THE INTENSITY OF THE CORRELATION BETWEEN THE HUMAN DEVELOPMENT INDEX, RESPECTIVELY THE HAPPY PLANET INDEX AND THE LIFE EXPECTANCY, IN ROMANIA

Gabriela Opait
gabriela.opait@ugal.ro
Dunarea de Jos University of Galați, Romania

This paper reflects the research concerning the intensity of the correlation between the Human Development Index, respectively the Happy Planet Index and the Life Expectancy in Romania, through by means of the Pearson correlation coefficient and the correlation report. The Happy Planet Index (HPI) is a new indicator which expresses the progress in any country, and also, we can say that the Happy Planet Index is a measure of sustainable well-being.

Key words: the Human Development Index, the Happy Planet Index, the Life Expectancy.

JEL Code: C1, C12, C2.

1. Introduction

This research reflects a statistical analysis of the intensity of the correlation between the Human Development Index and the Life Expectancy, respectively the Happy Planet Index and the Life Expectancy in Romania. The purpose of the research expresses the possibility for to reflect the trend model and the intensity of the correlation, between the Human Development Index and the Life Expectancy, respectively the Happy Planet Index and the Life Expectancy in Romania. The statistical methods applied are the „Coefficients of Variation Method", the „Least Squares Method", used for to calculate the parameters of the regression equation and the Pearson Coefficient of Correlation Method. The sections 2 presents the methodology of the „Least Squares Method" for to achieve the trend model between the Human Development Index and the Life Expectancy in Romania, in the period 2005-2013, in the view of the calculation of the Pearson correlation coefficient. The section 3 expresses also, the methodology for to reflect the trend model between the Happy Planet Index and the Life Expectancy in Romania, between 2006-2012 and for to calculate the correlation report. The state of the art in this domain is represented by the research belongs to Carl Friederich Gauss, who created the „Least Squares Method" and Karl Pearson who elaborated the Pearson correlation coefficient [1], [5].

2. The modeling of the trend between the Human Development Index and the Life Expectancy in Romania, in the period 2005-2013.

In the period 2005-2013, we observe the next evolution concerning the Human Development Index and the Life Expectancyin Romania, according to the table no. 1:

Table no. 1 The values regarding the Human Development Index and the Life Expectancy in Romania, between 2005-2013

YEARS	THE HUMAN DEVELOPMENT INDEX IN ROMANIA (HDI)	THE LIFE EXPECTANCY IN ROMANIA (YEARS)
2005	0,750	72,30
2006	0,763	72,80
2007	0,772	73,30
2008	0,781	73,50
2009	0,784	73,60
2010	0,779	73,80
2011	0,782	74,60
2012	0,782	74,50
2013	0,785	74,45

The sourse: dates debated from „Human Development Report 2014", United Nations Development Programme

First, we want to identify the trend model between the **Human Development Index** and the **Life Expectancy**, in Romania, in the period 2005-2013, using the table no.1.

- if we formulate the null hypothesis H_0 *:* which mentions the assumption of the existence for the model of tendency of the correlation between *Y factor = Life Expectancy* and *X factor = Human Develoment Index*, as being the function $y_{x_i} = a + b \cdot x_i$, then the parameters *a* and *b* of the adjusted linear function, can to be calculated by means of the next system [1]:

$$\begin{cases} n \cdot a + b\sum_{i=1}^{n} x_i = \sum_{i=1}^{n} y_i \\ a\sum_{i=1}^{n} x_i + b \cdot \sum_{i=1}^{n} x_i^2 = \sum_{i=1}^{n} x_i \cdot y_i \end{cases}$$

Thus, $$a = \frac{\sum_{i=1}^{n} x_i^2 \sum_{i=1}^{n} y_i - \sum_{i=1}^{n} x_i \sum_{i=1}^{n} x_i y_i}{n\sum_{i=1}^{n} x_i^2 - (\sum_{i=1}^{n} x_i)^2}$$ and $$b = \frac{n\sum_{i=1}^{n} x_i y_i - \sum_{i=1}^{n} x_i \sum_{i=1}^{n} y_i}{n\sum_{i=1}^{n} x_i^2 - (\sum_{i=1}^{n} x_i)^2}$$

Table no. 2 The estimate of the value for the variation coefficient in the case of the adjusted linear function, in the hypothesis concerning the linear evolution of the correlation between the Human Development Index and the Life Expectancy in Romania, in the period 2005-2013

YEARS	THE HUMAN DEVELOP-MENT INDEX IN ROMANIA (HDI) (x_i)	THE LIFE EXPEC-TANCY IN ROMANIA (y_i)	*LINEAR TREND*			
			x_i^2	$x_i y_i$	$y_{x_i} = a + bx_i$	$\lvert y_i - y_{x_i} \rvert$
2005	0,750	72,30	0,562500	54,22500	72,16721821	0,13278179
2006	0,763	72,80	0,582169	55,54640	72,92809366	0,12809366
2007	0,772	73,30	0,595984	56,58760	73,45485359	0,15485359
2008	0,781	73,50	0,609961	57,40350	73,98161352	0,48161352
2009	0,784	73,60	0,614656	57,70240	74,15720016	0,55720016
2010	0,779	73,80	0,606841	57,49020	73,86455576	0,06455576
2011	0,782	74,60	0,611524	58,33720	74,04014240	0,55985760
2012	0,782	74,50	0,611524	58,25900	74,04014240	0,45985760
2013	0,785	74,45	0,616225	58,44325	74,21572904	0,23427096
TOTAL	6,978	662,85	5,411384	513,99455	662,8495487	2,77308464

If we calculate the statistical data for to adjust the linear function, we obtain for the parameters *a* and *b* the values:

$$a = \frac{5{,}411384 \cdot 662{,}85 - 6{,}978 \cdot 513{,}99455}{9 \cdot 5{,}411384 - (6{,}978)^2} = 28{,}27055756$$

$$b = \frac{9 \cdot 513{,}99455 - 6{,}978 \cdot 662{,}85}{9 \cdot 5{,}411384 - (6{,}978)^2} = 58{,}52888087$$

Hence, the coefficient of variation for the adjusted linear function is:

$$v_I = \left[\frac{\sum_{i=1}^{n}\left|y_i - y_{x_i}^I\right|}{n} : \frac{\sum_{i=1}^{n} y_i}{n}\right]\cdot 100 = \frac{\sum_{i=1}^{n}\left|y_i - y_{x_i}^I\right|}{\sum_{i=1}^{n} y_i}\cdot 100 = \frac{2,77308464}{662,85}\cdot 100 = 0,418357794\%$$

- in the situation of the alternative hypothesis H_1 *: which specifies the supposition of the existence for the model of tendency of the correlation between* *Y factor = Life Expectancy* and *X factor = Human Develoment Index*, as being the quadratic function $y_{x_i} = a + b\cdot x_i + cx_i^2$, the parameters *a*, *b* şi *c* of the adjusted quadratic function, can to be calculated by means of the system:

$$\begin{cases} n\cdot a + b\sum_{i=1}^{n} x_i + c\sum_{i=1}^{n} x_i^2 = \sum_{i=1}^{n} y_i \\ a\sum_{i=1}^{n} x_i + b\cdot\sum_{i=1}^{n} x_i^2 + c\sum_{i=1}^{n} x_i^3 = \sum_{i=1}^{n} x_i\cdot y_i \\ a\cdot\sum_{i=1}^{n} x_i^2 + b\sum_{i=1}^{n} x_i^3 + c\sum_{i=1}^{n} x_i^4 = \sum_{i=1}^{n} x_i^2\cdot y_i \end{cases}$$

Table no. 3 The estimate of the value for the variation coefficient in the case of the adjusted quadratic function, in the hypothesis concerning the parabolic evolution of the correlation between the Human Development Index and the Life Expectancy in Romania, in the period 2005-2013

YEARS	THE HUMAN DEVELOP-MENT INDEX IN ROMANIA (HDI) (x_i)	THE LIFE EXPEC-TANCY IN ROMA-NIA (y_i)	*PARABOLIC TREND*					
			x_i^2	x_i^3	x_i^4	$x_i^2\cdot y_i$	$y_{x_i} = a + bx_i + cx_i^2$	$\left\|y_i - y_{x_i}\right\|$
2005	0,750	72,30	0,562500	0,421875	0,316406	40,6687500	72,16730395	0,13269605
2006	0,763	72,80	0,582169	0,444195	0,338921	42,3819032	72,92812178	0,12812178
2007	0,772	73,30	0,595984	0,460100	0,355197	43,6856272	73,45487671	0,15487671
2008	0,781	73,50	0,609961	0,476380	0,372052	44,8321335	73,98166018	0,48166018
2009	0,784	73,60	0,614656	0,481890	0,377802	45,2386816	74,15726101	0,55726101
2010	0,779	73,80	0,606841	0,472729	0,368256	44,7848658	73,86459472	0,06459472
2011	0,782	74,60	0,611524	0,478212	0,373962	45,6196904	74,04019344	0,55980656
2012	0,782	74,50	0,611524	0,478212	0,373962	45,558538	74,04019344	0,45980656
2013	0,785	74,45	0,616225	0,483737	0,379733	45,8779512	74,21579533	0,23420467
TOTAL	6,978	662,85	5,411384	4,197330	3,256291	398,648141	662,8500006	2,77302824

If we calculate the statistical data for to adjust the quadratic function, we obtain for the parameters *a, b* and *c* the next values

$$\begin{cases} 9\cdot a + 6,978\cdot b + 5,411384\cdot c = 662,85 \\ 6,978\cdot a + 5,411384\cdot b + 4,19733\cdot c = 513,99455 \\ 5,411384\cdot a + 4,19733\cdot b + 3,256291\cdot c = 398,648141 \end{cases}$$

$$a = 28,37480223\ ;\ b = 58,25784641\ ;\ c = 0,176207763$$

So, the coefficient of variation for the adjusted quadratic function has the value:

$$v_{II} = \left[\frac{\sum_{i=1}^{n} \left| y_i - y_{x_i}^{II} \right|}{n} : \frac{\sum_{i=1}^{n} y_i}{n} \right] \cdot 100 = \frac{\sum_{i=1}^{n} \left| y_i - y_{x_i}^{II} \right|}{\sum_{i=1}^{n} y_i} \cdot 100 = \frac{2{,}77302824}{662{,}85} \cdot 100 = 0{,}418349285\%$$

- in the case of the alternative hypothesis H_2 *: which describes the assumption of the existence for the model of tendency of the of the correlation between Y factor = Life Expectancy* and *X factor = Human Develoment Index*, as being the exponential function $y_{x_i} = ab^{x_i}$, then the parameters *a* and *b* of the adjusted exponential function, can to be calculated by means of the next system:

$$\begin{cases} n \cdot \lg a + \lg b \cdot \sum_{i=1}^{n} x_i = \sum_{i=1}^{n} \lg y_i \\ \lg a \cdot \sum_{i=1}^{n} x_i + \lg b \cdot \sum_{i=1}^{n} x_i^2 = \sum_{i=1}^{n} x_i \cdot \lg y_i \end{cases}$$

Table no. 4 The estimate of the value for the variation coefficient in the case of the adjusted quadratic function, in the hypothesis concerning the exponential evolution of the correlation between the Human Development Index and the Life Expectancy in Romania, in the period 2005-2013

YEARS	THE HUMAN DEVELOP-MENT INDEX IN ROMANIA (HDI) (x_i)	THE LIFE EXPEC-TANCY IN ROMA-NIA (y_i)	*EXPONENTIAL TREND*				
			$\lg y_i$	$x_i \lg y_i$	$\lg y_{x_i} = \lg a + x_i \cdot \lg b$	$y_{x_i} = ab^{x_i}$	$\lvert y_i - y_{x_i} \rvert$
2005	0,750	72,30	1,859138297	1,394353723	1,858374449	72,17294861	0,12705139
2006	0,763	72,80	1,862131379	1,420806242	1,862879472	72,9255095	0,12550950
2007	0,772	73,30	1,865103975	1,439860268	1,865998335	73,45110519	0,15110519
2008	0,781	73,50	1,866287339	1,457570412	1,869117198	73,98048901	0,48048901
2009	0,784	73,60	1,866877814	1,463632206	1,870156819	74,15779680	0-,5577968
2010	0,779	73,80	1,868056362	1,455215906	1,868424117	73,86251940	0,0625194
2011	0,782	74,60	1,872738827	1,464481763	1,869463738	74,03954445	0,56045555
2012	0,782	74,50	1,872156273	1,464026205	1,869463738	74,03954445	0,46045555
2013	0,785	74,45	1,871864702	1,469413791	1,870503359	74,21699378	0,23300622
TOTAL	6,978	662,85	16,80435497	13,02936052			2,75838861

Consequently, if we calculate the statistical data for to adjust the exponential function, we obtain for the parameters *a* and *b* the values:

$$\begin{cases} 9 \cdot \lg a + 6{,}978 \cdot \lg b \cdot = 16{,}80435497 \\ 6{,}978 \cdot \lg a + 5{,}411384 \cdot \lg b = 13{,}02936052 \end{cases}$$

$$\lg a = \frac{\begin{vmatrix} 16{,}80435497 & 6{,}978 \\ 13{,}02936052 & 5{,}411384 \end{vmatrix}}{\begin{vmatrix} 9 & 6{,}978 \\ 6{,}978 & 5{,}411384 \end{vmatrix}} = 1{,}598469214$$

$$\lg b = \frac{\begin{vmatrix} 9 & 16{,}80435497 \\ 6{,}978 & 13{,}02936052 \end{vmatrix}}{\begin{vmatrix} 9 & 6{,}978 \\ 6{,}978 & 5{,}411384 \end{vmatrix}} = 0{,}346540312$$

Accordingly, the coefficient of variation for the adjusted exponential function has the next value:

$$v_{\exp} = \left[\frac{\sum_{i=1}^{n}\left|y_i - y_{x_i}^{\exp}\right|}{n} : \frac{\sum_{i=1}^{n} y_i}{n}\right] \cdot 100 = \frac{\sum_{i=1}^{n}\left|y_i - y_{x_i}^{\exp}\right|}{\sum_{i=1}^{n} y_i} \cdot 100 = \frac{2{,}75838861}{662{,}85} \cdot 100 = 0{,}416140697\%$$

We apply the coefficients of variation method as criterion of selection for the best model of trend.
We notice that:

$$v_{\exp} = 0{,}416140697\% < v_{II} = 0{,}418349285\% < v_I = 0{,}418357794\%$$

So, the path followed by* Y *factor is an exponential trend *of the shape* $y_{x_i} = ab^{x_i}$*, with other words it confirms the hypothesis* H_2.

For to reflect the intensity of the exponential correlation between the Human Development Index and the Life Expectancy in Romania, in the period 2005-1013 we use the Pearson correlation coefficient noted with *r*:

Table no. 5 The calculation of the value for Pearson correlation coefficient in the case of the exponential correlation between the Human Development Index and the Life Expectancy in Romania, in the period 2005-2013

YEARS	THE HUMAN DEVELOP-MENT INDEX IN ROMANIA (HDI) (x_i)	THE LIFE EXPEC-TANCY IN ROMA-NIA (y_i)	$\lg y_i$	$x_i \lg y_i$	x_i^2	$(\lg y_i)^2$
2005	0,750	72,30	1,859138297	1,394353723	0,562500	3,456395207
2006	0,763	72,80	1,862131379	1,420806242	0,582169	3,467533273
2007	0,772	73,30	1,865103975	1,439860268	0,595984	3,478612838
2008	0,781	73,50	1,866287339	1,457570412	0,609961	3,483028432
2009	0,784	73,60	1,866877814	1,463632206	0,614656	3,485232772
2010	0,779	73,80	1,868056362	1,455215906	0,606841	3,489634572
2011	0,782	74,60	1,872738827	1,464481763	0,611524	3,507150714
2012	0,782	74,50	1,872156273	1,464026205	0,611524	3,504969111
2013	0,785	74,45	1,871864702	1,469413791	0,616225	3,503877463
TOTAL	6,978	662,85	16,80435497	13,02936052	5,411384	31,37643438

$$r = \frac{n\sum_{i=1}^{n} x_i \lg y_i - \sum_{i=1}^{n} x_i \cdot \sum_{i=1}^{n} \lg y_i}{\sqrt{[n\sum_{i=1}^{n} x_i^2 - (\sum_{i=1}^{n} x_i)^2][n\sum_{i=1}^{n} (\lg y_i)^2 - (\sum_{i=1}^{n} \lg y_i)^2]}} =$$

$$= \frac{9 \cdot 13{,}02936052 - 6{,}978 \cdot 16{,}80435497}{\sqrt{[9 \cdot 5{,}411384 - (6{,}978)^2][9 \cdot 31{,}37643438 - (16{,}80435497)^2]}} = 0{,}87$$

In conclusion, because the value of the Pearson correlation coefficient tends to 1, there is a very strong correlation between the Human Development Index and the Life Expectancy in Romania, in the period 2005-2013.

3. The modeling of the trend between the Happy Planet Index and the Life Expectnacy in Romania, in the period 2006-2012.

In the period 2006-2012, we observe the next evolution concerning the Happy Planet Index and the Life Expectancyin Romania, according to the table no. 6:

Table no. 6 The values regarding the Happy Planet Index and the Life Expectancy in Romania, between 2006-2012

YEARS	THE HAPPY PLANET INDEX IN ROMANIA (HPI)	THE LIFE EXPECTANCY IN ROMANIA (YEARS)
2006	37,72	72,80
2007	44,30	73,30
2008	44,40	73,50
2009	43,90	73,60
2010	43,70	73,80
2011	44,90	74,60
2012	42,20	74,50

Source: dates debated from „The Happy Planet Index 2012 Report – A global index of sustainable well-being" „World Happiness Report 2013"

Also, we want to identify the trend model between the **Happy Planet Index** and the **Life Expectancy**, in Romania, in the period 2006-2013, using the table no.6.

- if we formulate the null hypothesis H_0 *:* which mentions the assumption of the existence for the model of tendency of the correlation between *Y factor = Life Expectancy* and *Z factor = Happy Planet Index*, as being the function $y_{x_i} = a + b \cdot z_i$, then the parameters *a* and *b* of the adjusted linear function, can to be calculated by means of the next system [1]:

$$\begin{cases} n \cdot a + b\sum_{i=1}^{n} z_i = \sum_{i=1}^{n} y_i \\ a\sum_{i=1}^{n} z_i + b \cdot \sum_{i=1}^{n} z_i^2 = \sum_{i=1}^{n} z_i \cdot y_i \end{cases}$$

Thus, $$a = \frac{\sum_{i=1}^{n} z_i^2 \sum_{i=1}^{n} y_i - \sum_{i=1}^{n} z_i \sum_{i=1}^{n} z_i y_i}{n\sum_{i=1}^{n} z_i^2 - (\sum_{i=1}^{n} z_i)^2}$$ and $$b = \frac{n\sum_{i=1}^{n} z_i y_i - \sum_{i=1}^{n} z_i \sum_{i=1}^{n} y_i}{n\sum_{i=1}^{n} z_i^2 - (\sum_{i=1}^{n} z_i)^2}$$

Table no. 7 The estimate of the value for the variation coefficient in the case of the adjusted linear function, in the hypothesis concerning the linear evolution of the correlation between the Happy Planet Index and the Life Expectancy in Romania, in the period 2006-2012

YEARS	THE HAPPY PLANET INDEX IN ROMANIA (HPI) (z_i)	THE LIFE EXPEC-TANCY IN ROMANIA (y_i)	*LINEAR TREND*			
			z_i^2	$z_i y_i$	$y_{z_i} = a + bz_i$	$\lvert y_i - y_{z_i} \rvert$
2006	37,72	72,80	1422,7984	2746,016	73,01441658	0,21
2007	44,30	73,30	1962,4900	3247,190	73,90152131	0,60
2008	44,40	73,50	1971,3600	3263,400	73,91500314	0,42

2009	43,90	73,60	1927,2100	3231,040	73,84759397	0,25
2010	43,70	73,80	1909,6900	3225,060	73,82063030	0,02
2011	44,90	74,60	2016,0100	3349,540	73,98241232	0,62
2012	42,20	74,50	1780,8400	3143,900	73,61840277	0,88
TOTAL	301,12	516,1	12990,3984	22206,146	516,1000000	3,00

If we calculate the statistical data for to adjust the linear function, we obtain for the parameters *a* and *b* the values:

$$a = \frac{12990{,}3984 \cdot 516{,}1 - 301{,}12 \cdot 22206{,}146}{7 \cdot 12990{,}3984 - (301{,}12)^2} = 67{,}92906836$$

$$b = \frac{7 \cdot 22206{,}146 - 301{,}12 \cdot 516{,}1}{7 \cdot 12990{,}3984 - (301{,}12)^2} = 0{,}134818351$$

Hence, the coefficient of variation for the adjusted linear function is:

$$v_I = \left[\frac{\sum_{i=1}^{n} \left| y_i - y_{z_i}^I \right|}{n} : \frac{\sum_{i=1}^{n} y_i}{n} \right] \cdot 100 = \frac{\sum_{i=1}^{n} \left| y_i - y_{z_i}^I \right|}{\sum_{i=1}^{n} y_i} \cdot 100 = \frac{3}{516{,}1} \cdot 100 = 0{,}581\%$$

- in the situation of the alternative hypothesis H_1 : which specifies the supposition of the existence for the model of tendency of the correlation between *Y factor = Life Expectancy* and *Z factor = Happy Planet Index*, as being the quadratic function $y_{z_i} = a + b \cdot z_i + c z_i^2$, the parameters *a*, *b* şi *c* of the adjusted quadratic function, can to be calculated by means of the system:

$$\begin{cases} n \cdot a + b\sum_{i=1}^{n} z_i + c\sum_{i=1}^{n} z_i^2 = \sum_{i=1}^{n} y_i \\ a\sum_{i=1}^{n} z_i + b \cdot \sum_{i=1}^{n} z_i^2 + c\sum_{i=1}^{n} z_i^3 = \sum_{i=1}^{n} z_i \cdot y_i \\ a \cdot \sum_{i=1}^{n} z_i^2 + b\sum_{i=1}^{n} z_i^3 + c\sum_{i=1}^{n} z_i^4 = \sum_{i=1}^{n} z_i^2 \cdot y_i \end{cases}$$

Table no. 8 The estimate of the value for the variation coefficient in the case of the adjusted quadratic function, in the hypothesis concerning the parabolic evolution of the correlation between the Happy Planet Index and the Life Expectancy in Romania, in the period 2006-2012

YEARS	THE HAPPY PLANET INDEX IN ROMANIA (HPI) (z_i)	THE LIFE EXPEC-TANCY IN ROMA-NIA (y_i)	*PARABOLIC TREND*					
			z_i^2	z_i^3	z_i^4	$z_i^2 \cdot y_i$	$y_{z_i} = a + bz_i + cz_i^2$	$\left\|y_i - y_{z_i}\right\|$
2006	37,72	72,80	1422,7984	53667,956	2024355,287	103579,7235	72,85659236	0,06
2007	44,30	73,30	1962,4900	86938,307	3851367,000	143850,5170	73,84866626	0,55
2008	44,40	73,50	1971,3600	87528,384	3886260,250	144894,9600	73,83106543	0,33
2009	43,90	73,60	1927,2100	84604,519	3714138,384	141842,6560	73,90928606	0,31
2010	43,70	73,80	1909,6900	83453,453	3646915,896	140935,1220	73,93372570	0,13

2011	44,90	74,60	2016,0100	90518,849	4064296,320	150394,3460	73,72838511	0,87
2012	42,20	74,50	1780,8400	75151,448	3171391,106	132672,5800	73,99227869	0,51
TOTAL	301,12	516,1	12990,3984	561862,916	24358724,24	958169,9045	516,1000000	2,76

If we calculate the statistical data for to adjust the quadratic function, we obtain for the parameters *a, b* and *c* the next values

$$\begin{cases} 7\cdot a + 301{,}12\cdot b + 12990{,}3984\cdot c = 516{,}1 \\ 301{,}12\cdot a + 12990{,}3984\cdot b + 561862{,}9157\cdot c = 22206{,}146 \\ 12990{,}3984\cdot a + 561862{,}9157\cdot b + 24358724{,}24\cdot c = 958169{,}9045 \end{cases}$$

$$a = -14{,}57426803 \;;\; b = 4{,}163123238 \;;\; c = -0{,}048919192$$

So, the coefficient of variation for the adjusted quadratic function has the value:

$$v_{II} = \left[\frac{\sum_{i=1}^{n}\left|y_i - y_{z_i}^{II}\right|}{n} : \frac{\sum_{i=1}^{n} y_i}{n}\right]\cdot 100 = \frac{\sum_{i=1}^{n}\left|y_i - y_{z_i}^{II}\right|}{\sum_{i=1}^{n} y_i}\cdot 100 = \frac{2{,}76}{516{,}1}\cdot 100 = 0{,}535\%$$

- in the case of the alternative hypothesis H_2 *:* which describes the assumption of the existence for the model of tendency of the of the correlation between *Y factor = Life Expectancy* and *Z factor = Happy Planet Index*, as being the exponential function $y_{z_i} = ab^{z_i}$, then the parameters *a* and *b* of the adjusted exponential function, can to be calculated by means of the next system:

$$\begin{cases} n\cdot \lg a + \lg b\cdot \sum_{i=1}^{n} z_i = \sum_{i=1}^{n} \lg y_i \\ \lg a\cdot \sum_{i=1}^{n} z_i + \lg b\cdot \sum_{i=1}^{n} z_i^2 = \sum_{i=1}^{n} z_i\cdot \lg y_i \end{cases}$$

Table no. 9 The estimate of the value for the variation coefficient in the case of the adjusted quadratic function, in the hypothesis concerning the exponential evolution of the correlation between the Happy Planet Index and the Life Expectancy in Romania, in the period 2006-2012

YEARS	THE HAPPY PLANET INDEX IN ROMANIA (HDI) (z_i)	THE LIFE EXPEC-TANCY IN ROMA-NIA (y_i)	*EXPONENTIAL TREND*				
			$\lg y_i$	$z_i \lg y_i$	$\lg y_{z_i} = \lg a + z_i\cdot \lg b$	$y_{z_i} = ab^{z_i}$	$\left\|y_i - y_{z_i}\right\|$
2006	37,72	72,80	1,862131379	70,23959563	1,863395851	73,01227000	0,21
2007	44,30	73,30	1,865103975	82,62410608	1,868644964	73,90008942	0,60
2008	44,40	73,50	1,866287339	82,86315786	1,868724738	73,91366516	0,41
2009	43,90	73,60	1,866877814	81,95593605	1,868325867	73,84581139	0,25
2010	43,70	73,80	1,868056362	81,63406301	1,868166318	73,81868732	0,02
2011	44,90	74,60	1,872738827	84,08597335	1,869123610	73,98158128	0,62
2012	42,20	74,50	1,872156273	79,00499471	1,866969704	73,61557414	0,88
TOTAL	301,12	662,85	13,07335197	562,4078267			2,99

Consequently, if we calculate the statistical data for to adjust the exponential function, we obtain for the parameters *a* and *b* the values:

$$\begin{cases} 7 \cdot \lg a + 301{,}12 \cdot \lg b \cdot = 13{,}07335197 \\ 301{,}12 \cdot \lg a + 12990{,}3984 \cdot \lg b = 562{,}4078267 \end{cases}$$

$$\lg a = \frac{\begin{vmatrix} 13{,}07335197 & 301{,}12 \\ 562{,}4078267 & 12990{,}3984 \end{vmatrix}}{\begin{vmatrix} 7 & 301{,}12 \\ 301{,}12 & 12990{,}3984 \end{vmatrix}} = 1{,}833304949$$

$$\lg b = \frac{\begin{vmatrix} 7 & 13{,}073335197 \\ 301{,}12 & 562{,}4078267 \end{vmatrix}}{\begin{vmatrix} 7 & 301{,}12 \\ 301{,}12 & 12990{,}3984 \end{vmatrix}} = 0{,}000797743$$

Accordingly, the coefficient of variation for the adjusted exponential function has the next value:

$$v_{\exp} = \left[\frac{\sum_{i=1}^{n} \left| y_i - y_{z_i}^{\exp} \right|}{n} : \frac{\sum_{i=1}^{n} y_i}{n} \right] \cdot 100 = \frac{\sum_{i=1}^{n} \left| y_i - y_{z_i}^{\exp} \right|}{\sum_{i=1}^{n} y_i} \cdot 100 = \frac{2{,}99}{516{,}1} \cdot 100 = 0{,}579\%$$

We apply the coefficients of variation method as criterion of selection for the best model of trend.
We notice that:

$$v_{II} = 0{,}535\% < v_{\exp} = 0{,}579\% < v_I = 0{,}581\%$$

So, the path followed by Z factor is a parabolical trend *of the shape* $y_{z_i} = a + b \cdot z_i + c z_i^2$*, with other words it confirms the hypothesis* H_1 .

For to reflect the intensity of the parabolical correlation between the Happy Planet Index and the Life Expectancy in Romania, in the period 2006-2012, we use the correlation report noted with η :

Table no. 10 The calculation of the value for Pearson correlation coefficient in the case of the exponential correlation between the Human Development Index and the Life Expectancy in Romania, in the period 2006-2012

YEARS	THE HAPPY PLANET INDEX IN ROMANIA (HPI) (z_i)	THE LIFE EXPECTANCY IN ROMANIA (y_i)	$z_i^2 y_i$	$(y_i)^2$	$z_i y_i$
2006	37,72	72,80	103579,7235	5299,84	2746,016
2007	44,30	73,30	143850,5170	5372,89	3247,190
2008	44,40	73,50	144894,9600	5402,25	3263,400
2009	43,90	73,60	141842,6560	5416,96	3231,040
2010	43,70	73,80	140935,1220	5446,44	3225,060
2011	44,90	74,60	150394,3460	5565,16	3349,540
2012	42,20	74,50	132672,5800	5550,25	3143,900
TOTAL	301,12	662,85	958169,9045	38053,79	22206,146

$$\eta = \sqrt{\frac{a\sum_{i=1}^{n} y_i + b\sum_{i=1}^{n} z_i y_i + c\sum_{i=1}^{n} z_i^2 y_i - \frac{\left(\sum_{i=1}^{n} y_i\right)^2}{n}}{\sum_{i=1}^{n} y_i^2 - \frac{\left(\sum_{i=1}^{n} y_i\right)^2}{n}}} =$$

$$= \sqrt{\frac{(-14{,}57426803)\cdot 516{,}1 + 4{,}163123238\cdot 22206{,}146 + (-0{,}048919192)\cdot 958169{,}9045 - \frac{(516{,}1)^2}{7}}{38053{,}79 - \frac{(516{,}1)^2}{7}}} = 0{,}612903905$$

In conclusion, because the value of the correlation report tends to 1, there is a strong correlation between the Happy Planet Index and the Life Expectancy in Romania, in the period 2006-2012.

4. Conclusions

We can to synthesize that, there is a correlation of exponential type between the Human Development Index and the Life Expectancy in Romania, which it reflects that the Life Expectancy in this country increases in a geometrical progression in a very strong correlation with the Human Development Index, in the period 2005-2013. Also, there is a strong influence of the Happy Planet Index upon the Life Expectancy in Romania, in the period 2006-2012 and in background, the correlation between the Happy Planet Index and the Life Expectancy Index reflects a parabolical trend.

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