

LIFE EXPECTANCY, EDUCATION AND DEVELOPMENT IN AFRICAN COUNTRIES 1980-2014: IMPROVEMENTS AND INTERNATIONAL COMPARISONS

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Abstract. Life expectancy has increased in the majority of African countries for the period 1980-2014, with an average increase slightly higher than that of World average for that period. Due to the low starting values of year 1960, and to the slow increase of the period 1960-1980, many Sub-Saharan countries presented, in year 2014, low values in comparison with World average: 59 years in Sub-Saharan Africa and 71 as World average. Northern Africa has experienced a very positive evolution reaching World average in year 2014. We present some econometric models to analyze the positive impact of education and development in the evolution of life expectancy of African countries, having into account that there are also other factors related with geography, social features, health assistance, sanitation infrastructures and other factors that also explain differences among countries. We include an analysis of several causes of death, with adjusted rates particularly high in many Sub-Saharan countries, in comparison with the World average of the Age Specific Death Rate (ASDR). Finally we call to support the initiatives for a kind of Marshall Plan for Africa, as those suggested many years ago by Angelopoulos and Klein and currently from some from European Union countries or other areas. The article concludes insisting on the main factors that might help to improve development, life expectancy and quality of life in Africa, and calling to foster international initiatives of cooperation in this regard.

Keywords: Life Expectancy, Education and Development, Quality of Life, Africa, Sub-Saharan Africa, Northern Africa, Adjusted Death Rates, ASDR.

JEL codes

1. Introduction

We analyze the relationships between education, health and economic development, particularly focused to the evolution of Life Expectancy (Lex) in Africa for the period 1980-2014. As seen in the references and in the Annex, several interesting contributions to this question point to a positive impact of education and development on diminution of adjusted death rates and on the increase of life expectancy. Several studies also point to the importance of other factors in the case of several Sub-Saharan countries, which contribute to increase the deaths rates of some diseases and to diminish life expectancy.

Section 2 present data of education, life expectancy and production per head in 30 African countries for that period. We may notice a positive evolution in the last decades. Section 3 presents international comparisons of Life Expectancy, Crude Death Rates (CDR) and Adjusted Specific Death Rates (ASDR).

Section 4 present our econometric models that relate education, development and life expectancy, including some dummy variables for other factors and circumstances. We include a reference to some of the main conclusions of other related studies. Section 5 presents a summary of the main conclusions and a call to support a kind of Marshall Plan for international cooperation in Africa. In the Annex we present some supplementary data of African countries, interesting graphs and a reference to international initiatives addressed to foster cooperation.

2. Life Expectancy in Africa 1980-2014 and international comparisons

Table 1 presents data of the evolution of life expectancy and education in 30 African countries.

Table 1: Life Expectancy (Lex), Production per head and Education (Ty), 1980-2014

		Lex 1980	Lex 2014	Dif. 1980- 2014	Gdp Per head	Tyr 80	Tyr 00	Tyr 10
1	Algeria	58.2	74.8	16.6	7564	1.74	5.50	7.04
2	Benin	47.2	59.5	12.3	1424	0.65	2.55	3.26
3	Botswana	60.5	64.4	3.9	12462	2.29	7.62	8.90
4	Burundi	47.3	56.7	9.4	366	1.09	1.83	2.69
5	Cameroon	51.2	55.5	4.3	2058	2.11	4.78	5.91
6	Central African R	48.9	50.7	1.8	708	1.02	2.84	3.54
7	Congo, DR	46.3	58.7	12.4	311	1.16	3.17	3.47
8	Congo, R	56.1	62.3	6.2	3808	2.45	5.55	5.88
9	Cote d'Ivoire	50.7	51.6	0.9	1704	1.32	2.75	3.31
10	Egypt, A.R.	58.3	71.1	12.8	5544	2.05	4.66	6.40
11	Ghana	52.3	61.3	9.0	1475	3.45	6.11	7.09
12	Kenya	57.8	61.6	3.8	1481	2.69	5.93	6.95
13	Lesotho	53.7	49.7	-4.0	1437	3.72	4.91	5.78
14	Malawi	44.7	62.7	18.0	791	1.75	3.04	4.24
15	Mali	39.6	58.0	18.4	955	0.37	1.02	1.38
16	Mauritania	54.2	63.0	8.8	2203	1.78	2.94	3.73
27	Morocco	57.5	74.0	16.5	4227	1.24	3.37	4.37
18	Mozambique	41.9	55.0	13.1	845	0.73	0.89	1.20
29	Namibia	57.7	64.7	7.0	5808	4.23	6.58	7.36
30	Niger	39.4	61.5	22.1	653	0.46	1.09	1.44
21	Rwanda	48.0	64.0	16.0	1044	1.14	2.26	3.34
22	Senegal	48.9	66.4	17.5	1736	2.39	3.65	4.45
23	Sierra Leone	40.7	50.9	10.2	742	0.98	2.23	2.88
24	South Africa	57.0	57.2	0.2	9477	4.79	7.23	8.21
25	Tanzania	50.5	64.9	14.4	1286	2.54	4.57	5.11
26	Togo	52.3	59.7	7.4	895	1.72	4.37	5.27
27	Tunisia	62.0	74.1	12.1	8566	2.02	4.84	6.48
28	Uganda	49.2	58.5	9.3	1141	1.87	3.86	4.72
29	Zambia	51.5	60.0	8.5	1401	3.31	5.89	6.54
30	Zimbabwe	59.4	57.5	-1.9	500	3.23	5.89	7.25

Source : Authors Elaboration from World Bank(2016), for Life Expectancy and Gross Domestic Product per head, and from Barro and Lee(2010) for Tyr (Total years of Schooling, average year per adult, for population +25 years age). GDP per head in year 2010, expressed in Dollars of 2005 accordingly to Purchasing Power Parities.

There is a positive degree of correlation de 51.35% between Lex 14 and economic development represented by GDP per head, ad a correlation of 65.83% between GDP per head and educational level of population represented by Tyr10.

In table 1 the highest increases of life expectation, for the period 1980-2014, with more than 20 points, corresponded to Eritrea, Ethiopia and Niger. Increases between 11 and 19 points were reached in: Algeria, Angola, Benin, Burkina Faso, Congo D.R., Egypt,

Guinea, Madagascar, Malawi, Mali, Morocco, Mozambique, Rwanda, Senegal, Tanzania and Tunisia. Increases between 8 and 10 points corresponded to Burundi, Ghana, Mauritania, Sierra Leone, Uganda and Zambia. A lower increase, below 7 points corresponded to: Botswana, Cameroon, Central African R, Chad, Congo R., Cote d'Ivoire, Kenya, Namibia, Nigeria, South Africa and Togo. In table 1 also appear two African countries with diminution of life expectancy for the period 1980-2014: Lesotho and Zimbabwe.

The position of 51 African countries, in life expectancy of years 2014 and 2015, may be classified in the following groups:

1) Group 1: Higher than 70. The highest values of African countries, around or over the World average, corresponded to 7 countries: four countries of Northern Africa (Algeria, Egypt, Morocco and Tunisia) and three African countries from other areas (Mauritius, Cape Verde and Seychelles).

2) Group 2: Between 60 and 70 years. The following countries appear in decreasing order: Sao Tome, Senegal, Rwanda, Gabon, Namibia, Botswana, Madagascar, Ethiopia, Eritrea, Congo, Djibouti, Comoros, Kenya, Mauritania, South Africa, Ghana, Uganda, Libéria, Tanzania, Zambia, Niger, Gambia and Zimbabwe.

3) Group 3: Between 45 and 60 years. This group includes, in descending order, the following countries: Benin, Burkina Faso, Congo DR, Burundi, Guinea, Swaziland, Togo, Malawi, Mali, Equatorial Guinea, Mozambique, Cameroon, Somalia, Nigeria, Guinea-Bissau, Lesotho, Cote d'Ivoire, Chad, Central Africa, Angola and Sierra Leone-

Low values of life expectancy depend on high death rates of some diseases that affect to young population. In table A1 of the Annex we present data of 8, out of 50 causes of death, with high incidence in many Sub-Saharan countries.

Table 2 presents a comparison of the evolution of life expectancy by gender for the period 1960-2014 in African areas and other areas of the World.

Accordingly to WB(2016) World average evolved from 62.8 in year 1980 to 71.5 in year 2014. Accordingly to WHO international statistics life expectancy has experienced an important increase during the period 1980-2015. In year 2015 the maximum value for both sexes was reached by Japan (83.7) and the minimum was 50.1 in Sierra Leone. The top 5 countries of the World where: Japan, Switzerland, Singapore, Australia and Spain, followed by Iceland, Italy, Israel, Sweden and France. For the period 1980-2015 the World average of male life expectancy increased in 8.9 points, from 60.7 to 69.6 and female life expectancy experienced a very alike increase, of 8.8 points, from 65.0 to 73.8

We may notice an important increase of 19 years in World life expectancy for the period 1960-2014, with the highest increases in the following World regions: East Asia and Pacific with an increase of 29 (particularly important in the period 1960-1980), MENA countries, South Asia with an increase of 26 (particularly important in the period 1980-2014) and MENA countries with an increase of 25 (particularly important in the period 1980-2014). The World areas of Sub-Saharan Africa and Latin America and Caribbean have increased like World average in the period 1960-2014. The increases have been lower, but also positive, in areas with high starting levels. In comparison with other areas with low starting values of life expectancy in year 1960 (below 50), Sub-Saharan Africa has increased less than MENA, East Asia and South Asia, for the period 1960-1980, but has experienced a higher increase than East Asia for the period 1980-2014.

Table 2. Life Expectancy (Lex), by gender, at birth 1960-2014 World areas

Country Name	1960	1970	1980	1990	2000	2014	Δ 60- 80	Δ 80- 14	Δ 60- 14
World Female	54	61	65	68	70	74	11	9	20
World Male	51	57	61	63	66	69	10	8	18
World Total	52	59	63	65	68	71	11	8	19
Sub-Saharan Africa Female	42	46	50	52	51	60	8	10	18
Sub-Saharan Africa Male	39	43	47	48	49	57	8	10	18
Sub-Saharan Africa Total	40	44	48	50	50	59	8	11	19
East Asia & Pacific Female	47	60	67	70	72	76	20	9	29
East Asia & Pacific Male	44	56	63	66	69	72	19	9	28
East Asia & Pacific Total	45	58	65	68	70	74	20	9	29
Europe & Central Asia Female	70	73	74	76	77	80	4	6	10
Europe & Central Asia Male	64	66	66	68	69	74	2	8	10
Europe & Central Asia Total	67	69	70	72	73	77	3	7	10
Latin America & Carib. Female	58	63	67	71	75	78	9	11	20
Latin America & Carib. Male	54	58	61	64	68	72	7	11	18
Latin America & Carib. Total	56	60	64	68	71	75	8	11	19
MENA Female	47	53	61	67	71	74	14	13	27
MENA Male	46	51	56	63	67	70	10	14	24
MENA Total	47	52	58	65	69	72	11	14	25
South Asia Female	41	48	54	59	64	70	13	16	29
South Asia Male	42	48	54	58	62	67	12	13	25
South Asia Total	42	48	54	58	63	68	12	14	26
United States Female	73	75	77	79	79	81	4	4	8
United States Male	67	67	70	72	74	77	3	7	10
United States Total	70	71	74	75	77	79	4	5	9

Source: Elaboration from WB(2016). Notes: East Asia & Pacific (IDA & IBRD countries). Latin America & Caribbean (excluding high income) MENA=Middle East & North Africa (excluding high income). South Asia (IDA & IBRD)

Deaths Rates in Sub-Saharan countries in comparisons with other areas: CDR and ASDR

Life expectancy is low in countries with very high death rates for young individuals. We may compare the evolution of Africa, in comparison with World average and other major areas, for the period 2000-2015. For that purpose it is preferable to compare adjusted rates (ASDR that means Age Specific Death Rates) instead of CDR (Crude Death Rates). When comparing two areas or countries, CDR varies with age composition and with death rates for each disease or cause, while ASDR is not affected by age composition and varies accordingly to the death rates for each cause of death. Lower levels of ASDR imply higher levels of Life Expectancy.

Table 3 presents the evolution of both kinds of death rates by major regions of the World, accordingly to the World Bank classification, elaborated with data from WHO(2016). It shows an important diminution of adjusted death rates for the period 2000-2015. The highest reduction in ASDR for that period occurred in Sub-Saharan Africa with a diminution of 504 annual adjusted deaths per 100 thousand people. As seen in the Annex, international news have pointed to this positive evolution of the period 2000-2014, thanks to prevention measures, access to low cost medication or other

measures. In spite of the decrease, there was a difference of 503.7 between Sub-Saharan African and Global values of ASDR in year 2015.

Table 3. Annual death rates per 100 thousand people: Crude (CDR) and Specific (ASDR)

WB major regions 2000-2015	CDR 2015	ASDR 2015	CDR 2000	ASDR 2000	Variation ASDR
Global	768.5	735.6	851.5	943.5	-207.9
East Asia and Pacific	724.5	619.4	654.3	777.9	-158.5
Europe and Central Asia	1024.2	555.7	1091.9	755.6	-199.9
Latin America and Caribbean	585.8	593.2	572.0	737.5	-144.3
Middle East and North Africa	521.9	748.5	546.6	876.3	-127.8
North America	810.3	448.8	834.3	549.8	-101.0
South Asia	710.7	912.3	857.8	1153.3	-241.0
Sub-Saharan Africa	944.3	1372.4	1506.1	1876.1	-503.7

Note: Elaborated from WHO(2016). Major Areas accordingly to World Bank (WB) classification. CDR=Crude Death Rates (affected by age composition) and ASDR=Age Specific Death Rates (not affected by age composition).

Table 3 shows important differences in Adjusted rates of death between Sub-Saharan Africa and World average in year 2015. While many differences are explained by poverty and lack of enough medical assistance, other ones are mainly explained by geographical circumstances, lack of means for sanitation and other measures of prevention. There are a difference of 503.7 annual deaths, per 100 thousand people, in ASDR of Subsaharan countries (with an adjusted rate of 1372.4) , in comparison with World average (with an adjusted rate of 944.3).

While in many other causes of death African countries show values of adjusted death rates (ASDR) close to World average, or even below World average, in these 8 causes a great number of Central and Southern Africa countries present death rates very high in comparison with other areas and World average. T

The fifty main causes of death accounts for the 97% of total annual deaths in the World. If we compare the *age specific death rate* (ASDR), due to the 50 main causes, we find that World average in year 2014 was 656 deaths per 100 thousand people. The United States was below World average, with 475, and other countries with generally very good health prevention and cure systems reached lower values, around 300, like Switzerland (334), Spain (339) and other ones.

The international comparisons show that only a few African countries were near World average and that the majority were unfortunately far beyond this value, with extreme cases lake Lesotho which reached a value of ASDR of 1769 annual deaths per 100 thousand people, due to the 50 main causes, in year 2014. In Kenya, which is a country representative of the average death rates of Sub-Saharan Africa, the value of ASDR, due to the 50 main causes, reached a value of 1112.

Besides WLE(2016) presents ASDR by country, from WHO(2016) data. Accordingly to this source, taking the case Kenya as representative of Sub-Saharan Africa, we make a comparison of ASDR, in the 50 main causes of death at World level, and found four outstanding differences, with Kenya were much higher than World averages: 1) *Influenza and Pneumonia* with only 42 at World level and 165 in Kenya, 2) *HIV/AIDS* with 21 at World level and 144 in Kenya, 3) *Malnutrition* with 6 at World level and 57 in Kenya, 4) *Diarrhoeal diseases* with 20 at World level and 60 in Kenya.

Table 4. Adjusted Rates of Death (ASDR) in year 2015: Sub-Saharan Africa and World

Code		ASDR Sub- Saharan Africa	ASDR World	Difference
0	All	1372.4	735.6	636.8
20	1A. Infectious and parasitic diseases	363.6	76.3	287.3
30	Tuberculosis	86.0	18.5	67.5
100	HIV/AIDS	104.1	14.4	89.7
110	Diarrhoeal diseases	83.9	18.4	65.5
120	Childhood-cluster diseases	10.0	3.5	6.5
170	Meningitis	20.6	4.3	16.3
210	Parasitic and vector diseases	41.0	8.2	32.8
220	a Malaria	31.4	5.8	25.6
380	1B. Respiratory Infectious	139.6	41.3	98.3
390	Lower respiratory infections	139.3	41.2	98.1
420	1C. Maternal conditions	23.0	4.2	18.8
490	1D. Neonatal conditions	37.3	23.5	13.8
540	1E. Nutritional deficiencies	25.0	5.8	19.2
550	Protein-energy malnutrition	17.0	4.3	12.7
610	2A. Malignant neoplasms	110.3	116.2	-5.9
790	2B. Other neoplasms	3.6	2.7	0.9
800	2C. Diabetes mellitus	40.5	20.9	19.6
810	2D. Endocrine, blood, immune disorders	15.2	5.5	9.7
820	2E. Mental and substance use disorders	4.4	4.3	0.1
940	2F. Neurological conditions	29.0	25.5	3.5
1020	2G. Sense organ diseases	0.0	0.0	0.0
1100	2H. Cardiovascular diseases	306.1	231.2	74.9
1120	Hypertensive heart disease	26.0	12.3	13.7
1130	Ischaemic heart disease	121.7	114.2	7.5
1140	Stroke	117.5	81.9	35.6
1160	Other circulatory diseases	28.6	13.3	15.3
1170	2I. Respiratory diseases	46.9	51.2	-4.3
1180	Chronic obstructive pulmonary disease	29.1	41.5	-12.4
1190	Asthma	14.5	5.1	9.4
1210	2J. Digestive diseases	67.2	31.2	36.0
1230	Cirrhosis of the liver	33.9	15.6	18.3
1260	2K. Genitourinary diseases	23.6	18.2	5.4
1270	Kidney diseases	15.6	14.9	0.7
1330	2L. Skin diseases	4.8	1.2	3.6
1340	2M. Musculoskeletal diseases	1.3	2.0	-0.7
1400	2N. Congenital anomalies	12.8	7.6	5.2
1470	2O. Oral conditions	0.0	0.0	0.0
1505	2P. Sudden infant death syndrome	0.3	0.3	0.0
1520	3A. Unintentional injuries	91.0	47.2	43.8
1530	Road injury	35.2	18.2	17.0
1550	Falls	14.4	8.5	5.9
1590	Other unintentional injuries	17.2	9.0	8.2
1600	3B. Intentional injuries	27.1	19.2	7.9

Source: Elaborated from WHO(2016). More detailed data in table A3 of the Annex.

While some main causes of death in African countries have ratios close to World averages, we have identified 8 causes where the majority of Central and Southern African countries have rates extraordinarily high in comparison with World averages. Table A1 in the Annex presents data for African countries. Many of those causes are evitable by improving prevention and cure systems. Graphs 3 to 5, in the Annex, show the relationship between the sum of annual deaths due to the 8 causes of death (SUM8) of table A1 and other variables like life expectancy, development and educational level of population.

4. Impact of development and education on Life Expectation: Africa and the World

Equation 1 shows the estimated relationship between Life Expectancy in year 2010 and the average years of schooling of adult population for the period 2000-2010, with a sample of 132 countries of the World.

Equation 1. Life Expectancy and Education in 132 countries of the World, year 2010

Dependent Variable: Lex10. Method: Least Squares. Sample: 1 132				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	56.58383	0.963608	58.72078	0.0000
Educational Level	2.262624	0.117322	19.28559	0.0000
D12 Benin	7.322590	2.868769	2.552520	0.0121
D20 Cameroon	-9.319793	2.811171	-3.315270	0.0012
D22 Central African R.	-12.96251	2.801506	-4.626977	0.0000
D23 Chad	-7.602622	2.797548	-2.717602	0.0076
D49 Guinea	5.803674	2.870902	2.021551	0.0456
D63 Kenya	-10.63766	2.647514	-4.017980	0.0001
D70 Lesotho	-10.77911	2.827111	-3.812765	0.0002
D81 Morocco	5.041974	2.657793	1.897053	0.0604
D104 Senegal	11.88040	2.867537	4.143068	0.0001
D109 South Africa	-9.160968	2.845903	-3.219002	0.0017
D122 Uganda	-10.35288	2.668136	-3.880193	0.0002
D132 Zimbabwe	-11.02068	2.832191	-3.891220	0.0002
DAREA2 NW Africa	-12.51033	1.282938	-9.751313	0.0000
DAREA3 Sahel-Central Africa	-5.073017	1.194227	-4.247950	0.0000
DAREA6 Southern Africa	-9.176871	1.185015	-7.744098	0.0000
DAREA7 Western Asia	2.661467	1.049908	2.534952	0.0126
DAREA14 Mexico and Central America	2.543684	0.907230	2.803792	0.0060
DAREA19 West Latin Europe	2.925370	1.361731	2.148273	0.0339
DAREA21 Russia and Former USSR	-3.483613	0.819819	-4.249244	0.0000
R-squared	0.934420	Mean dependent var		69.74167
Adjusted R-squared	0.922604	S.D. dependent var		9.406308
S.E. of regression	2.616852	Akaike info criterion		4.906731
Sum squared resid	760.1183	Schwarz criterion		5.365359
Log likelihood	-302.8442	Hannan-Quinn criter.		5.093096
F-statistic	79.07945	Durbin-Watson stat		2.072770
Prob(F-statistic)	0.000000			

Source: Own elaboration. Norte: See Annex for data sources and list of areas and countries.

The estimated Life Expectancy results in a value of 56.6 years for a country with education (average total years of schooling of adult population) equal to zero years, and

may increase in the amount of 2.26 year for each year of education, what amounts to $56.6 + 22.6 = 79.2$ years for countries with 10 years of education. The equation includes several dummies in order to have into account particular effects of other variables in several areas and countries. In equation 1, we may notice a significant, a negative, of dummies coefficients for 3 areas of Africa and 8 countries. The effect is accumulative, as to say some countries may have two negative coefficients: one share with other countries of the area and another country specific. There a few African countries with a positive dummy coefficient: Benin, Guinea, Morocco and Senegal.

Equation 2, relates Life Expectancy (Lex) in year 2010 with the educational level of population (Tyr10x) and Gross Domestic Product per capita (Ph10pp05) in thousand USD, in 132 countries of the World. Both variables show a significant and positive effect.

Equation 2. Life Expectancy related with education and development in 132 countries

Dependent Variable: LEX14. Least Squares. Sample 1 132				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	57.67858	1.078389	53.48586	0.0000
TYR10X (Education)	1.648743	0.170240	9.684835	0.0000
PH10PP05/1000 (Gdp pc)	0.160985	0.037583	4.283451	0.0000
D3 Angola	-13.03179	3.431505	-3.797690	0.0002
D20 Cameroon	-13.42458	3.409889	-3.936954	0.0001
D22 Central African R.	-14.74267	3.418027	-4.313209	0.0000
D23 Chad	-11.04131	3.450366	-3.200040	0.0018
D31 Côte d'Ivoire	-12.93132	3.427350	-3.772978	0.0003
D46 Ghana	-9.261818	3.421657	-2.706822	0.0079
D70 Lesotho	-17.70497	3.410239	-5.191710	0.0000
D90 Nigeria	-15.29888	3.408577	-4.488349	0.0000
D105 Sierra Leone	-12.26619	3.440653	-3.565076	0.0005
D109 South Africa	-15.26015	3.401286	-4.486582	0.0000
D121 Turkmenistan	-9.595899	3.436486	-2.792358	0.0062
D122 Uganda	-9.749410	3.411121	-2.858125	0.0051
D131 Zambia	-9.494795	3.414623	-2.780628	0.0064
D132 Zimbabwe	-12.13002	3.419792	-3.547005	0.0006
D81 Morocco	7.957836	3.418854	2.327632	0.0217
D88 Nicaragua	6.990463	3.408115	2.051123	0.0426
D129 Vietnam	7.624863	3.407563	2.237629	0.0272
R-squared	0.874096	Mean dependent var		71.07197
Adjusted R-squared	0.852737	S.D. dependent var		8.816798
S.E. of regression	3.383432	Akaike info criterion		5.414385
Sum squared resid	1282.132	Schwarz criterion		5.851174
Log likelihood	-337.3494	Hannan-Quinn criter.		5.591876
F-statistic	40.92453	Durbin-Watson stat		2.082206

Note: Dummy variables for some countries. List of country numbers in the Annex.

Both education and economic development show a significant and positive effect on life expectancy. We have included 17 dummies to have into account special features of some countries. We have found significant and positive coefficients for 3 countries and significant and negative coefficients for 14 countries. All the countries with a significant and negative coefficient, in the World sample of 132 countries, belonged to Africa. This implies that, besides education and development there are other factors related with climate, prevention facilities, access to medication, or other factors, in those countries.

Finally equations 3 and 4 shows impacts of education and development on life expectancy of a subsample of 38 African countries.

Equation 3. Life expectancy related with Education in 38 African countries

Dependent Variable: EVIDA14. Method: Least Squares				
Sample: 1 132 IF DAF=1. Included observations: 38				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	57.99977	2.417105	23.99555	0.0000
TYR10X	0.869384	0.458502	1.896140	0.0687
D81	11.94890	4.765959	2.507134	0.0185
D3	-9.264248	4.779243	-1.938434	0.0631
D22	-11.33372	4.766196	-2.377937	0.0247
D23	-8.912293	4.854417	-1.835914	0.0774
D31	-9.868616	4.783467	-2.063067	0.0488
D70	-13.30657	4.780044	-2.783776	0.0097
D90	-10.51171	4.795701	-2.191903	0.0372
D105	-9.930432	4.825082	-2.058086	0.0494
D109	-7.789620	4.974801	-1.565815	0.1290
R-squared	0.616676	Mean dependent var		60.44211
Adjusted R-squared	0.474704	S.D. dependent var		6.463270
S.E. of regression	4.684403	Akaike info criterion		6.163552
Sum squared resid	592.4781	Schwarz criterion		6.637590
Log likelihood	-106.1075	Hannan-Quinn criter.		6.332211
F-statistic	4.343649	Durbin-Watson stat		1.958156

Equation 4. Life Expectancy related with Development in 38 African countries

Dependent Variable: LEX14. Method: Least Squares				
Sample: 1 132 IF DAF=1. Included observations: 38				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	59.01040	0.871115	67.74125	0.0000
(PH10PP05)/1000	1.471278	0.267967	5.490516	0.0000
D81	8.770863	3.527445	2.486463	0.0194
D3	-14.87509	3.598578	-4.133603	0.0003
D22	-9.351542	3.509654	-2.664520	0.0128
D23	-9.218718	3.496281	-2.636721	0.0137
D31	-9.916862	3.488934	-2.842376	0.0084
D70	-11.42390	3.492502	-3.270978	0.0029
D90	-9.377023	3.486241	-2.689724	0.0121
D105	-9.201731	3.508611	-2.622614	0.0142
D109	-15.75393	3.991976	-3.946398	0.0005
R-squared	0.794772	Mean dependent var		60.44211
Adjusted R-squared	0.718761	S.D. dependent var		6.463270
S.E. of regression	3.427599	Akaike info criterion		5.538795
Sum squared resid	317.2077	Schwarz criterion		6.012833
Log likelihood	-94.23710	Hannan-Quinn criter.		5.707454
F-statistic	10.45608	Durbin-Watson stat		1.041653

Note: Gross Domestic Product per capita (PH10PP05/1000) in thousand US Dollars in year 2010, at 1995 Purchasing Power Parities. See evolution of GDP per capita in the Annex. Source: Own elaboration in this article by Guisan and Exposito(2016).

In the bibliography, we include some interesting studies, relating health and education and economic development in Africa or in other areas, as the study by Ganyauputu(2014) for

Southern Africa, Guisan and Exposito(2006) and (2010) for Africa, Guisan and Aguayo(2007) for Latin America, Licumba et al (2016) for Southern Africa, Mcarthy and Holger for life expectancy in Africa, Mosher and Ichida for poverty reduction in Sub-Saharan Africa, Nembot-Ndeffo(2010) for the positive effect of Foreign Direct Investment in Sub-Saharan Africa, Prados de la Escosura(2013) focused on human development in Africa, Ssozi and Shirin (2015) on the effectiveness of health expenditure on health care in Africa, and Verner(2005) about the factors that influence the educational level of population. These studies, as well the our econometric models here presented, show the positive impact of education and economic development on life expectancy and that in the case of Sub-Saharan Africa, there are other factors, like climate, geography and the lack of prevention or cure facilities that have also impact on this regard.

Graphs 6 to 8, in the Annex, show the positive relationships between Education, Development and Life Expectancy in 132 countries of the World. Here we present our analysis of the impact of Education and Development on Life Expectancy (Life).

Economic development usually depends, at a great extent, of the development of industry. For that reason it is of uppermost importance to foster investments and production in many African countries in this regard. Table 5 shows some important features of economic development in African areas.

Table 5. Manufacturing (QMH), Investment (IH), Savings (SH) and Economic Development in African areas and international comparisons 2000-2010

Area	QMH 00	QMH 10	PH 00	PH 10	IH 00	IH 10	SH 00	SH 10
1. Northern Africa	659	752	4412	5851	1012	1657	1684	1427
2. North West Africa	94	144	1359	1894	80	412	733	567
3. Sahel-Central Africa	87	86	729	878	118	170	159	120
4. North East Africa	33	38	534	907	108	193	190	146
5. Eastern Africa	100	124	965	1246	168	293	280	213
6. Southern Africa	645	529	3924	4859	659	931	973	810
Africa	278	282	2080	2638	413	620	733	578
Asia-Pacific	903	1443	4004	6333	1093	2115	2625	2315
America	3312	3052	19865	21908	3977	3811	3471	3094
Europe and Eurasia	3220	3191	17408	20828	3722	4151	4310	4195
World	1494	1728	7905	9852	1788	2403	2746	2422

Source: Elaboration from table A5 in the Annex. QMH is real production in manufacturing per head. PH is total production per head, IH and SH are, respectively, investment and savings per head. Data by country and list of countries belonging to each area in tables A4 and A6 of the Annex.

We may notice very low levels of manufacturing per head in several areas of Africa, and stagnations in African average from year 2000 (278 USD) to year 2010 (282 USD), clearly below World average and far below the most developed areas of the World.

5. Conclusions

- 1) Many African countries have experienced an important increase in life expectancy in the period 1980-2014, but in many of them the levels are yet very low, in comparison with World average.
- 2) The educational level of population and the level of economic development generally have positive impact on life expectancy, but in some cases there are country features that have additional positive or negative effects. In some African countries life expectancy is

below the expected values accordingly to the educational level, or the economic development level, and dummy variables for those countries shows significant and negative effects in the econometric models.

3) Regarding African countries with low life expectancy we find that many causes of death have adjusted rates similar to more developed countries, but there are 8 causes with too much higher rates in many Sub-Saharan countries in comparison with other areas. Some outstanding differences in adjusted rates correspond to HIV/Aids with 160 annual deaths, Influenza and Pneumonia with 144 and Diarrhoeal diseases with 67.

5) Economic development is very much related with industry. From table 5, we may notice that there was not increase in the low levels of production per head in manufacturing of Africa, evolving from 278 to 282 in years 2000-2010, while Asia-Pacific evolved from 903 to 1443, and the World from 1491 to 1728.

6) We support suggestions for a kind of Global Plan for Employment and Development, as those published by Klein(1984) and Angelopoulos(1984) and other more recent contributions, like the idea of a kind of Marshall Plan for Africa, focused to a more effective eradication of poverty and underdevelopment suggested by German politicians in year 2016. It is important to include in the Plan initiatives not only addressed to production and education but also to the goals of the increase in life expectancy.

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Annex 1. Life Expectancy and Adjusted Specific Death Rates in Africa.

Table A1. Adjusted Rates of 8 causes of death in 47 African countries and comparisons

	Country	HIV	Dia	Infl	Mala	Maln	Road	Tub	Vio	Sum8
1	Angola	92.95	151.57	173.54	56.81	90.00	34.96	60.31	10.89	671.03
2	Benin	39.56	47.50	176.42	56.00	36.80	27.30	14.46	9.07	407.11
3	Botswana	359.96	23.04	41.55	0.11	1.31	22.04	31.71	19.08	498.80
4	Burkina Faso	35.26	57.04	220.99	61.39	31.37	36.56	12.99	8.85	464.45
5	Burundi	62.58	99.90	169.22	23.28	78.24	21.83	35.79	8.43	499.27
6	Cameroon	207.30	61.33	181.62	40.83	28.81	21.27	46.05	8.05	595.26
7	Cape Verde	3.33	8.73	55.00	0.00	7.43	20.06	26.76	3.35	124.66
8	Central Africa	324.74	188.00	170.48	75.61	121.11	16.25	69.46	12.42	978.07
9	Chad	154.74	139.68	265.86	74.18	61.57	27.04	27.88	8.59	759.54
10	Comoros	6.01	55.51	139.37	63.90	46.55	32.52	10.03	11.27	365.16
11	Congo	148.29	82.10	105.79	70.41	46.23	17.53	62.79	13.36	546.50
12	Cote d'Ivoire	211.36	63.09	194.50	48.57	39.40	24.51	34.21	14.26	629.90
13	Djibouti	101.36	52.57	118.36	7.68	41.77	21.90	118.62	10.26	472.52
14	DR Congo	49.89	162.71	150.42	57.64	119.40	22.53	97.14	31.08	690.81
15	Equ. Guinea	202.13	109.65	166.09	55.80	51.61	12.27	0.00	19.79	617.34
16	Eritrea	48.18	79.21	132.20	4.28	58.04	27.94	8.76	8.73	367.34
17	Ethiopia	64.02	49.54	176.36	17.00	48.19	20.16	31.49	13.05	419.81
18	Gabon	184.26	55.62	98.05	61.72	34.93	21.23	56.16	9.48	521.45
19	Gambia	33.23	36.84	149.55	63.96	23.34	24.55	83.64	11.25	426.36
20	Ghana	49.90	29.83	127.53	61.63	32.09	24.60	10.65	5.53	341.76
21	Guinea	55.33	66.61	182.55	61.91	32.50	20.33	34.51	9.49	463.23
22	Guinea-Bissau	169.13	70.43	210.98	62.71	39.35	34.37	46.45	8.84	642.26
23	Kenya	143.53	60.06	165.60	28.28	56.68	25.11	34.80	6.05	520.11
24	Lesotho	761.77	52.61	107.01	0.00	6.42	25.94	22.75	41.91	1018.41
25	Liberia	61.49	41.78	158.16	51.18	26.69	25.48	70.86	7.12	442.76
26	Madagascar	33.68	51.96	88.74	25.46	36.64	23.43	72.04	11.53	343.48
27	Malawi	343.93	50.43	125.65	48.44	32.72	22.12	10.64	3.03	636.96
28	Mali	44.24	78.84	101.45	49.70	48.68	32.49	11.41	8.49	375.30
29	Mauritania	21.93	49.75	141.26	53.04	21.95	33.75	143.33	5.10	470.11
30	Mauritius	4.85	2.20	22.60	0.07	2.09	12.89	1.25	3.25	49.20
31	Mozambique	466.11	60.00	121.19	42.75	37.49	22.23	66.93	13.77	830.47
32	Namibia	193.52	24.07	55.84	0.09	2.42	22.82	22.63	20.39	341.78
33	Niger	24.59	98.89	209.03	58.61	56.01	30.59	17.30	5.51	500.53
34	Nigeria	170.85	66.96	234.12	60.46	31.20	35.39	29.12	21.57	649.67
35	Rwanda	65.90	38.62	100.86	38.04	26.39	24.06	17.34	24.37	335.58
36	Senegal	16.57	64.19	215.18	55.51	9.62	25.47	28.30	3.06	417.90
37	Sierra Leone	70.26	117.91	256.87	69.56	112.66	27.40	230.17	15.35	900.18
38	Somalia	35.09	148.26	188.73	26.53	83.15	21.65	123.01	9.11	635.53
39	South Africa	412.82	29.54	59.33	0.13	1.66	24.64	53.62	28.97	610.71
40	South Sudan	181.46	77.10	168.80	52.70	52.53	21.80	50.29	14.64	619.32
41	Sudan	18.26	57.38	144.59	16.00	46.47	31.13	37.44	12.23	363.50
42	Swaziland	537.97	43.26	99.20	0.05	3.17	18.31	94.78	35.51	832.25
43	Tanzania	196.99	53.01	107.39	42.42	29.61	29.12	16.68	14.41	489.63
44	Togo	131.60	52.28	158.15	62.09	35.40	18.03	15.15	10.63	483.33
45	Uganda	245.98	53.91	139.64	42.12	30.26	37.14	14.19	20.93	584.17
46	Zambia	361.95	27.61	86.86	51.91	40.84	26.51	33.84	11.75	641.27
47	Zimbabwe	353.86	45.59	97.22	7.63	12.58	10.65	45.59	11.32	584.44
	Mean of 47	159.63	66.74	143.83	40.60	40.71	24.68	46.45	13.09	535.73
Nor th. Afr ·	Algeria	6.30	3.20	29.19	0	3.03	19.11	19.12	3.65	83.60
	Egypt	3.21	0.43	21.06	0	4.17	15.34	0.56	2.97	47.74
	Morocco	6.84	3.62	44.27	0	7.33	19.98	12.80	2.61	97.45
	Tunisia	1.78	0.49	21.40	0	15.54	18.61	3.01	2.10	62.93
Am	Brazil	2.82	7.54	43.59	0.06	4.21	24.13	3.08	30.53	115.96
Eu	Spain	1.77	0.8	9.43	0.01	0.16	3.65	0.39	0.64	16.85

Note: SUM8 is the sum of 8 rates of death. Source: Elaborated from statistics of Adjusted Death Rates (ASDR), based on WHO(2016) and available at WLE(2016).

Table A1 presents the annual deaths rates per 100 thousand people (ASDR), in this set of 8 causes, out of 50 causes of death, which show high rates in may Sub-Saharan Africa. It includes data of 47 Central and Southern African countries, in comparison with four countries of Northern Africa, one country of Europe (Spain) and one country of South America (Brazil).

Three of these 8 causes account for a great part of the difference in the average annual deaths rates of 47 African countries (595) in comparison with Northern Africa (less than 50 in Egypt and less than 100 in Algeria, Morocco and Tunisia), with Brazil (lower than 120), and with Spain (lower than 20).

Grupo 1A (Infectious and parasitic diseases) explains a great part of the difference (287.3) with Tuberculosis, HIV/AIDS, Diarrhoeal diseases, Parasitic and vector diseases (particularly due to Malaria) as the main causes within this group.

Group 1B (Respiratory Infections) account for a difference of 98.3.

Groups 1C, 1D and 1E account for a difference of 51.8

Groups 2A and 2B are very alike in Sub-Saharan countries in comparison with World average of ASDR, even slightly below.

Groups 2B, 2E and 2F present small differences between Sub-Saharan Africa and Global ASDR, but groups 2C present a difference of 19.6 and group 2H a high difference of 74.9 (with Stroke as a main cause of this difference).

In the groups of Injuries, road traffic is the main cause of difference, with

Table A1 shows important differences in Adjusted rates of death between Sub-Saharan Africa and World average. While many differences are explained by poverty and lack of enough medical assistance, other ones are mainly explained by geographical circumstances, lack of means for sanitation and other measures of prevention. There are a difference of 636.8 annual deaths, per 100 thousand people, in ASDR of Subsaharan countries, in comparison with World average.

Table A2. Descriptive statistics, of indicators of table A1, in 47 Sub-Saharan countries

	HIV	Diar.	Infl.	Malaria	Malnutrition	Road	Tuber.	Violence
Mean	160	67	144	41	41	25	46	13
Median	101	56	145	50	37	25	34	11
Maximum	762	188	266	76	121	37	230	42
Minimum	3	2	23	0	1	11	0	3
Std. Dev.	162	40	55	25	29	6	43	8
Variation Coeff.	101	60	38	134	71	24	93	62

Groups of countries of Central and Southern Africa accordingly to indicator of 8 causes of death of table 2 (Sum8)

Group 1. 2 countries with indicator lower than 200 deaths: Cape Verde and Mauritius

Group 2. 8 countries with indicator between 200 and 400 deaths: Comoros, Eritrea, Ghana, Madagascar, Mali, Namibia, Rwanda, 41 Sudan.

Group 3. 20 countries with indicator between 400 and 600 deaths : Benin, Botswana, Burkina Faso, Burundi, Cameroon, Congo R., Djibouti, Ethiopia, Gabon, Gambia, Guinea, Kenya, Liberia, Mauritania, Niger, Senegal, Tanzania, Togo, Uganda, Zimbabwe.

Group 4. 12 countries with indicator between 600 and 800: Angola, Chand, Côte d'Ivoire, Congo DR., Equatorial Guinea, Guinea-Bissau, Malawi, Nigeria, Somalia, South Africa, South Sudan, Zambia,

Group 5. 5 countries with indicator higher than 800 deaths: Central Africa, Lesotho, Mozambique, Sierra Leone, Swazilandia.

These 8 causes of death are: 1=HIV/AIDS, 2= Diarrhoeal diseases, 3=Influenza and Pneumonia, 4=Malaria, 5= Malnutrition, 6= Road traffic deaths, 7=Tuberculosis, 8=violence. The highest means, in table 4, correspond to HIV/Aids (160) and "Influenza and Pneumonia" (144). The other causes of death of this group of countries have lower means, in decreasing order: Diarrhoeal diseases (67), Tuberculosis (46), Malaria (41), Malnutrition (41), Road traffic (25) and Violence (13).

Five causes that imply ratios higher than 100 annual deaths per 100 thousand people

HIV/Aids: 25 Countries have, in table 2, more than 100 annual deaths per 100 thousand people due to HIV/Aids, with the highest value, over 400, corresponding to Lesotho, Swaziland, Mozambique and South Africa.

Diarrhoeal Diseases: 4 countries have more than 100 in the indicator of deaths due to this cause: Angola, Central Africa, Chad and Somalia.

Influenza and Pneumonia: 37 countries have more than 100 annual deaths per 100 thousand people, due to Influenza and Pneumonia, with the highest values, over 200, corresponding to Chad, Sierra Leone, Nigeria, Burkina Faso, Senegal, Guinea Bissau and Niger,

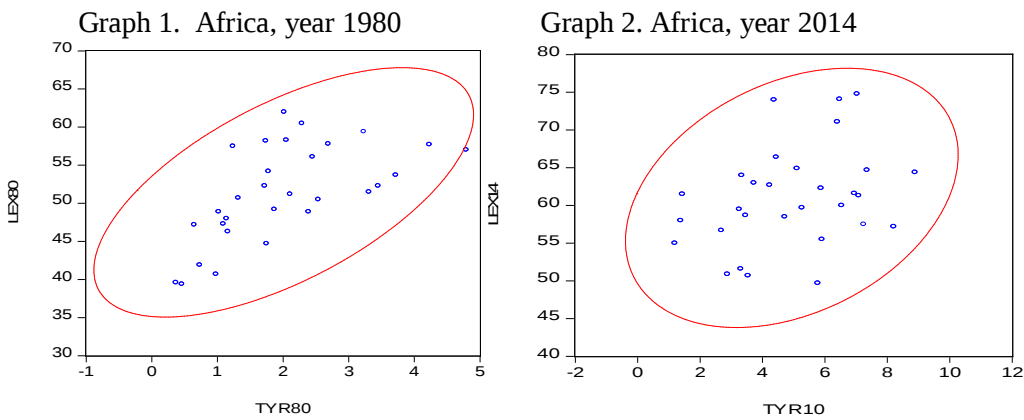
Malnutrition: 2 countries have more than 100 annual deaths per 100 thousand people due to malnutrition: Central Africa and Sierra Leone.

Tuberculosis: 4 countries have more than 100 annual deaths, per 100 thousand people, due to Tuberculosis: Sierra Leone, Mauritania, Somalia y Djibouti.

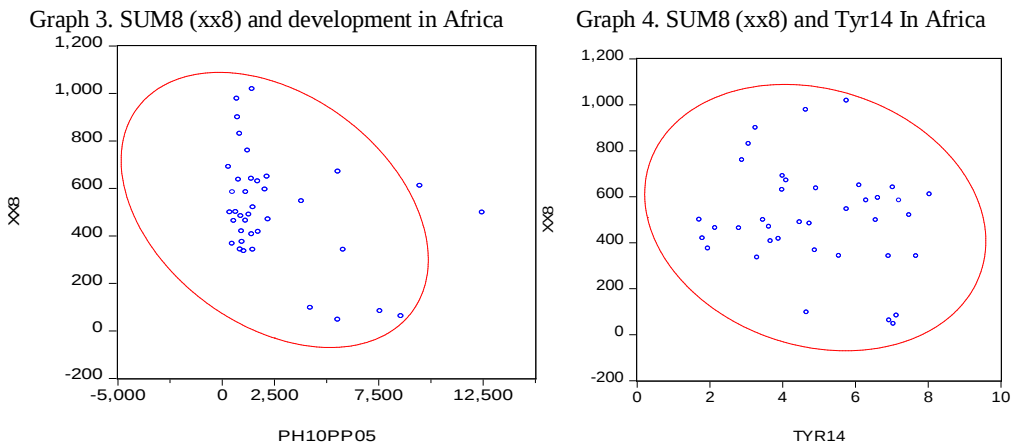
Graphs 1 and 2 relates educational level of population (average schooling of population +25 years old) and life expectancy in African countries in years 1980 and 2014.

Graph 3 shows the relationship between Sum8 (the sum of ASDRL of 8 death causes in table 4) and economic development in 38 African countries while Graph 4 shows the relationship between Sum8 and the educational level of population, measured by Tyr14, in those countries. Graphs 3 and 4 show that, in spite of the general positive effect of education and development on life expectancy, not always economic development and/or educational level of population imply an important diminution in Sum8 and life expectancy. This points to the existence of other important factors, geographical or social, that explain the differences among countries.

Graph 5, shows the negative relationship between Sum8 and Life Expectancy: the higher the value of Sum8 the lower the Life Expectancy. In Graph 5, we may notice that the diminution of Sum8 is of uppermost importance for the increase of Life Expectation.



In any case we expect that clear improvements in economic development and education, together with other measures increasing international cooperation for prevention and access to cure, will be very positive to reduce Sum8 in Central and Southern African countries.



Graph 5. Life Expectation and Sum8 (XX8) (ASDR of 8 causes of death) in Africa

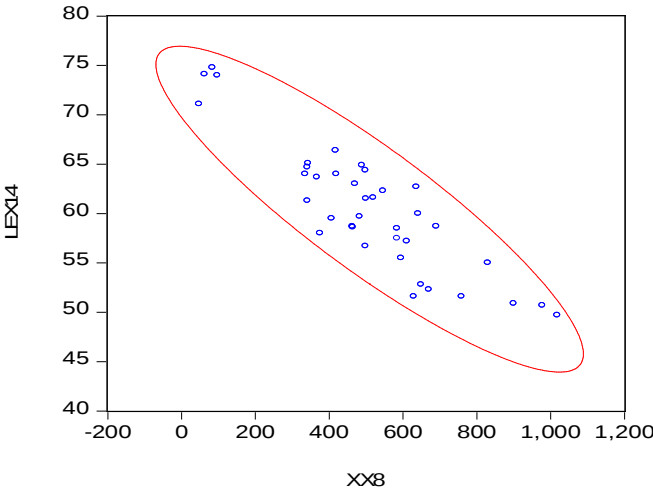


Table A3. Adjusted Specific Death rates ASDR in year 2015 per 100 thousand people
Differences between Sub-Saharan Africa and Global

Code		ASDR Sub- Saharan Africa	ASDR Global	Difference
0	All	1372.4	735.6	636.8
10	I COMMUNICABLE	588.5	151.1	437.4
20	A Infectious and parasitic diseases	363.6	76.3	287.3
30	Tuberculosis	86.0	18.5	67.5
100	HIV/AIDS	104.1	14.4	89.7
110	Diarrhoeal diseases	83.9	18.4	65.5
120	Childhood-cluster diseases	10.0	3.5	6.5
170	Meningitis	20.6	4.3	16.3
210	Parasitic and vector diseases	41.0	8.2	32.8
220	a Malaria	31.4	5.8	25.6
380	B. Respiratory Infectious	139.6	41.3	98.3
390	Lower respiratory infections	139.3	41.2	98.1
420	C. Maternal conditions	23.0	4.2	18.8
490	D. Neonatal conditions	37.3	23.5	13.8
500	Preterm birth complications	14.6	10.8	3.8
510	Birth asphyxia and birth trauma	13.6	7.0	6.6
540	E. Nutritional deficiencies	25.0	5.8	19.2
550	Protein-energy malnutrition	17.0	4.3	12.7
600	II. NONCOMMUNICABLE DISEASES	665.6	517.8	147.8
610	A. Malignant neoplasms	110.3	116.2	-5.9
640	Stomach cancer	4.2	10.0	-5.8
650	Colon and rectum cancers	5.5	10.2	-4.7
660	Liver cancer	8.1	10.5	-2.4
680	Trachea. bronchus, lung cancers	3.9	22.5	-18.6
700	Breast cancer	10.5	7.6	2.9
710	Cervix uteri cancer	12.7	3.7	9.0
740	Prostate cancer	13.3	4.5	8.8
780	Other malignant neoplasms	20.4	7.8	12.6
790	B. Other neoplasms	3.6	2.7	0.9
800	C. Diabetes mellitus	40.5	20.9	19.6
810	D. Endocrine. blood. immune disorders	15.2	5.5	9.7
820	E. Mental and substance use disorders	4.4	4.3	0.1
940	F. Neurological conditions	29.0	25.5	3.5
950	Alzheimer disease and other dementias	20.7	19.3	1.4
960	Parkinson disease	0.9	1.6	-0.7
970	Epilepsy	6.3	2.1	4.2
980	Multiple sclerosis	0.1	0.3	-0.2
990	Migraine	0.0	0.0	0.0
1000	Non-migraine headache	0.0	0.0	0.0

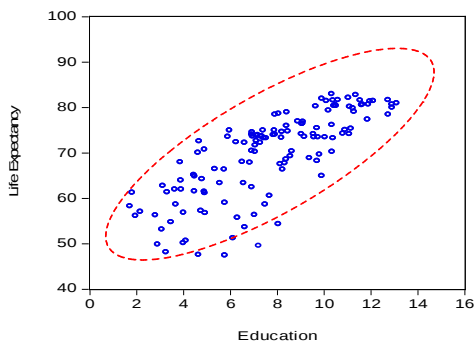
1010	Other neurological conditions	0.9	2.2	-1.3
1020	G. Sense organ diseases	0.0	0.0	0.0
1100	H. Cardiovascular diseases	306.1	231.2	74.9
1120	Hypertensive heart disease	26.0	12.3	13.7
1130	Ischaemic heart disease	121.7	114.2	7.5
1140	Stroke	117.5	81.9	35.6
1160	Other circulatory diseases	28.6	13.3	15.3
1170	I. Respiratory diseases	46.9	51.2	-4.3
1180	Chronic obstructive pulmonary disease	29.1	41.5	-12.4
1190	Asthma	14.5	5.1	9.4
1210	J. Digestive diseases	67.2	31.2	36.0
1230	Cirrhosis of the liver	33.9	15.6	18.3
1260	K. Genitourinary diseases	23.6	18.2	5.4
1270	Kidney diseases	15.6	14.9	0.7
1330	L. Skin diseases	4.8	1.2	3.6
1340	M. Musculoskeletal diseases	1.3	2.0	-0.7
1400	N. Congenital anomalies	12.8	7.6	5.2
1470	O. Oral conditions	0.0	0.0	0.0
1505	P. Sudden infant death syndrome	0.3	0.3	0.0
1510	III. INJURIES	118.0	66.4	51.6
1520	A. Unintentional injuries	91.0	47.2	43.8
1530	Road injury	35.2	18.2	17.0
1550	Falls	14.4	8.5	5.9
1590	Other unintentional injuries	17.2	9.0	8.2
1600	B. Intentional injuries	27.1	19.2	7.9
1610	Self-harm	13.4	10.7	2.7
1620	Interpersonal violence	11.7	6.4	5.3

Source: Elaborated from Who(2016)

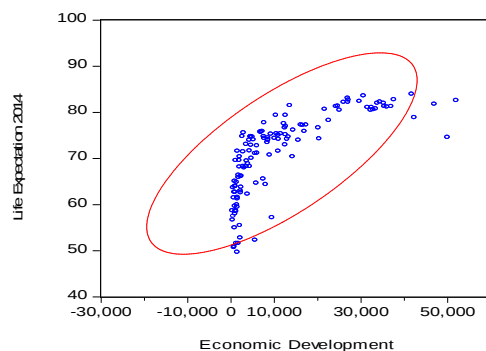
Annex 2. Education, Development and Life Expectancy in the World

Graph 6 shows the positive impact of the educational level of population and life expectancy. Graph 7 shows a great impact of economic development on life expectation in the interval between one thousand and thirty thousand USD of production per head, and stabiization in life expectation for income higher than 30 thousand USD per head.

Graph 6. Education and Life Expectancy in 132 Countries of the World, year 2010

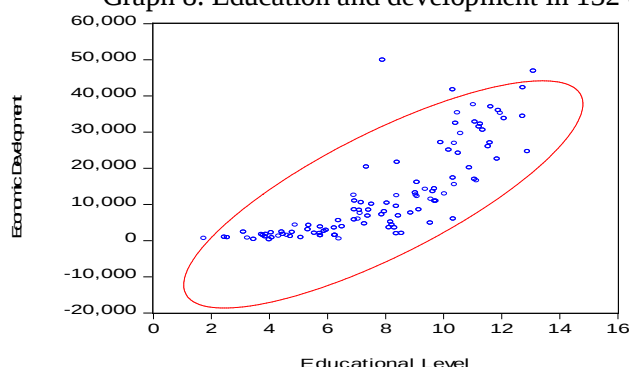


Graph 7. Development and Life Expectancy in 132 countries of the World, year 2014



Graph 8 shows the general positive effect of the educational level of population of Economic Development. We may notice that the effect seems not be generally very high until a level of average 6 years of schooling per head, but it is very positive for higher levels of average schooling of population

Graph 8. Education and development in 132 countries



Annex 3. Development and Population in Africa.

Table A4. Investment, Savings and Production per head in Countries of Africa(USD at 2005 PPPs)

Country number	Country	IH00	SH00	IH00-SH00	IH10	SH10	IH10-SH10	PH80	PH00	PH10
2	Algeria	1522	NA	NA	3132	2597	535	6606	6087	7564
3	Angola	395	632	-237	807	879	-72	3018	2633	5549
12	Benin	224	118	106	367	103	264	1043	1178	1424
14	Botswana	3131	4011	-880	3531	3293	238	4155	9783	8008
17	Burkina Faso	152	45	108	211	93	117	708	896	1127
18	Burundi	20	14	7	45	0	45	523	338	366
20	Cameroon	311	275	37	339	324	15	2004	1832	2058
22	C.Afri.R.	73	NA	NA	64	34	30	825	734	708
23	Chad	202	NA	NA	452	119	333	725	878	1229
28	Congo DR	8	NA	NA	45	20	25	921	255	311
29	Congo R	695	937	-242	782	1694	-913	3252	3021	3808
31	Cote d'Ivoire	194	141	53	236	200	36	2233	1761	1704
37	Egypt AR	842	758	84	1047	986	61	2549	4211	5544
39	Eritrea	163	27	136	73	0	73	772	681	490
41	Ethiopia	105	84	21	201	155	46	515	526	934
46	Ghana	244	152	91	394	302	92	883	1015	1475
49	Guinea	202	152	51	214	105	109	809	1012	1081
63	Kenya	219	180	39	286	231	55	1256	1287	1481
70	Lesotho	502	275	227	402	161	241	820	1196	1437
73	Madagascar	129	77	51	176	48	129	1096	858	869
74	Malawi	99	71	28	196	35	161	684	705	791
76	Mali	214	137	77	184	94	90	800	857	955
77	Mauritania	303	NA	NA	602	0	602	1484	1597	2203
81	Morocco	775	715	60	1484	1300	184	2350	2980	4227
82	Mozambique	157	56	101	200	92	109	275	506	845
84	Namibia	666	979	-313	1363	1971	-608	4512	3916	5808
89	Niger	62	28	34	115	30	85	909	568	653

90	Nigeria	NA	NA	NA	465	777	-313	1671	1456	2152
102	Rwanda	115	83	32	249	107	142	1006	640	1044
104	Senegal	281	196	84	503	191	312	1293	1403	1736
105	Sierra Leone	27	-15	42	117	97	20	796	381	742
109	South Africa	1197	1197	0	1825	1559	266	7981	7480	9477
116	Tanzania	156	112	43	371	272	99	831	864	1286
118	Togo	138	8	131	167	9	158	949	769	895
119	Tunisia	1470	1252	218	2258	1738	520	3754	5444	8566
122	Uganda	147	109	39	271	214	57	545	775	1141
131	Zambia	175	-10	185	314	315	-1	1417	1029	1401
132	Zimbabwe	386	NA	NA	30	0	30	3104	2759	500
	Average of Africa	413	733		620	578	42	6606	6087	7564

Note: Elaborated by Guisan(2014) from World Bank Statistics. NA=Not available. Country number correspond to a list of 132 countries of the World.

Table A5. Manufacturing, GDP, Investment and Savings, per inhabitant in 21 areas of the World.
(USD at Purchasing Power Parities of year 2005)

Area	QMH 00	QMH 10	GDPH 00	GDPH 10	IH 00	IH 10	SH 00	SH 10
1. Northern Africa	659	752	4412	5851	1012	1657	1684	1427
2. North West Africa	94	144	1359	1894	80	412	733	567
3.Sahel-Central Africa	87	86	729	878	118	170	159	120
4. North East Africa	33	38	534	907	108	193	190	146
5. Eastern Africa	100	124	965	1246	168	293	280	213
6. Southern Africa	645	529	3924	4859	659	931	973	810
7. Western Asia	1149	1262	10800	12237	2005	2172	2926	2303
8.South Western Asia	513	646	3741	4836	1023	260	451	368
9. India and South	245	411	1635	2887	393	983	1168	975
10.China and North East	1444	2648	5547	9606	1657	3671	4333	4109
11. Indochina	708	1044	2555	4039	614	1169	1370	1257
12. South Pacific	1207	1278	5320	6978	1281	1882	2436	2054
13. USA and Canada	6249	5617	38456	41594	7691	6511	5269	4801
14. Mexico & Central A.	1858	1764	9237	9848	2155	2344	2539	2172
15. Andean America	1219	1217	7064	9181	1421	2089	2483	2189
16. South Eastern America	1544	2442	8748	11921	1443	2117	1544	2442
17. Nordic and British E.	5109	3819	30081	33474	5634	5458	5705	5428
18. Central West Europe	6387	6668	31306	34227	6949	6229	8389	8260
19. West Latin Europe	4761	3562	27173	27659	5995	5698	5216	4792
20. Central E. & E.Med.	2150	2695	10812	15093	2522	3213	2573	2524
21. Russia&former USSR	1052	1527	6038	10208	1172	2435	2729	2745
Africa	278	282	2080	2638	413	620	733	578
Asia-Pacific	903	1443	4004	6333	1093	2115	2625	2315
America	3312	3052	19865	21908	3977	3811	3471	3094
Europe and Eurasia	3220	3191	17408	20828	3722	4151	4310	4195
World	1494	1728	7905	9852	1788	2403	2746	2422

Note: Data have been elaborated by Guisan(2014) from country data of World Bank(2014). In case of non available data, we have included our provisional estimations. West Latin Europe includes

countries of Western Europe with major languages from Latin. Data in US Dollars per head at 2005 Prices and Purchasing Power Parities.

Low levels of Manufacturing usually imply low levels of Gross Domestic Product per head. In the case of African areas de highest values both of QMH10 and GDPH10 corresponded to Northern Africa and Southern Africa. To foster economic development implies increase manufacturing and investment per head, particularly in the case of the poorest areas and countries. We may notice that both Savings and Investment per head in year 2010 were below low average in all the African areas, with great differences among African areas. Investment per head varied, in year 2010, between a minimum of 170 USD in Sahel-Central Africa to a maximum of 1657 USC in Northern Africa.

Table A6. Areas of Africa: countries and population (Pop) (million)

Area	Countries and territories	Pop 2000	Pop 2010
1. N Africa	2 Algeria, 37 Egypt AR, 77 Mauritania, 81 Morocco, 119 Tunisia	138	162
2. NW Africa	12 Benin 31 Cote d'Ivoire 46 Ghana 49 Guinea 90 Nigeria 104 Senegal, 105 Sierra Leone 118 Togo	190	246
3.Sahel-Central Africa	17 Burkina F. 18 Burundi 20 Cameroon 22 C.African R 23 Chad 28 Congo DR, 29 Congo 76 Mali 89 Niger 102Rwanda	130	172
4. NE Africa	39 Eritrea 41 Ethiopia	68	88
5. EasternAfrica	63 Kenya 73 Madagascar 116 Tanzania 122 Uganda	106	139
6.Southern Africa	3 Angola 14 Botswana 70 Lesotho 74 Malawi 82 Mozambique 84 Namibia 109 South Africa 131 Zambia 132 Zimbabwe	116	139
Total Africa		748	946

Annex 4. Initiatives for international cooperation with life expectancy and development of Africa.

News about the increase of life expectancy in Sub-Saharan Africa for the period 2000-2014

<https://www.ft.com/content/38c2ad3e-0874-11e6-b6d3-746f8e9cdd33>

Africa's life expectancy jumps dramatically

Longevity gains provide upbeat counterpoint to gloom enveloping the continent

Proposals for a kind of Plan Marshal for Africa and other areas

The idea of the German Minister suggesting a Plan Marshall for Africa, sounds interesting
<http://www.europapress.es/internacional/noticia-alemania-pide-plan-marshall-africa-20161111195808.html>

https://books.google.es/books/about/Global_plan_for_employment.html?id=0JO4AAAAIAAJ&redir_esc=y&hl=es

In year 1984, Angelopoulos and Klein called for increase of international cooperation, in a kind of Marshall Plan, in order to eradicate poverty and to increase health and quality of life in Sub-Saharan Africa and other areas of the World.

https://www.amazon.com/Angelos-Theod%C5%8Drou-Angelopoulos/e/B001JX5HXW/ref=ntt_dp_epwbk_0

Foreword by Lawrence R. Klein(1984)

“The diagnosis of Professor Angelopoulos on the current economic diseases of the world has impressed me ... His ideas are very attractive and overflow enthusiasm and freshness ... His Plan, detailed and developed in this work, ... can be placed at the same level as the Marshall Plan, Which so extensively restored the alliance between the democracies after the Second World War ... and is imbued with the ideas of equity and social justice”.

There is a lot of work to do in many of those countries in order to avoid hundreds of evitable deaths with prevention and access to cure, and both domestic measures and international cooperation should be favored in this regard. Data of four Northern African countries (Algeria, Egypt, Morocco and Tunisia) show good levels, with ratios of deaths by these causes much lower than the group of 47 Central and Southern African countries.

This section may be updated with information about other interesting initiatives.