

## External versus Domestic Financing of Development in African Countries

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### Abstract

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This paper presents across-section quantitative assessment of African countries development and its financing. The first part of our investigation consists in computing a development index that summarizes six development indicators for the selected countries in a reference year (1991), relying on a Principal Component Analysis. The second part of the paper specifies and estimates a “development equation” which relates the development index computed in the first part, to variables reflecting foreign and domestic financing of development on one hand, and on the second hand, the tertiary sector importance in the economy, supposed to measure the weight of private entrepreneurship in the selected countries. Domestic saving appeared as the first determining factor of development, followed by foreign aid. The well-known fact that debt, on the contrary, has a negative impact on African countries’ development and is a real burden for them is also confirmed by our estimation. Moreover, it appears that the reduction of the debt burden by a given percentage procures more gain in term of development than the increase by the same percentage of domestic saving or foreign aid. As for the impact of ‘private entrepreneurship’, it seems to have no significant contribution to ‘development’, which reflects the lack of appropriate incentives in favor of the private sector.

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### I. Introduction

Development theories try to explain the transition from a backward agricultural and low income economy to a modern industrialized and high income one. Development strategies resulting or implied by these theories and implemented by international organizations have been subjected to controversies and yielded poor results in general, forcing them to move toward more specific objectives such as poverty alleviation, the enhancement of the private sector, and finally to multiple long term objectives such as those of the ‘Millenium Development Goals’ of the World Bank. The assessment of the development objectives and the measurement of the development level of the different countries appear then to be a meaningful and useful activity, and is even the main activity of some international organizations. The aim of this paper is twofold: firstly, we want to evaluate empirically and approximately the ‘development’ levels of African countries for a given year and compare these levels; secondly, we are interested by the comparative efficiency of the external and domestic financing of development in Africa and by the real influence of the private sector in the development process. This question is a difficult one, quantification and modeling of development being an ambitious task, and our attempt to answer it is only preliminary. Another specificity of this paper is that it tries to quantify the impact of foreign financing on “development”, appropriately measured, and not only on growth. Many studies have been devoted to the link between growth and external debt or aid, relying on more or less advanced econometric methodology (time series, cross section or panel data econometrics). Concerning aid, an exhaustive summary of such studies is H. Doucouliagos and M. Paldam (2005). Concerning the debt-growth nexus analysis, some references are Elbadawi, Ndulu and Ndungu’u (1999), Hansen (2004), Patillo, Poirson and Ricci (2002) for example.

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Our approach is a bit more ambitious than those of these referenced studies, as it tries to quantify the notion of "development" by means of a principal component analysis in the first hand, and then use this quantification to assess the comparative impact of debt, aid, domestic saving and 'private entrepreneurship' on development, for African countries in a given year. The year 1991 has been retained because the computation of the development index via a principal component analysis gives good results for this year. This is not the case for several other years tried.

## II. Measuring and Comparing the Development levels of African Countries by a Principal Component Analysis

Development, as we know, is a multidimensional concept which can be only approximately defined and estimated. The notion of human development is the most sophisticated empirical approximation of this concept and has been popularized by the UNDP reports on this question. To assess the development level of African countries, we'll adopt a methodology similar to that used by many other authors to build general wealth index for households in developing countries (see for example Filmer and Pritchett (1998)), namely the implementation of a principal component analysis. Our first task will then be to construct a general development index by means of a Principal Component Analysis applied to a group of selected development indicators. Principal component analysis is a well known statistical technique, consisting in summarizing  $p$  measures (here  $p$  development indicators) on  $n$  individuals (here  $n$  countries) by optimal and orthogonal linear combinations of these measures, "optimal" meaning "with minimal variance". If the first principal component obtained (namely the one with the least variability) is significantly correlated with most of the initial development indicators, it may be interpreted as a synthetic (or global) development indicator, summarizing the individual development indicators. The orthogonal projection of the individuals (countries) on this first principal component can therefore be used to compute a general or synthetic 'development' index for the different countries relatively to a benchmark country (the country with the smallest coordinate on the axis for example).

To apply this approach to African countries, we select six development indicators in our statistical source<sup>2</sup>: three economic indicators (gross national product per capita, industrial and agricultural contribution to gross domestic product), two health development indicators (infant mortality rate, life expectancy at birth), and an educational level indicator (number of pupils per teacher in the primary school). These indicators have been chosen because there are simultaneously available for the greatest number of African countries (34 precisely) in our statistical source for the year considered (1991). We submitted our data to a principal component analysis and found that the first principal component explains 64.9% of the total variability of the table. Moreover, all the six indicators are significantly correlated with the first principal component (see table 2 in the appendix), which is then an acceptable measure of "global" or multidimensional development. This first component is positively correlated to three variables, namely life expectancy at birth, contribution of industry to gross domestic product, and gross national product per capita, and negatively correlated to the three remaining variables (infant mortality, agricultural contribution to GDP and number of pupils per teacher in the primary school). Fourteen countries present positive coordinates on this axis, contrary to 20 of them presenting negative ones. The country labeled  $C_5$  has the most negative coordinate on the first principal component and was consequently the 'least developed' country among those considered, and the country  $C_{33}$  with its greatest coordinate was the most developed one. We choose  $C_5$  as a benchmark to compute the development index of the countries<sup>3</sup>. The results of this computation and the ordering of the countries relatively to this index are displayed in table 1 in the appendix. This table gives also the more traditional ranking of the countries relatively to GDP per capita. It appeared that 16 countries have a better ranking in term of the general development index, and 17 have a worse one. The fact that a few countries (one third of the total) have very different rankings for the two criteria is however a sufficient argument in favor of the computation and use of a synthetic development index. We can now move to the second part of this paper, that is use our computed development index for the comparison of the impact of external and domestic financing on the development level of African countries (in the beginning of the 1990s).

<sup>2</sup>World development report 1993, The World Bank

<sup>3</sup> The formula used is:  $devindex = 100(1 + (c_{1i} - c_{1r}))$  where  $c_{1i}$  is the coordinate of country  $i$  and  $c_{1r}$  the coordinate of the reference country on the first principal component axis.

### III. Do External Sources of Financing Better Contribute to Development than Domestic Ones?

Two issues often examined in the development literature are reexamined here specifically for our 34 African countries: the first issue is the usefulness of foreign aid and indebtedness in the development process, and the second is the relative efficiency of domestic saving and foreign financing (aid or debt mainly) in the same process. Concerning the first issue, many studies revealed the misuse and inefficiency of foreign aid in developing countries (see for example Cassen and associates (1986)) or analyzed the causes of the debt crisis which is the ultimate illustration of the great failure of the developing countries' indebtedness policies (Green (1989) and van der Hoeven(1992)) are good references). Our contribution to the debate relies on the estimation of an equation explaining our development index constructed in the previous section, by four variables: total indebtedness per capita, which reflects the indebtedness level of a country and ought to be positively correlated to development if debt is correctly affected; total indebtedness expressed as a percentage of GDP, which reflects the country's reimbursement capability or its solvability, and which must be positively correlated to development if the countries can economically support their indebtedness level ; total foreign aid received within a five year period (from 1987 to 1991) divided by the country population in the terminal year, which measures the level of medium term assistance to the country and must be positively correlated to development if foreign aid really "works"; domestic saving as a percentage of GDP; contribution to GDP of the tertiary sector, which reflects the private sector development because this sector consists mainly of individual or family owned trade and service enterprises, in many African countries.

A first estimate of this regression model gave results displayed in table 3 in the appendix. The only variable with a good significance level is domestic saving as a percentage of GDP (the variable called SAVINGRATE in the table). The ratios of debt to GDP (called RATIODEBTGDP in the table) is significant at 10% level and is negatively related to the development index. The other three explaining variables have no significant impact on the development index. So, this first estimate reveals four things: the positive role of domestic saving, the misuse and negative contribution of indebtedness to development, and the inefficiency of foreign aid and of the tertiary sector. These conclusions could perhaps be amended if the estimation process takes more in account the data generation process via appropriate dummy variables. The different level of development of the countries for example can be taken in account by a dummy variable that takes on the value 1 for countries with positive coordinate on the first axis of the Principal Component Analysis (most developed of the 34 countries), and the value 0 for the countries with a negative coordinate (least developed of the 34 countries). This dummy variable is named DUM1A better description of the data can also result from the introduction of a dummy taking in account the difference in indebtedness level of the countries, equal to 1 for the most indebted countries (those with per capita indebtedness greater than \$1000 for example), and equal to 0 for the others (this dummy variable is called DUM2). Finally, a third dummy can be introduced to distinguish two of the countries having roughly the same development index, and is labeled DUM3. We re-estimate the model by introducing the three dummies simultaneously.

This estimation of our development equation with dummies is displayed in table 4 in the appendix. Three of the five regressors are now highly significant: ratio of debt to GDP, total foreign aid from 1987 to 1991 (per capita), and domestic saving in percentage of GDP. One variable, per capita cumulative indebtedness is significant at the 10% level. Only the tertiary sector contribution to GDP is still not significant. Consequently, this new estimation of our equation reveals that foreign aid contributes significantly and positively to development, as well as domestic saving. The well known debt problems of African countries (bad economic allocation and too high relative level) are stressed by the negative contributions of the two debt variables of the model. The necessity to settle better conditions for the development of the tertiary sector in general, and the private sector in particular, is revealed by the non significant contribution of the tertiary sector in our development equation.

### IV. Concluding Remarks

We undertake in this paper a quantitative analysis of African countries development and its financing. The first part of the paper computes the development levels of the countries with factorial analysis methods and the second part evaluates econometrically the respective impact of external financing variables, domestic saving, and the tertiary sector on this development level. Domestic saving appeared as the first determining factor of development, followed by foreign aid. The well known fact that debt, on the contrary, has a negative impact on development and is a real burden is also confirmed by our estimations for the 34 countries selected for our investigation.

The severity of the debt problem in African countries since the 1980s forced them to adopt drastic adjustment programs under the IMF and World Bank supervision, which generally failed to rescue their economies and resulted in stagnation and increasing poverty. The bad allocation and management of the huge indebtedness of these countries by their public authorities induced the launching of the private sector enhancement paradigm by these international organizations. Our "development equation" shows that along with this necessary boosting of the tertiary sector (which implies consequently policies encouraging the development of private commercial enterprises and services), development depends crucially on a good level of domestic saving and of foreign aid. Moreover, this relation reveals that, on the average, the gain in terms of development of a reduction of the debt burden of African countries is greater than that implied by an increase by the same percentage of foreign aid or domestic saving.

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## Appendix

**Table 1: Coordinates of the countries on the first principal component, values of their development index and GNP per capita, and their ranks in term of these variables**

Countries	First Comp.	Devindex	Rdevindex	GNP/cap.	RGNP/cap.
C1	-1.33206	103.31	33	80	34
C2	-0.94033	142.48	30	100	33
C3	-0.78016	158.50	24	120	32
C4	-0.82206	154.31	25	170	31
C5	-1.36512	100.00	34	180	30
C6	-0.91664	144.85	29	210	26
C7	-0.84591	151.92	26	210	26
C8	-0.36673	199.84	20	210	26
C9	-0.95097	141.41	31	210	26
C10	-0.84862	151.65	27	230	25
C11	-0.54849	181.66	21	270	24
C12	-0.96138	140.37	32	280	23
C13	-0.74678	161.83	23	290	22
C14	-0.57346	179.17	22	300	21
C15	0.53841	290.35	9	340	19
C16	0.27667	264.18	12	340	19
C17	-0.31970	204.54	19	380	18
C18	-0.87562	148.95	28	390	17
C19	-0.13328	223.18	17	400	16
C20	-0.02537	233.98	15	410	15
C21	-0.20832	215.68	18	460	14
C22	-0.03612	232.90	16	510	13
C23	0.71589	308.10	8	580	12
C24	1.05720	342.23	6	610	11
C25	1.02736	339.25	7	650	10
C26	0.02780	239.29	13	690	9
C27	0.02634	239.15	14	720	8
C28	0.40567	277.08	11	850	7
C29	1.23463	359.97	5	1030	6
C30	0.43469	279.98	10	1120	5
C31	1.63618	400.13	4	1500	4
C32	1.96460	432.97	2	1980	3
C33	2.53109	489.62	1	2530	2
C34	1.72058	408.57	3	3780	1

**Note:** Meaning of the columns' headers:

$C_i$ ,  $i=1$  to 34: the countries' anonymous labels.

First Comp.=Countries' coordinates on the first component of the Principal Component Analysis.

Devindex = Development index computed with the formula given in the footnote 2 (Reference country = Guinea-Bissau)

Rdevindex = Rank of the countries in term of the development index.

GNP/cap = GNP per capita.

RGNP/cap = Rank of the countries in term of GNP per capita.

**Table 1B: Countries Included in the Study**

Kenya	Nigeria	Benin	Centrafric Rep
Ghana	Togo	Guinea	Mauritania
Lesotho	Egypt	Zimbabwe	Côte d'Ivoire
Senegal	Cameroon	Morocco	Congo Rep
Tunisia	Algeria	Botswana	Gabon
Mozambique	Tanzania	Ethiopia	Uganda
Guinea Bissau	Burundi	Chad	Madagascar
Sierra Leone	Malawi	Rwanda	
Burkina Faso	Niger	Mali	

**Table 2: The 3 best Principal Components' Correlation with the Variables Submitted to the Principal Component Analysis**

Variables	Principal Component		
	1	2	3
Life expectancy at birth	0.893	-0.291	-0.237
Infant mortality rate	-0.851	0.228	0.431
Industry contribution to GDP	0.870	0.332	0.126
Number of pupils per teacher in the primary school	-0.478	0.767	-0.414
Agriculture contribution to GDP	-0.862	-0.317	-1.209E-02
Per capita GNP	0.803	0.321	0.325

**Table 3: Estimate of the "Development Equation" without Dummy Variables**

Dependent Variable: DEVINDEX

Included observations: 34

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	107.6811	54.81175	1.964563	0.0595
DEBT91_CA	0.014156	0.023315	0.607172	0.5486
RATIODEBTGDP	-0.499585	0.247171	-2.021214	0.0529
AID8791_CA	0.134354	0.103085	1.303329	0.2031
SAVINGRATE	4.621897	1.001358	4.615626	0.0001
TERTCONTGDP	1.507688	1.344552	1.121332	0.2717
R-squared	0.682504	Mean dependent var		236.5118
Adjusted R-squared	0.625808	S.D. dependent var		99.99942
S.E. of regression	61.17085	F-statistic		12.03802
		Prob(F-statistic)		0.000003

**Table 4: Estimate of the "Development Equation" Including three Dummy Variables**

Dependent Variable: DEVINDEX

Included observations: 34

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	127.2337	33.16743	3.836104	0.0008
DEBT91_CA	-0.035589	0.020772	-1.713291	0.0990
RATIODEBTGDP	-0.449082	0.148269	-3.028837	0.0056
AID8791_CA	0.221192	0.062560	3.535689	0.0016
SAVINGRATE	2.449828	0.654470	3.743225	0.0010
TERTCONTGDP	0.247946	0.837999	0.295878	0.7698
DUM1	129.0088	18.28828	7.054181	0.0000
DUM2	65.16326	29.23435	2.228996	0.0350
DUM3	-118.2087	28.98314	-4.078533	0.0004
R-squared	0.902945	Mean dependent var		236.5118
Adjusted R-squared	0.871887	S.D. dependent var		99.99942
S.E. of regression	35.79261	F-statistic		29.07324
		Prob(F-statistic)		0.000000

**Definition of the Variables**

DEBT91\_CA = per capita cumulative indebtedness in 1991 (\$).

RATIODEBTGDP = total debt in 1991 expressed as GDP percentage.

AID8791\_CA = per capita cumulative aid between 1987 and 1991 (\$).

SAVINGRATE = saving rate in 1991 (%).

TERTCONTGDP = contribution to GDP of the tertiary sector (%).

DUM1 = dummy variable equal to 1 for countries with positive coordinate on the first principal component, and equal to 0 for countries with negative coordinate.

DUM2 = dummy variable equal to 1 for countries with per capita indebtedness greater than \$1000, and equal to 0 for the other countries.

DUM3 = dummy variable equal to 1 for the two countries with roughly the same development index, and equal to 0 for the other ones.

DEVINDEX = development index.