

**EDUCATION, DEVELOPMENT AND HEALTH EXPENDITURE IN AFRICA: A
CROSS-SECTION MODEL OF 39 COUNTRIES IN 2000-2005**

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Abstract

This article analyzes the evolution of education, health expenditure and economic development in 39 African countries for the period 2000-2005, which shows that the low levels of health expenditure in many Africa countries are far from evolving to the necessary speed to meet the social demand. We find that the main causes of this bad situation are the low levels of economic development and the low levels of international cooperation to increase average years of schooling of population. We estimate a cross-section model which shows the important positive effect of the educational level of population on economic development and the highly positive effect of economic development on health expenditure in those countries. The main conclusion is that international cooperation addressed to improve health expenditure in Africa should devote a particular attention to human capital and help to increase the average years of schooling of adult population in the poorest countries.

JEL classification:

Keywords:

1. Introduction

The Millennium Development Goals are addressed to improve economic development in the poorest developed countries, with particularly emphasis on the eradication of poverty and the increase in health expenditure per capita. These MDGs are of great interest but they will not be achieved without more emphasis on the educational level of population and improvement of production per inhabitant.

Several authors as Bredie and Beeharry(1998), Agenor et al (2005), Artadi and Sala-i-Martin(2003), Bobel(2005) and Guisan and Exposito(2005), among others, analyze the problems of Sub-Saharan Africa in this regard. Besides Case(2001), Guisan and Arranz(2001), among other authors, analyze the positive effects of economic development on health expenditure.

Here we present some econometric models which express the important positive impact of the educational level of population on economic development and health expenditure per inhabitant, so we stress the importance of increasing international cooperation in the fields of education and health.

Section 2 presents and overview of the variables in 38 African countries for the period 2000-2005. Section 3 presents the estimation of several econometric models and section 4 presents a summary of the main conclusions.

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2. A general view of Education, Health Expenditure and Development in Africa

In this section we analyze the following variables in 38 African countries:

Gdph2005= Real Gross Domestic Product per inhabitant in year 2005 (\$2000 PPPs)

Pop2005 = Population (million inhabitant)

Incr.Gdph = Increase of Gdph in the period 2000-2005

Total % HE= Percentage of public and private Health Expenditure on GDP

HE2000: Health expenditure per capita in year 2000 (\$2000 PPPs)

HE2005: Health expenditure per capita in year2005 (\$2000 PPPs)

Educc1995= Public Educational expenditure per inhabitant (current and capital)

Educ2000= Current educational expenditure per inhabitant (private and public)

Tyr95= Total average years of schooling from Barro and Lee estimations in year 1995

Tyr99 = Total average years of schooling from Barro and Lee estimations in year 1999

Total average years of schooling per adult includes provisional own estimations in case of non available data.

Values in dollars per inhabitant are expressed at prices and Purchasing Power Parities of year 2000 (\$2000 PPPs):

Table 1 presents the correlation coefficient between those variables, and table 2 presents the data.

Table 1. Correlation between Health expenditure per capita and other variables

	PH05	HE05	EDUCC95	EDUC00	TYR95	TYR99
PH05	1.0000	0.9572	0.8953	0.9668	0.6782	0.6957
HE05	0.9572	1.0000	0.7856	0.9481	0.7137	0.7039
EDUCC95	0.8953	0.7856	1.0000	0.9091	0.6203	0.6717
EDUC00	0.9668	0.9481	0.9091	1.0000	0.7014	0.7178
TYR95	0.6782	0.7137	0.6203	0.7014	1.0000	0.9901
TYR99	0.6957	0.7039	0.6717	0.7178	0.9901	1.0000

We may notice a high positive correlation between all the variables with the highest correlations between Educ00 and PH05 (0.9668), HE05 and PH05 (0.9572), HE05 and Educ00 (0.948), and Tyr95 with Tyr99 (0.9901).

Table 1. Health Expenditure, education and Gdp per capita in Africa, 2000-2005

	PH 2005	Pop 2005	Incr. Gdph	Total %HE	HE 2000	HE 2005	Educc 1995	Educ 2000	Tyr 95	Tyr 99
Algeria	6361	32.8	943	3.50	190	223	384	242	3.9	4.7
Angola	2170	15.9	375	2.50	45	54	33	56	1.9	2.2
Benin	1000	8.4	41	4.70	45	47	111	23	1.9	2.1
Botswana	9652	1.7	1950	5.40	416	521	399	432	4.7	5.3
Burkina Faso	1093	13.2	95	5.20	52	57	12	24	2.0	2.2
Burundi	584	7.5	0	3.10	18	18	21	21	2.0	2.3
Cameroon	1978	16.3	112	4.40	82	87	59	51	2.7	3.1
Central Afr. R.	1024	4.0	-131	4.00	46	41	30	18	1.9	2.1
Chad	1616	9.7	776	6.70	56	108	19	12	2.2	2.4
Congo, DR	679	57.5	10	3.70	25	25	38	6	2.9	3.1
Congo, R.	931	4.0	-27	1.80	17	17	101	33	4.2	4.6
Cote d'Ivoire	1401	18.1	-175	4.70	74	66	90	72	3.0	3.6
Egypt, AR	3985	74.0	386	5.43	195	216	181	159	4.2	5.0
Eritrea	907	4.4	-5	4.50	41	41	26	22	2.7	3.0
Ethiopia	896	71.2	115	5.70	45	51	26	24	2.0	2.3
Ghana	2149	22.1	256	5.40	102	116	63	54	3.7	4.0
Guinea	2040	9.4	64	4.80	95	98	40	40	2.4	2.8
Kenya	1042	34.2	24	4.30	44	45	90	63	3.5	4.0
Lesotho	2472	1.8	350	5.80	123	143	84	156	4.2	4.5
Madagascar	802	18.6	-23	2.10	17	17	10	15	2.4	2.7
Malawi	597	12.9	11	8.60	50	51	20	26	2.6	2.6
Mali	930	13.5	150	4.70	37	44	11	21	0.7	0.7
Mauritania	1993	3.1	263	2.50	43	50	91	62	2.8	3.0
Morocco	3954	30.2	409	4.70	167	186	200	216	4.7	5.1
Mozambique	1220	19.8	343	5.50	48	67	34	16	1.0	1.2
Namibia	6980	2.0	922	7.00	424	489	340	441	3.9	4.2
Niger	716	13.9	13	4.40	31	32	25	16	0.7	0.8
Nigeria	1058	131.5	176	4.30	38	45	7	7	2.5	2.9
Rwanda	1193	9038	154	4.30	45	51	27	37	1.7	2.0
Senegal	1615	11.6	180	4.40	63	71	70	47	2.0	2.2
Sierra Leone	720	5.5	254	3.80	18	27	11	5	1.6	2.0
South Africa	11044	45.2	1556	8.10	769	895	272	520	8.0	7.9
Tanzania	653	38.3	131	4.40	23	29	32	12	2.8	3.2
Togo	1411	6.1	-28	4.60	66	65	71	59	2.6	2.8
Tunisia	7423	10.0	1171	5.60	350	416	293	384	3.6	4.2
Uganda	1363	28.8	114	6.60	82	90	19	24	2.7	2.9
Zambia	930	11.7	156	5.50	43	51	26	19	5.5	5.4
Zimbabwe	1832	13.0	-667	7.80	195	143	169	172	4.4	4.9
38 countries	2333	832	215				87			
World	8541	6437	1212				258			5.8

Source: Elaborated from WB(2006), and other sources with provisional own estimations by the authors in case of non available data. Notes: Health Expenditure (HE) includes public and private expenditure. Educc is public expenditure on education (current and capital) and Educ is current expenditure on education (public and private). Tyr is Total average years of education per adul, as estimated by Barro and Lee and from provisional own estimations in case of non available data.

Poverty has been unfortunately quite common in many African countries for the last decades. Accordingly to WB(2006) the poverty count, indicating the percentage of people below 2 dollars per inhabitant of income per day, amount to more than 80% in the poorest African countries, with an estimated average by Guisan(2006) of 65% for the group of 24 countries with available data., which amounts to 424 million people out of 655 million inhabitants in those countries. This group is a representative sample of the 38 countries analyzed in this study, and even the percentage might be a little higher if data would be available for the whole group. The low level of average production per inhabitant is the main variable explaining the poverty count, as shown in that study. The main policy to diminish poverty count is to foster economic development in the poorest countries, which need to improve the educational level of population and capital investment.

One of the most negative consequences of low production per inhabitant is the low capacity of the country to expend on education and health which are of uppermost important for socio-economic wellbeing. As seen in Guisan and Exposito(2002), (2005) and in other studies the low level of education of many African countries is the main explanation of their low degree of production per inhabitant, because although production has experienced percentages of increase similar to world average, population has experienced the highest world percentages of increase, with 91% of increase in the period 1980-2005, while world average increase was 45%, and other areas evolved similarly to this average or below: Asia-Pacific 48%, America 45%, Europe and Eurasia 10%. Table 2 shows the evolution of world population.

Table 3 presents a comparison of the educational level of population of Africa and other areas of the world.

Table 3. Educational indicators: Tyr99 and Educ95 in the World

Area	Tyr99	Educ95
13. USA and Canada	12.1	1396
14. México and Central America	5.9	307
15. Andean America	6.1	204
16. East South America	5.3	260
Total America	8.1	704
17. Nordic and British Europe.	9.7	1122
18. Germanic Europe and Benelux	9.5	942
19. Latin Europe	7.4	969
20. Central Europe and East Med.	7.0	235
21. Russia and neighbouring countries	6.9	212
Total Europe and Eurasia	7.7	562
Africa	3.4	87
Asia and South Pacific	5.3	113
America	8.1	704
Europe and Central Asia	7.7	562
World (210 countries)	5.8	258

Source: Elaborated by Guisan and Exposito from WB(2006) and Barro and Lee data for Tyr.

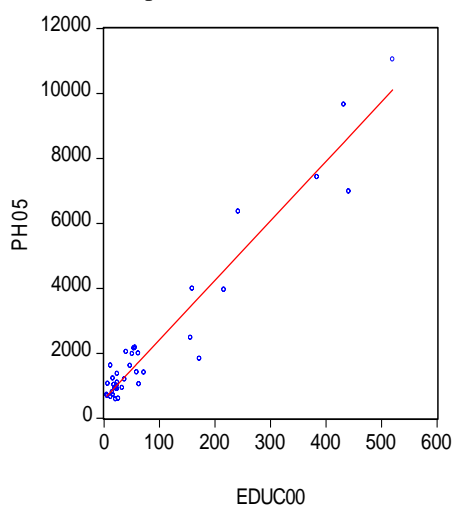
Table 4. Population of 132 countries: 1980-2005 (millions)

	1980	1990	2000	2005	Δ	%
Asia-Pacífico	2483	2986	3467	3681	1198	48
África	435	586	746	832	397	91
América	596	696	804	866	270	45
Europa+Eurasia	779	823	850	860	81	10
Total	4293	5091	5867	6239	1946	45

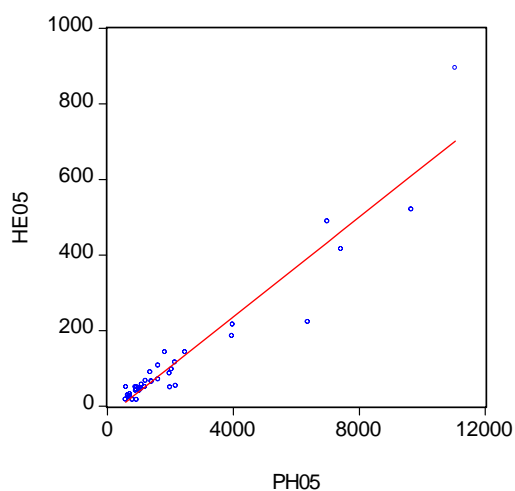
Source: Elaborated from WB(2006).

Graphs 1 to 3 shows the positive relationship between PH05 and Educ00, HE05 and PH05, and HE05 and Educ00.

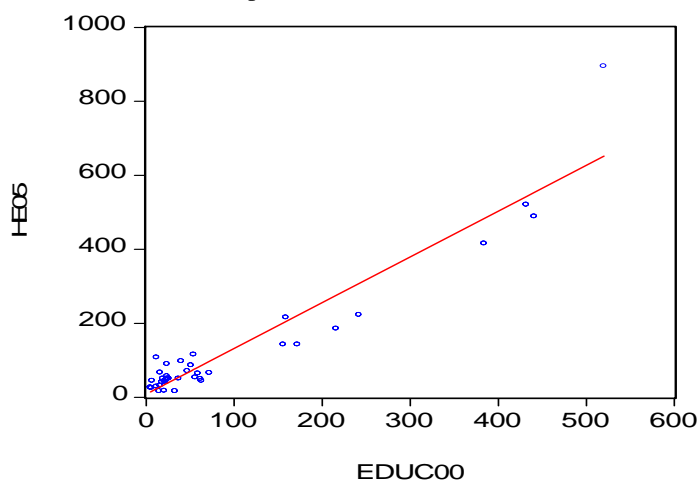
Graph 1. PH05 and Educ00



Graph 2. HE05 and PH=5



Graph 3. HE05 and Educ00



3. Econometric models

The following models express the relationships between HE00 and PH00 and the Educational indicators. Dummy variables have been included in model 1 when the coefficients were significantly different from zero.

Model 1. HE00 and PH00

Dependent Variable: HE00				
Method: Least Squares. Observations 38 countries				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
PH00	0.055164	0.00170	32.3068	0.0000
DDZ	-103.8317	26.4565	-3.9246	0.0004
DZA	273.5939	29.6112	9.2395	0.0000
R-squared	0.974550	Mean dependent var	113.6779	
Adjusted R-squared	0.973096	S.D. dependent var	151.1137	
S.E. of regression	24.78629	Akaike info criterion	9.3341	
Sum squared resid	21502.61	Schwarz criterion	9.4633	
Log likelihood	-174.3482	Durbin-Watson stat	1.6873	

Note: DDZ dummy for Algeria and DZA dummy for South Africa.

Model 2. PH00 and Educc95

Dependent Variable: PH00				
Method: Least Squares. Observations 38 countries				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	393.8664	198.5662	1.983552	0.0550
EDUCC95	17.82985	1.397902	12.75472	0.0000
R-squared	0.818807	Mean dependent var	2051.842	
Adjusted R-squared	0.813774	S.D. dependent var	2144.196	
S.E. of regression	925.3056	Akaike info criterion	16.54932	
Sum squared resid	30822856	Schwarz criterion	16.63551	
Log likelihood	-312.4371	F-statistic	162.6829	
Durbin-Watson stat	1.042756	Prob(F-statistic)	0.000000	

Model 3. EDUCC99 and the increase of PH for 1990-1999

Dependent Variable: EDUH99				
Method: Least Squares. Observations 38 countries				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
PH99-PH90	0.033886	0.017386	1.949067	0.0598
EDUH90	1.436152	0.072941	19.68929	0.0000
Ddz	-305.4262	52.84944	-5.779176	0.0000
Dza	339.8762	43.16843	7.873259	0.0000
Dmo	-105.2117	41.82031	-2.515804	0.0169
R-squared	0.953888	Mean dependent var	119.15	
Adjusted R-squared	0.948299	S.D. dependent var	176.21	
S.E. of regression	40.06743	Akaike info criterion	10.3410	
Sum squared resid	52978.15	Schwarz criterion	10.5565	
Log likelihood	-191.4806	Durbin-Watson stat	1.5368	

Model 4. PH05 related with the educational indicators

Dependent Variable: PH05				
Method: Least Squares. Included observations: 38				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
TYR95	322.0509	69.09718	4.660840	0.0000
TYR99*EDUC00	2.649990	0.242675	10.91992	0.0000
R-squared	0.863581	Mean dependent var		2326.684
Adjusted R-squared	0.859791	S.D. dependent var		2562.358
S.E. of regression	959.4618	Akaike info criterion		16.62182
Sum squared resid	33140410	Schwarz criterion		16.70801
Log likelihood	-313.8145	Durbin-Watson stat		1.241948

4. Conclusions

The main conclusions may summarized as follows: 1) Economic development in many African countries for the period 2000-2005 has been very low, not enough to reach the Millennium Development Goals. 2) Health Expenditure has very low values in many African countries and it is of uppermost urgency to reach highest values, at least closer to World average. 3) For that purpose the main policies of international cooperation should be addressed to increase real Gdp per inhabitant with particular focus on the increase of the average level of education of population, because the many positive benefits that this variable shows to improve economic development.

References

- Agenor, P.R.; Bayraktar, N., Pinto Moreira, E. and El Aynaoui, K. (2005). Achieving the Millennium Development Goals in Sub-Saharan Africa : a macroeconomic monitoring framework. *The World Bank, Policy Research Working Paper Series* number 3750
- Artadi, E.V. and Sala-i-Marti, X. (2003). The Economic Tragedy of the XXth Century: Growth in Africa. *National Bureau of Economic Research, Working paper Series* number 9865.
- Böbel, I. (2005). The Growing Threat of Global Poverty: The Case of Africa. *Development and Comp Systems Series* number 0507006.
- Bredie, J.W.B. and Beeharry, G.K. (1998). School Enrollment Decline in Sub-saharan Africa. Beyond the Supply Constraint. *World Bank - Discussion Papers* number 395.
- Case, A. (2001). Health, Income and Economic Development. Princeton University, Woodrow Wilson School of Public and International Affairs, *Research Program in Development Studies, Working Papers Series* nb 271
- Guisan, M.C., Aguayo, E. and Exposito, P.(2001). "Economic Growth and Cycles: Cross-country Models of Education, Industry and Fertility and International Comparisons". *Applied Econometrics and International Development*, Vol. 1-1, ^{1,2}

Guisan, M.C. and Arranz, M.(2001). "Consumption expenditure on Health and Education: Econometric models and evolution of OECD countries 1970-96", working paper series *Economic Development*, number 50.^{1,2}

Guisan, M.C. and Exposito, P.(2005). Human Capital and Economic Development in Africa: An Econometric Analysis for 1950-2002. *Applied Econometrics and International Development*, Vol. 5-1.^{1,2}

Guisan, M.C. and Exposito, P.(2004). "Econometric Models and Causality Relationships Between Manufacturing and Non-Manufacturing Production in Morocco, Tunisia and Other Northern African Countries, 1950-2000". Workin paper *Economic Development*, no. 78.^{1,2}

Guisan and Exposito (2003). Education, Industry, Trade and Development of Asia-Pacific countries in 1980-99. *Applied Econometrics and International Development*, Vol. 3-2.^{1,2}

Guisan, M.C. and Exposito, P. (2002). Education, Industry, Trade and Development of African Countries in 1980-1999. *Applied Econometrics and International Development*, Vol. 2-2.^{1,2}

Guisan, M.C. and Exposito, P. (2001). Economic Development of African and Asia-Pacific Areas in 1951-99. *Applied Econometrics and International Development*, Vol. 1-2.^{1,2}

Shaohua, Ch., Datt, G. and Ravallion, M.(1993). Is poverty increasing in the developing world?. *World Bank, Policy Research Working Paper* nb 1146

UN(1995). "Progress of work in the field of population in 1995" Department for Economic and Social Information and Policy Analysis of the United Nations. Report of the Secretary-General.⁵

UN(2005). Investing in Development: A Practical Plan to Achieve the Millennium Development Goals, Report to the United Nations Secretary General, New York, January.

WB(2002), Achieving the Millennium Development Goals in Africa: Progress, Prospects, and Policy Implications, Global Poverty Report. World Bank, Washington.

WB(2006). World Development Indicators. World Bank, on line.

WHO(2005). Health and the Millennium Development Goals, World Health Organization,

¹<http://ideas.repec.org>

²<http://www.usc.es/~economet/welcomei.htm>

³<http://www.un.org/documents/ecosoc/cn9/1996/english/ecn91996-7.htm>