

RELATION BETWEEN THE EXTENT OF FORESTS AND LIFE EXPECTANCY AT BIRTH

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ABSTRACT

A forest should not be simply regarded as a set of trees, it means much more than that. With no exaggeration, forests are indispensable for preserving the health of the human body and soul; particularly in densely inhabited European countries. In our research, we studied various macro indicators of twenty countries in order to determine which factors are correlated with life expectancy at birth. Index numbers available included: per capita GDP (gross domestic product) (in USD); number of the country's population (n); territory of the country (km²); extent of forests (%); and Human Development Index (HDI). Our aim was to determine whether any correlation exists, and if yes, to which degree, between the extent of forests and life expectancy at birth in the different countries.

Keywords: forests, Human Development Index (HDI), health gain, gross domestic product (GDP), life expectancy at birth

INTRODUCTION

A forest is regarded in the vernacular simply as a set of trees, but it means much more than that. "A forest is the most complex natural (ecological) system on the mainland, the existence of which, due to its effects exerted on the environment, is one of the basic conditions of healthy human life" (No. 54 Hungarian Law of the year 1996). The role of forests in the lives of humans and in human society underwent many changes and great development throughout history; in our days it guards manifold-biological-ecological-values including objects (undisturbed ruins, castles, remainders of settlements), as well as national treasures and memories. At the same time, the existence of forest means the protection of the environment, sustainable development, the long-term preservation of invested capital, in summary, a pledge for the future. Among other factors, the existence of forests promotes an environmentally-conscious lifestyle within a liveable environment, the maintenance of nature's equilibrium, and regarding the formation of approaches in this regard, it contributes to the conservation of biological diversity, and the respect of nature.

The population's health and psychic status is verifiably influenced in a positive direction by an appropriate state of the environment. With no exaggeration, forests are indispensable for preserving the health of the human body and soul; particularly in the densely inhabited European countries, the society requires forests for recreation and relaxation as well.

Human health-citing Professor PÉTER RÓNA, lawyer and economist of Hungarian origin at Oxford- “is a special property, an irreplaceable commodity; its lack demolishes man’s ability to produce an income”. In society, man is of paramount value. One of the basic determinants of human capital is man’s health, the attainment and preservation of which is a shared interest of individuals and the state alike.

When economical theories are reinterpreted (paradigm change), it should be reconsidered that profit maximization expressed in money has to be replaced by an attitude which appreciates not only the monetary benefit. In association with the paradigm change, economists should cooperate with – among others – ecologists, educators, and social scientists better than up to now in order to hinder e.g. environmental damage, and appropriately estimate health and its value (Seregi, 2012).

OBJECTIVE AND METHOD

We studied various macro indicators of twenty countries in order to determine which factors are correlated with life expectancy at birth in the given countries. Index numbers available included: per capita GDP (gross domestic product) (USD); number of the country’s population (n); territory of the country (km²); extent of forests (%); and Human Development Index (HDI).

We set out to determine whether any correlation exists, and if yes, to which degree, between the extent of forests and life expectancy at birth in the individual countries.

RESULTS

We presumed that some relationship exists between the extent of forests and life expectancy at birth (CIA, 2013). After having directly examined the presumption (by fitting a regression line), we had come to the conclusion that a relationship exists between the two variables. We performed various transformations in order to analyze the correlation with the extent of forests. Following several tests (logarithmic, square root) we found that the relationship can be described best as a linear relationship. The value of the correlation between the primary variable and the extent of forests was 0.46 (Figure 1).

In the next phase, the study was aimed at building a predictive model from our variables; it had to predict life expectancy at birth as accurately as possible. The following macro variables were available for the analysis from 48 countries (2012):

- Per capita GDP (Worldbank, 2014a),
- Per capita health care expenditure in relation to GDP (Worldbank, 2014b),
- Percentage of the forested areas (Brown, 2012),
- Human Development Index (HDI) (HDRO, 2014).

The preliminary tests with a single variable found a very strong positive correlation for GDP ($R^2=0.4887$) and a somewhat weaker but still significant ($R^2=0.2963$) correlation for per capita health care expenditure.

We tested our results in a linear model (Table 1) and with Pearson Correlation (Table 2).

Figure 1

Correlation between life expectancy at birth and the extent of forests (%)

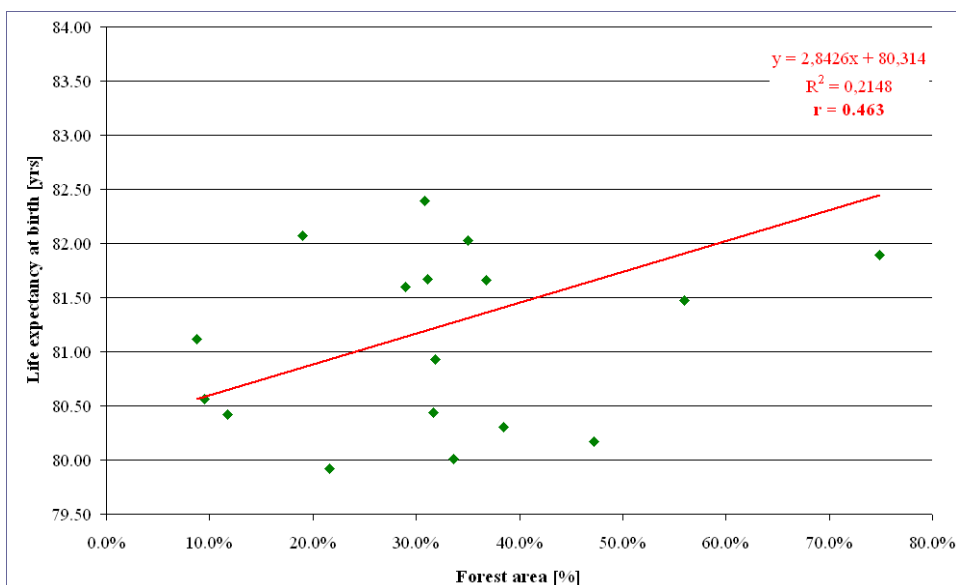


Table 1

Descriptive statistics

	Mean	Std. Deviation	N
Life expectancy (yrs)	78.998750	2.0960445	48
Extent of forests (%)	0.335446	0.1897733	48
Per capita health care expenditure	8.473345	2.7488292	48
Forests reciprocal	8.858180	22.7125983	48
GDP	3.019208E4	2.4303377E4	48

Table 2

Pearson Correlation

Correlations	Life expectancy (yrs)	Extent of forests (%)	Per capita health care expenditure	Forests reciprocal	GDP
Life expectancy	1.000	0.157	0.544	-0.130	0.699
Extent of forests (%)	0.157	1.000	0.129	-0.467	-0.024
Per capita health care expenditure	0.544	0.129	1.000	-0.324	0.349
Forests reciprocal	-0.130	-0.467	-0.324	1.000	-0.087
GDP	0.699	-0.024	0.349	-0.087	1.000

Our final model includes both GDP and health care expenditure. Both variables bear a positive beta value, i.e. a higher GDP with proportional health care expenses projects a higher age in the individual countries. Our two model variables explain nearly 59.2% of the primary variable (Table 3, Figure 2).

Table 3

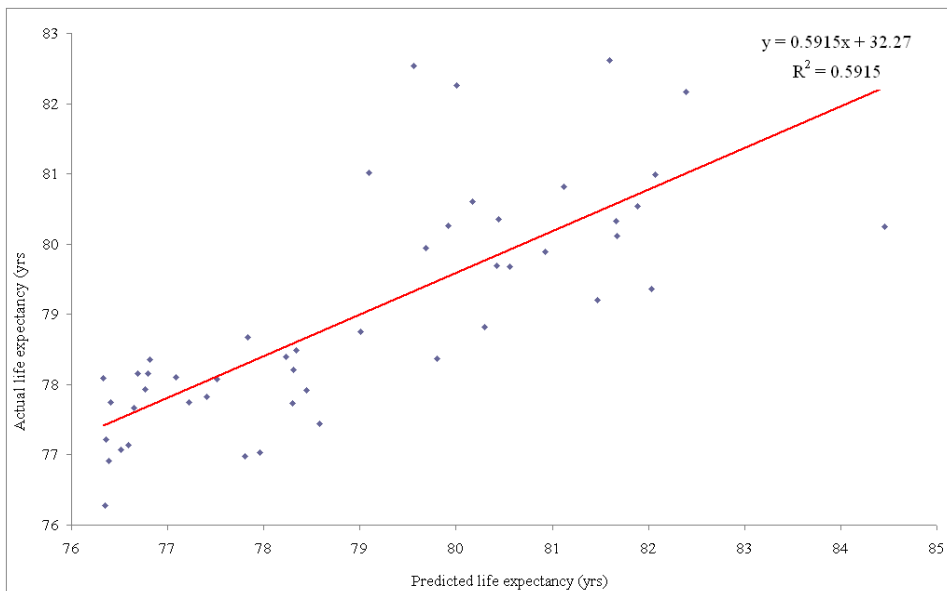
Final Model

Coefficients ^a						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	77.178	.351		219.903	.000
	GDP	6.029E-5	.000	.699	6.631	.000
2	(Constant)	75.279	.648		116.259	.000
	GDP	5.000E-5	.000	.580	5.703	.000
	Per capita health care expenditure	0.261	.078	.342	3.365	.002

a. *Dependent Variable: Life_expectancy*

Figure 2

Actual vs. predicted life expectancy



Also other analyses have demonstrated the effect exerted by the extent of forest on life expectancy at birth. In addition to the known relationship between the GDP

and life expectancy at birth, the degree of the extent of forests may also be worthwhile. We calculated the average life expectancy at birth in forty eight countries from the same database, according to an order based on the per capita GDP and an order of the extent of forests (*Table 4*).

Table 4

Average life expectancy at birth based on an order of per capita GDP and an order of the extent of forests (n=48)

Life expectancy (years), 2012		Per capita GDP, 2012		
		1-16. countries ("richer")	17-32. countries ("average")	33-48. countries ("poorer")
Extent of forests (%)	1-16. countries (greater)	81.6 ± 1.9 (n = 5)	78.5 ± 2.1 (n = 5)	76.8 ± 0.8 (n = 6)
	17-32. countries (average)	81.1 ± 1.3 (n = 6)	80.6 ± 1.4 (n = 7)	77.9 ± 0.4 (n = 3)
	33-48. countries (smaller)	80.6 ± 1.1 (n = 5)	78.6 ± 1.4 (n = 4)	77.2 ± 0.7 (n = 7)

In the first sixteen countries in an order based on their GDP the average life expectancy at birth shows a decrease (81.6 years, 81.1 years and 80.6 years on average) as the extent of the forests decreases. We observed similar tendencies also in the countries classified as "average" or "poorer". The same also applies to the setting when we calculated the average life expectancy at birth (81.1 years, 78.1 years and 77.2 years) according to the order of the rates of health care expenses in GDP and on the order of the extent of forests (*Table 5*).

Table 5

Average life expectancy at birth based on an order of the rates of health care expenses in GDP and on an order of the extent of forests (n=48)

Life expectancy (years), 2012		Health care expenses in GDP, 2012 [%]		
		1-16. countries ("richer")	17-32. countries ("average")	33-48. countries ("poorer")
Extent of forests (%)	1-16. countries (greater)	81.1 ± 1.0 (n = 6)	80.0 ± 1.0 (n = 3)	79.9 ± 3.0 (n = 7)
	17-32. countries (average)	78.1 ± 1.2 (n = 4)	79.8 ± 1.8 (n = 6)	79.1 ± 2.2 (n = 6)
	33-48. countries (higher)	77.2 ± 1.5 (n = 5)	77.7 ± 1.7 (n = 4)	77.6 ± 0.9 (n = 7)

This phenomenon can be observed even more pronouncedly in relation to the twenty richest countries based on their per capita GDP (Luxembourg, Norway, Switzerland,

Australia, Denmark, Sweden, United States, Austria, Japan, Netherlands, Ireland, Finland, Belgium, Germany, United Arab Emirates, Brunei, France, Canada, United Kingdom, New Zealand) (*Table 6*). As compared to the other countries, in countries with a higher sum of per capita GDP and also with a higher extent of forests, the positive effect of these is reflected by the life expectancy at birth: the population lives longer by 2.1 years on average in these countries.

Table 6

Average life expectancy at birth (years) based on an order according to per capita GDP and on an order of the extent of forests (n=20)

Life expectancy (years), 2012		Per capita GDP, 2012	
		1-10. countries ("richer")	11-20. countries ("poorer")
Extent of forests (%)	1-10. countries (greater)	81.6 ± 2.1 (n = 4)	80.2 ± 1.8 (n = 6)
	11-20. countries (higher)	81.0 ± 1.4 (n = 6)	79.5 ± 1.6 (n = 4)

Regarding the twenty countries with the greater extent of forests (Sweden, Finland, Japan, Dominica, South Korea, Slovenia, Panama, Spain, Bosnia and Herzegovina, Brunei, Austria, Paraguay, Croatia, Ecuador, Slovakia, Costa Rica, Greece, France, Portugal, Albania) this phenomenon can also be seen (*Table 7*).

Table 7

Average life expectancy at birth (years) based on the extent of forests and on an order according to per capita GDP (n=20)

Life expectancy (years), 2012		Extent of forests (%)	
		1-10. countries (greater)	11-20. countries (higher)
Per capita GDP, 2012	1-10. countries ("richer")	80.7 ± 2.6 (n = 7)	77.7 ± 1.1 (n = 3)
	11-20. countries ("poorer")	80.3 ± 0.8 (n = 3)	77.1 ± 1.0 (n = 7)

CONCLUSIONS

Prolongation of life expectancy at birth bears a benefit of inestimable value for the whole society. The role of the extent of forests in the health and life expectancy at birth of the population has not yet been satisfactorily demonstrated, primarily due to a dominating influence of per capita GDP; nevertheless, in the richest countries life expectancy increased in proportion to the extent of forests.

More than a decade ago attempts were already made in order to describe the correlations of life expectancy at birth. That time twenty seven indices of economy

were examined and in the final analysis nine of those were found to be significant (*Chen and Ching, 2010*). The degree of the extent of forests was one of these; the results showed a moderately strong correlation with the life expectancy at birth.

Our differing results can be explained by the increased role of recreation in the previous decade; countries producing a high GDP can spend more also for the purposes of recreation. For example, physical activity outdoors (hiking, cycling in the forest) results in lower expenses for health care. In parallel with the growing economy of the country, forests can be used for purposes of recreation therapy; it is not a mere chance that at present we obtained such a result in relation to the richer countries.

The maintenance of health requires a new approach, which may create an effective demand also for products and services generated by several branches of industry; thus an investment to health promises much higher yields than investments in any other fields. For instance, areas of the forests and their changes, timber yields can be measured statistically, but the added value (health benefit) is immeasurable, so the value of the forest(s) is inestimable.

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