

**WORLD DEVELOPMENT FOR 1995-2020: ECONOMETRIC
RELATIONSHIPS OF HUMAN CAPITAL, DEVELOPMENT, QUALITY OF
GOVERNMENT AND LIFE SATISFACTION
IN 164 COUNTRIES**

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Abstract: We analyze the evolution of real Gross Domestic Product, Population and Production per capita of the World, for a period of 25 years: 1995-2020, together with the evolution of Schooling, Fertility, Investment and their effects on Production per capita and, diminution of Poverty and increase in Health care expenditure and Life Expectancy. We also relate economic development, with three indicators of Quality of Life (Happiness, Quality of Government, Peace), and found some unilateral or bilateral relationships. We estimate several econometric relationships on the impact of Education on moderation of Fertility rates and its positive effects on the increase of Economic Development and on the indicators of Quality of Life: Happiness, Quality of Government and Peace. The main emphasis of our conclusions, regarding low income countries, is to increase support to Education and Investment. For all the countries (low, middle and high income) it is important to foster good levels of Happiness which is related with not only with economic development but also with Quality of Government and with Peace. Finally we comment on the perspectives, for year 2030 of sustainable development

Keywords: World Development , Africa, Asia, America, Europe, Eurasia, Schooling, Population, Production, Investment, Happiness, Quality of Government, Peace

JEL Codes: C2, C3, D74, O1, O5, O55, O57, Q56

1. Introduction

Section 2 presents several studies related with a general perspective of World Development and with econometric models that relate World Development with Happiness and other Indicators of Quality of Life (Quality of Government and Peace).

Section 3, presents the definition of the variables of this study and an overview of World Development for 1995-2020, showing the average values of the main variables by groups of countries classified accordingly to its level of Production per head.

Section 4, presents the estimation of econometric equations, for an international sample of 164 countries or territories. The equations correspond to several important relationships: 1) Fertility rates moderate by the increase of Education. 1) Production per head (PH) increasing with moderation of Fertility rates and increase of Education. 3) Happiness increasing with Production per capita, Education, Quality of Government. 4) Quality of Government related with Education and Production per head.

Section 5, presents the main conclusions.

Finally, we include several Annexes: A1) with data of the main variables, A2) with estimation of equations of African countries, A3) with reference to other indicators. A4) with data of other countries.

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2. Revision of the Literature

For the last decades, the availability of new international quantitative indicators of economic and social development has provide the opportunity to estimate econometric models and analyze causality between Happiness, Education, Population Growth, Production, Quality of Government, and other interesting variables. Some interesting contributions, at World level, are the following ones:

Guisan, Aguayo and Exposito(2001) analyzed the effect of Schooling on average Fertility Rate and economic development, estimating an econometric model with a sample of 86 countries all over the World and data of Education from Barro and Lduction per inhabitant. The model showed that one of main positive effects of Education on real Production per head is the moderation of the average Fertility rate.

Several authors analyzed the effects of Production per head on several indicators of quality of life, as Education and Health care expenditure, Life Expectancy, diminution of poverty and other ones. In the bibliography we include some references in this regard.

Deaton(2008) analyzed the relation between Income, Health and Well-being around the World with evidence from the Gallup World Poll. In table 1 he presents the estimation of an econometric model relating Average Life Satisfaction with the logarithm of Per capita Gross Domestic Product (PH) of year 2003, with a sample of 123 countries. The results show a significant coefficient equal to 0.838 and $R^2=0.694$. He also included more explanatory variables, like Life Expectancy, in other tables, but they did not show a significant effect in case of high degree of multicollinearity with PH.

Guisan(2009) analyzed relationships between Education, Development, Quality of Government and Women Participation in income and social life, with an international sample of 132 countries. We include a summary of that study in Annex 5.

Clifton(2012) showed that the indicator Thriving increases with average level or income, both for Women and for Men. From lows levels of 14% and 16% of optimist people (both Women and Men) in low-income and lower middle-income countries, the percentage increased to 35% for Women and 37% for men in upper middle-income countries and to 45% (both for Women and Men) in High-income countries. Although there are some particular exceptions, as a whole the increase of real income plays usually a very important role in increasing Welfare and Happiness.

Helliwell, Huang and Wang(2019) present the estimation of an econometric model with a sample of 1516 observations (157 countries for the period 2005 to 2018), that relates (Happiness) with logarithm of PH and other variables (Social Support, Healthy Life Expectancy at birth, Freedom to make life choices, daily Positive experiences, daily Negative Experiences, and perceptions of Corruption). PH has a positive and significant effect and some of the other explanatory variables have the expected signs and are significant, but not all. The high degree of multicollinearity, in spite of the big sample size, may explain lack of precision in some estimators.

In Guisan and Exposito(2021) we have estimated an equation for Africa showing the important impact that the increase of investment in Industrial Production has on the development of Services.

3. Variables, sources of data and summary of World development for 1995-2020

3.1. Variables and sources of data

PH = *Production per capita*, in Dollars at constant prices and Purchasing Power Parities (PPPs) of year 2017. Source: Elaborated from WB(2021) WDI.

TYR = *Total Years of Schooling* attainment, average of adult population (25 years and older). Source: UNDP(2021).

FER = *Fertility rates*, number of average children expected per woman in her life. Source: Elaborated from WB(2021) WDI.

X1 is an *Index of Happiness* (source WHR(2021), and some provisional estimations in a few cases)

X2 is an *Index of Quality of Government* in decimal scale, that we have calculated by transforming the WB(2021) WGI data of the Index Voice of Citizens, from the scale - 2.5 to 2.5 into the decimal scale (0 worst quality and 10 maximum quality).

$$X2=5+2 \times IQGVoice \quad (0 < X2 < 10)$$

Source of X2: calculated by transforming data of the Index IQGVoice."Voice and Accountability", from WB(2021) WGI (published in the scale -2.5 to 2.5 where 0 represents World average), into a scale 0 to 10, with 0 for worst and 10 for the best.

X3 = *Index of Conflict*, in decimal scale. It was calculated by transforming the Index of Conflict (GPI) published by EIP(2021), that is in scale 0 to 4, by 2.5:

$$X3 = 2.5 * GPI \quad 0 < X3 < 10 \quad (0 \text{ minimum Conflict, } 10 \text{ maximum Conflict})$$

X4=*Index of Peace*, in the decimal Scale, calculated as:

$$X4=2.5*(4-GPI), \text{ or } X4=10-X3 \quad (0 \text{ minimum Peace, } 10 \text{ maximum Peace})$$

We have used data of PH in years 1995 and 2019 (PH95, PH19), in order to know the general trend of the period, without the occasional diminution of year 2020 caused by the pandemic of Covid19. In the Annex we include a comment on PH20.

For the level of Schooling we have used the values of Tyr10, Tyr19, or de average of 2010 and 2019: XTyr=(Tyr10+Tyr19)/2. The source is the Human Development Report of UNDP(2021). Values of Tyr in that statistical source are not identical to data of WB(2021) based on Barro and Lee, but UNDP includes more years and countries.

As indicator of Quality of Government, we have chosen "*Voice of citizens and Accountability*" because in previous studies we have found that this indicator is the most, or one of the most, representatives of quality of Government. It is highly related with other interesting indexes of Quality of Government as "*Effectiveness*".

In a few cases, without availability of data in the original sources, or for other reason, we have included our provisional estimations, as indicated in table A1 in the Annex.

In Annex 4 we include information for countries not included in the equations, in many cases due to lack of enough statistical information and special circumstances.

3.2. A summary of World Development for the period 1995-2020.

In table 1 we include the average of 9 groups of countries, based on the information of 164 countries of table A1 (in the Annex). Groups are classified by level of real Gross Domestic Product per capita in 2019 (PH19), measure in Dollars at 2017 prices and Purchasing Power Parities (PPPs)

Table 1. Average of PH, Tyr, Fer, X1, X2, X3, X4 and XM (mean of X1, X2, X4) in 9 Groups of countries (values of PH in \$ at 2017 prices and PPPs)

Group	Ph95	Ph19	Incr.	Tyr 10	Fer 19	X1 Happi	X2 Gov	X3 Conflict	X4 Peace	XM Mean
1	1172	1668	496	3.38	4.82	4.25	3.12	6.00	4.00	3.79
2	2268	3591	1323	4.90	3.75	4.59	3.26	5.43	4.57	4.14
3	3171	5674	2503	6.57	3.42	4.94	4.10	5.48	4.52	4.52
4	5133	8667	3534	6.52	2.54	5.46	4.51	5.13	4.87	4.95
5	7165	12930	5765	8.71	2.56	5.25	4.30	5.48	4.52	4.69
6	9691	19444	9753	8.63	2.02	5.63	4.98	5.05	4.95	5.19
7	15924	31060	15136	10.73	1.79	6.07	5.94	4.53	5.47	5.83
8	33389	44521	11132	11.01	1.65	6.71	7.14	4.30	5.70	6.52
9	50482	69249	18767	11.66	1.53	7.07	8.24	3.70	6.30	7.20
All	9886	16135	6249	8.09	2.40	5.35	5.0	5.20	4.80	5.38

Source: Elaborated with data of 164 countries, from WB(2021) WDI and WGI, UNDP(2021), WHR(2021), EIP(2021), and own elaboration from table A1, in the Annex, as explained in 3.1.

Notes: Non-weighted averages of each group. Incr. is the increase of PH for the period 1995-2019; Tyr10 is the average of years of Schooling of Population 25+ in year 2010, Fer is the average of Fertility rates of the countries of each group. XM= is the average of 3 indicators of quality of life X1, X2 and X4, all of them with positive impact and measured in the decimal scale. See Section 3.1: X1 (Happiness), X2 (Quality of Government), X3 (Conflict), X4 (Peace).

Table 1 includes the non-weighted averages of the following variables in each group: PH95 and PH19, expressed in Dollars at 2017 prices and Purchasing Power Parities (PPPs). Besides we include indicators of average years of Schooling (Tyr10) and Fertility (Fer19), and averages of three indicators of degree of quality of life, in scale 0, 10 (X1, X2, X4) calculated as indicated in section 3.1. X4 is an indicator of Peace with a minimum 0 (when GPI is equal to 4) and a maximum of 10 (when GDPI is equal to 0) The last column (XM) is a combined indicator of Quality of Life, calculated as the mean of these 3 indicators ($XM=(X1+X2+X4)/3$).

The following lists includes the countries of table A1 belonging to each group, together with the non-weighted average of the indicator of Quality of Government (QGVoice), in original scale -2.5 to 2.5, and the average of the indicator of "Conflict" (GPI) (in the scale 0 minimum conflict and 4 maximum conflict).

1) Group 1 that includes 19 countries with Ph19 below 5000: Burundi, Central African R, Malawi, Congo DR, Niger, Mozambique, Liberia, Chad, Togo, Madagascar, Sierra Leone, Guinea-Bissau, Afghanistan, Burkina Faso, Uganda, Ethiopia, Gambia, Rwanda and Mali. Average of QGVoice -0.94. Average of GPI 2.40 (Conflict in scale 0 to 4)..

2) Group 2 that includes 21 countries with Ph19 in the interval (2500-5000): Guinea, Tanzania, Lesotho, Zimbabwe, Haiti, Comoros, Benin, Senegal, Tajikistan, Nepal,

Zambia, Timor-Leste, Cameroon, Congo R, Sao Tome and Principe, Sudan, Kenya, Papua-New Guinea, Cambodia, Pakistan and Bangladesh. Average QGVoice -0.87. Average GPI 2.17.

3) Group 3 that includes of 16 countries with PH19 in the interval (5000-7500): Myanmar, Nigeria, Mauritania, Cote d'Ivoire, Kyrgyz R, Ghana, Nicaragua, Djibouti, Honduras, West Bank and Gaza, Tonga, Samoa, Angola, India, Uzbekistan, Cabo Verde. Average of QGVoice -0.45. Average of GPI 2.19.

4) Group 4 that includes 10 countries with PH19 in the interval (7500-10000): Morocco, Lao PDR, Vietnam, Eswatini (former Swaziland), Guatemala, Bolivia, El Salvador, Philippines, Namibia, Jamaica. Average of QGVoice -0.25. Average of GPI 2.05

5) Group 5 that includes 25 countries with PH19 in the interval (10000-15000): Jordan, Tunisia, Iraq, Ecuador, Algeria, Egypt, Indonesia, Mongolia, Iran, South Africa, Paraguay, Ukraine, Peru, Moldova, Sri Lanka, Guyana, Armenia, Albania, Azerbaijan, Lebanon, Colombia, Brazil, Bosnia-Herzegovina, Gabon, Georgia. Average of QGVoice -0.35. Average of GDP 2.23.

6) Group 6 that includes 19 countries with PH19 in the interval (15000-25000): Libya, Turkmenistan, China, New Macedonia, Botswana, Serbia, Dominican R, Thailand, Equatorial Guinea, Belarus, Maldives, Mexico, Costa Rica, Uruguay, Montenegro, Argentina, Mauritius, Bulgaria, Chile. Average of QGVoice -0.10, Average of GPI 2.02.

7) Group 7 that includes 20 countries with PH19 in the interval (25000-40000): Trinidad and Tobago, Kazakhstan, Russian Fed., Oman, Seychelles, Turkey, Malaysia, Croatia, Greece, Romania, Latvia, Panama, Slovak R, Hungary, Poland, Puerto Rico, Portugal, Estonia, Lithuania, Slovenia. Average QGVoice 0.47. Average GPI 1.81.

8) Group 8 that includes 17 countries with PH19 in the interval (40000-50000): Israel, Cyprus, Spain, Czech R, Japan, Italy, Korea R, New Zealand, Malta, Bahrain, France, UK, Saudi Arabia, Finland, Canada, Australia, Kuwait. Average of QGVoice 1.07. Average of GPI 1.72.

9) Group 9 that includes 17 countries, o territories, with PH19 higher that 50000: Belgium, Sweden, Germany, Austria, Iceland, Netherlands, Denmark, China Hong-Kong, USA, Norway, United Arab Emirates, Switzerland, Bermuda, Ireland, Qatar, Singapore, Luxembourg. Average of QGVoice 1.62, Average of GPI 1.48.

10) Total of the World, with data of 189 countries from WB(2021) WDI, experienced an increase of 6249 Dollars per inhabitant for a period of 24 years, what amounts to an annual increase of 260 Dollars. This implies a high increase of total real Gross Domestic Product, having into account the important. There was an small diminution of -4.34% in year 2020 as consequence of the Pandemic of Covid19. In the Annex we include more information.

Education is usually the main factor for economic development and quality of life, with its positive effects not only on real income per capita but also on health care expenditure, life expectancy, diminution of poverty and other improvement of quality of life. There are a few exceptions to this general rule but usually it holds.

3.3. Evolution of the Indicators of Happiness, Quality of Government and Conflict.

IQGov (Indicator of Quality of Government "Voice of Citizens", in scale -2.5 to 2.5): For the period 2010-2020, we have found, with data from WB(2021) WGI, that only 60 countries, or territories, out of 163, experienced an increase, while in 103 countries, or territories, there was a diminution.

The average increase of the cases with positive evolution was 0.324 and the average variation of the cases with negative evolution was -0.156. The sum of the indicators of the 60 countries with positive evolution was 19.44 points while there was a total negative variation of -16.08 points. The net increase of Quality of Government in the World was very small, with only 3.36 point for 163 countries, what amounts to an average of 0.0206 points for the World average.

Happiness: Helliwell et al(2021) analyzed the countries that have experienced an increase or a decrease in the average values of Happiness indexes, comparing the average, for each country, of two periods (2006-2008) and (2016-2018). There was a net increase positive, calculated as the difference between the sum of positive changes and the sum of negative changes. Having into account that World Production per head increased during that period, with its positive effects on diminution of poverty and health care, it was expected a net positive increase of Happiness.

GPI Indicator of Conflict (in scale 0 to 4)t: The report of EIP(2021) on GPI indicator of Conflict, shows an overall score of GPI from 2.04 in year 2008 to 2.08 in year 2021. There is little variation but it should be necessary to analyze each component of this indicator in order to evaluate if there is more or less social violence in the World from the beginning to the end of that period. The report shows that the average score of the least peaceful countries have increased (more conflict) and the average score of the most peaceful countries have decreased (less conflict).

Homicides rate (Hom): Violence measured by the rate of homicides present high differences among countries, from values lower than 1 per 100 thousand inhabitants, in countries with lowest rates to rates higher than 25 in several countries, and even higher than 50 in a few ones. WB(2021) shows a diminution of the World rate of intentional homicides from 6.3 to 5.2, per 100 thousand people, for the period 2012-2015. In the Annex we include a table with negative correlations of the Homicides rate with other variables: X1, X2, PH and XTyr.

Violence against children and women: Regarding violence against children or women, we include, in the Annex, some references showing the effect of Education and Development on the diminutions of some indicators of violence in many countries

Schooling for the period 1995-2019: Accordingly to the available information, we may notice an increase of Schooling all over the World, from World averages of Tyr=6.57 in year 1995 and Tyr=8.78 in year 2019. This change has had its positive impact on the moderation of excessive Fertility rate (from a World average of Fer=3.59 in year 1995 to 2.40 in year 2019). These changes favored the increase of real Production per capita (for 9.8 to 16.1 thousand Dollars per head, at constant prices) with its positive effects on diminution of Poverty rates, increase of Health care expenditure per capita and Life Expectancy and positive effects on Happiness.

4. Econometric models of 163 countries or territories

The graphs and equations estimated in this section has been elaborated by the author, from data of table A1 in the Annex. We estimate equations for the following dependent variables:

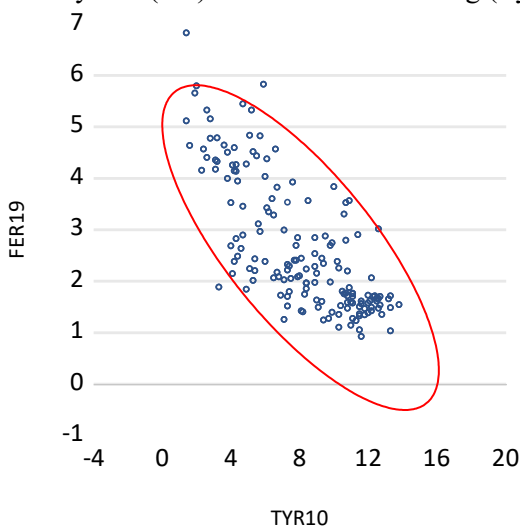
- 1) Fertility (Fer) related negatively with Schooling (Tyr)
- 2) Production per head (PH), related positively with Schooling (Tyr) and negatively with Fertility (Fer)
- 3) Happiness (X1) related positively with PH and X2, and negatively with X3.
- 4) Quality of Government (X2) related positively with PH, Tyr and negatively with X3.
- 5) Conflict (X3) related negatively with Quality of Government (X2). As PH and Tyr have a positive effect on X2, they have also, usually, an impact on the diminution of X3.

4.1. Fertility: Effect of Schooling on moderation of high average Fertility rates

Moderation of Fertility Rates and Development: The exponential rate of growth of real Production per head for the World reached an average of 2.06% per year, for the period 1995-2019, higher than the average of the 20th century (1.56% as seen in Guisan, Aguayo and Exposito(2001). The exponential rate of growth of PH is equal to the difference between the exponential rate of growth of real Gross Domestic Product(GDP) and the exponential rate of growth of Population. At World level the annual rate of growth of GDP was 2.97 through the 20th century and 3.30 for the period 1995-2019, and the annual rate of Population growth was 1.40% for the 20th century and 1.24% for the period 1995-2020.

Graph 1 and Equation 1 show the moderation effect of average years of Schooling of each country (Tyr10) of its average Fertility Rate (Fer19).

Graph 1. Fertility rate (Fer) related with Schooling (Tyr)



We have estimated, with a sample of 163 countries, or territories, of Table A1 in the Annex, the following equations to measure the effect of Schooling on Fertility.

$$\text{FER19} = \beta_0 + \beta_1 \text{XTYR} + \alpha_{01} \text{DUM11} + \alpha_{02} \text{DUM12} + \varepsilon \quad (1)$$

Where $\text{XTYR} = (\text{Tyr10} + \text{Tyr19})/2$, the mean of Tyr10 and Tyr19 in each country, is used as an indicator of the Education level of adult population, and DUM11 and DUM12 are dummy variables of Equation 1, which take account of some special circumstances in a few countries.

Equation 1. Fertility depending of an indicator of Schooling and 2 Dummies

Dependent Variable: FER19. Method Least Squares. Sample: 163				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.200775	0.156463	33.23960	0.0000
XTYR	-0.307441	0.017110	-17.96884	0.0000
DUM11	-1.648137	0.352714	-4.672730	0.0000
DUM12	1.698934	0.250901	6.771341	0.0000
R-squared	0.714800	Mean dependent var		2.660552
Adjusted R-squared	0.709419	S.D. dependent var		1.278120
S.E. of regression	0.688978	Akaike info criterion		2.117019
Sum squared resid	75.47580	Schwarz criterion		2.192939
Log likelihood	-168.5370	Hannan-Quinn criter.		2.147842
F-statistic	132.8345	Durbin-Watson stat		1.982246

Source: Author from data of table A1 in the Annex.

Equation 1 includes an intercept, that represents the expected value of Average Fertility in year 2019 (FER19) for countries with zero Schooling. The coefficient of the Indicator of Schooling (the mean of Tyr10 and Tyr19 for each country) is negative, with an estimated value of -0.3074 and significantly different from zero (with a t-Student statistic of -17.06).

A different of 1 point in the indicator of Schooling implies a diminution of 0.3073 in the Fertility rate. Dummy variables (DUM1 and DUM2) are included to take account of values of FER19 higher or lower than expected. Those differences may be due to a overestimation or underestimation of the indicator of Schooling or to other particular circumstances that contributes to a higher or lower value than expected.

DUM11 takes a value equal to 1 in countries the following countries and zero in other case: Congo DR, Israel, Malawi, Niger, Nigeria, Samoa, Tajikistan and Tanzania

DUM12 takes a value equal to 1 in the following and zero in other case: Maldives, Myanmar, Nepal and Thailand.

4.2. Production per head (PH): Effects of Schooling and Fertility rates

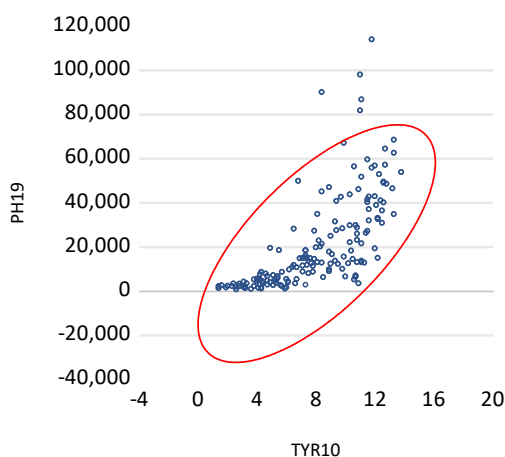
Graph 2.1 shows the positive effect of the indicator of Schooling (Tyr10) and Production per inhabitant (PH) and graph 2.2 shows the positive effect of diminution of high fertility rates on the increase of PH.

Equation 2 relates PH19 with its lagged value in year 2010 PH10, one indicator of Education (Tyr) and one indicator of Fertility (Fer) on PH:

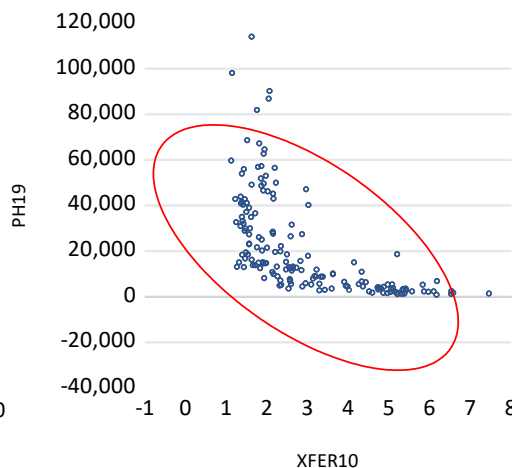
$$PH19 = \beta_1 PH10 + \beta_2 XTYR + \beta_3 XFER + \varepsilon \quad (2)$$

Where $XTYR = (tyr10 + tyr19)/2$ and $XFER = (Fer10 + Fer19)/2$.

Graph 2.1. PH19 and Tyr10



Graph 2.2. PH19 and Fer10



Equation 2. PH related with PH and indicators of Education (TYR) and Fertility (FER)

Dependent Variable: PH19. Method Least Squares. Sample 163				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
PH10	1.001540	0.022373	44.76485	0.0000
XTYR	496.5767	85.60413	5.800850	0.0000
XFER	-528.2298	158.3880	-3.335037	0.0011
R-squared	0.962805	Mean dependent var		21194.39
Adjusted R-squared	0.962340	S.D. dependent var		21317.07
S.E. of regression	4136.833	Akaike info criterion		19.51148
Sum squared resid	2.74E+09	Schwarz criterion		19.56842
Log likelihood	-1587.186	Hannan-Quinn criter.		19.53460
Durbin-Watson stat	1.976975			

Source: Author from data of table A1 in the Annex.

The goodness of fit is high and the coefficients are significantly different from zero. There are some missing variables that might contribute to a more complete model, but the three included explanatory variables are very important to explain PH19.

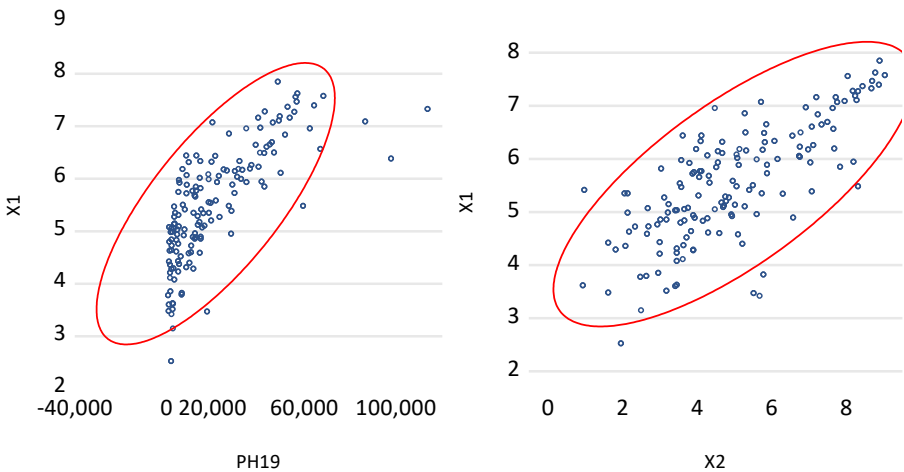
There are many variables that explain the level and evolution of real Gross Domestic Product (GDP), in the context of a macroeconomic model: availability of natural resources, human capital, stock of physical capital, industrial and technical capacity, social capital (including quality of institutions), foreign trade and other variables, as explained in Guisan(2013) and other studies. The educational level of population,

measured by XTYR, has a positive impact on PH, because contributes to moderate Fertility rate, and to increase, stock of physical capital, industrial and technical capacity, and improvement of social capital.

4.3. Happiness: Effects of PH. Quality of Government and Conflict

Graphs 3.1 and 3.2, show, respectively, the positive impact of Production per head (PH), and the Indicator of Quality of Government (X2), on the Index of Happiness (X1).

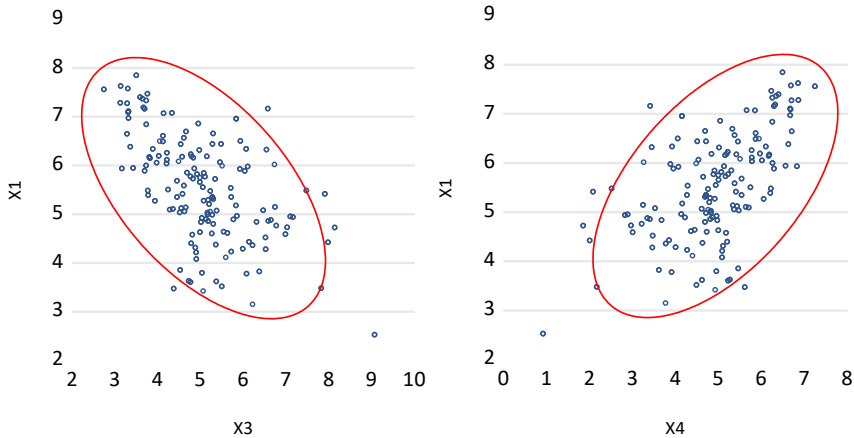
Graph 3.1. Happiness & Production per head Graph 3.2. Happiness & Quality of Government



Source: Elaborated from data of table A1 in the Annex

Graph 3.3 and 3.4 show, respectively, the positive relation of X1 with the Index of Peace (X3) and the negative relation of X1 with the Index of Conflict (X4).

Graph 3.3. Happiness (X1) and Conflict (X3) Graph 3.4. Happiness (X1) and Peace (X4)



Equation 3.1. includes Production per head as explanatory variable, in thousand Dollars (PH19/1000). Equation 3.2 includes Quality of Government (X2) as explanatory variable. Equation 3.3 shows a negative impact of Conflict (X3) on Happiness (X1).

Equation 3.1 X1 and PH19

Dependent variable X1. Method Least Squares. Sample 153				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.697414	0.082959	56.62355	0.0000
PH19/1000	0.038733	0.002773	13.97006	0.0000
R ²	0.5638	Mean of X1	5.5250	

Source: Author from data of table A1 in the Annex.

Equation 3.2. X1 and X2

Dependent variable X1. Method Least Squares. Sample 153				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.486733	0.162565	21.44826	0.0000
X2	0.409627	0.030421	13.46520	0.0000
R ²	0.5456	Mean of X1	5.5250	

Source: Author from data of table A1 in the Annex. Note:

Production per head has a direct effect on Happiness, usually through its positive effects on poverty diminution, more opportunities of decent work, improvement of Health care and other ones. Also it has several positive indirect effects as PH contributes to increase the value of X2 (which has also a positive effect on X1) and there are other positive effects on Education expenditure and increase of Schooling and other ones.

Equation 3.3. Happiness (X1) and Conflict (X3)

Dependent Variable: X1. Method Least Squares. Sample 152				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.184447	0.331665	24.67684	0.0000
X3	-0.522688	0.063772	-8.196267	0.0000
R-squared	0.309325	Mean dependent var	5.5331	

Source: Author from data of table A1 in the Annex.

Equation 3.4 for the dependent variable X1 includes PH and X2 as explanatory variables, and a dummy variable DUM3, to have into account some circumstances of a few countries with Happiness below the expected value.

Equation 3.4. Happiness (X1) related with PH and X2

Dependent Variable: X1. Method Least Squares. Sample 153				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.020299	0.153765	26.14581	0.0000
PH19/1000	0.022716	0.003893	5.835786	0.0000
X2	0.221887	0.041888	5.297125	0.0000
DUM3	-1.852474	0.218853	-8.464486	0.0000
R-squared	0.734591	Mean dependent var	5.525013	
Adjusted R-squared	0.729248	S.D. dependent var	1.084052	
S.E. of regression	0.564074	Akaike info criterion	1.718533	
Sum squared resid	47.40874	Schwarz criterion	1.797761	
Log likelihood	-127.4678	Hannan-Quinn criter.	1.750717	
F-statistic	137.4662	Durbin-Watson stat	1.913840	

Source: Author from data of table A1 in the Annex.

DUM3 is a dummy variable for countries that, for different circumstances, have an Index of Happiness below expected accordingly to their production per head and indicator of quality of Government (X2). It takes a value equal to 1 in the following cases: Afghanistan, Botswana, Hong-Kong (China), India, Rwanda, Singapore and Zimbabwe.

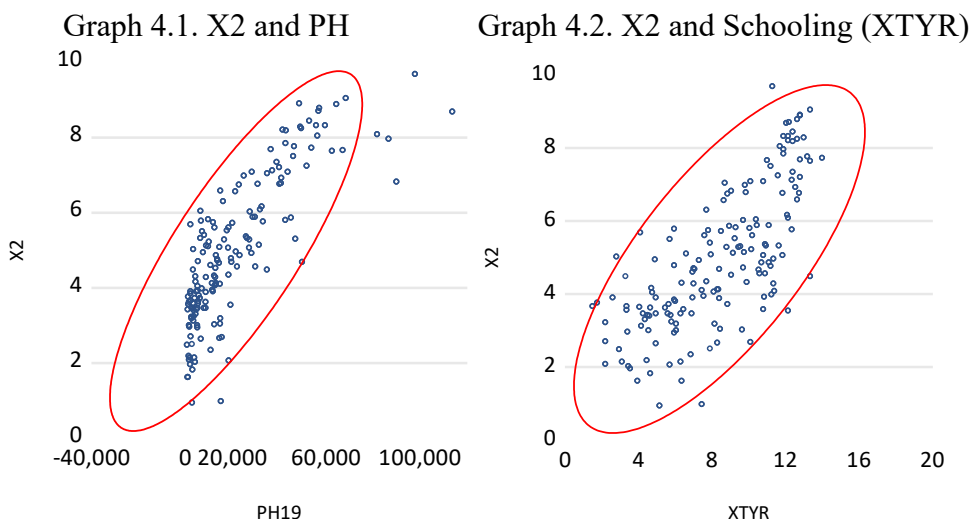
The case of Botswana has been analyzed in several publications, as we indicate in Guisan and Exposito(2021), and it seems due to problems of poverty and low levels of health care expenditure, and other social services, in spite of a relatively high level of PH19.

Although X3 has a negative correlation with X1, its coefficient does not show a value significantly different from zero, if we add X3 to Equation 3.4. It may be due to some degree of multicollinearity of this variable with others and also to the fact that this indicator is based in many components and not all of them may have a similar degree of effect on X1. The coefficient of correlation between X3 and X1 is -0.5562, between X3 and X2 is -0.6994, between X3 and PH19 is -0.5733 and between X3 and XTYR is -0.5118.

In the Annex we include some comments about other indicators of violence and the positive effects of Education on their diminution.

4.4. Quality of Government (X2): Effects of Schooling. Production and Peace

Graphs 4.1 and 4.2. and equation 4.1 and 4.2, show the relationship of Quality of Government (X2) with Production per head (PH) and Schooling (TYR).



Equation 4 relates Quality of Government (X2) with the Production per head (PH), Schooling (XTYR) and the Index of Peace (X4). These three variables show a positive and significant effect on X2. Besides we have included 2 dummy variables, one for positive effects and another one for negative effects, to have into account special features of some countries that have levels of X2 higher or lower than expected.

Dum41 is equal to 1 in India and Rwanda. Dum42 is equal to 1 in Equatorial Guinea, Haiti, Libya, Qatar, Romania and Turkmenistan.

Equation 4.1. Quality of Government (X2) related with PH, XTYR and X4

Dependent Variable: X2. Method Least Squares. Sample 163				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.390512	0.323351	1.207704	0.2290
PH19/1000	0.045823	0.004326	10.59139	0.0000
TYR19	0.142734	0.027811	5.132199	0.0000
X4	0.488073	0.066643	7.323662	0.0000
DUM41	2.270745	0.557597	4.072378	0.0001
DUM42	-2.227645	0.326842	-6.815666	0.0000
R-squared	0.840654	Mean dependent var		4.977531
Adjusted R-squared	0.835547	S.D. dependent var		1.918165
S.E. of regression	0.777870	Akaike info criterion		2.371819
Sum squared resid	94.39273	Schwarz criterion		2.486174
Log likelihood	-186.1173	Hannan-Quinn criter.		2.418249
F-statistic	164.6006	Durbin-Watson stat		1.994550

Source: Author from data of table A1 in the Annex.

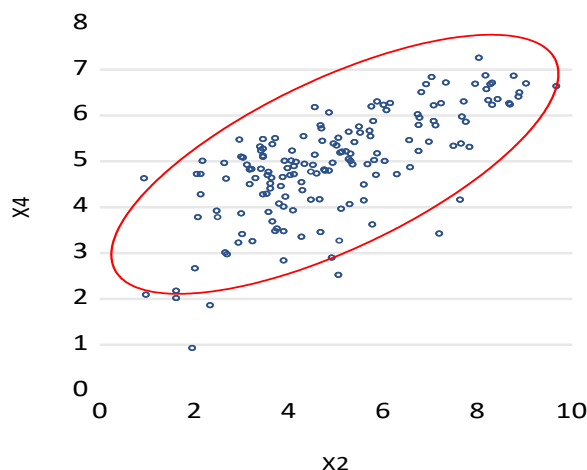
The coefficients of DUM41 and DUM42 are significantly different from zero. It may be due to underestimation of X2 in countries with DUM41=1 or overestimation of X2 in countries with DUM41, or to special circumstances.

Regarding the explanatory variable X4 (Indicator of Peace) there is a high positive correlation with X2, but it is convenient to analyze the direction of causality. In section 4.6 we estimate, by TSLS, a bilateral relationship, between X2 and X4, which shows that the main direction of causality seems to be from X2 to X4.

4.5. Peace (X4) related with the indicator of Voice of Citizens (X2)

Graph 5 and Equation 5 show a positive impact of X2 on X4

Graph 5. Peace (X4) and Voice of Citizens (X2)



Equation 5. Peace (X4) related with X2 (Voice of Citizens)

Dependent Variable: X4 Method Least Squares. Sample 162				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.084504	0.138948	22.19898	0.0000
X2	0.400490	0.025807	15.51838	0.0000
DUM5	-2.098966	0.196163	-10.70011	0.0000
R-squared	0.702856	Mean dependent var		4.935432
Adjusted R-squared	0.699118	S.D. dependent var		1.143134
S.E. of regression	0.627040	Akaike info criterion		1.922733
Sum squared resid	62.51551	Schwarz criterion		1.979910
Log likelihood	-152.7413	Hannan-Quinn criter.		1.945948
F-statistic	188.0467	Durbin-Watson stat		2.226986

Source: Author from data of table A1 in the Annex.

DUM5 is a dummy variable, equal to 1 in the countries with values of X4 lower than expected by its relationship with X2: Afghanistan, Colombia, Congo DR, India, Iraq, Israel, Pakistan, Russia, Turkey and the United States.

4.6. Estimating a bilateral relation between X2 and X4 by TSLS

The estimation by Two Stage Least Squares (TSLS) of a system of 2 Equation with possible interdependence between X2 and X4. Equations 4.2 and 5.2 present the TSLS estimations.

Equation 4.2. Equation of Quality of Government (X2) estimated by TSLS

Dependent Variable X2. Method TSLS. Sample 162.				
Instrument specification: C DUM3 DUM41 DUM42 PH19/1000 XTYR				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.361531	1.910515	0.189232	0.8502
PH19/1000	0.045256	0.012108	3.737809	0.0003
XTYR	0.141667	0.045312	3.126476	0.0021
X4	0.509103	0.495937	1.026549	0.3062
DUM41	2.278402	0.555565	4.101054	0.0001
DUM42	-2.230463	0.357912	-6.231875	0.0000
R-squared	0.841966	Mean dependent var		4.977531

Source: Author from data of table A1 in the Annex.

Equation 5.2. Equation of Peace (X4) estimated by TSLS

Dependent Variable: X4. Method TSLS. Smpl 162				
Instrument specification: C DUM3 PH19/1000 XTYR DUM41 DUM42				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	2.995825	0.197353	15.18001	0.0000
X2	0.395696	0.037651	10.50949	0.0000
DUM5	-0.693860	0.314424	-2.206765	0.0288
R-squared	0.502973	Mean dependent var		4.935432

Source: Author from data of table A1 in the Annex.

The coefficient of X4 has a low t-Statistic, in equation 4.2, and does not show a significant effect on X2, while X2, in equation 5.2, has a high value of the t-Statistic, and shows a significant effect on X4. The main direction of causality seems to be from X2 to X4. The indicator of Quality of Government, "Voice of Citizens", seems to have usually a positive contribution to increase Peace.

4.7. Prospects of Population growth and sustainable development 2021-2030.

Besides Development for low income countries the World needs improvements in Quality of Government (X2) and diminution of the Index of Conflicts (X3).

As seen in Guisan and Exposito(2020), 85% of the increase of Total Emissions of CO2 in the World where due to the high increase of Population in several geographical areas and only a 15% was due to an increase of CO2 Emissions per capita.

For the period 1970-2015, World Population evolved from 3684 to 7341 million people. Total CO2 Emissions evolved from 15583 to 36191 million Tm. CO2 Emissions per capita evolved from 4.23 to 4.93 Tm per inhabitant.

Total Emissions diminished in a group of 6 European countries (France, Germany, Italy, Spain, Switzerland and the United Kingdom) and experienced an increase of 360 million Tm in OECD countries, 378 in Russian Federation, 9649 in China, 2223 in India and 7998 in the rest of the World.

The authors highlight that moderation of Population growth is important not only to moderate CO2 Emissions and other environmental contamination, but also to foster sustainable economic development in the World, particularly in the poorest countries. They include in table 8 of that study values of Total CO2 perspectives for year 2030, under 3 Hypotheses for Population growth and 3 Hypotheses for Emissions per capita.

With the most moderate of the 3 hypothesis of Population growth, World Population would amount to 8259 million people, which implies to diminish the average annual rate of World Population from 1.12% in the period 2015-2019 to 0.78% for the period 2015-2030.

The increase of Schooling in countries with high fertility rates would contribute to moderate population growth. Under this hypothesis Total CO2 Emissions in the World would diminish from 36191 in year 2015 to 32996 million in year 2030, even with an average value of Emissions per capita of 4 Tm per inhabitant.

With the UNDP(2019) prospect World population would reach a value of 8548 million people in year 2030, and increases for the period 2031 to 2100 until a maximum of 10875 million. In our view is important to moderate the rates of Population growth, in order to stabilize Population around 8259 million since year 2030 in order to favor an important increase of Development and Quality of Life for low income countries, compatible with the quality of Environment and with diminution of Total CO2 Emissions.

In the highest hypothesis of the study by Guisan and Exposito(2020), with an average rate of Population growth of 1.16% for the period 2015-2030, World Population in year 2030 would reach 8733 million people. Total Emissions would evolve between 34932

and 43665 million Tm, depending of the evolution of Emissions per capita (in the hypotheses between 4 and 5 Tm per inhabitant).

Moderation of Fertility rates is not only important to diminish World environmental problems, but also it is important for economic development of many less developed countries, because they are countries with low level of Schooling (and high average Fertility rates) what imply to fall in an underdevelopment trap. They need international cooperation to increase Schooling, Investment and Production per inhabitant, and to develop favorable conditions for economic activities and quality of life.

5. Conclusions

The main conclusions from the estimated equations are the following ones:

1) As seen in Equations 1 there is an important impact of Education on the moderation of average high fertility rates. This is very important to avoid the underdevelopment trap in low-income countries. The increase of Schooling can moderate high average Fertility rates and increase the difference between the exponential rate of growth of Production and the exponential rate of Population growth, what is usually necessary to foster development and quality of life.

2) As seen in Equation 2 Production per inhabitant usually is positively related to its lagged value and to the Education level and negatively to high rates of Fertility. Increase of Education and diminution of high Fertility rates help to increase industrial investment per capita and other variables important for development.

3) As seen in Equation 3.3 there is usually an important impact of real Production per head on Happiness, through the increase of real income and health care per inhabitant, diminution of poverty and other positive effects of production, and there is also a positive impact, on X1, of the indicator of Quality of Government (Voice of Citizens). Both variables are important for Happiness. An increase of PH and X2 is usually a necessary conditions but not sufficient, for the increase of Happiness. In a few countries there are some special circumstances, related with poverty, violence or other factors, that diminish the average Happiness, below the expected value from the equation.

The indicator of Conflict (X3) seems to have a negative impact on Happiness (X1) but due to high correlation with other explanatory variables (multicollinearity) this indicator did not show a significant effect on the equation. It should be interesting to analyze different components of the indicator of Peace, which are important for Happiness.

4) As seen in Equations 4.1. and 4.2, Production per inhabitant and average Schooling have a positive impact on the indicator of Quality of Government (X2), with a few exceptions including some countries with value of X2 higher than expected and other countries with value of X2 lower than expected accordingly to equation 4.1.

4) As seen in Equations 5.1 and 5.2 Quality of Government (X2) has usually a positive and significant effect on the Indicator of Peace (X4).

The main conclusions for economic policy recommendations are the following ones:

5) We highlight our suggestion to foster international cooperation to avoid poverty and low levels of Education in low-income countries, in order to help them to exit from the poverty trap. This includes not only to increase cooperation for Schooling of children, but also expenditure on activities of Education for adults who have low levels of Schooling. Education is important to increase productivity, quality of production and moderation of population growth, with its positive effects on Development and Happiness. Many institutions and donators can help, for example with a fund for Schooling expenses, including salaries of teachers and other employees.

6) We also highlight economic and social policies addressed to diminish violence and unsafety and to improve quality of Government. International institutions, social means of communication and many organizations can help in this regard. Newspapers and Televisions, for example, should be more addressed to foster advancements in quality of life instead of trying to create social tensions.

7) Sustainable development, from an environmental perspective, is possible with an increase of Schooling and moderation of high averages Fertility rates. Stabilization of World population below 8500 million in year 2030 would be of great help to foster sustainable development in low income countries and besides a diminution of World Total CO2 Emissions, given that, accordingly to Guisan and Exposito(2020), the 85% of the increase of the period 1970-2015 was due to World Population growth, and only 15% to the increase of CO2 Emissions per capita.

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Annex 1. Data for the period 1995-2020

Table A1 includes data, for 164 countries of the following variables:

PH95 and PH19: Real Production per Head (PH), in Dollars per inhabitant at 2017 prices and Purchasing Power Parities (PPPs) of years 1995 and 2019.

Tyr10 and Tyr 19: Average years of Schooling of adult population in 2010 and 2019.

Fer19: Fertility rate of year 2019.

Indicator of Quality of Life, around year 2020: X1 (Happiness), X2 (Quality of Government measured by "Voice of Citizens"), and X4 (Index of Peace, with 0 in less peaceful countries and 10 in the most peaceful ones). XM is the average of 3 indexes of quality of life ($XM=(X1+X2+X4)/3$). Data used for the Indicator of Conflict, in scale 0 to 10, may be calculated as $X3=10-X4$.

Homicides (HOM): The column *Hom*, includes an indicator of violence and conflict: rate of international homicides per 100 thousand people. In Annex 3 we analyze correlations of this indicator with other variables.

Effect of year 2020: The last column shows the % of change of PH from 2019 to 2029.

Table A1. Development, Schooling, Fertility rate, Happiness, Government, Homicides

Nb	Country	PH 95	PH 19	Tyr 10	Fer 19	X1	X2	X4	Hom
1	Afghanistan	1287*	2065	3.2	4.32	2.52	1.96	0.92	6.35
2	Albania	4472	13671	9.3	1.60	5.12	4.72	5.44	2.70
3	Algeria	7935	11511	7.1	2.99	4.89	3.94	4.22	1.36
4	Angola	4140	6670	4.7	5.44	3.79	2.64	4.96	4.85
5	Argentina	17363	22064	10.3	2.25	5.93	4.56	5.14	5.94
6	Armenia	3008	13654	11.1	1.76	5.28	4.76	4.81	2.98
7	Australia	32947	49456	12.6	1.66	7.18	8.24	6.33	0.94
8	Austria	40367	55833	11.8	1.46	7.27	8.32	6.71	0.66
9	Azerbaijan	3025	14439	10.5	1.80	5.17	4.66	4.17	2.14
10	Bahrain	47157	45060	8.4	1.96	6.65	5.86	4.70	0.52
11	Bangladesh	1697	4754	5.3	2.01	5.03	3.42	4.83	2.50
12	Belarus	5805	19283	12.0	1.38	5.53	3.54	4.29	3.58
13	Belgium	37778	51736	11.1	1.57	6.83	7.24	6.26	1.95
14	Benin	2253	3287	2.8	4.77	5.05	4.48	4.77	6.18
15	Bermuda	68313	81804	11.0	1.59	NA	8.08	NA	12.96
16	Bolivia	5050	8724	7.8	2.69	5.72	3.88	4.65	6.30
17	Bosnia+Herz.	2053	14897	7.1	1.25	5.81	3.04	5.08	1.28
18	Botswana	9935	17777	8.9	2.84	3.47	5.52	5.62	15.04
19	Brazil	11251	14759	6.9	1.72	6.33	4.10	3.93	29.53
20	Bulgaria	10966	23192	10.8	1.58	5.27	4.86	6.06	1.14
21	Burkina Faso	1076	2178	1.4	5.11	4.83	3.66	3.68	0.37
22	Burundi	948	752	2.6	5.32	3.78	2.48	3.91	6.02
23	Cabo Verde	2547	7172	5.1	2.24	5.50	5.50	5.75	11.49
24	Cambodia	1182	4389	4.4	2.48	4.83	4.16	4.98	1.84
25	Cameroon	2531	3642	5.3	4.51	5.14	3.24	3.25	4.17
26	Canada	31934	49017	12.6	1.47	7.10	8.28	6.68	1.68
27	Central Afr. R	1099	945	3.6	4.64	3.48	1.62	2.17	19.76
28	Chad	941	1580	1.9	5.65	4.36	2.08	3.78	9.04

29	Chile	13288	24969	9.0	1.63	6.17	6.98	5.42	3.46
30	China	2391	16092	7.3	1.70	5.34	1.72*	4.72	0.62
31	China. H-K	34546	59586	11.5	1.05	5.48	8.32	6.23	0.38
32	Colombia	9400	14585	7.4	1.79	6.01	5.08	3.27	25.50
33	Comoros	2751	3059	4.2	4.14	4.29	1.82	NA	7.70
34	Congo. DR	1040	1098	5.9	5.82	4.42	1.62	2.01	13.55
35	Congo. Rep.	4548	3872	6.1	4.37	5.35	2.14	4.27	9.32
36	Costa Rica	10996	20106	8.3	1.74	7.07	5.72	5.66	11.90
37	Cote d'Ivoire	4065	5213	4.2	4.59	5.31	4.04	4.69	11.63
38	Croatia	15003	28754	10.8	1.47	5.88	5.88	6.30	1.04
39	Cyprus	28692	40227	11.5	1.32	6.22	6.76	5.22	1.11
40	Czech R	22759	40981	12.4	1.71	6.97	6.92	6.68	0.61
41	Denmark	43016	57162	12.7	1.70	7.62	8.78	6.86	0.98
42	Djibouti	1708*	5535	4.0	2.68	4.37	3.64	4.64	6.48
43	Dominican R	7397	18413	7.3	2.32	5.55	4.34	4.94	15.18
44	Ecuador	8576	11371	7.8	2.40	5.76	4.12	4.89	5.85
45	Egypt. AR	6483	11763	6.5	3.28	4.28	3.90	4.01	2.51
46	El Salvador	6212	8796	7.1	2.02	6.06	4.28	4.54	35.0*
47	Eq Guinea	1781	18503	5.5	4.43	5.35	2.06	4.72	2.31
48	Estonia	12744	36437	12.5	1.66	6.19	7.68	5.97	3.19
49	Eswatini	5259	8622	5.7	2.96	4.31	3.46	5.11	NA
50	Ethiopia	677	2221	2.3	4.15	4.28	3.90	3.47	7.56
51	Finland	31449	48563	12.8	1.35	7.84	8.90	6.49	1.42
52	France	35178	46018	10.9	1.87	6.69	7.50	5.33	1.35
53	Gabon	18515	14950	7.6	3.92	4.85	3.18	4.82	8.04
54	Gambia	2128	2223	2.8	5.15	5.05	3.66	5.37	9.13
55	Georgia	3244	14989	12.2	2.06	4.89	6.58	4.87	0.99
56	Germany	39278	53809	13.8	1.54	7.16	7.72	6.30	1.18
57	Ghana	2515	5411	6.7	3.82	5.09	4.70	5.71	1.68
58	Greece	24966	29723	10.3	1.35	5.72	5.88	5.17	0.75
59	Guatemala	6030	8648	4.3	2.82	6.44	3.62	4.51	27.26
60	Guinea	1595	2567	1.6	4.63	4.98	3.22	4.83	8.82
61	Guinea-Bissau	2088	1939	2.6	4.40	4.98	2.14	4.72	9.55
62	Guyana	6664	13082	8.1	2.44	6.44	4.12	4.72	18.37
63	Haiti	2591	2905	4.7	2.89	3.62	0.94	4.62	10.04
64	Honduras	4025	5736	5.4	2.43	5.92	3.80	4.07	56.52
65	Hungary	16610	32554	12.2	1.49	5.99	6.16	6.27	2.07
66	Iceland	33339	56383	10.6	1.75	7.55	8.04	7.25	0.30
67	India	2106	6717	5.4	2.20	3.82	5.78	3.62	3.22
68	Indonesia	5892	11812	7.4	2.29	5.35	5.74	5.54	0.50
69	Iran. IR.	9320	12389	9.0	2.15	4.85	3.02	3.41	2.47
70	Iraq	4479	10815	6.4	3.60	4.72	2.34	1.86	9.85
71	Ireland	32309	86710	11.1	1.70	7.09	7.96	6.69	0.80
72	Israel	28385	40074	12.6	3.01	7.16	7.20	3.42	1.36
73	Italy	38947	42663	9.7	1.27	6.48	5.80	5.87	0.67
74	Jamaica	9957	9775	8.9	1.97	6.31	5.82	5.02	47.01
75	Japan	34415	41477	11.5	1.36	5.94	8.20	6.57	0.28
76	Jordan	8334	10071	9.8	2.69	4.39	5.22	5.21	1.55
77	Kazakhstan	8552	26352	11.4	2.90	6.15	5.32	5.16	4.81
78	Kenya	2968	4330	6.1	3.42	4.61	4.30	4.37	4.87
79	Korea. R	18120	42719	11.6	0.92	5.85	7.84	5.31	0.70
80	Kuwait	63725	49854	6.8	2.08	6.11	4.68	5.78	1.80

81	Kyrgyz R	2517	5258	10.6	3.30	5.74	3.92	5.00	4.49
82	Lao PDR	2330	7887	4.6	2.63	5.03	3.46	5.48	7.01
83	Latvia	9506	30859	12.5	1.61	6.03	6.76	5.79	3.36
84	Lebanon	13309	14552	7.9	2.08	4.58	2.66	3.01	3.99
85	Lesotho	1622	2695	5.6	3.11	3.51	3.18	4.50	41.25
86	Liberia	1589*	1428	4.1	4.25	4.63	2.18	5.00	3.23
87	Libya	15909*	15174	7.3	2.21	5.41	0.98	2.09	2.50
88	Lithuania	10640	37063	11.6	1.61	6.26	7.12	5.78	5.25
89	Luxembourg	76727	113940	11.8	1.34	7.32	8.68	6.26	0.72
90	Madagascar	1569	1619	6.0	4.03	4.21	3.00	5.09	7.69
91	Malawi	743	1086	4.3	4.13	3.60	3.42	5.23	1.73
92	Malaysia	14260	28364	9.8	1.98	5.38	7.08	6.21	2.11
93	Maldives	10598	19531	4.9	1.84	5.20	4.78	4.79	0.75
94	Mali	1458	2322	2.0	5.79	4.72	2.70	2.97	10.90
95	Malta	19626	43703	10.3	1.10	6.60	7.08	5.87	0.94
96	Mauritania	4769	5197	3.8	4.50	4.23	3.46	4.28	9.94
97	Mauritius	9567	22870	8.2	1.40	6.05	6.74	6.02	1.82
98	Mexico	14809	19701	8.0	2.10	6.32	4.68	3.45	19.26
99	Moldova	5696	13022	11.1	1.27	5.77	4.08	5.23	3.19
100	Mongolia	4129	12317	9.5	2.87	5.68	4.32	5.54	5.66
101	Montenegro	10537*	21534	11.1	1.75	5.58	4.96	5.38	4.46
102	Morocco	3821	7537	4.2	2.38	4.92	4.94	4.96	1.24
103	Mozambique	469	1282	3.2	4.78	4.79	3.56	4.69	3.40
104	Myanmar	775	5083	4.1	2.14	4.43	3.00	3.86	2.27
105	N. Macedonia	9025	16600	9.1	1.52	5.10	5.28	5.64	NA
106	Namibia	6237	9728	6.2	3.34	4.57	5.10	5.18	17.14
107	Nepal	1585	3436	3.3	1.88	5.27	3.12	4.92	2.16
108	Netherlands	39498	56784	12.0	1.57	7.46	8.70	6.24	0.55
109	New Zealand	29816	42878	12.0	1.72	7.28	8.18	6.87	0.99
110	Nicaragua	3385	5452	6.0	2.38	5.97	3.58	3.89	7.37
111	Niger	1012	1225	1.4	6.82	5.07	3.76	3.53	4.44
112	Nigeria	2902	5135	5.2	5.32	4.76	2.94	3.22	9.85
113	Norway	49261	64453	12.7	1.53	7.39	8.88	6.41	0.51
114	Oman	29045	27299	7.9	2.84	6.85	5.28	5.05	0.66
115	Pakistan	3180	4690	4.7	3.45	4.93	3.90	2.83	4.41
116	Panama	12643	31440	9.3	2.44	6.18	5.14	5.20	9.67
117	Papua N.G	3272	4350	4.0	3.52	NA	3.30	4.63	7.85
118	Paraguay	9314	12619	7.7	2.40	5.65	4.06	5.01	9.29
119	Peru	6154	12854	8.4	2.23	5.84	4.52	4.92	7.67
120	Philippines	4178	8915	8.9	2.53	5.88	5.12	3.96	11.02
121	Poland	12460	33121	12.2	1.42	6.17	5.76	6.19	0.67
122	Portugal	25524	34880	8.1	1.42	5.93	7.04	6.83	0.64
123	Puerto Rico	25288	34805	13.3	1.03	6.95	4.48	4.16	18.51
124	Qatar	84144*	90044	8.4	1.85	NA	6.82	6.50	0.38
125	Romania	12117	29858	10.7	1.76	6.14	4.56	6.17	1.25
126	Russian Fed	13308	27211	11.5	1.50	5.48	5.06	2.52	10.82
127	Rwanda	746	2228	3.8	3.99	3.42	5.68	4.93	2.52
128	Samoa	4097	6517	10.0	3.83	NA	6.04	5.00	3.15
129	Sao Tome+P	1482*	4005	4.9	4.27	NA	3.72	5.50	3.36
130	Saudi Arabia	42856	46962	8.9	2.28	6.49	5.30	4.06	1.50
131	Senegal	2380	3361	2.4	4.56	5.13	5.02	5.34	7.38
132	Serbia	7752	18292	10.4	1.52	6.08	5.06	5.51	1.39

133	Seychelles	15488	27521	9.4	2.34	NA	6.02	6.23	12.74
134	Sierra Leone	1111	1720	3.1	4.17	3.85	2.96	5.47	1.71
135	Singapore	48642	97989	11.0	1.14	6.38	9.68	6.63	0.32
136	Slovak R	13256	31888	11.6	1.56	6.33	6.08	6.11	1.05
137	Slovenia	21479	38945	12.1	1.61	6.64	7.34	6.71	0.48
138	South Africa	9541	12482	10.2	2.38	4.96	5.60	4.14	33.97
139	Spain	29042	40804	9.4	1.24	6.49	6.78	5.95	0.63
140	Sri Lanka	4790	13070	10.8	2.19	NA	4.86	4.79	2.55
141	Sudan	1805	4186	3.1	4.35	NA	2.02	2.66	5.16
142	Sweden	34234	52851	12.3	1.70	7.36	8.44	6.35	1.08
143	Switzerland	52196	68474	13.3	1.48	7.57	9.04	6.69	0.54
144	Tajikistan	1354	3402	10.9	3.56	5.47	3.58	4.76	1.61
145	Tanzania	1294	2660	5.1	4.81	3.62	3.46	5.27	6.95
146	Thailand	10017	18451	7.3	1.51	5.99	5.60	4.49	3.24
147	Timor-Leste	2411*	3553	4.4	3.94	NA	3.40	5.32	3.95
148	Togo	1207	1599	4.3	4.26	4.11	3.62	4.40	9.00
149	Tonga	4652	6378	10.7	3.52	NA	5.32	5.00	0.95
150	Trinidad+T	11946	25931	10.8	1.71	NA	5.36	4.93	30.88
151	Tunisia	5931	10756	6.7	2.17	4.60	4.60	4.73	3.05
152	Turkey	13638	28199	6.5	2.06	4.95	4.92	2.89	4.31
153	Turkmenistan	3988	15538	9.9	2.74	5.07	2.68	4.62	4.22
154	UAE	101571	67119	9.9	1.39	6.56	7.66	5.38	0.89
155	Uganda	1083	2187	5.7	4.82	4.64	3.84	4.45	11.52
156	UK	32571	46406	13.2	1.65	7.06	7.76	5.86	1.20
157	Ukraine	7617	12809	11.3	1.23	4.88	4.28	3.35	6.34
158	Uruguay	11997	21346	8.4	1.96	6.43	6.56	5.46	7.69
159	USA	42975	62555	13.3	1.71	6.95	7.64	4.16	5.35
160	Uzbekistan	2494	7014	10.7	2.79	6.18	3.98	4.85	3.00
161	Vietnam	2253	8041	7.5	2.05	5.41	5.40	5.41	1.52
162	W.Bank&Gaza	4047	6245	8.5	3.56	4.52	3.72	3.48	NA
163	Zambia	1909	3470	6.6	4.56	4.07	3.46	5.09	5.30
164	Zimbabwe	3227	2800	7.3	3.53	3.15	2.50	3.77	6.67

Sources: Elaborated by the author from WB(2021) WDI and WGI for PH, Fer and X2; WHR(2021) for X1, EIP(2021) for X3 and X4, UNDP(2021) for Tyr and UN(2021) for Hom. PH is real Production per inhabitant at 2017 prices and Purchasing Power Parities (PPPs). Fer is Fertility average (number of children per women in her life). Tyr is average Schooling years per adult (population 25+), Hom is the rate of intentioned homicides, in year 2021, per 100000 people. Note: The figure for China in the indicator X2 has been revised, on 16th February of 2023, with data from UN(2022) World Happiness Report of year 2022 Other figures marked with * are our own provisional estimations, in a few cases of unavailable data (NA) in the main source, got from other sources or estimated from other indicators.

Data for countries not included in the equations are included in Annex A4.

Annex A2. Estimating equations for African countries

Given the great concentration of low income countries in Africa, we include an analysis more detailed of economic development with a sample of 52 African countries, analyzing the differences between the different levels of development. Countries with low values of number of years of Schooling fall very often in a underdevelopment trap, with high values of average Fertility rates, high annual rates of Population growth and

almost null difference between the rate of growth of GDP and the rate of Population growth, with stagnation or scarce increase of real value of PH.

Equation A2.1. Fertility rate as function of Education and Production per head.

Dependent Variable: FER19. Method: Least Squares. 52 countries				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.773446	0.314389	18.36403	0.0000
TYR10	-0.285457	0.082214	-3.472104	0.0011
PH19PP17/1000	-0.053274	0.027180	-1.960022	0.0556
R-squared	0.538825	Mean dependent var		4.104528

In Equation A.21. the estimated average Fertility rate varies from a value higher than 5 (for countries with very low levels of Education and Production per head) to lower values when TYR and PH increase. Other cultural factors, besides years of Schooling may had an effect on moderation of fertility rates. In Equation 3 the highest, in absolute value, of negative residual correspond to Morocco (indicating that there are other cultural factors that contributed to a more moderate fertility rate that expected, and the highest positive residual correspond to Niger.

Equation A2.2. PH19 as a function of PH10, TYR10 and 3 dummies

Dependent Variable: PH19. Method: Least Squares. 52 countries				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
PH10	0.792086	0.052884	14.97780	0.0000
TYR10	301.2714	66.21493	4.549901	0.0000
D17	-10664.72	2055.647	-5.188011	0.0000
D34	7097.130	1451.316	4.890136	0.0000
D43	7959.237	1508.928	5.274764	0.0000
R-squared	0.954305	Mean dependent var		5767.596

In Equation A2.2, we have included 3 dummy variables (variables que take 0 value in countries without special features and 1 in countries with some special effect), in order to take account of the effect of some missing relevant variables, as Tourism and Industrial increase. D17 (for Equatorial Guinea), takes account of effect of the diminution of industrial real production per head (very high but with a high diminution for the period 2010-2019). D34 (for Mauritius) and D43 (for Seychelles) take account of the effect of an important increase of income per capita from Tourism in those cases.

Equation A3.3. Happiness (X1) related with PH19 and Quality of Government (X2)

Dependent Variable: X1. Method Least Squares. 52 countries				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.430173	0.213220	16.08745	0.0000
PH19/1000	0.070766	0.014151	5.000657	0.0000
X2	0.128615	0.063852	2.014274	0.0496
D1	1.118493	0.535069	2.090372	0.0419
D4	-1.628141	0.555535	-2.930762	0.0052
R-squared	0.539273	Mean dependent var		4.276604

We have included two dummy variables: D1 to take account of some factors that explain a higher level than expected in country 1 (Algeria) and D4 to take account of some factors that explain a lower level than expected in country 4 (Botswana).

Equation A2.4. Quality of Government (X2) related with Education. Development and Peace

Depend. variable: X2. Method: Least Squares. Method Least Squares. Sample 52				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
TYR10	0.157221	0.059669	2.634903	0.0112
(PH19-PH10)/1000	0.170399	0.040299	4.228362	0.0001
X4	0.613557	0.068463	8.961862	0.0000
R-squared	0.572374	Mean dependent var		3.527308
Adjusted R-squared	0.554920	S.D. dependent var		1.286522
S.E. of regression	0.858294	Akaike info criterion		2.588221
Sum squared resid	36.09674	Schwarz criterion		2.700792
Log likelihood	-64.29373	Hannan-Quinn criter.		2.631378
Durbin-Watson stat	1.934952			

Equation A2.5. Combined Index of Quality of Life (XM) and Production per head (PH)

Dependent Variable: XM. Method Least Squares. 52 Countries				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.739146	0.096548	38.72836	0.0000
PH19/1000	0.068287	0.011234	6.078558	0.0000
DP1	1.176219	0.348948	3.370757	0.0015
DN1	-1.650430	0.252238	-6.543143	0.0000
R-squared	0.668390	Mean dependent var		4.050786

DP1 is a dummy variable for positive effects on equation 1: equal to 1 for countries with levels of XMED higher than its average expectation for its level of development: 7 (Cabo Verde) and 42 (Senegal). DN1 is a dummy variable for negative effects on equation 1: for countries with XMED lower than average expectation for its level of development: 9 (Central African R). 12 (Congo DR). 29 Libya and 45 Somalia.

Annex 3. Other Indicators.

Indicator of Poverty count (percentage of poor people) are yet very high in many countries, but the general balance of the period 1995-2020 is a diminution in the percentage at World level and in many countries. Accordingly to the WB(2021) WDI, there was a diminution from 53.9% in year 2010 to 46.1% in year 2021. The highest rates of poverty are usually concentrated on countries with low levels of Schooling and very high Fertility rates. Health care and Life Expectancy have experienced great advancements in many countries, At World level Life Expectancy evolved from 52 years in 1960 to 65 in year 1990 and 72.4 in year 2019 and 72.6 in year 2020.

Regarding Women rights there are several publications, some of them cited in the Bibliography, that show the positive impact that Education and Economic Development on Women opportunities to participate in income, work and social activities.

Besides there are interesting studies, some of them cited in the Bibliography, that show great advancements in the diminution of violence against women with Education, Development, Peace and Quality of Government.

Regarding the types of violence that have a higher negative effect on happiness we expect to include more information in a new report.

In this section we include the correlation of the variable Hom21 (number of intended homicides), with other variables.

Table A3. Correlation of Hom21 with other variables.

	HOM21	X1	X2	X4	PH19	XTYR
HOM21	1.0000	-0.1063	-0.2539	-0.2855	-0.2938	-0.2193
X1	-0.1063	1.0000	0.7346	0.5592	0.7478	0.7097
X2	-0.2539	0.7346	1.0000	0.7013	0.8283	0.7238
X4	-0.2855	0.5592	0.7013	1.0000	0.5745	0.5167
PH19	-0.2938	0.7478	0.8283	0.5745	1.0000	0.7237
XTYR	-0.2193	0.7097	0.7238	0.5167	0.7237	1.0000

Annex 4. Information of the countries and territories not included in table A1.

Table A4. Economic Development in countries not included in table A1

	Country	PH95	PH05	PH19	PH20	Tyr10	Fer19	X1	Gov	GPI
	Bahamas	34676	40354	37100	30764	11.5	1.74			
	Barbados	13043	15752	15639	12870	9.4	1.62		0.49	
	Belize	5818	7277	7166	6048	9.5	2.27	5.96	+0.65	
	Bhutan	3415	5457	11832	10909	2.3	1.95	5.01	0.37	1.510
	Brunei-D	72447	69788	62098	62244	8.8	1.82		1.44	
	Cuba					11.0	1.60		-0.17	2.042
	Dominica	8384	10161	11906	9891	7.8	-		-0.18	
	Fiji	9019	10656	13684	10997	9.6	2.75		0.30	
	Grenada	8666	14247	17050	15066	8.3	2.04		-0.07	
	Kiribati	2058	2150	2270	2292	7.9	3.53		-0.14	
	Kosovo	NA	6832	11486	10776	-	1.97		-0.32	2.017
	Macao, China	58204	77847	127903	55118	-	1.23		1.13	
	Marshall I.	4023	3447	4023	4023	10.7			-1.41	
	Micronesia	3450	3586	3466	NA	7.2	3.01		-0.08	
	Solomon I	2975	2123	2661	2483	5.1	4.36		-0.91	
	St Kitts+N	17592	23617	26236	23259	3.8			0.70	
	St. Lucia	12398	13434	15448	12270	8.4	1.42		0.15	
	St. Vincent+G	7572	10667	12485	12105	8.3	1.87		0.15	
	Suriname	11345	14245	17047	14444	7.7	2.39		-0.54	
	Syrian AR					10.3	2.77	3.46	-1.73	3.371
	Tuvalu	2906	3167	4275	4411	-			-0.65	
	Vanuatu	2923	2836	3118	2763	6.7	3.74		-0.46	
	Venezuela					8.9	2.25	5.08	-1.78	2.934
	Yemen					3.4	3.70	4.20	-2.31	
190	World	9886	12425	16867	16135	7.9				2