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Public Debt, Economic Growth, and Inflation in African Economies

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ABSTRACT

We analyse the implications of public debt on economic growth and inflation in a group of 52 African economies between 1950 and 2012. The results indicate that the limits of public debt affect economic growth and exhibit negatively, from a given level of debt, an inverted U behaviour regarding the relationship between economic growth and public debt. The highest average rates of real and *per capita* growth are achieved when public debt reaches 60% of the real GDP and an average inflation rate of 8.2%. When this ratio falls between 60-90%, the average rate of economic growth drops by up to 1.32 p.p. and continues dropping by up to 1.64 p.p. when the ratio exceeds 90%. Briefly, the high levels of public debt are reflected in reduced rates of economic growth and rising levels of inflation.

Our results for three specific geographical areas resemble those of the overall analysis, despite some differences. In North African countries, the growth rates of the GDP and inflation also show an inverted U behaviour as the ratio of public debt/GDP increases. The highest rate of economic growth is recorded when the ratio public debt/GDP is below 30% of GDP and corresponds to an average inflation rate of 5.33%. Identical behaviour of the GDP growth rates and inflation also appears in Sub-Saharan countries until the third interval (60-90%). However, the highest growth rate of the GDP and GDP *per capita* is registered when the public debt/GDP ratio is in the second interval (30-60%). For SADC countries, the highest average rate of economic growth (6.8%) is similar to North African countries, when the ratio public debt/GDP is below 30% of GDP, with an average inflation rate of 11%. The high level of public debt is reflected in reduced rates of economic growth and increasing inflation rates.

Keywords: Public Debt, Economic Growth, Inflation, African Countries.

JEL Codes: E31, E62, H63, O40

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1. Introduction

Public debt in African countries is an issue of global concern. The burden of public debt and widespread indebtedness of these economies has been the subject of spirited debate amongst economists, academics, policy makers, and the general public.

The fiscal policy measures adopted seeking to increase the state revenues and reverse the course of growing national debt have not produced the desired results and the socio-economic conditions of the citizens has worsened. The aggravation of taxation does not seem to be consensual and has resulted in the economic contraction and the consequent thinning of the tax base. At the same time, the inability of African governments to develop economic policies that generate employment, accrued to financial fragility associated with a weak economic base, has led to poor control of the economic activities, with a negative impact at the level of the tax system. The uncontrolled proliferation of small informal economic activities as a source of livelihood and survival of many families affects the mechanism of effective taxation and defeats the purpose of the fiscal policy measures.

In this situation countries are obliged to borrow more money to fill in the gap between the expenditures and the revenues during fiscal periods. The internal and external loans are, thus, a common option for covering the primary deficit and amount to a strategic plan of governments to make new investments, ensuring the improvement of the socio-economic conditions of the citizens. However, excessive debt and weak capacity of return of investments are a vicious cycle that tends to deteriorate the situation. In short, public debt is an issue of major concern, related to the inability of countries to self-finance their economies. This situation of imbalanced budget and increasing financial obligations to third parties has forced these countries to continuously search for models and policy measures that might lead to steady economic growth within a consistent inflationary trend.

The issue of public debt and economic growth was recently examined in a polemical article by Reinhart and Rogoff (2010). Their findings indicate the following: (i) the relationship between government debt and real GDP growth is weak for the debt/GDP ratio below a threshold of 90 percent of the GDP. Above 90 percent the average growth rates fall by about one percentage point; (ii) emerging markets face lower thresholds for both public and private external debt. When the external debt reaches 60 percent of the GDP, annual growth declines by about two percentage points. At higher debt levels growth rates decrease 50%, (iii) there is no apparent link between inflation and public debt levels for the advanced countries as a group (some countries, such as the United States, experienced higher inflation when the ratio debt/GDP was high). One contradictory reaction to this article is based on the argument that low economic growth can cause high levels of public debt (Krugman, 2010).

The efficient use of public debt resources is crucial. Therefore, the analysis should be focused on how this debt is used. Georgiev (2012) argues that the importance of the impact of public debt on economic growth depends especially on the skill and competence demonstrated by governments in managing their resources. Public debt can be beneficial

for countries if it is channelled to research and development (R&D), education, training, and investments that promote growth.

Mismanagement of public debt causes adverse and negative effects on economic growth. A similar opinion is shared by Escobari and Mollick (2013), for whom: "the positive effect of government activities in the production depends, in theory, on the relative efficiency of public sector." Considering a dynamic intervention of economic agents, these authors conclude that public expenditure scheduled or not, affects growth negatively, although to a lesser extent when not scheduled. Their study was based on the Solow growth model applied to a sample of 56 industrial and emerging countries, covering a period from 1970 to 2004.

In a recent essay on public debt and economic growth, following the publication of "Growth in a Time of Debt" by Reinhart and Rogoff, Pescatori *et al.* (2014) question whether there is, effectively, a public debt limit above which the prospects of economic growth are compromised in the long term. Analysing long historical series from a database developed by the department for tax affairs of the IMF, and using regression analysis between the stock of public debt and GDP growth, they conclude that there is no solid evidence to prove that high debts adversely affect economic growth. For these authors, this issue should not be neglected, as high debt levels may be associated with sporadic and volatile economic growth, although the relationship is very weak. Very recently, Eberhardt and Presbitero (2014) studied the long-term relationship between debt and growth in a large panel of countries. They investigated the problem of public debt limit using empirical models and dynamic time series, and presented important inputs to enrich the ongoing debate about public debt and growth initiated by the work of Reinhart and Rogoff. The results suggest that the relationship between public debt and economic growth differs between countries and that there is some support for a nonlinear relationship in the long term, but no evidence of a threshold of common debt for countries over time. The authors concluded that the controversial limit of 90% of the debt can be due to a poor empirical specification or a misinterpretation of results.

Our work aims to study the relationship between the limits of public indebtedness, economic growth, and inflation in African countries, as in the work of Reinhart and Rogoff (2010). Using a time series of historical data from 1950 until 2012, it contributes to a better understanding of the implications of debt levels in the macroeconomic performance of African countries.

This work is divided into five sections. Section 2 reviews the recent literature studying the relationship between public debt and economic growth and public debt and inflation in African countries. The third section addresses the issue of data collection and methodology i.e., the various sources used and the constraints encountered in the process; while the fourth and the fifth sections present the results of the analysis and conclusions, respectively.

2. Literature Review

2.1. Public Debt and Economic Growth

Public debt arises as a result of budget deficit and the failure of tax revenues to cover projected expenses, and is an instrument used to cover those budget deficits. As old as the origin of the State, public debt is understood as a set of State obligations to third parties and is classified as internal when the debt is issued on the domestic market, and external when it is sold to the foreign market, regardless of the currency and the nationality of the creditors.

It is extremely important not to overlook the fact that the internal public debt at the level of developing countries, particularly African countries, is quantitatively much less significant than the external public debt. Pianizza (2008) states that traditionally, developing countries rely on domestic debt only when the access to external resources is blocked. However, this does not mean that domestic public debt is negligible. Christensen (2005) shows that there is a tradition of domestic public debt in poor or low-income countries. For this author, the domestic public debt in 1980 represented about 10% of the GDP in Sub-Saharan African countries and was contracted at commercial banks. Public debt has, therefore, been a path followed by many countries for maximizing their development.

Sustainable economic growth is a priority for all countries, and is an important goal for macroeconomic policy. Obviously, such growth requires financial resources that should ultimately be converted into investments that generate internal and external dynamics of value creation. Public investment supports for productive activities are essential. The scarcity of resources and reduced financial capacity of countries, particularly the poorest ones, require the mobilization of resources, through active expansionary fiscal policy to reduce domestic and/or external debt.

Public debt has undoubtedly been the most frequent strategy for raising these funds. But, if on the one hand, public debt is essential to the goals of governments, even in the pursuit of their main functions such as promoting fairness in its role in countercyclical policies in times of recession, on the other, it is a matter of much controversy with regard to satisfactory levels of debt.

In the late 1970s, the financial and international environment was manifestly favourable for developing countries, especially in Africa. The increase in exports, the negative real interest rates in international capital markets, and high levels of export prices were crucial to an explosion of public consumption and investment, with direct impact on the considerable increase of public debt in these countries, according to the World Bank (1989). This study argues that an exaggerated debt service by indebted and least developed countries was a barrier to economic growth. High debt hinders the negotiation process for obtaining new loans for new productive investments, with severe repercussions in terms of

generation of future net margins necessary to fulfil the obligations related to old debt service.

The steep increase in public debt negatively affects economic growth. For Iyoha (1999), the effect of debt-overhang and crowding-out on economic growth of Sub-Saharan countries is significant. This means that the high stock of external debt and the excessive burden of debt service had a depressing effect on investment in these countries, with direct effect in reducing the rate of economic growth. The concept of debt-overhang, as such, and its negative effect on the economic growth of countries, is also discussed by Sachs (1989), who shares with Krugman (1988) the view that foreign debt can have a negative impact on the levels of investments and consequently on economic growth through debt-overhang. According to the latter, this concept refers to an existing “inherited” and sufficiently heavy debt that lenders fear will not be fully recovered, i.e., the debt inherited by some countries is greater than the value of the transfer resources expected by their creditors in the future. The choice between continuity of funding aimed at economic growth and debt forgiveness is a trade-off, because the funding can, if well invested, guarantee the repayment of debt, and ease the country’s obligations to creditors. Moreover, the debt burden increases the difficulties in payment to creditors. For these authors, the economic growth in these countries can be enhanced and leveraged with debt forgiveness.

Using a macroeconomic model to simulate the effect of external debt on economic growth in Sub-Saharan Africa, Iyoha (1999) performs a sensitivity analysis based on the reduction of the debt stock (5%, 10%, 20%, and 50%). The model is inspired by Solow’s production function (1957) and assumes that the output depends on the working factor and *per capita* investment. The study concludes that the simulations have contributed significantly to the increase in the volume of investment and in the GDP, although much slower in the latter. A reduction of 50% in the debt stock during the period 1987-1994 led to an increase in the formation of gross fixed capital of about 40% and increased GDP by about 3%. The study also shows that debt forgiveness is a powerful stimulus to the recovery of investment and economic growth in Sub-Saharan African countries and recommends the heavily indebted countries of Sub-Saharan Africa to articulate creative strategies for debt reduction, avoiding the negative impact on economic growth as a result of high stock of debt and the crushing burden of debt service.

In a different perspective, Ogunmuyiwa (2008) examines how the external public debt leverages the growth in developing countries, particularly in Nigeria, using a time series from 1970 to 2007 and various econometric methods, namely the Augmented Dickey Fuller test (ADF), the Granger Causality Test, and Johansen Co-integration, among others. The results show that the causality between external debt and economic growth in Nigeria is imperceptible.

The weight/volume of debt also negatively affects the economic growth in Sub-Saharan Africa, by reducing productivity levels (Fosu, 1996). The study estimates the effect of external debt on economic growth in Sub-Saharan Africa during the 1980s, when the debt was a heavy burden. Using World Bank data for the period 1980-1990 relating to 35

countries in Sub-Saharan Africa, the author notes that the net debt is detrimental to economic growth for given levels of production factors, and that the economic growth of these countries would have been 50% greater without foreign loans.

When relating the public debt with the dynamics of public investment and its impact on economic growth in low income countries, Clements *et al.* (2003) conclude that high levels of public debt may affect the growth of these countries negatively. Debt affects growth more via the most efficient use of resources than through the depressing effect it has on private investment. For these authors, external debt has an indirect effect on growth through public investment. While the stock of public debt seems to have a depressing effect on public investment, the same is not true for debt service. According to these authors, the relief of the external public debt service could boost economic growth through its effects on public investment. They further argue that if half of all the resources from debt service relief were channelled to this purpose, without increasing the budget deficit, growth in these countries would accelerate by about 0.5% per year. Moreover, this argument is strongly defended by Deshpande (1997), who explores the issue of debt-overhang, examining empirically the investment experiences of 13 highly indebted countries. He concludes that the relationship between external debt and investment is negative and consistent.

In a general perspective, using the method of ordinary least squares (OLS) in a panel of 79 developing countries and a time series of 1970-2002, Cordela *et al.* (2005) conclude that there is a marginal negative relationship between debt and growth at intermediate levels of debt, which does not happen at the lower levels. Countries with good governance and strong institutions face debt-overhang when debt rises above 15-30 percent of the GDP, but the marginal effect of debt on growth becomes irrelevant above 70-80 percent. In countries with inadequate policies and poor institutions, debt-overhang and the limits of irrelevance seem to be lower.

Bi *et al.* (2014) reinforce the importance of the effects of fiscal policy in developing countries, by analyzing two tax issues, namely the fiscal consolidation and the effects of public spending, and taking into account different values for the ratio of public debt. For this purpose, they design and implement a dynamic stochastic general equilibrium model of a small open economy expressed in real terms, with two production sectors (tradable and non-tradable). The authors conclude that fiscal consolidation has a negative effect on production. The increase in public spending in heavily indebted countries pushes economies to operate very closely to their fiscal limits, with direct consequences on public debt. In this case, the expansionary effect is weaker in economies with higher levels of debt.

2.2. Public Debt and Inflation

Price stability is one of the expedients to better economic performance and one of governments' concerns regarding macroeconomic management. Inflation is defined as a

general and persistent increase in prices of goods and services, and is related with erosion and reduction of purchasing power of money. Moreover, as a tool used by governments to finance the budget deficit, public debt must be used efficiently in order to expand production capacity in the country.

Kwon *et al.* (2006) corroborate the thesis defended by Sargent and Wallace (1981) that an increase in public debt is typically inflationary in highly indebted countries. Based on an empirical analysis of panel data, these authors demonstrate that the relationship between public debt and inflation is much more intense in the highly indebted countries and almost nonexistent in developed economies. They also claim that the relationship between inflation and debt is weak in inflexible exchange rate regimes. The results underline the importance of institutional and structural factors in the relationship between fiscal policy and inflation.

Bildirici and Ersin (2007) investigate the relationship between public debt and inflation in countries with high rates of inflation and conclude that inflation is fed with the rising costs of domestic public debt. These authors argue that the increase in debt to the GDP ratio has led countries to get loans at higher cost and low maturity.

Obi and Nurudeen (2009) analyse the effects of fiscal deficits and public debt on interest rates in Nigeria using Vector Auto Regressive methods for the period 1981-2006. Considering the interest rate as an intrinsic variable to the model and as fiscal deficit and public debt function, they conclude that fiscal deficits and public debt have a positive impact on interest rates. They also suggest that the government should increase revenues and reduce unnecessary spending.

Budget deficits and the consequent accumulation of debt and interest are barriers to the financing of economic growth through expansionary fiscal policies. Luporini (2004) shows that the issue of sustainability of public debt becomes relevant in the context of the unpleasant monetarist arithmetic of Sargent and Wallace, according to which, the growing indebtedness associated with an unsustainable fiscal policy will eventually generate an inflationary process. He argues that it is difficult to establish a relationship between budget deficits and inflation. Yet, inflation has failed to establish a systematic relationship between fiscal deficits and inflation rates. The reduction or total elimination of budget deficits can be considered a stylized fact of stabilization programmes that have been successful.

Muhammad *et al.* (2012) consider inflation as a major problem for many countries. They analysed the impact of domestic public debt in Pakistan for the period 1972-2009 and concluded that the volume of domestic public debt and related debt service tend to push up price levels. The floating debt, i.e. treasury bills, makes up the largest proportion of domestic public debt whose return or interest rate is very high. This helps to increase the efficiency of institutions and families and to increase the aggregate demand and price levels. For these authors, debt service resulting from the internal public debt is one of the causes of the budget deficit in Pakistan and, hence, inflation.

Pelesai and Oyinpreye (2013) empirically investigate the relationship between the budget deficit and inflation in 15 ECOWAS countries between 1980 and 2011 using co-

integration analysis.⁴ The results show strong evidence that financing a budget deficit by increasing the money supply causes a general increase in price levels. The authors conclude that the relationship between budget deficit and inflation is positive and significant in most countries in the long run.

3. Data and Analysis

Time series for the variables used in this study differ from country to country. For the variables real GDP, GDP *per capita*, and population, time series cover the period between 1950 and 2012. Although there are longer series for some countries, we chose this temporal coverage in order to have the same time period for all countries. For the variables inflation rate and public debt in percentage of GDP (public debt/GDP), the time series used vary greatly, as shown in Appendix 1.

The database of reference used herein was the website “This Time is Different” by Carmen Reinhart and Kenneth Rogoff. Due to the lack of a complete data set on this site for all African countries (until 2012), alternative databases such as the World Bank (World Development Indicators - WDI) and the International Monetary Fund (World Economic Outlook - WEO) were used. Data for real GDP until 2008 are expressed in Geary-Khamis international dollars at 1990 prices and the source is The Conference Board Total Economy Database. From 2009 until 2012, the update of the real GDP for certain countries is made from the growth rates of real GDP obtained from the database of the IMF (WEO), starting from 2008 as a reference year.

The source used for the data on the ratio of public debt to GDP until 2010 is the above-mentioned website of Reinhart and Rogoff. For other countries, and until 2012, the source used was the IMF (WEO).

Analysis of all 52 African economies was also performed based on the division of the continent into three geographical areas: (1) North Africa, (2) Sub-Saharan Africa, and (3) Southern Africa Development Community (SADC) countries. A detailed description of all countries is in Appendix 2.

In the context of this work, the division of the continent in three geographical areas above is due, basically, to the specific characteristics of each one. The African continent is divided by the Sahara desert into two main geographical areas, North Africa and Sub-Saharan Africa. From the latter, we separated a set of countries that are members of SADC to make up the third geographical area. North Africa includes the countries that fundamentally base their growth strategies on the production and export of oil, gas, and tourism, and some of them have reached levels of development amongst the highest on the continent. The SADC countries are on the whole major producers and exporters of oil, diamonds, gold, iron, coal, etc. and are the richest on the continent. Of the three

⁴ ECOWAS is the Economic Community of West African States.

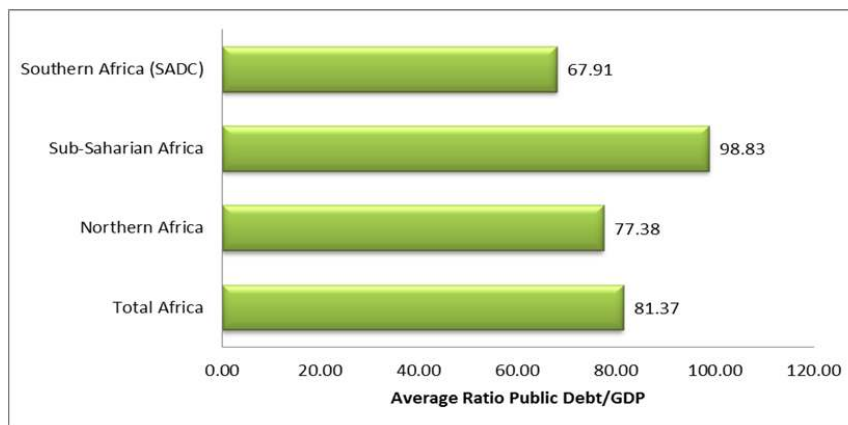
geographical areas, Sub-Saharan Africa has faced the greatest difficulties to leverage its economies, despite their high agricultural potential.

4. Results

4.1. Public Debt in Africa

The average ratio of public debt to GDP in all African economies and in the three different geographical areas taken into account, is large although differing, as we can see in Figure 1. The highest average belongs to the set of 31 countries which form the Sub-Saharan African area (98.83%), followed by 6 North African countries (77.38%). The lowest levels belong to the group of countries in the SADC Countries, with 67.91%.

Figure 1 - Ratio of Public Debt to GDP for African Economies by Geographic Areas



The average ratio of public debt for the 52 African economies is 81.37% of their GDP.

4.2. Public Debt, Economic Growth, and Inflation

The vast majority of the African countries analysed in this article have been buffeted by political and social instability that affected the development of their economies, particularly over the past two decades. The tables and figures below show an integrated and relational analysis of different levels of debt, economic growth, and inflation in a number of African economies. This pooled analysis of 52 economies is also sectioned into three geographical areas, namely North Africa, Sub-Saharan Africa, and the SADC countries.

4.2.1. Overall Analysis

The economic growth trend analysis of 52 African economies, according to the various intervals of the ratio debt/GDP and for time series from 1950 to 2012, was based on calculations found in Tables 1 and 2.

Table 1 - GDP Growth as Public Debt in Percentage of GDP Changes

COUNTRIES	PERIOD	PUBLIC DEBT/GDP			
		< 30%	30 - 60%	60-90%	> 90%
Algeria	1964 - 2012	4.26	5.61	4.62	3.15
Angola	2000 - 2012	17.25	9.23	8.92	3.08
Benin	2000 - 2012	4.01	4.07	-	-
Botswana	1998 - 2012	4.21	-	-	-
Burkina Faso	2002 - 2012	5.60	6.33	-	-
Burundi	2000 - 2012	-	3.86	-	2.69
Cameroon	2000 - 2012	3.31	2.30	4.08	-
Cape Verde	2002 - 2012	-	-	6.00	4.66
Central African Republic	2000 - 2012	2.38	3.71	2.56	-0.06
Chad	1999 - 2012	0.00	9.29	4.40	-
Comoros Islands	2000 - 2012	-	1.91	2.46	-1.18
Côte d'Ivoire	1970 - 2012	6.10	8.78	0.98	1.15
Democratic Republic of Congo (Brazzaville)	2000 - 2012	-	7.05	-	4.23
Djibouti	2003 - 2012	-	4.29	-	-
Egypt	1970 - 2012	3.80	6.71	5.66	4.33
Equatorial Guinea	1980 - 2012	12.02	43.68	31.70	7.52
Eritrea	2000 - 2012	-	-	-	2.36
Ethiopia	1992 - 2012	8.14	11.51	0.81	6.68
Gabon	1990 - 2012	3.88	3.88	-0.10	2.86
Gambia	2000 - 2012	-	-	4.17	4.82
Ghana	1952 - 2012	-1.20	3.60	5.18	4.78
Guinea	1990 - 2012	-	3.94	3.01	3.40
Guinea Bissau	2000 - 2012	-	2.45	-	1.91
Kenya	1963 - 2012	6.27	4.33	3.08	1.22
Lesotho	1988 - 2012	8.09	4.75	5.14	2.14
Liberia	2000 - 2012	8.12	6.12	-	1.47
Libya	1990 - 2012	10.15	3.36	-1.48	-0.79
Madagascar	1990 - 2012	-	2.63	4.60	2.00
Malawi	2002 - 2012	-	5.96	-	3.83
Mali	2000 - 2012	4.96	3.64	4.29	-
Mauritania	2000 - 2012	-	-	8.87	3.70
Mauritius	1970 - 2012	9.05	4.57	4.42	-
Morocco	1965 - 2012	4.92	4.48	4.05	5.82
Mozambique	1999 - 2012	-	7.29	8.00	7.38
Namibia	1993 - 2012	3.69	-	-	-
Niger	1995 - 2012	5.06	11.24	4.88	2.93
Nigeria	1970 - 2012	5.80	8.38	3.73	2.54
Republic of Congo (Ex-Zaire - Kinshasa)	1990 - 2012	5.34	7.47	6.15	-1.33
Rwanda	1995 - 2012	7.97	-	9.96	10.31
São Tomé and Príncipe	2001 - 2012	-	5.88	4.37	5.71
Senegal	2000 - 2012	3.69	4.40	2.81	-
Seychelles	1990 - 2012	-	-	5.18	1.45
Sierra Leone	2000 - 2012	-	7.69	-	10.90
South Africa	1950 - 2012	2.55	3.41	-	-
Sudan	1992 - 2012	-	-	5.37	10.75
Swaziland	1993 - 2012	2.44	-	-	-
Tanzania	2002 - 2012	7.29	6.93	-	-
Togo	2001 - 2012	-	4.63	1.94	-
Tunisia	1990 - 2012	-	4.22	4.56	-
Uganda	1997 - 2012	7.23	4.62	6.88	7.10
Zambia	1990 - 2012	6.61	-	5.34	1.81
Zimbabwe	1965 - 2012	-	3.95	1.31	-7.99
Average		5.72	6.39	5.08	3.44
Median		5.20	4.62	4.42	3.08
Observations	1142	235	337	233	337

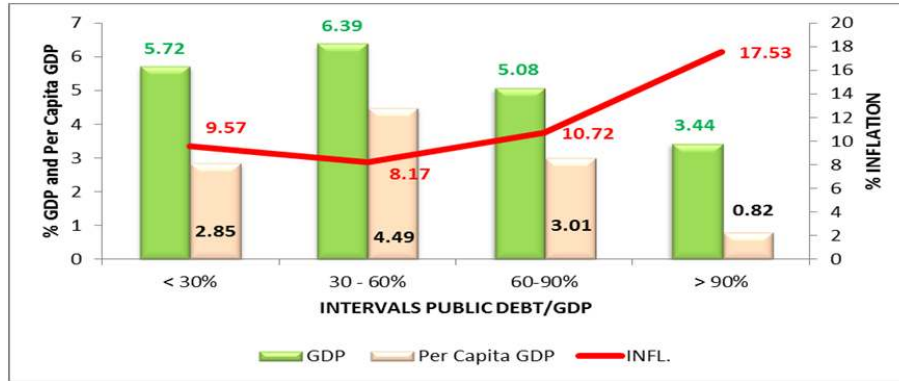
Similarly, we performed the analysis of inflation growth trends with different levels of public debt as a percentage of the GDP (Table 2).

Table 2 - Inflation as Public Debt in percentage of GDP Changes

COUNTRIES	PERIOD	PUBLIC DEBT/GDP			
		< 30%	30 - 60%	60-90%	> 90%
Algeria	1964 - 2012	9.97	6.67	7.47	10.68
Angola	2000 - 2012	11.95	20.11	103.62	238.81
Benin	2000 - 2012	3.35	3.34	-	-
Botswana	1998 - 2012	8.31	-	-	-
Burkina Faso	2002 - 2012	3.03	2.56	-	-
Burundi	2000 - 2012	-	11.28	-	11.07
Cameroon	2000 - 2012	3.09	1.99	1.79	-
Cape Verde	2002 - 2012	-	-	2.59	2.23
Central African Republic	2000 - 2012	2.51	3.21	4.47	2.97
Chad	1999 - 2012	0.45	3.06	2.60	-
Comoros Islands	2000 - 2012	-	5.25	4.03	5.90
Côte d'Ivoire	1970 - 2012	10.94	5.06	4.06	5.06
Democratic Republic of Congo (Brazzaville)	2000 - 2012	-	4.99	-	6.13
Djibouti	2003 - 2012	-	4.30	-	-
Egypt	1970 - 2012	4.83	16.15	11.85	6.53
Equatorial Guinea	1980 - 2012	5.57	3.93	4.15	18.20
Eritrea	2000 - 2012	-	-	-	17.49
Ethiopia	1992 - 2012	18.15	24.65	6.69	3.57
Gabon	1990 - 2012	2.51	2.83	5.54	-2.30
Gambia	2000 - 2012	-	4.89	-	7.44
Ghana	1952 - 2012	76.95	22.08	14.12	16.00
Guinea	1990 - 2012	-	15.23	15.24	12.49
Guinea Bissau	2000 - 2012	-	2.78	-	2.99
Kenya	1963 - 2012	6.70	9.25	11.55	37.40
Lesotho	1988 - 2012	13.94	6.27	9.04	8.39
Liberia	2000 - 2012	7.66	7.29	-	9.83
Libya	1990 - 2012	4.74	-3.21	7.16	2.46
Madagascar	1990 - 2012	-	9.19	18.51	14.71
Malawi	2002 - 2012	-	10.76	-	12.80
Mali	2000- 2012	3.12	2.56	-	2.22
Mauritania	2000 - 2012	-	-	5.57	6.21
Mauritius	1970 - 2012	18.94	8.12	9.27	-
Morocco	1965 - 2012	1.78	5.31	4.30	7.92
Mozambique	1999 - 2012	-	8.59	12.32	8.22
Namibia	1993 - 2012	10.50	-	-	-
Niger	1995 - 2012	2.61	0.47	2.15	3.86
Nigeria	1970 - 2012	13.64	15.07	16.65	32.82
Re public of Congo (Ex-Zaire - Kinshasa)	1990 - 2012	3.92	4.34	6.02	5.55
Rwanda	1995 - 2012	8.28	-	9.22	10.99
São Tomé and Príncipe	2001 - 2012	-	31.99	13.81	14.46
Senegal	2000 - 2012	4.58	1.03	2.01	-
Seychelles	1990 - 2012	-	-	2.54	6.51
Sierra Leone	2000 - 2012	-	14.30	-	5.91
South Africa	1950 - 2012	8.57	7.78	-	-
Sudan	1992 - 2012	-	-	12.68	46.58
Swaziland	1993 - 2012	8.25	-	-	-
Tanzania	2002 - 2012	8.65	8.30	-	-
Togo	2001- 2012	-	2.68	6.27	1.60
Tunisia	1990 - 2012	-	4.17	3.97	-
Uganda	1997 - 2012	8.79	16.40	4.93	4.21
Zambia	1990 - 2012	9.89	-	18.33	58.26
Zimbabwe	1965 - 2012	-	22.61	2346.82	176.08
Average		9.57	8.17	10.72	17.53
Median		7.96	5.79	6.69	7.92
Observations	1142	235	337	233	337

Reading and joint analysis of Tables 1 and 2 are made with support of Figure 2.

Figure 2 - Real GDP, GDP Per Capita, and Inflation as Public Debt/GDP Changes



As seen in Figure 2, a public debt which is less than 30% of the GDP (first interval) is associated with an economic growth of 5.72%. The increase in debt in the second interval (30-60% of the GDP) continues to enhance the growth of economies, providing an average rate of 6.39%, which corresponds to an increase of 11.71%. With an increase of public debt for the third interval (60-90% of the GDP) and fourth interval (> 90%), the economies are still growing, but with decreasing average rates.

The transition of the volume of public debt to the third interval results in a decrease of average economic growth rate of 1.31 percentage points (from 6.39% to 5.08%), equivalent to a change of -20.54%. At levels of public debt above 90% of the GDP, the average economic growth rate drops to 3.44%, i.e. a GDP decrease of -32.28% over the previous interval and -46.17% over the second interval. We conclude, therefore, that African economies grow more when the public debt falls within the second interval, i.e. 30-60% of the GDP, thus exhibiting an inverted U relationship between economic growth and public debt.

Moreover, the interpretation of Figure 2 allows us to confirm the existence of an inverse proportionality between the average growth of the economies at different intervals of public debt/GDP and the average rates of corresponding inflation. The average inflation rate, which is associated with a higher economic growth (6.39%), is about 8% and falls within the interval 30-60% of the public debt/GDP ratio. The difference of the average growth of the economies between the first and second interval is 0.67 percentage points (from 5.72% to 6.39%), equivalent to an increase of 11.71%. This is related to a decrease in the average inflation rate to 1.4 pp., corresponding to a variation of 14.1%. From the second to the last interval, the average growth rate will decrease much faster.

From the second to the third interval the average inflation rate increases from 8.17% to 10.72 %, i.e. a positive change of 31.21 %, while between the third and fourth interval, the average rate of inflation confirms its growing trend from 10.72% to 17.53%, corresponding to a variation of 63.53%.

The behaviour of GDP *per capita* for different intervals of the ratio public debt/GDP expresses the same trend as the GDP shown above. The calculations performed, which also served as the basis for Figure 2 above, are shown in Table 4 in Appendix 3. We note that the growth rate of the GDP *per capita* from the second interval falls at a much faster pace than the growth rate of the GDP. One cause for this is, of course, the fact that the growth rates of population are higher than the rates of GDP growth, with consequent deterioration of socio-economic conditions of the population.

The percentage change of the differential between the growth rates of the GDP and *per capita* GDP is very strong between the intervals of the public debt/GDP ratio. The greatest variation is between the third and the fourth intervals, which is 26.69%. The calculations performed show that as the public debt/GDP ratio increases, this differential also increases at an accelerating pace from the second interval.

In conclusive terms, the greatest growth of African economies occurs when debt levels are in the second interval. As debt levels increase the growth of these economies decreases. The results show an inverted U relationship between economic growth and public debt. There are, however, opposing trends in the relationship between inflation and debt levels. High levels of indebtedness are related with high rates of inflation, i.e. the average inflation rates increase with increasing levels of public debt.

A clearer and more comprehensive view of the time periods for the different variables (real GDP, inflation, and public debt/GDP ratio), for all countries, is summarized in Appendix 1.

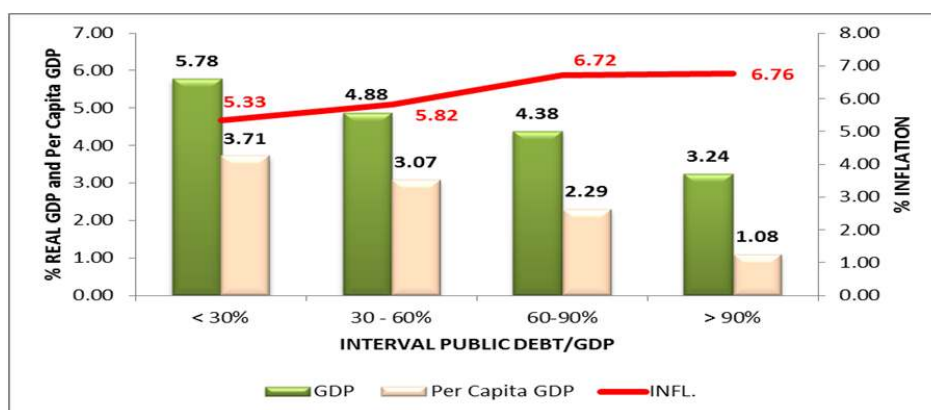
4.2.2. Analysis by Geographical Areas

An analysis of all 52 African economies based on the division of the continent into three geographical areas was also performed: (1) North Africa, (2) Sub-Saharan Africa, and (3) SADC countries, with the purpose of a more nuanced view of the continent. The analysis shows that there are significant differences between these three geographical areas. The results of the calculations for GDP *per capita*, GDP, and inflation with varying levels of public debt in the three geographical areas are in Tables 3, 4, and 5 in Appendix 3.

4.2.2.1. North Africa

For all the observations concerning this geographical area it is clear that the average growth rate of the economy for all the intervals of public debt/GDP ratio is positive, although decreasing, as can be read in Figure 3.

Figure 3 - Real GDP, GDP *Per Capita*, and Inflation as Public Debt/GDP Changes (North Africa)



The average rates of economic growth are differentiated for all the intervals of the public debt/GDP ratio. The largest economic growth of these economies (5.78%) occurs when the ratio is below 30%, which contradicts the results of the overall analysis performed above. The transition of debt limits for the following intervals results in reductions in the average rates of economic growth. From the first to the second, the decline in the average growth rate is 0.9 percentage points, corresponding to a change of -15.77%. When the ratio of public debt/GDP is between 60-90%, the decrease in the economic growth rate corresponds to a change of -10.25%. This change is much higher (-26.03%) when debt limits are over 90 % of the GDP.

Regarding the behaviour of inflation for the four intervals of the public debt/GDP ratio, it appears that the ratio, the higher the average rate of inflation is. For these North African countries the average inflation rate associated with the highest average rate of economic growth (5.78%) is 5.33%, and is equivalent to an interval of the public debt/GDP ratio below of 30%. As the debt ratio increases, the average inflation rates also increase faster. Between the first and the last interval a variation of the average inflation rate of 26.79% is negatively correlated with economic growth, corresponding to a change of -43.91 %.

The comparative analysis between the GDP and *per capita* GDP growth rate for the group of countries in the North African area differs slightly from the overall analysis only in the first interval. In other intervals the trend is very similar. The differential between the GDP and *per capita* GDP growth rate is significant between the various ratios of public debt/GDP. Note that this variation decreases 12.78% between the first and second interval. The biggest change in the differential is seen when there is a change from the second to the third interval (15.91%).

In conclusive terms, the highest rate of economic growth is recorded in the interval lower than 30%, corresponding to an average inflation rate of 5.33%. The behaviour of the GDP growth rates and inflation are negative as the public debt/GDP ratio increases.

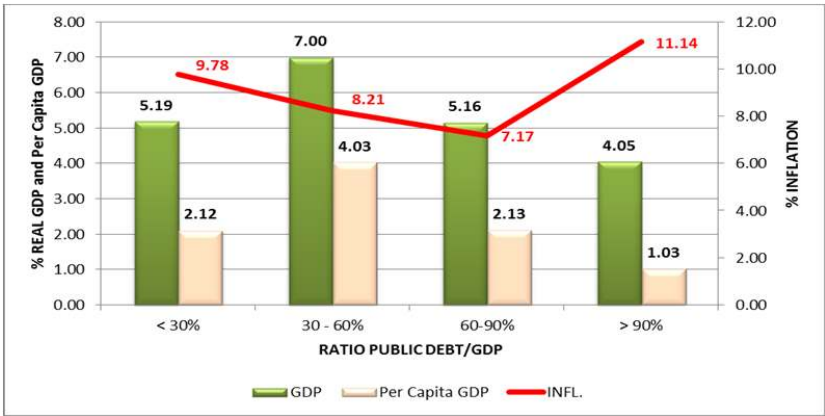
Regarding the behaviour of the GDP and the *per capita* growth rate, it is clear that they are decreasing over all intervals of the public debt/GDP ratio and at a faster pace. This may be related to the reduction of economic performance (GDP) due to the increase in the public debt/GDP ratio and to a population growth rate which is higher than the real GDP growth rate.

4.2.2.2. Sub-Saharan African Countries Excluding SADC

In this group 31 countries were analysed. Sub-Saharan African countries obtain higher average rates of economic growth (7%), when the limit of public debt/GDP is in the second interval. In the third interval, the average rate of economic growth slows to 16.5%, i.e. it varies -26.26%. When the public debt exceeds 90% of the GDP, the average rate of economic growth falls to 4.5%, corresponding to a change of -21.51%.

The evolution of the *per capita* GDP growth rate follows the same overall trend. The rate of growth of the *per capita* GDP reaches its highest level in the second interval of the public debt/GDP ratio, and decreases significantly in the third and fourth intervals. The calculations indicate a change in the differential between the growth rate of the GDP and the GDP *per capita* of -3.35% in the second interval of the public debt/GDP ratio. In the third interval, the variation of the differential undergoes a slight increase to 1.93%, falling back to -0.31% in the fourth interval. Figure 4 illustrates the trend analysis.

Figure 4 - Real GDP, GDP Per Capita, and Inflation as Level of Public Debt/GDP Changes (Sub-Saharan Africa)



We therefore conclude that the growth rate of the GDP and GDP *per capita* reach their highest point in the second interval and from there both decrease, although the *per capita* GDP does so at a much faster rate, with particular emphasis on the fourth interval, where the ratio of public debt/GDP is higher than 90%.

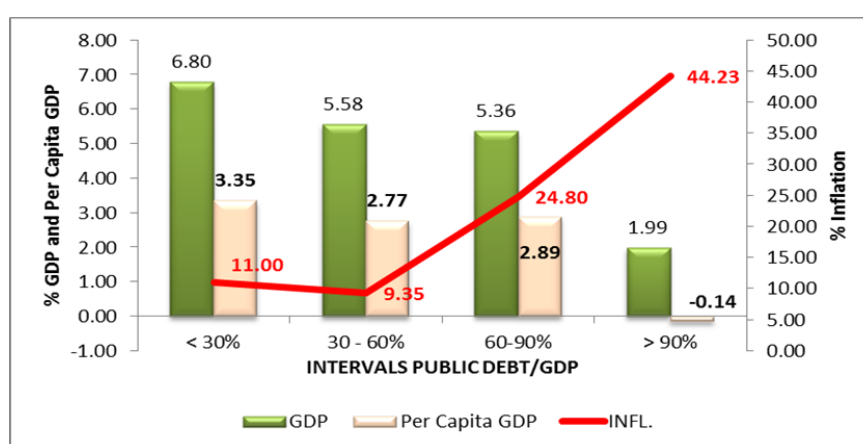
With regard to the inflation rate, the growth trends show patterns of behaviour that are contrary to the overall trends already observed. Increased public debt in the third

interval adversely affects the inflation rate, i.e. as the public debt as a percentage of the GDP increases, the inflation rate decreases, contrary to the overall conclusion. This trend is reversed in the fourth interval in which the public debt exceeds 90% of the GDP.

4.2.2.3. SADC Countries

The Southern African Development Community encompasses a set of 15 states.

Figure 5 - Real GDP, GDP Per Capita, and Inflation as Public Debt/GDP Changes (SADC Countries)



As can be seen in Figure 5, the highest average rate of economic growth (6.8%) is recorded when the ratio of public debt/GDP falls in the first interval, with an average inflation rate of 11%. For debt ratios in the following three intervals we found that the average rates of economic growth are decreasing, especially in the fourth interval. Meanwhile, the average rate of economic growth shows a variation of -62.85% compared to the previous interval, and -70.69% to the first interval. The same trend can be seen in the average rate of inflation, which grows exponentially from the second interval. Between the second and last interval the average rate of inflation increases from 9.35% to 44.23%, which corresponds to a variation of 373%.

On the other hand, the trends in the *per capita* GDP growth rate are completely different from the trend of the same variable for the entire continent and for the other geographical areas, namely North and Sub-Saharan Africa, with particular emphasis on the fourth interval, where it obtains negative values.

4.3. Robustness Analysis

We draw special attention to the fact that in order to test the consistency and quality of our results we performed our analysis using an alternative database, the Penn World Tables (PWT). The calculations for the whole of Africa and those concerning the division of its

economies in the three geographical areas, using the PWT, version 8, are shown in Tables 6, 7, 8, and 9 of Appendix 4.

Although data from PWT 8 includes only 48 countries and also contains a number of observations far below our original database, the comparative analysis of the results shows the following:

- The relationship of the GDP and *per capita* GDP growth rates and the public debt/GDP ratio are similar, although they display some quantitative differences.
- The analysis by geographical areas also follows the above-mentioned trend, except for the geographical area corresponding to North Africa, where the trends of the variables are very different.
- Regarding the Sub-Saharan African geographical area, the results of data analysis from PWT 8 indicate negative *per capita* GDP growth rates in the fourth interval of the debt/GDP ratio, which is contrary to the reference database, although the pattern is the same.
- For the geographical area of Southern Africa (SADC), the *per capita* GDP growth rates are overall negative for all the intervals, although the trends are similar to the reference database.

5. Conclusion

Our analysis involving 52 African economies was focused on the relationship between the limits of public debt as a percentage of the GDP and economic growth and inflation.

Overall, African economies achieve their highest performance in terms of average rates of economic growth (6.39%) while the limits of public debt as a percentage of the GDP are in the second intervals with an average inflation rate of 8.17%. From this limit, any increase in public debt is converted into a reduction of the average growth rates of economies and into an increase in average inflation rates. The findings show, unequivocally, that there is an inverse relationship between these two macroeconomic variables, depending on the levels of indebtedness.

Briefly, we can conclude that the highest average growth rates are achieved when the public debt is in the second interval. When this ratio is situated in the third interval the average rates of economic growth suffer a drop of 1.32 percentage points and 1.64 percentage points when this ratio exceeds 90%. These results are much lower than those found by Reinhart and Rogoff in the essay “Growth in Time of Debt”, for which an amount of debt equivalent to 60% of the GDP causes a drop in the annual growth of around 2 p.p. and even much more when the public debt exceeds 90%, causing growth reductions up to 50%.

Note also that the results obtained by these authors in terms of emerging countries are very similar to those herein regarding the inflation rate: “...in emerging economies, high debt levels coincide with high rates of inflation” (Reinhart and Rogoff, 2010).

On the other hand, the growth rate of the *per capita* GDP shows a trend similar to that of the real GDP in relation to public debt, although their rhythms are more accelerated. The average growth rate of the *per capita* GDP is higher when the level of the public debt is in the second interval. The increase in public debt in the third interval results in a decrease of the average growth rate of the *per capita* GDP of 1.48 p.p., rising to 2.19 p.p., when the public debt exceeds 90%.

The same analysis by geographical areas reaches similar conclusions regarding the behaviour of economic growth and inflation in the limits of public debt. Partial analyses dividing the African continent by geographical areas show that the three variables analysed as a function of the public debt/GDP ratio for Sub-Saharan Africa manifest trends and behaviours similar to the overall analysis. It should be noted, however, that for all the countries of North and Southern Africa (SADC) the highest level of average growth rates of the economies are observed when the levels of public debt are in the first interval and an average inflation rate is between 9.78% and 11%.

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APPENDIX 1 - TEMPORAL DIMENSION OF VARIABLES FOR AFRICAN ECONOMIES

COUNTRIES	PERIOD		
	GDP	% INFLATION	DEBT/GDP
Algeria	1950 -2012	1950 -2012	1964 -2012
Angola	1950 -2012	1950 -2012	2000 - 2012
Benin	1950 -2012	1980 - 2012	2000 - 2012
Botswana	1950 -2012	1975 -2012	1998 -2012
Burkina Faso	1950 -2012	1961 - 2012	2002 - 2012
Burundi	1950 -2012	1966 - 2012	2000 - 2012
Cameroon	1950 -2012	1980 - 2012	2000 - 2012
Cape Verde	1950 -2012	1980 - 2012	2002 - 2012
Central African Republic	1950 -2012	1957 - 2012	2000 - 2012
Chad	1950 -2012	1980 - 2012	1999 - 2012
Comoros Islands	1950 -2012	1980 - 2012	2000 - 2012
Democratic Republic of Congo (Brazaville)	1950 -2012	1961 - 2012	1970 - 2012
Republic of Congo (Ex-Zaire - Kinshasa)	1950 -2012	1980 - 2012	2000 - 2012
Côte d'Ivoire	1950 -2012	1952 - 2012	2003 - 2012
Djibouti	1950 -2012	1992 -2012	1970 -2012
Egypt	1950 -2012	1950 - 2012	1980 - 2012
Equatorial Guinea	1950 -2012	1981 - 2012	2000 - 2012
Eritrea	1992 -2012	1993 - 2012	1992 - 2012
Ethiopia	1950 -2012	1966 - 2012	1990 - 2012
Gabon	1950 -2012	1963 - 2012	2000 - 2012
Gambia	1950 -2012	1962 - 2012	1952 - 2012
Ghana	1950 -2012	1950 - 2012	1990 - 2012
Guinea	1950 -2012	1980 - 2012	2000 - 2012
Guinea Bissau	1950 -2012	1980 - 2012	1963 - 2012
Kenya	1950 -2012	1950 - 2012	1988 - 2012
Lesotho	1950 -2012	1980 - 2012	2000 - 2012
Liberia	1950 -2012	2000 - 2012	1990 - 2012
Libya	1950 -2012	1965 - 2012	1990 - 2012
Madagascar	1950 -2012	1965 - 2012	2002 - 2012
Malawi	1950 -2012	1980- 2012	2000- 2012
Mali	1950 -2012	1980 - 2012	2000 - 2012
Mauritania	1950 -2012	1980 - 2012	1970 - 2012
Mauritius	1950 -2012	1950 - 2012	1965 - 2012
Morocco	1950 -2012	1999 - 2012	1999 - 2012
Mozambique	1950 -2012	1980 - 2012	1993 - 2012
Namibia	1950 -2012	1991 - 2012	1995 - 2012
Niger	1950 -2012	1980 - 2012	1970 - 2012
Nigeria	1950 -2012	1954 - 2012	1990 - 2012
Rwanda	1950 -2012	1980 - 2012	1995 - 2012
São Tomé and Príncipe	1950 -2012	1980 - 2012	2001 - 2012
Senegal	1950 -2012	1968 - 2012	2000 - 2012
Seychelles	1950 -2012	1971 - 2012	1990 - 2012
Sierra Leone	1950 -2012	1980 - 2012	2000 - 2012
South Africa	1950 -2012	1950 - 2012	1950 - 2012
Sudan	1950 -2012	1961 - 2012	1992 - 2012
Swaziland	1950 -2012	1966 - 2012	1993 - 2012
Tanzania	1950 -2012	1966 - 2012	2002 - 2012
Togo	1950 -2012	1967 - 2012	2001- 2012
Tunisia	1950 -2012	1950 - 2012	1990 - 2012
Uganda	1950 -2012	1980 - 2012	1997 - 2012
Zambia	1950 -2012	1950 - 2012	1990 - 2012
Zimbabwe	1950 -2012	1950 - 2012	1965 - 2012

APPENDIX 2 - DISTRIBUTION OF AFRICAN COUNTRIES BY GEOGRAPHIC AREAS

GEOGRAPHIC AREAS	COUNTRIES
North Africa	Algeria, Egypt, Libya, Tunisia, Morocco, Mauritania.
Sub-Saharan Africa (Excluding SADC)	Benin, Burkina Faso, Burundi, Cameroon, Cabo Verde, Central African Republic, Chad, Comoros, Republic of Congo (Ex-Zaire - Kinshasa), Cote d'Ivoire, Djibouti, Equatorial Guinea, Eritrea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea Bissau, Kenya, Liberia, Mali, Niger, Nigeria, Rwanda, São Tomé and Príncipe, Senegal, Sierra Leone, Sudan, Togo, Uganda.
Southern Africa Development Community (SADC)	Angola, Botswana, Democratic Republic of Congo, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia, Zimbabwe.

APPENDIX 3 - TABLES FROM THE ORIGINAL DATABASE
Table 3 - GDP Growth as Public Debt Changes, by Geographic Areas

COUNTRIES	PERIOD	PUBLIC DEBT / DGP			
		< 30%	30 - 60%	60-90%	> 90%
Northern Africa					
Algeria	1964 - 2012	4.26	5.61	4.62	3.15
Egypt	1970 - 2012	3.80	6.71	5.66	4.33
Libya	1990 - 2012	10.15	3.36	-1.48	-0.79
Morocco	1965 - 2012	4.92	4.48	4.05	5.82
Tunisia	1990 - 2012	-	4.22	4.56	-
Mauritania	2000 - 2012	-	-	8.87	3.70
Average		5.78	4.88	4.38	3.24
Median		4.59	4.48	4.59	3.70
Observations	190	32	49	69	40
Sub-Saharan Africa excluding SADC					
Benin	2000 - 2012	4.01	4.07	-	-
Burkina Faso	2002 - 2012	5.60	6.33	-	-
Burundi	2000 - 2012	-	3.86	-	2.69
Cameroon	2000 - 2012	3.31	2.30	4.08	-
Cape Verde	2002 - 2012	-	-	6.00	4.66
Central African Republic	2000 - 2012	2.38	3.71	2.56	-0.06
Chad	1999 - 2012	0.00	9.29	4.40	-
Comoros Islands	2000 - 2012	-	1.91	2.46	-1.18
Republic of Congo (Ex-Zaire - Kinshasa)	1990 - 2012	5.34	7.47	6.15	-1.33
Côte d'Ivoire	1970 - 2012	6.10	8.78	0.98	1.15
Djibouti	2003 - 2012	-	4.29	-	-
Equatorial Guinea	1980 - 2012	12.02	43.68	31.70	7.52
Eritrea	2000 - 2012	-	-	-	2.36
Ethiopia	1992 - 2012	8.14	11.51	0.81	6.68
Gabon	1990 - 2012	3.88	3.88	-0.10	2.86
Gambia	2000 - 2012	-	-	4.17	4.82
Ghana	1952 - 2012	-1.20	3.60	5.18	4.78
Guinea	1990 - 2012	-	3.94	3.01	3.40
Guinea Bissau	2000 - 2012	-	2.45	-	1.91
Kenya	1963 - 2012	6.27	4.33	3.08	1.22
Liberia	2000 - 2012	8.12	6.12	-	1.47
Mali	2000 - 2012	4.96	3.64	4.29	-
Niger	1995 - 2012	5.06	11.24	4.88	2.93
Nigeria	1970 - 2012	5.80	8.38	3.73	2.54
Rwanda	1995 - 2012	7.97	-	9.96	10.31
São Tomé and Príncipe	2001 - 2012	-	5.88	4.37	5.71
Senegal	2000 - 2012	3.69	4.40	2.81	-
Sierra Leone	2000 - 2012	-	7.69	-	10.90
Sudan	1992 - 2012	-	-	5.37	10.75
Togo	2001 - 2012	-	4.63	1.94	-
Uganda	1997 - 2012	7.23	4.62	6.88	7.10
Average		5.19	7.00	5.16	4.05
Median		5.34	4.51	4.17	2.93
Observations	599	126	126	124	223
SADC					
Angola	2000 - 2012	17.25	9.23	8.92	3.08
Botswana	1998 - 2012	4.21	-	-	-
Democratic Republic of Congo	2000 - 2012	-	7.05	-	4.23
Lesoto	1988 - 2012	8.09	4.75	5.14	2.14
Madagascar	1990 - 2012	-	2.63	4.60	2.00
Malawi	2002 - 2012	-	5.96	-	3.83
Mauricias	1970 - 2012	9.05	4.57	4.42	-
Mocambique	1999 - 2012	-	7.29	8.00	7.38
Namibia	1993 - 2012	3.69	-	-	-
Seycheles	1990 - 2012	-	-	5.18	1.45
South Africa	1950 - 2012	2.55	3.41	-	-
Swazilandia	1993 - 2012	2.44	-	-	-
Tanzania	2002 - 2012	7.29	6.93	-	-
Zambia	1990 - 2012	6.61	-	5.34	1.81
Zimbabwe	1965 - 2012	-	3.95	1.31	-7.99
Average		6.80	5.58	5.36	1.99
Median		6.61	5.35	5.16	2.14
Observations	353	77	162	40	74

Table 4 - GDP Per Capita Growth as Public Debt Changes, by Geographic Areas

COUNTRIES	PERIOD	PUBLIC DEBT/GDP			
		< 30%	30 - 60%	60-90%	> 90%
Northern Africa					
Algeria	1964 - 2012	2.18	3.17	1.90	0.67
Egypt	1970 - 2012	1.59	4.38	3.73	2.67
Libya	1990 - 2012	8.62	1.79	-3.48	-2.25
Morocco	1965 - 2012	2.46	2.98	2.56	3.54
Tunisia	1990 - 2012	-	3.03	3.04	-
Mauritania	2000 - 2012	-	-	5.99	0.77
Average		3.71	3.07	2.29	1.08
Median		2.32	3.03	2.80	0.77
Observations	190	32	49	69	40
Sub-Saharan Africa excluding SADC					
Benin	2000 - 2012	0.90	0.91	-	-
Burkina Faso	2002 - 2012	2.56	3.27	-	-
Burundi	2000 - 2012	-	0.47	-	-0.42
Cameroon	2000 - 2012	0.70	-0.31	1.40	-
Cape Verde	2002 - 2012	-	-	5.22	3.30
Central African Republic	2000 - 2012	0.42	1.68	0.65	-1.76
Chad	1999 - 2012	-3.10	5.64	0.65	-
Comoros Islands	2000 - 2012	-	-0.62	-0.15	-3.66
Republic of Congo (Ex-Zaire - Kinshasa)	1990 - 2012	2.49	4.28	2.93	-3.94
Côte d'Ivoire	1970 - 2012	1.34	5.23	-1.56	-1.69
Djibouti	2003 - 2012	-	2.80	-	-
Equatorial Guinea	1980 - 2012	8.78	39.18	27.59	2.91
Eritrea	2000 - 2012	-	-	-	-1.35
Ethiopia	1992 - 2012	5.34	8.52	-2.19	3.48
Gabon	1990 - 2012	1.41	1.38	-2.53	0.18
Gambia	2000 - 2012	-	-	0.94	1.62
Ghana	1952 - 2012	-3.82	0.98	2.36	1.94
Guinea	1990 - 2012	-	1.31	-0.46	0.43
Guinea Bissau	2000 - 2012	-	0.09	-	-0.30
Kenya	1963 - 2012	2.64	1.30	-0.20	-1.86
Liberia	2000 - 2012	5.08	2.45	-	-1.90
Mali	2000 - 2012	1.70	0.53	-	1.35
Niger	1995 - 2012	1.19	7.05	1.13	-0.72
Nigeria	1970 - 2012	3.01	5.59	1.15	-0.05
Rwanda	1995 - 2012	5.01	-	2.59	6.57
São Tomé and Príncipe	2001 - 2012	-	2.82	1.50	3.34
Senegal	2000 - 2012	0.88	1.51	0.20	-
Sierra Leone	2000 - 2012	-	5.49	-	6.68
Sudan	1992 - 2012	-	-	2.89	7.62
Togo	2001 - 2012	-	1.94	-0.67	0.43
Uganda	1997 - 2012	3.69	1.17	3.43	3.55
Average		2.12	4.03	2.13	1.03
Median		1.70	1.81	1.03	0.43
Observations	599	126	126	124	223
SADC					
Angola	2000 - 2012	2.18	3.17	1.90	0.67
Botswana	1998 - 2012	2.90	-	-	-
Democratic Republic of Congo	2000 - 2012	-	4.14	-	1.40
Lesoto	1988 - 2012	6.26	3.80	3.77	1.22
Madagascar	1990 - 2012	-	-0.23	1.59	-1.08
Malawi	2002 - 2012	-	2.86	-	1.11
Mauricias	1970 - 2012	7.35	3.43	3.40	-
Mocambique	1999 - 2012	-	4.54	5.02	4.58
Namibia	1993 - 2012	1.64	-	-	-
Seycheles	1990 - 2012	-	-	4.85	0.09
South Africa	1950 - 2012	1.20	1.20	-	-
Swazilandia	1993 - 2012	0.90	-	-	-
Tanzania	2002 - 2012	4.19	3.93	-	-
Zambia	1990 - 2012	3.54	-	2.63	-0.74
Zimbabwe	1965 - 2012	-	0.84	-0.01	-8.53
Average		3.35	2.77	2.89	-0.14
Median		2.90	3.30	3.01	0.67
Observations	353	77	162	40	74

Table 5 - Inflation as Public Debt Changes, by Geographic Areas

COUNTRIES	PERIOD	PUBLIC DEBT/GDP			
		< 30%	30 - 60%	60-90%	> 90%
Northern Africa					
Algeria	1964 - 2012	9.97	6.67	7.47	10.68
Egypt	1970 - 2012	4.83	16.15	11.85	6.53
Libya	1990 - 2012	4.74	-3.21	7.16	2.46
Morocco	1965 - 2012	1.78	5.31	4.30	7.92
Tunisia	1990 - 2012	-	4.17	3.97	-
Mauritania	2000 - 2012	-	-	5.57	6.21
Average		5.33	5.82	6.72	6.76
Median		4.79	5.31	6.36	6.53
Observations	190	32	49	69	40
Sub-Saharan Africa excluding SADC					
Benin	2000 - 2012	3.35	3.34	-	-
Burkina Faso	2002 - 2012	3.03	2.56	-	-
Burundi	2000 - 2012	-	11.28	-	11.07
Cameroon	2000 - 2012	3.09	1.99	1.79	-
Cape Verde	2002 - 2012	-	-	2.59	2.23
Central African Republic	2000 - 2012	2.51	3.21	4.47	2.97
Chad	1999 - 2012	0.45	3.06	2.60	-
Comoros Islands	2000 - 2012	-	5.25	4.03	5.90
Republic of Congo (Ex-Zaire - Kinshasa)	1990 - 2012	3.92	4.34	6.02	5.55
Côte d'Ivoire	1970 - 2012	10.94	5.06	4.06	5.06
Djibouti	2003 - 2012	-	4.30	-	-
Equatorial Guinea	1980 - 2012	5.57	3.93	4.15	18.20
Eritrea	2000 - 2012	-	-	-	17.49
Ethiopia	1992 - 2012	18.15	24.65	6.69	3.57
Gabon	1990 - 2012	2.51	2.83	5.54	-2.30
Gambia	2000 - 2012	-	4.89	-	7.44
Ghana	1952 - 2012	76.95	22.08	14.12	16.00
Guinea	1990 - 2012	-	15.23	15.24	12.49
Guinea Bissau	2000 - 2012	-	2.78	-	2.99
Kenya	1963 - 2012	6.70	9.25	11.55	37.40
Liberia	2000 - 2012	7.66	7.29	-	9.83
Mali	2000- 2012	3.12	2.56	-	2.22
Niger	1995 - 2012	2.61	0.47	2.15	3.86
Nigeria	1970 - 2012	13.64	15.07	16.65	32.82
Rwanda	1995 - 2012	8.28	-	9.22	10.99
São Tomé and Príncipe	2001 - 2012	-	31.99	13.81	14.46
Senegal	2000 - 2012	4.58	1.03	2.01	-
Sierra Leone	2000 - 2012	-	14.30	-	5.91
Sudan	1992 - 2012	-	-	12.68	46.58
Togo	2001- 2012	-	2.68	6.27	1.60
Uganda	1997 - 2012	8.79	16.40	4.93	4.21
Average		9.78	8.21	7.17	11.14
Median		4.58	4.34	5.54	5.91
Observations	599	126	126	124	223
SADC					
Angola	2000 - 2012	11.95	20.11	103.62	238.81
Botswana	1998 - 2012	8.31	-	-	-
Democratic Republic of Congo	2000 - 2012	-	4.99	-	6.13
Lesoto	1988 - 2012	13.94	6.27	9.04	8.39
Madagascar	1990 - 2012	-	9.19	18.51	14.71
Malawi	2002 - 2012	-	10.76	-	12.80
Mauricias	1970 - 2012	18.94	8.12	9.27	-
Mocambique	1999 - 2012	-	8.59	12.32	8.22
Namibia	1993 - 2012	10.50	-	-	-
Seycheles	1990 - 2012	-	-	2.54	6.51
South Africa	1950 - 2012	8.57	7.78	-	-
Swazilandia	1993 - 2012	8.25	-	-	-
Tanzania	2002 - 2012	8.65	8.30	-	-
Zambia	1990 - 2012	9.89	-	18.33	58.26
Zimbabwe	1965 - 2012	-	22.61	2346.82	176.08
Average		11.00	9.35	24.80	44.23
Median		9.89	8.44	15.32	12.80
Observations	353	77	162	40	74

APPENDIX 4 - TABLES AND CALCULATION FROM PWT 8 DATABASE

Table 6 - GDP Growth (PWT 8) as Public Debt Changes

COUNTRIES	PERIOD	PUBLIC DEBT/GDP			
		< 30%	30 - 60%	60-90%	> 90%
Angola	2000 - 2011	16.79	12.63	11.67	-12.63
Benin	2000 - 2011	3.77	3.79		
Botswana	1998 - 2011	5.42			
Burkina Faso	2002 - 2011	5.20	6.33		
Burundi	2000 - 2011		-0.05		4.56
Cameroon	2000 - 2011	3.50	-0.47	0.95	
Cape Verde	2002 - 2011			7.05	5.76
Central African Republic	2000 - 2011	2.06	4.01	4.16	-0.44
Chad	1999 - 2011	1.92	15.79	3.18	
Comoros Islands	2000 - 2011		1.82	2.24	0.46
Côte d'Ivoire	1970 - 2011	8.28	-20.07	2.71	1.03
Democratic Republic of Congo (Brazzaville)	2000 - 2011		17.33		8.96
Djibouti	2003 - 2011		6.46		
Egypt	1970 - 2011	6.62	5.93	6.61	7.37
Equatorial Guinea	1980 - 2011	18.72	89.69	24.48	8.73
Ethiopia	1992 - 2011	8.91	12.21	1.82	2.39
Gabon	1990 - 2011	7.45	5.78	8.18	-2.14
Gambia	2000 - 2011			3.95	3.64
Ghana	1952 - 2011	-4.13	4.16	4.49	3.60
Guinea	1990 - 2011			1.19	-0.72
Guinea Bissau	2000 - 2011		3.19		3.36
Kenya	1963 - 2011	5.11	2.46	2.20	5.38
Lesotho	1988 - 2011	5.59	5.05	3.68	5.08
Liberia	2000 - 2011	8.27	6.98		5.37
Madagascar	1990 - 2011		3.10	1.65	1.67
Malawi	2002 - 2011		10.07		3.43
Mali	2000 - 2011	6.16	1.97		3.74
Mauritania	2000 - 2011			35.82	6.07
Mauritius	1970 - 2011	10.03	2.12	5.78	
Morocco	1965 - 2011	2.54	4.54	1.76	3.29
Mozambique	1999 - 2011		7.93	9.89	5.31
Niger	1995 - 2011	3.47		2.20	3.71
Nigeria	1970 - 2011	4.22	18.91	17.36	-12.95
Republic of Congo (Ex-Zaire - Kinshasa)	1990 - 2011	11.08	-0.76	-3.43	-1.52
Rwanda	1995 - 2011	8.47		11.51	9.19
Senegal	2000 - 2011	2.02	2.78	-0.96	
Sierra Leone	2000 - 2011		5.61		6.09
South Africa	1950 - 2011	2.73	3.80		
Sudan	1992 - 2011			7.39	5.96
Swaziland	1993 - 2011	7.12			
Tanzania	2002 - 2011	7.90	8.01		
Togo	2001 - 2011		6.52	0.54	4.62
Tunisia	1990 - 2011		3.04	3.32	
Uganda	1997 - 2011	6.95	4.32	6.29	4.27
Zambia	1990 - 2011	14.59		4.71	2.71
Zimbabwe	1965 - 2011		6.15	5.75	-5.03
Average		6.58	7.53	6.19	2.66
Median		6.16	4.80	4.06	3.68
Observations					

Table 7 - GDP Per Capita Growth (PWT 8) as Public Debt Changes

COUNTRIES	PERIOD	PUBLIC DEBT/GDP			
		< 30%	30 - 60%	60-90%	> 90%
Algeria	1964 - 2012				
Angola	2000 - 2012	13.43	8.29	4.81	-11.99
Benin	2000 - 2012	0.72	0.67		
Botswana	1998 - 2012	3.92			
Burkina Faso	2002 - 2012	3.64	3.34		
Burundi	2000 - 2012		-2.55		1.86
Cameroon	2000 - 2012	1.25	-2.68	-1.32	
Cape Verde	2002 - 2012			5.86	3.97
Central African Republic	2000 - 2012	-1.61	2.02	2.26	-2.08
Chad	1999 - 2012	-0.84	12.23	-0.28	
Comoros Islands	2000 - 2012		-0.82	-0.47	-2.14
Côte d'Ivoire	1970 - 2012	3.43	-23.58	-0.02	-1.82
Democratic Republic of Congo (Brazaville)	2000 - 2012		14.47		6.23
Djibouti	2003 - 2012		4.49		
Egypt	1970 - 2012	4.37	3.53	4.52	5.49
Equatorial Guinea	1980 - 2012	15.23	83.65	20.53	4.10
Eritrea	2000 - 2012				
Ethiopia	1992 - 2012	6.60	9.71	-1.00	-0.45
Gabon	1990 - 2012	5.46	3.62	5.57	-5.13
Gambia	2000 - 2012			1.12	0.65
Ghana	1952 - 2012	-6.71	1.62		
Guinea	1990 - 2012			-1.89	-3.45
Guinea Bissau	2000 - 2012		1.07		1.33
Kenya	1963 - 2012	8.76	10.16	-1.18	2.10
Lesotho	1988 - 2012	3.65	4.01	2.16	3.51
Liberia	2000 - 2012	4.75	2.75		1.65
Libya	1990 - 2012				
Madagascar	1990 - 2012		0.13	-1.35	-1.40
Malawi	2002 - 2012		6.78		0.71
Mali	2000 - 2012	2.94	-1.13		0.70
Mauritania	2000 - 2012			32.23	3.22
Mauritius	1970 - 2012	8.34	0.95	4.70	
Morocco	1965 - 2012	0.03	2.95	0.22	0.92
Mozambique	1999 - 2012		5.41	7.03	2.62
Namibia	1993 - 2012				
Niger	1995 - 2012	-0.13		-1.30	0.18
Nigeria	1970 - 2012	12.12	90.25	14.58	-15.07
Republic of Congo (Ex-Zaire - Kinshasa)	1990 - 2012	8.83	-3.43	-6.06	-4.45
Rwanda	1995 - 2012	5.38		4.34	5.54
São Tomé and Príncipe	2001 - 2012				
Senegal	2000 - 2012	-0.69	0.06	-3.52	
Seychelles	1990 - 2012				
Sierra Leone	2000 - 2012		3.14		1.95
South Africa	1950 - 2012	1.74	1.51		
Sudan	1992 - 2012			4.65	3.37
Swaziland	1993 - 2012	5.56			
Tanzania	2002 - 2012	4.82	5.06		
Togo	2001 - 2012		4.31	-1.63	2.17
Tunisia	1990 - 2012		1.82	1.98	
Uganda	1997 - 2012	3.55	1.05	3.03	0.95
Zambia	1990 - 2012	11.55		2.24	0.13
Zimbabwe	1965 - 2012		2.97	4.94	-5.43
Average		4.49	7.16	3.44	0.00
Median		3.92	2.96	2.16	0.92
Observations					

Table 8 - GDP Growth (PWT 8) as Public Debt Changes, by Geographic Areas

COUNTRIES	PERIOD	DEBT/GDP			
		< 30%	30 - 60%	60-90%	> 90%
North Africa					
Algeria	1964 - 2012				
Egypt	1970 - 2012	6.62	5.93	6.61	7.37
Libya	1990 - 2012				
Morocco	1965 - 2012	2.54	4.54	1.76	3.29
Tunisia	1990 - 2012		3.04	3.32	
Mauritania	2000 - 2012			35.82	6.07
Average		4.58	4.50	11.88	5.58
Median		4.58	4.54	4.97	6.07
Observations					
Sub-Saharan Countries					
Benin	2000 - 2012	3.77	3.79		
Burkina Faso	2002 - 2012	5.20	6.33		
Burundi	2000 - 2012		-0.05		4.56
Cameroon	2000 - 2012	3.50	-0.47	0.95	
Cape Verde	2002 - 2012			7.05	5.76
Central African Republic	2000 - 2012	2.06	4.01	4.16	-0.44
Chad	1999 - 2012	1.92	15.79	3.18	
Comoros Islands	2000 - 2012		1.82	2.24	0.46
Republic of Congo (Ex-Zaire - Kinshasa)	1990 - 2012	11.08	-0.76	-3.43	-1.52
Côte d'Ivoire	1970 - 2012	8.28	-20.07	2.71	1.03
Djibouti	2003 - 2012		6.46		
Equatorial Guinea	1980 - 2012	18.72	89.69	24.48	8.73
Eritrea	2000 - 2012				
Ethiopia	1992 - 2012	8.91	12.21	1.82	2.39
Gabon	1990 - 2012	7.45	5.78	8.18	-2.14
Gambia	2000 - 2012			3.95	3.64
Ghana	1952 - 2012	-4.13	4.16	4.49	3.60
Guinea	1990 - 2012			1.19	-0.72
Guinea Bissau	2000 - 2012		3.19		3.36
Kenya	1963 - 2012	5.11	2.46	2.20	5.38
Liberia	2000 - 2012	8.27	6.98		5.37
Mali	2000 - 2012	6.16	1.97		3.74
Niger	1995 - 2012	3.47		2.20	3.71
Nigeria	1970 - 2012	4.22	18.91	17.36	-12.95
Rwanda	1995 - 2012	8.47		11.51	9.19
São Tomé and Príncipe	2001 - 2012				
Senegal	2000 - 2012	2.02	2.78	-0.96	
Sierra Leone	2000 - 2012		5.61		6.09
Sudan	1992 - 2012			7.39	5.96
Togo	2001 - 2012		6.52	0.54	4.62
Uganda	1997 - 2012	6.95	4.32	6.29	4.27
Average		5.86	7.89	5.12	2.79
Median		5.20	4.16	3.18	3.71
Observations					
SADC					
Angola	2000 - 2012	16.79	12.63	11.67	-12.63
Botswana	1998 - 2012	5.42			
Democratic Republic of Congo	2000 - 2012		17.33		8.96
Lesoto	1988 - 2012	5.59	5.05	3.68	5.08
Madagascar	1990 - 2012		3.10	1.65	1.67
Malawi	2002 - 2012		10.07		3.43
Mauritius	1970 - 2012	10.03	2.12	5.78	
Mocambique	1999 - 2012		7.93	9.89	5.31
Namibia	1993 - 2012				
Seycheles	1990 - 2012				
South Africa	1950 - 2012	2.73	3.80		
Swazilandia	1993 - 2012	7.12			
Tanzania	2002 - 2012	7.90	8.01		
Zambia	1990 - 2012	14.59		4.71	2.71
Zimbabwe	1965 - 2012		6.15	5.75	-5.03
Average		8.77	7.62	6.16	1.19
Median		7.51	7.04	5.75	3.07
Observations					

Table 8 - GDP Per Capita Growth (PWT 8) as Public Debt Changes, by Geographic Areas

COUNTRIES	PERIOD	DEBT/GDP			
		< 30%	30 - 60%	60-90%	> 90%
North Africa					
Algeria	1964 -2012				
Egypt	1970 -2012	4.37	3.53	4.52	5.49
Libya	1990 - 2012				
Morocco	1965 - 2012	0.03	2.95	0.22	0.92
Tunisia	1990 - 2012		1.82	1.98	
Mauritania	2000 - 2012			32.23	3.22
Average		2.20	2.77	9.74	3.21
Median		2.20	2.95	3.25	3.22
Observations					
Sub-Sahara					
Benin	2000 - 2012	0.72	0.67		
Burkina Faso	2002 - 2012	3.64	3.34		
Burundi	2000 - 2012		-2.55		1.86
Cameroon	2000 - 2012	1.25	-2.68	-1.32	
Cape Verde	2002 - 2012			5.86	3.97
Central African Republic	2000 - 2012	-1.61	2.02	2.26	-2.08
Chad	1999 - 2012	-0.84	12.23	-0.28	
Comoros Islands	2000 - 2012		-0.82	-0.47	-2.14
Republic of Congo (Ex-Zaire - Kinshasa)	1990 - 2012	8.83	-3.43	-6.06	-4.45
Côte d'Ivoire	1970 - 2012	3.43	-23.58	-0.02	-1.82
Djibouti	2003 - 2012		4.49		
Equatorial Guinea	1980 - 2012	15.23	83.65	20.53	4.10
Eritrea	2000 - 2012				
Ethiopia	1992 - 2012	6.60	9.71	-1.00	-0.45
Gabon	1990 - 2012	5.46	3.62	5.57	-5.13
Gambia	2000 - 2012			1.12	0.65
Ghana	1952 - 2012	-6.71	1.62		
Guinea	1990 - 2012			-1.89	-3.45
Guinea Bissau	2000 - 2012		1.07		1.33
Kenya	1963 - 2012	8.76	10.16	-1.18	2.10
Liberia	2000 - 2012	4.75	2.75		1.65
Mali	2000 - 2012	2.94	-1.13		0.70
Niger	1995 - 2012	-0.13		-1.30	0.18
Nigeria	1970 - 2012	12.12	90.25	14.58	-15.07
Rwanda	1995 - 2012	5.38		4.34	5.54
São Tomé and Príncipe	2001 - 2012				
Senegal	2000 - 2012	-0.69	0.06	-3.52	
Sierra Leone	2000 - 2012		3.14		1.95
Sudan	1992 - 2012			4.65	3.37
Togo	2001 - 2012		4.31	-1.63	2.17
Uganda	1997 - 2012	3.55	1.05	3.03	0.95
Average		3.82	8.69	2.17	-0.18
Median		3.55	2.02	-0.15	0.83
Observations					
SADC					
Angola	2000 - 2012	2.18	3.17	1.90	0.67
Botswana	1998 -2012	2.90	-	-	-
Democratic Republic of Congo	2000 - 2012	-	4.14	-	1.40
Lesoto	1988 - 2012	6.26	3.80	3.77	1.22
Madagascar	1990 - 2012	-	-0.23	1.59	-1.08
Malawi	2002 - 2012	-	2.86	-	1.11
Mauricias	1970 - 2012	7.35	3.43	3.40	
Mocambique	1999 - 2012	-	4.54	5.02	4.58
Namibia	1993 - 2012	1.64	-	-	-
Seycheles	1990 - 2012	-	-	4.85	0.09
South Africa	1950 - 2012	1.20	1.20	-	-
Swazilandia	1993 - 2012	0.90		-	-
Tanzania	2002 - 2012	4.19	3.93	-	-
Zambia	1990 - 2012	3.54	-	2.63	-0.74
Zimbabwe	1965 - 2012	-	0.84	-0.01	-8.53
Average		3.35	2.77	2.89	-0.14
Median		2.90	3.30	3.01	0.67
Observations	353	77	162	40	74