ranks. The six aggregate indicators are based on 30 underlying data sources reporting the perceptions of governance of a large number of survey respondents and expert assessments worldwide and they cover a wide range of countries.

**Table 6. Growth rate of real GDP (g) is the endogenous variable, sub-period 2000-2009 and 48 Africa's countries**

| | Notation | Mod. 1 | Mod. 2 | Mod. 3 | Mod. 4 | Mod. 5 | Mod. 6 | Mod. 7 | Mod. 8 | Mod. 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| | constant | -1.04 | 0.62 | 1.01 | 1.24 | 1.73 | 7.69 | 3.76 | 0.40 | 2.50 |
| | t-stat | -0.80 | 0.32 | 0.46 | 0.33 | 0.44 | 1.64 | 0.95 | 0.08 | 0.74 |
| 1. Initial condition | $y_{2000}$ | -0.0001 | -0.0002 | -0.0003 | -0.0001 | -0.0002 | -0.0006 | -0.0005 | -0.0004 | -0.0004 |
| | t-stat | -0.66 | -0.82 | -0.91 | -0.39 | -0.51 | -1.26 | -1.02 | -1.27 | -1.21 |
| 2. Tangible capital | inv | 0.17 | 0.10 | 0.09 | 0.11 | 0.10 | 0.05 | 0.09 | | 0.09 |
| | t-stat | 4.39 | 1.87 | 1.67 | 1.85 | 1.64 | 0.75 | 1.32 | | 1.45 |
| | roads | | | | | | 0.02 | 0.01 | 0.01 | |
| | t-stat | | | | | | 0.65 | 0.39 | 0.53 | |
| 3. Human capital | hcp | | 0.02 | 0.02 | 0.01 | 0.01 | | | | 0.01 |
| | t-stat | | 0.73 | 0.62 | 0.34 | 0.31 | | | | 0.42 |
| | hcs | | | | | | 0.01 | 0.01 | | |
| | t-stat | | | | | | 0.18 | 0.17 | | |
| | hclife | | | | | | | | 0.01 | |
| | t-stat | | | | | | | | 0.10 | |
| | hclt | | -0.04 | -0.04 | | | | | | |
| | t-stat | | -1.18 | -1.14 | | | | | | |
| 4. institutional capital | icp | | | | | | | | | -0.38 |
| | t-stat | | | | | | | | | -0.44 |
| | icg | | | | | | 0.61 | 1.17 | | |
| | t-stat | | | | | | 0.48 | 0.59 | | |
| | icl | | | 0.34 | | 0.47 | | | | |
| | t-stat | | | 0.43 | | 0.52 | | | | |
| | icc | | | | | | | | | 1.15 |
| | t-stat | | | | | | | | | 0.76 |
| | icv | | | | | | 1.61 | 0.55 | | |
| | t-stat | | | | | | 1.70 | 0.31 | | |
| | icr | | | | | | | | 1.85 | |
| | t-stat | | | | | | | | 2.20 | |
| 5. Macroeconomic stability | inf | 0.03 | | | -0.01 | -0.01 | 0.03 | 0.03 | 0.002 | 0.006 |
| | t-stat | 0.38 | | | -0.06 | -0.06 | 0.32 | 0.31 | 0.02 | 0.07 |
| | fdservicv | | 0.22 | 0.23 | 0.25 | 0.25 | 0.29 | 0.25 | | |
| | t-stat | | 2.14 | 2.15 | 2.03 | 2.01 | 2.12 | 1.78 | | |
| 6. Sectotial structure | industry | | 0.02 | 0.02 | 0.01 | 0.001 | -0.06 | -0.06 | | -0.04 |
| | t-stat | | 0.70 | 0.69 | 0.11 | 0.02 | -0.81 | -0.72 | | -0.58 |
| | agri | | | | 0.002 | 0.003 | -0.031 | 0.003 | 0.002 | 0.003 |
| | t-stat | | | | 0.05 | 0.06 | -0.61 | 0.07 | 1.37 | 0.69 |
| | u | | | | -0.02 | -0.02 | -0.04 | -0.03 | | |
| | t-stat | | | | -0.79 | -0.80 | -1.23 | -1.07 | | |
| 7. Economic Openness | openxm | | -0.003 | -0.002 | | | | | 0.02 | 0.004 |
| | t-stat | | -0.19 | -0.13 | | | | | 1.21 | 0.26 |
| | openm | | | | | | -0.04 | -0.03 | | |
| | t-stat | | | | | | -1.07 | -0.77 | | |
| | openx | | | | | | 0.07 | 0.07 | | |
| | t-stat | | | | | | 1.24 | 1.02 | | |
| 8. natural capital (Geography) | ncf | | | | -0.02 | -0.02 | -0.03 | -0.02 | | |
| | t-stat | | | | -0.70 | -0.65 | -1.01 | -0.65 | | |
| | ncw | | | | -0.02 | -0.02 | -0.04 | -0.02 | | |
| | t-stat | | | | -0.84 | -0.77 | -1.43 | -0.75 | | |
| | ncrent | | | | 0.02 | 0.02 | 0.04 | 0.04 | 0.04 | 0.07 |
| | t-stat | | | | 0.37 | 0.52 | 0.86 | 0.72 | 1.68 | 1.51 |
| 9. Financial Sector | r | -0.04 | -0.06 | -0.05 | -0.06 | -0.05 | -0.07 | -0.04 | -0.05 | -0.08 |
| | t-stat | -0.82 | -1.18 | -1.10 | -0.97 | -0.90 | -1.16 | -0.76 | -0.99 | -1.35 |
| | dcps | | | | 0.01 | 0.01 | 0.001 | | | |
| | t-stat | | | | 0.42 | 0.35 | 0.03 | | | |
| | R2 | 0.37 | 0.28 | 0.29 | 0.30 | 0.31 | 0.45 | 0.39 | 0.23 | 0.28 |

**Source**: Our calculation

**Table 7. Growth of real per capita GDP ($g_y$) is the endogenous variable, sub-period 2000-2009 and 48 Africa's countries**

| | Notation | Mod1 | Mod2 | Mod3 | Mod4 | Mod5 | Mod6 | Mod7 | Mod8 | Mod9 |
|---|---|---|---|---|---|---|---|---|---|---|
| | constant | 0.99 | 5.25 | 5.52 | 4.97 | 5.89 | 13.00 | 12.90 | 3.46 | -1.10 |
| | t-stat | 0.68 | 2.48 | 2.35 | 1.24 | 1.42 | 2.70 | 2.85 | 0.66 | -0.36 |
| 1. Initial conditions | $y_{2000}$ | -0.0004 | -0.0003 | -0.0004 | -0.0003 | -0.0004 | -0.001 | -0.001 | -0.0005 | -0.0003 |
| | t-stat | -1.78 | -1.15 | -1.17 | -0.87 | -1.08 | -1.34 | -1.37 | -1.50 | -0.92 |
| 2. Tangible capital | inv | 0.19 | 0.09 | 0.09 | 0.11 | 0.09 | 0.05 | 0.05 | | 0.10 |
| | t-stat | 4.39 | 1.63 | 1.48 | 1.75 | 1.47 | 0.71 | 0.76 | | 1.63 |
| | roads | | | | | | 0.02 | 0.02 | 0.01 | |
| | t-stat | | | | | | 0.68 | 0.72 | 0.30 | |
| 3. Human capital | hcp | | 0.01 | 0.01 | 0.01 | 0.01 | | | | 0.02 |
| | t-stat | | 0.28 | 0.21 | 0.27 | 0.23 | | | | 0.76 |
| | hcs | | | | | | 0.00 | -0.01 | | |
| | t-stat | | | | | | -0.12 | -0.16 | | |
| | hclife | | | | | | | | 0.004 | |
| | t-stat | | | | | | | | 0.04 | |
| | hclt | | -0.05 | -0.05 | | | | | | |
| | t-stat | | -1.39 | -1.36 | | | | | | |
| 4. Governance and institutional capital | icp | | | | | | | | | -0.79 |
| | t-stat | | | | | | | | | -0.99 |
| | icg | | | | | | 0.25 | 0.23 | | |
| | t-stat | | | | | | 0.19 | 0.18 | | |
| | icl | | | 0.25 | | 0.88 | | | | |
| | t-stat | | | 0.29 | | 0.92 | | | | |
| | icc | | | | | | | | | 1.40 |
| | t-stat | | | | | | | | | 1.00 |
| | icv | | | | | | 2.14 | 2.13 | | |
| | t-stat | | | | | | 2.20 | 2.24 | | |
| | icr | | | | | | | | 1.85 | |
| | t-stat | | | | | | | | 2.04 | |
| 5. Macroeconomic stability | inf | 0.08 | | | 0.02 | 0.02 | 0.05 | 0.05 | 0.03 | -0.034 |
| | t-stat | 0.99 | | | 0.17 | 0.18 | 0.61 | 0.63 | 0.35 | -0.46 |
| | fdservice | | 0.28 | 0.28 | 0.24 | 0.24 | 0.35 | 0.35 | | |
| | t-stat | | 2.47 | 2.45 | 1.85 | 1.86 | 2.47 | 2.52 | | |
| 6. Sectoral structure of the economy | industry | | 0.03 | 0.03 | -0.02 | -0.03 | -0.07 | -0.07 | | -0.02 |
| | t-stat | | 0.82 | 0.82 | -0.28 | -0.43 | -0.91 | -0.92 | | -0.34 |
| | agri | | | | 0.004 | 0.004 | -0.04 | -0.04 | 0.06 | 0.02 |
| | t-stat | | | | 0.08 | 0.09 | -0.81 | -0.83 | 1.73 | 0.56 |
| | u | | | | -0.04 | -0.04 | -0.05 | -0.05 | | |
| | t-stat | | | | -1.20 | -1.24 | -1.71 | -1.75 | | |
| 7. Economic Openness | openxm | | -0.01 | -0.01 | | | | | 0.01 | 0.01 |
| | t-stat | | -0.78 | -0.73 | | | | | 0.54 | 0.85 |
| | openm | | | | | | -0.06 | -0.06 | | |
| | t-stat | | | | | | -1.44 | -1.46 | | |
| | openx | | | | | | 0.06 | 0.06 | | |
| | t-stat | | | | | | 1.05 | 1.09 | | |
| 8. Geography (natural capital) | ncf | | | | -0.01 | -0.01 | -0.02 | -0.02 | | |
| | t-stat | | | | -0.40 | -0.32 | -0.89 | -0.93 | | |
| | ncw | | | | -0.03 | -0.02 | -0.05 | -0.05 | | |
| | t-stat | | | | -0.94 | -0.84 | -1.63 | -1.66 | | |
| | ncrent | | | | 0.04 | 0.06 | 0.06 | 0.06 | 0.06 | 0.04 |
| | t-stat | | | | 0.95 | 1.19 | 1.19 | 1.21 | 2.07 | 1.02 |
| 9. Financial Sector | r | -0.05 | -0.08 | -0.08 | -0.08 | -0.08 | -0.10 | -0.10 | -0.08 | -0.06 |
| | t-stat | -0.90 | -1.59 | -1.51 | -1.33 | -1.22 | -1.73 | -1.78 | -1.35 | -1.09 |
| | dcps | | | | 0.01 | 0.01 | -0.002 | | | |
| | t-stat | | | | 0.37 | 0.27 | -0.07 | | | |
| | R2 | 0.36 | 0.35 | 0.35 | 0.37 | 0.39 | 0.54 | 0.54 | 0.29 | 0.22 |

**Source**: Our calculation

**Table 8. Growth rate of real GDP (g) is the endogenous variable, sub-period 2000-2009 and 47 Africa's countries (Botswana excluded)**

| | Notation | Mod1 | Mod2 | Mod3 | Mod4 | Mod5 | Mod6 | Mod7 | Mod8 | Mod9 |
|---|---|---|---|---|---|---|---|---|---|---|
| | constant | 1.96 | 6.71 | 7.64 | 7.37 | 8.19 | 13.90 | 14.53 | 13.16 | 4.83 |
| | t-stat | 1.48 | 3.36 | 3.50 | 1.84 | 2.00 | 3.02 | 3.22 | 2.48 | 1.53 |
| **1. Initial conditions** | $y_{2000}$ | -0.0004 | -0.0002 | -0.0003 | -0.0004 | -0.0004 | -0.0007 | -0.0007 | -0.0006 | -0.0002 |
| | t-stat | -2.08 | -0.68 | -0.97 | -0.98 | -1.17 | -1.54 | -1.41 | -1.94 | -0.56 |
| **2. Tangible capital** | inv | 0.20 | 0.10 | 0.08 | 0.11 | 0.09 | 0.07 | 0.07 | | 0.12 |
| | t-stat | 5.17 | 1.82 | 1.52 | 1.77 | 1.50 | 1.02 | 0.96 | | 1.92 |
| | roads | | | | | | 0.03 | 0.02 | 0.02 | |
| | t-stat | | | | | | 1.11 | 0.87 | 0.82 | |
| **3. Human capital** | hcp | | -0.01 | -0.02 | -0.02 | -0.02 | | | | -0.04 |
| | t-stat | | -0.54 | -0.73 | -0.56 | -0.62 | | | | -1.49 |
| | hcs | | | | | | -0.04 | -0.03 | | |
| | t-stat | | | | | | -1.15 | -0.90 | | |
| | hclife | | | | | | | | -0.10 | |
| | t-stat | | | | | | | | -1.14 | |
| | hclt | | -0.04 | -0.04 | | | | | | |
| | t-stat | | -1.40 | -1.36 | | | | | | |
| **4. Governance and institutional capital** | icp | | | | | | | | | 0.55 |
| | t-stat | | | | | | | | | 0.68 |
| | icg | | | | | | -0.08 | 0.09 | | |
| | t-stat | | | | | | -0.06 | 0.08 | | |
| | icl | | | 0.84 | | 0.94 | | | | |
| | t-stat | | | 1.05 | | 0.99 | | | | |
| | icc | | | | | | | | | -0.94 |
| | t-stat | | | | | | | | | -0.65 |
| | icv | | | | | | 1.80 | 1.87 | | |
| | t-stat | | | | | | 1.96 | 2.06 | | |
| | icr | | | | | | | | 2.26 | |
| | t-stat | | | | | | | | 2.60 | |
| **5. Macroeconomic stability** | inf | 0.02 | | | -0.03 | -0.03 | 0.01 | 0.01 | -0.03 | -0.003 |
| | t-stat | 0.32 | | | -0.36 | -0.34 | 0.11 | 0.09 | -0.39 | -0.04 |
| | fdservice | | -0.07 | -0.05 | -0.02 | -0.02 | 0.06 | 0.07 | | |
| | t-stat | | -0.67 | -0.46 | -0.17 | -0.17 | 0.47 | 0.52 | | |
| **6. Sectorial structure of the economy** | industry | | 0.05 | 0.05 | 0.04 | 0.03 | -0.04 | -0.04 | | 0.07 |
| | t-stat | | 1.57 | 1.61 | 0.56 | 0.45 | -0.56 | -0.53 | | 1.05 |
| | agri | | | | -0.01 | 0.00 | -0.05 | -0.05 | -0.001 | 0.01 |
| | t-stat | | | | -0.10 | -0.06 | -0.91 | -1.02 | -0.03 | 0.30 |
| | u | | | | -0.02 | -0.02 | -0.04 | -0.03 | | |
| | t-stat | | | | -0.63 | -0.66 | -1.17 | -1.09 | | |
| **7. Economic Openness** | openxm | | -0.003 | -0.001 | | | | | -0.003 | -0.01 |
| | t-stat | | -0.21 | -0.10 | | | | | -0.19 | -0.87 |
| | openm | | | | | | -0.07 | -0.07 | | |
| | t-stat | | | | | | -1.78 | -1.88 | | |
| | openx | | | | | | 0.10 | 0.10 | | |
| | t-stat | | | | | | 1.84 | 1.76 | | |
| **8. Geography (natural capital)** | ncf | | | | 0.01 | 0.01 | -0.01 | -0.01 | | |
| | t-stat | | | | 0.21 | 0.27 | -0.24 | -0.60 | | |
| | ncw | | | | -0.04 | -0.03 | -0.07 | -0.06 | | |
| | t-stat | | | | -1.24 | -1.10 | -2.06 | -1.97 | | |
| | ncrent | | | | -0.004 | 0.01 | 0.01 | 0.01 | 0.04 | -0.02 |
| | t-stat | | | | -0.08 | 0.20 | 0.28 | 0.19 | 1.52 | -0.55 |
| **9. Financial Sector** | r | -0.12 | -0.14 | -0.13 | -0.17 | -0.16 | -0.19 | -0.19 | -0.17 | -0.14 |
| | t-stat | -2.32 | -2.79 | -2.61 | -2.67 | -2.52 | -3.49 | -3.42 | -3.15 | -2.63 |
| | dcps | | | | 0.01 | 0.01 | 0.02 | | | |
| | t-stat | | | | 0.61 | 0.46 | 0.81 | | | |
| | R2 | 0.48 | 0.42 | 0.44 | 0.42 | 0.44 | 0.60 | 0.59 | 0.40 | 0.39 |

**Source**: Our calculation

**Table 9. Growth rate of real per capita GDP ($g_y$) is the endogenous variable, sub-period 2000-2009 and 47 Africa's countries (Botswana excluded)**

| | Notation | Mod1 | Mod2 | Mod3 | Mod4 | Mod5 | Mod6 | Mod7 | Mod8 | Mod9 |
|---|---|---|---|---|---|---|---|---|---|---|
| | constant | -0.72 | 3.80 | 4.15 | 2.27 | 2.62 | 4.21 | 4.68 | 7.05 | 1.62 |
| | t-stat | -0.52 | 1.79 | 1.77 | 0.53 | 0.59 | 0.79 | 0.90 | 1.26 | 0.49 |
| **1. Initial conditions** | $y_{2000}$ | -0.0001 | 0.0001 | 0.0001 | 0.0001 | 0.0001 | -0.0005 | -0.0004 | -0.0003 | 0.0001 |
| | t-stat | -0.61 | 0.44 | 0.30 | 0.27 | 0.17 | -0.82 | -0.74 | -0.90 | 0.38 |
| **2. Tangible capital** | inv | **0.16** | **0.06** | **0.06** | **0.08** | **0.07** | **0.09** | **0.08** | | **0.08** |
| | t-stat | 3.86 | 1.12 | 0.99 | 1.23 | 1.09 | 1.05 | 1.02 | | 1.19 |
| | roads | | | | | | 0.03 | 0.02 | 0.03 | |
| | t-stat | | | | | | 0.76 | 0.61 | 0.94 | |
| **3. Human capital** | hcp | | -0.02 | -0.03 | -0.04 | -0.04 | | | | -0.04 |
| | t-stat | | -0.87 | -0.92 | -1.36 | -1.37 | | | | -1.60 |
| | hcs | | | | | | -0.05 | -0.04 | | |
| | t-stat | | | | | | -1.13 | -1.02 | | |
| | hclife | | -0.05 | -0.05 | | | | | -0.09 | |
| | t-stat | | -1.40 | -1.36 | | | | | -0.94 | |
| | hclt | | | | | | | | | |
| | t-stat | | | | | | | | | |
| **4. Governance and institutional capital** | icp | | | | | | | | | 0.07 |
| | t-stat | | | | | | | | | 0.09 |
| | icg | | | | | | 1.99 | 2.12 | | |
| | t-stat | | | | | | 1.39 | 1.52 | | |
| | icl | | | 0.32 | | 0.40 | | | | |
| | t-stat | | | 0.37 | | 0.40 | | | | |
| | icc | | | | | | | | | -0.38 |
| | t-stat | | | | | | | | | -0.25 |
| | icv | | | | | | -0.46 | -0.41 | | |
| | t-stat | | | | | | -0.44 | -0.39 | | |
| | icr | | | | | | | | 1.81 | |
| | t-stat | | | | | | | | 1.97 | |
| **5. Macroeconomic stability** | inf | -0.01 | | | -0.04 | -0.04 | -0.03 | -0.03 | -0.06 | -0.04 |
| | t-stat | -0.10 | | | -0.49 | -0.48 | -0.30 | -0.32 | -0.77 | -0.56 |
| | fdservice | | 0.05 | 0.06 | 0.08 | 0.08 | 0.05 | 0.06 | | |
| | t-stat | | 0.47 | 0.53 | 0.56 | 0.55 | 0.35 | 0.39 | | |
| **6. Sectorial structure of the economy** | industry | | 0.04 | 0.04 | 0.05 | 0.05 | -0.07 | -0.07 | | 0.05 |
| | t-stat | | 1.22 | 1.22 | 0.69 | 0.63 | -0.84 | -0.83 | | 0.67 |
| | agri | | | | 0.02 | 0.02 | 0.03 | 0.02 | 0.03 | 0.03 |
| | t-stat | | | | 0.39 | 0.40 | 0.46 | 0.40 | 0.78 | 0.54 |
| | u | | | | -0.02 | -0.02 | -0.03 | -0.03 | | |
| | t-stat | | | | -0.59 | -0.59 | -0.97 | -0.93 | | |
| **7. Economic Openness** | openxm | | -0.0003 | 0.0003 | | | | | 0.0047 | -0.0007 |
| | t-stat | | -0.02 | 0.02 | | | | | 0.32 | -0.05 |
| | openm | | | | | | -0.06 | -0.06 | | |
| | t-stat | | | | | | -1.46 | -1.54 | | |
| | openx | | | | | | 0.13 | 0.13 | | |
| | t-stat | | | | | | 2.01 | 1.98 | | |
| **8. Geography (natural capital)** | ncf | | | | -0.001 | -0.001 | 0.003 | -0.003 | | |
| | t-stat | | | | -0.05 | -0.02 | 0.10 | -0.11 | | |
| | ncw | | | | -0.002 | -0.001 | -0.01 | -0.01 | | |
| | t-stat | | | | -0.08 | -0.03 | -0.31 | -0.22 | | |
| | ncrent | | | | -0.001 | 0.004 | 0.03 | 0.03 | 0.05 | -0.01 |
| | t-stat | | | | -0.03 | 0.09 | 0.55 | 0.50 | 1.72 | -0.12 |
| **9. Financial Sector** | r | -0.03 | -0.03 | -0.03 | -0.04 | -0.04 | -0.06 | -0.05 | | -0.04 |
| | t-stat | -0.49 | -0.62 | -0.55 | -0.59 | -0.52 | -0.86 | -0.78 | | -0.77 |
| | dcps | | | | 0.01 | 0.01 | 0.02 | | | |
| | t-stat | | | | 0.29 | 0.23 | 0.53 | | | |
| | R2 | 0.30 | 0.21 | 0.22 | 0.19 | 0.20 | 0.35 | 0.34 | 0.19 | 0.18 |

**Source**: Our calculation