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DIVERSIFICATION OF THE HEALTHY LIFE EXPECTANCY (HLE) AND THE FACTORS AFFECTING IT

Abstract

Healthy Life Expectancy (HLE) is one of fundamental indexes of the assessment of the state of health of the population. The aim of this article is to answer how HLE depends on economic development. The increase of welfare implies the existence of good living conditions influencing longer HLE estimation of the studied population. A graph of the value of the HLE in relation to health expenditure has been plotted. The relationship between them is consistent with the view that health expenditure has diminishing returns. The relationship is positive up to a certain expenditure level *per capita*. Additional expenditure beyond this level has a negligible incremental effect on the HLE.

1. Introduction

In recent researches on health inequalities, not only quantitative measures of health (the Healthy Life Expectancy), based on the probability of death, but also factors concerning the quality of life have been considered more and more frequently. There are two kinds of methods applied to measuring general health of communities: the direct and indirect methods. The direct methods involve factors characteristic of human living environment and those characterizing health service. The group of these measures describes the food supply situation in a given country, the level of consumption of medicine, alcohol, cigarettes, industrialization, employment, population density, education.

When using direct methods of measuring the state of health of a population, we apply negative and positive factors. Major negative factors are: incidence of diseases, prevalence of a disease in a given population, death rate, infant death rate. They are applied to analyses of negative health phenomena.

Positive measures are evidence of positive phenomena, i.e. good state of health of the population. They include, among others: mean length of life-span, healthy life expectancy, good nourishment, good condition of sight and hearing (see [5; 6]).

The Healthy Life Expectancy (HLE) is an indicator used for assessment of general health and of the level of health inequality.

The aim of this paper is an attempt to provide an answer to the question: how does Healthy Life Expectancy depend on socio-economic development? The author tries to answer the question: whether the more affluent countries have healthier communities due to high expenditure on health care?

If this relationship is strong, it means that economic development is an important factor initiating changes and influencing the HLE. As a rule, increase in well-being creates conditions for good living and influences subjective assessment of the state of life of the considered population. If the relationship is weak, it indicates occurrence of other important, non-economic factors influencing the level of general good health of the population.

Statistical data for 77 countries, taken from *The World Health Report 2003*, and *Human Development Report 2004* are analyzed.

2. Diversity of mean Healthy Life Expectancy

The HLE index combines information about health rates and disease incidences in a given population. The method of assessment of mean HLE was developed by D.F. Sullivan. Its ground are HLE tables based on demographic data and information acquired from representative surveys. The method involves calculating expected life-span for a given population, whereas the expected life-span is understood here as a period of life spent in different states of health. The discussed index is a subjective and positive index, which means that the value of the index is calculated on the basis of the assessment of his or her state of health by the respondent and takes into consideration detailed measures, reflecting good state of health[1] of a given person.

To calculate Healthy Life Expectancy it is necessary to have data concerning average life-span and information concerning subjective assessment of health, which are collected during representative survey of assessment of the state of health of a population. When constructing tables of life-span it is necessary to consider (see [10]) participation of people assessing their health as "bad" and "very bad" in a given age group, whereas the number of years that a person (a woman or a man) assessing her/his state of health as "good" or "very good" in the age range $[x, x + 5)$ is expressed according to the formula:

$$i=(1-\pi_x)\times L_x\,, \tag{1}$$

where L_x is a number of years to live by a person (a man or a woman) within the age range $[x, x + 5)$.

[1] The state of health of a given person can be also assessed on the basis of medical examination, but Sullivan's method takes into consideration mainly a subjective assessment of a respondent.

Total number of healthy life (D_x) is determined by:

$$D_x = \sum_{y \geq x} {}_n L_y \,. \tag{2}$$

The Healthy Life Expectancy HLE_x can be calculated on the basis of D_x value:

$$HLE_x = \frac{D_x}{l_x} \tag{3}$$

The only so far worldwide HLE research was carried out by the World Health Organisation and the results are presented in the *World Health Report 2003 – Shaping the future*. The report has revealed the HLE index characterizes the health situation in 192 countries of the world and the countries are divided into three regions, defined on the basis of their geographical position, state of economic and democratic development, the death rate of the children under 5 and the death rate level of the adults.

Countries assigned to the first region, i.e. the developing countries, comprise countries denoted in Table 1 by abbreviations Amr-A, Eur-A, Eur-B, Eur-C and Wpr-A. The letters (A, B, C, D, E) standing next to the abbreviations denote sub-regions which differ in terms of children death rates and adult death rates. The sub-region denoted by letter A comprises populations characterized by very low death rate of children and low death rate of adults; the sub-region denoted by letter B comprises populations characterized by low death rate of children and low death rate of adults; the sub-region denoted by letter D comprises populations characterized by high death rate of children and high death rate of adults; and the sub-region denoted by letter E means very high death rate of children and high death rate of adults.

Figure 1 shows diversification of HLE of men and women in developed countries in relation to mean values.

Diversification of the healthy life expectancy of women and men is not very evident in the analyzed countries. What is evident, however, is the fact that women and men have higher HLE than the mean values for the entire examined population of 192 countries. When compared to the other countries in the region, women have the shortest HLE in Turkey (62.8 years) and the longest HLE in Japan (77.7 years).

In Poland, in 2002, the HLE for women was 63.5 years and was lower than the HLE of women in Slovakia (69.4 years) and in the Czech Republic (70 years). The HLE of men in Poland was 63.1 years, in Slovakia it was quite similar (63 years), whereas in the Czech Republic it was 65.9 years.

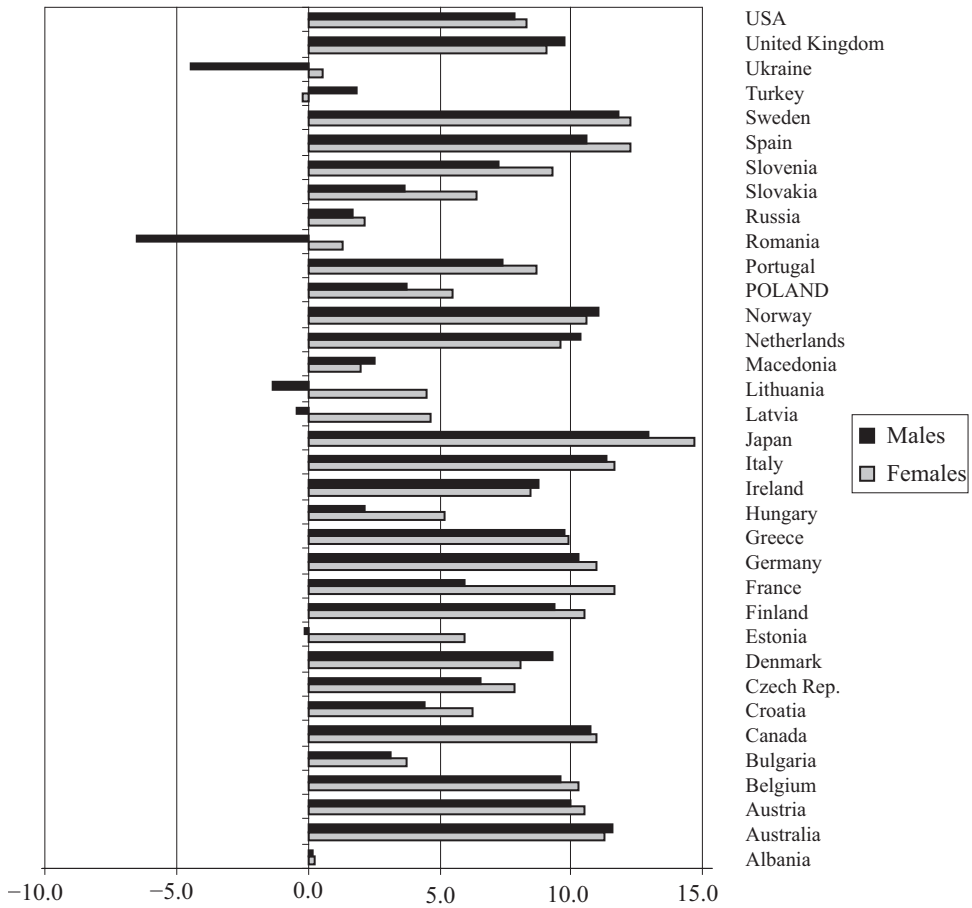

Fig. 1. Diversification of HLE of men and women in the countries assigned to the first region in relation to mean values

Source: based on [4; 8].

Only men in Estonia, Lithuania, Latvia and Ukraine have shorter healthy life expectancy than the mean value for the examined 77 countries, which may be connected with high alcohol consumption in this region of Europe. Diversification of HLE among the countries of the first region is to a large extent dependent on external factors, such as economic situation of a given country at the time of the survey, culture and tradition of a given community, tendency for complaining or optimism [7], hence even in geographically close countries results of self-assessment may be different, which affects the value of the HLE.

Countries of the second region, i.e. developing countries with high mortality, are the countries marked in Table 2 with abbreviations Afr-D, Afr-E, Amr-D, Emr-D, Sear-D.

Figure 2 shows diversification of HLE for men and women in relation to mean values in the examined population of 77 countries. In those countries, diversification of HLE for women and men is also low, but there is a large difference between the expected HLE in those countries and the mean HLE of the investigated population of 77 countries.

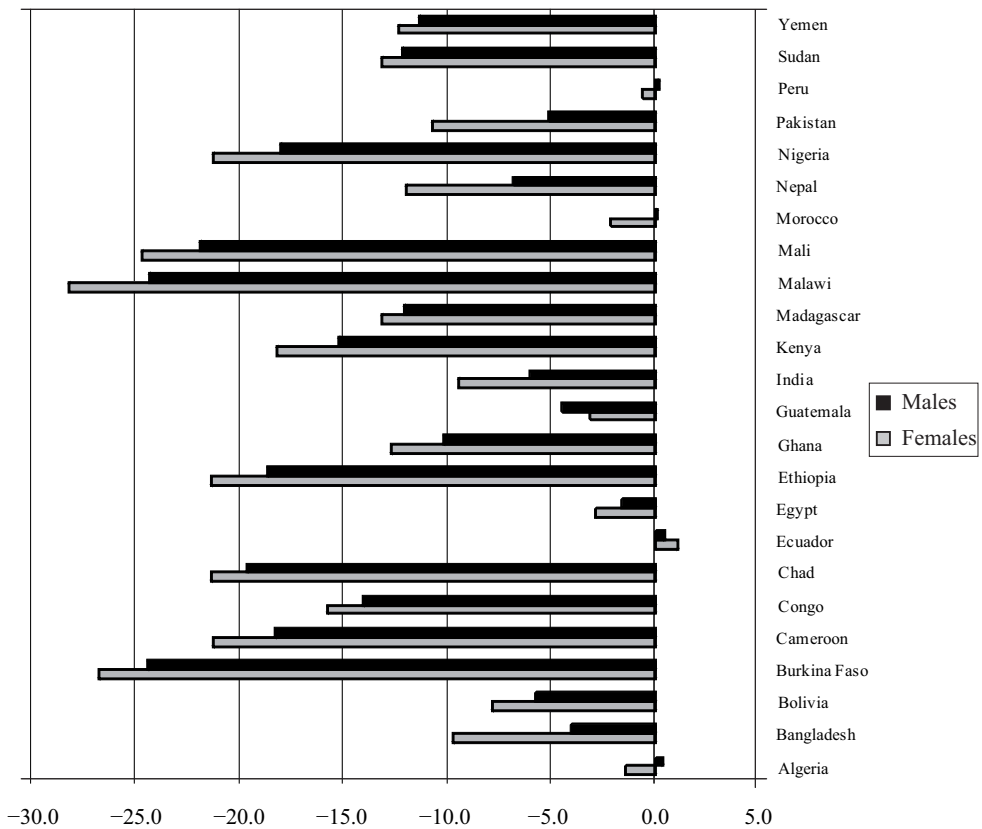

Fig. 2. Diversification of HLE for men and women from selected countries belonging to the second region in relation to mean values

Source: based on [4; 8].

Countries denoted in Table 1 with abbreviations Amr-B, EMR-B, Sear-B, Wpr-B belong to the third region, i.e. to developing countries with low mortality level.

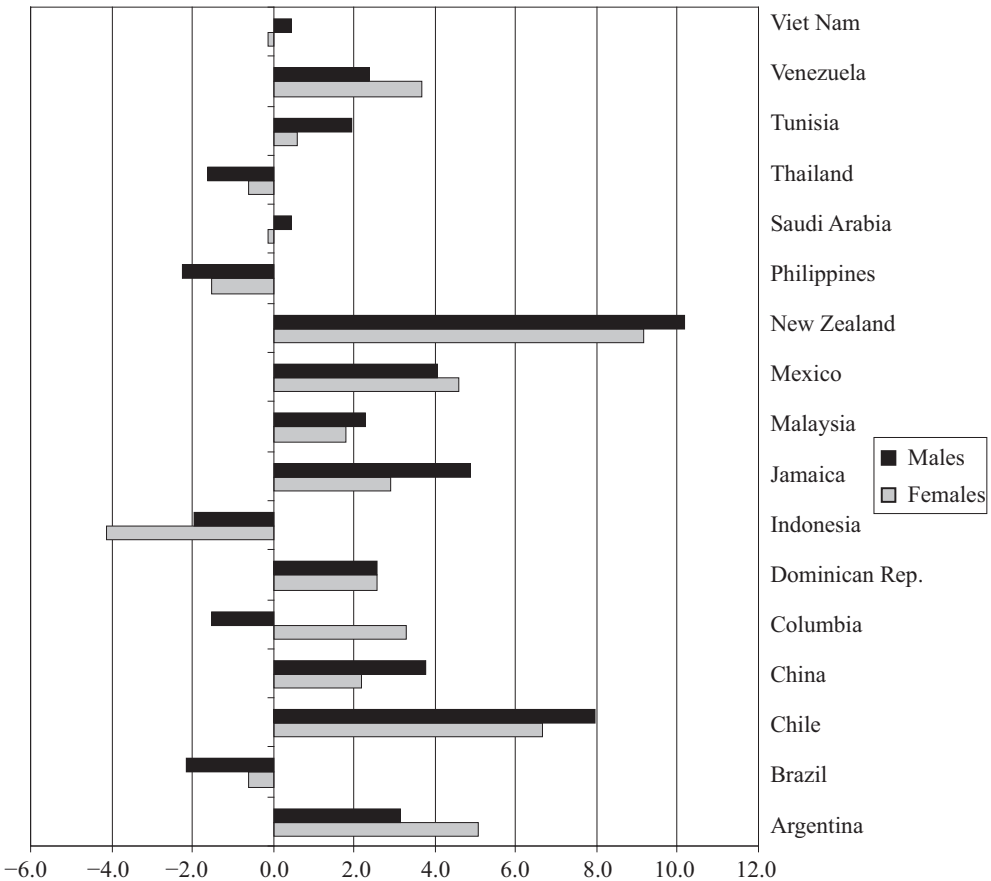

Fig. 3. Diversification of HLE for men and women from selected countries belonging to the third region in relation to mean values

Source: based on [4; 8].

The analyzed countries show a much higher diversification of the HLE for women and men than the two regions discussed earlier. In the countries assigned to this region, there are populations where HLE for men is much higher than the HLE for men in the investigated population of 77 countries.

3. Selected indexes of socio-economic development

In economics, economic development is understood as structural transformations of the economy taking place in such fields as labour, capital, natural resources, innovation, and efficiency of economy, which accompany growth of the economy. None of the statistical measures calculated so far fully reflects this type of

transformations. In practice, the value of gross domestic product (GDP) *per capita*, expressed in US dollars, according to its purchasing power (GNP *per capita* in PPP in USD) is commonly used as one of the measures of economic development.

The index used for assessment of socio-economic situation in the countries of the world is the Human Development Index (HDI). It is a measure based on:

- life span measured by average Life Expectancy Index (LEI) e_x:

$$\text{LEI} = \frac{e_x - 25}{85 - 25}, \tag{4}$$

where:

e_x – average infant's life expectancy at birth,

25 and 85 are the assumed top and bottom threshold values of the measure (e_x);

- educational index is measured by an adult literacy rate and a combined gross enrolment for primary, secondary and tertiary schools:

$$\text{EI} = \frac{2}{3} \times \text{ALI} + \frac{1}{3} \times \text{GEI}, \tag{5}$$

where:

$$\text{Adult Literacy Index} \quad \text{ALI} = \frac{\text{ALR} - 0}{100 - 0} \tag{6}$$

$$\text{Gross Enrolment Index} \quad \text{GEI} = \frac{\text{CGER} - 0}{100 - 0}, \tag{7}$$

i.e.,

ALR – adult literacy rate (ages 15 and older),

CGER – combined gross enrolment ratio for primary, secondary and tertiary schools,

0 and 100 – threshold values of the measure;

- standard of living, measured with a GNP value *per capita* at PPP in USD

$$\text{GDPI} = \frac{\log(\text{GDPpc}) - \log(100)}{\log(40000) - \log(100)}, \tag{8}$$

where:

GDPpc – GDP *per capita* at PPP in USD.

The HDI is defined as a non-weighted arithmetic average of the three indexes:

$$\text{HDI} = \frac{1}{3}(\text{LEI} + \text{EI} + \text{GDPI}). \tag{9}$$

The Human Development Index (HDI) measures achievements of individual countries in terms of development and social well-being. It was proposed by the UNO for better reflecting of achievements of individual countries in terms of improving the quality of life of their populations, monitoring of achievement of targets set by the United Nations Development Program (UNDP) and identification of problems requiring international intervention.

The index shall be used for attempted assessment of the relationship between the HLE and socio-economic development.

Another economic index taken into consideration when looking for the relationship between socio-economic development and the HLE index is the total value of expenditure for health protection. Total expenditure for health protection includes the costs of all material and human resources engaged in meeting the health needs, covered by both public and private sector. Total expenditure is the sum of consumption and investment expenses [3].

4. Relationships between socio-economic development and the HLE index

Table 1 shows the HLE index and the available socio-economic indexes of selected countries.

Table 1. The HLE index and selected socio-economic indexes

No.	Country	Abbreviated names of countries	HLE(F)	HLE(M)	GDP *per capita*	Human Development Index (HDI)	Total expenditure for health protection[2]	Class symbol in terms of GDP *per capita*
1	2	3	4	5	6	7	8	9
1	Albania	Eur-B	63.3	59.5	4830	0.781	302	UN
2	Algeria	Afr-D	61.6	59.7	5760	0.704	182	UN
3	Argentina	Amr-B	68.1	62.5	10880	0.853	956	UN
4	Australia	Wpr-A	74.3	70.9	28260	0.946	2699	W
5	Austria	Eur-A	73.5	69.3	29220	0.934	2220	W
6	Bangladesh	Sear-D	53.3	55.3	1700	0.509	54	N
7	Belgium	Eur-A	73.3	68.9	27570	0.942	2515	W
8	Bolivia	Amr-D	55.2	53.6	2460	0.681	179	UN
9	Brazil	Amr-B	62.4	57.2	7770	0.775	611	UN
10	Bulgaria	Eur-B	66.8	62.5	7130	0.796	499	U
11	Burkina Faso	Afr-D	36.3	34.9	1100	0.302	38	N
12	Cameroon	Afr-D	41.8	41.1	2000	0.501	68	N
13	Canada	Amr-A	74.0	70.1	29480	0.943	2931	W
14	Chad	Afr-D	41.7	39.7	1020	0.379	47	N
15	Chile	Amr-B	69.7	67.3	9820	0.839	642	UN
16	China	Wpr-B	65.2	63.1	4580	0.745	261	U
17	Columbia	Amr-B	66.3	57.8	6370	0.773	536	U
18	Congo	Afr-E	47.3	45.3	980	0.494	25	N
19	Croatia	Eur-A	69.3	63.8	10240	0.830	630	UN
20	Czech Rep.	Eur-A	70.9	65.9	15780	0.868	1118	UN
21	Denmark	Eur-A	71.1	68.6	30940	0.932	2583	W
22	Dominican Rep.	Amr-B	65.6	61.9	6640	0.738	295	U

[2] Classes of Gross Global Domestic Product *per capita*, according to *World Bank Atlas Method in 2001*.

Table 1, cont.

1	2	3	4	5	6	7	8	9
23	Egypt	Emr-D	60.2	57.8	3810	0.653	192	U
24	Ecuador	Amr-D	64.1	59.8	3580	0.735	197	UN
25	Estonia	Eur-C	69.0	59.2	12260	0.853	604	UN
26	Ethiopia	Afr-E	41.7	40.7	780	0.359	21	N
27	Finland	Eur-A	73.5	68.7	26190	0.935	1943	W
28	France	Eur-A	74.7	65.3	26920	0.932	2736	W
29	Germany	Eur-A	74.0	69.6	27100	0.925	2817	W
30	Ghana	Afr-D	50.3	49.2	2130	0.568	73	N
31	Greece	Eur-A	72.9	69.1	18720	0.902	1814	W
32	Guatemala	Afr-D	59.9	54.9	4080	0.649	199	N
33	Hungary	Eur-C	68.2	61.5	13400	0.848	1078	UN
34	India	Sear-D	53.6	53.3	2670	0.595	906	N
35	Indonesia	Sear-B	58.9	57.4	3230	0.692	110	N
36	Ireland	Eur-A	71.5	68.1	36360	0.936	2367	W
37	Italy	Eur-A	74.7	70.7	26430	0.920	2166	W
38	Jamaica	Amr-B	65.9	64.2	3980	0.764	234	U
39	Japan	Wpr-A	77.7	72.3	26940	0.938	2133	W
40	Kenya	Afr-E	44.8	44.1	1020	0.488	70	N
41	Korea Rep.	Sear-B	70.8	64.8	16950	0.888	57	W
42	Lithuania	Eur-C	67.7	58.9	10320	0.842	549	UN
43	Latvia	Eur-C	67.5	58.0	9210	0.823	477	UN
44	Macedonia	Eur-B	65.0	61.9	6470	0.793	341	U
45	Madagascar	Afr-D	49.9	47.3	740	0.469	18	N
46	Malawi	Afr-E	34.8	35.0	580	0.388	48	N
47	Malaysia	Wpr-B	64.8	61.6	9120	0.793	349	U
48	Mali	Afr-D	38.3	37.5	930	0.326	33	N
49	Morocco	Emr-D	60.9	59.5	3810	0.62	186	UN
50	Mexico	Amr-B	67.6	63.4	8970	0.802	55	UN
51	Nepal	Sear-D	51.1	52.5	1370	0.504	64	N
52	The Netherlands	Eur-A	72.6	69.7	29100	0.942	2564	W
53	New Zealand	Wpr-B	72.2	69.5	21740	0.926	1857	W
54	Nigeria	Afr-D	41.8	41.3	860	0.466	43	N
55	Norway	Eur-A	73.6	70.4	36600	0.956	3409	W
56	Pakistan	Emr-D	52.3	54.2	1940	0.491	62	N
57	Peru	Amr-D	62.4	59.6	5010	0.752	226	U
58	Philippines	Wpr-B	61.5	57.1	4170	0.753	153	UN
59	Poland	Eur-B	68.5	63.1	10560	0.850	657	UN
60	Portugal	Eur-A	71.7	66.7	18280	0.897	1702	W
61	Romania	EurB	65.2	61.0	6560	0.778	469	U
62	Russia	Eur-C	64.3	52.8	8230	0.795	535	U
63	Saudi Arabia	Emr-B	62.9	59.8	12650	0.768	534	UN
64	Slovakia	Eur-B	69.4	63.0	12840	0.842	723	UN
65	Slovenia	Eur-A	72.3	66.6	18540	0.895	1547	W
66	Spain	Eur-A	75.3	69.9	21460	0.922	1640	W
67	Sudan	Emr-D	49.9	47.2	1820	0.505	58	N

1	2	3	4	5	6	7	8	9
68	Sweden	Eur-A	75.3	71.1	26050	0.946	2512	W
69	Thailand	Sear-B	62.4	57.7	7010	0.768	321	U
70	Tunisia	Emr-B	63.6	61.3	6760	0.745	415	U
71	Turkey	Eur-B	62.8	61.2	6390	0.751	420	U
72	Ukraine	Eur-C	63.6	54.9	4870	0.777	210	N
73	United Kingdom	Eur-A	72.1	69.1	26150	0.936	2160	W
74	USA	Amr-A	71.3	67.2	35750	0.939	5274	W
75	Venezuela	Amr-B	66.7	61.7	5380	0.778	272	UN
76	Viet Nam	Wpr-B	62.9	59.8	2300	0.691	148	N
77	Yemen	Emr-D	50.7	48.0	870	0.482	58	N

Source: based on [4; 8].

The relationships between GDP *per capita* and the HLE(M) or HLE(F) indexes are illustrated on Fig. 4.

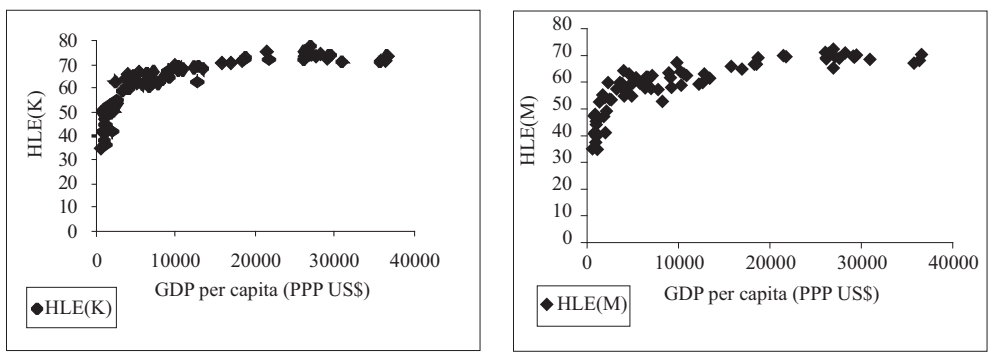

Fig. 4. The indexes HLE (M) and HLE (F) and the GDP *per capit*a (in PPP USD) in 2002

Source: based on [4; 8].

The relation between income and health is non-linear: 20% fall in GDP *per capita* (PPP in USD) has greater importance for development of the HLE value in the middle and top section of the distribution than it is for the bottom section. Equal increases of income in the countries of low income are accompanied by high HLE values. As income grows, the increases of HLE values diminish considerably.

Classification of the countries according to annual domestic income *per capita*[3] was used for further investigation. The investigated countries are divided into: countries of low income – up to 745 USD, countries of moderate income – 746 to 2975 USD, countries of moderately lower and higher income – 2976 to 9205 USD, countries of high income – from 9206 USD. Mean values and coefficients of variation of the HLE were calculated for the countries of above limits of income.

[3] The data are given in the Annex.

Table 2. The HLE Index according to gross national income *per capita*

Classes of countries according to GDP *per capita*	No. of countries	Index [Healthy Life Expectancy]							
		$\frac{\min}{\max}$	$\frac{\min}{\max}$	Countries of $\frac{\min}{\max}$ value	Countries of $\frac{\min}{\max}$ value	mean	mean	coefficient of variation %	coefficient of variation %
		F	M	F	M	F	M	F	M
Low	21	34.8	34.9	Malawi	Burkina Faso	48.8	47.31	16.68	15.6
		63.6	59.8	Ukraine	Viet Nam				
Medium	14	40.2	52.8	Romania	Russia	62.54	60.31	10.29	4.71
		66.8	64.2	Bulgaria	Jamaica				
Medium low and medium high	20	55.2	53.6	Bolivia	Bolivia	65.73	60.73	2.23	5.17
		70.9	67.3	Czech Rep.	Chile				
High	22	70.8	64.8	Korea Rep.	Korea Rep.	73.29	68.93	2.23	2.72
		77.7	72.3	Japan	Japan				

F – females, M – males

Source: based on [4; 8].

The values of the HLE index listed in Fig. 4 indicate the existence of a relationship between the HLE and the state of economy. The value of the coefficient of variation is the highest in the class of low income, which may mean that in this class even a small increase of income may result a significant growth of the HLE.

The HDI index is also used as a basis for classification of economic systems in terms of the level of social development. Classification includes: low human development – index values lower than 0.499, medium human development – index values between 0.500 and 0.799, high human development – index values equal to or higher than 0.800.

The HLE values and coefficients of variation have been calculated for the distinguished economic systems.

Table 3. The HLE index in classification of economic systems

Classification of economic systems	No. of countries	Index [Healthy Life Expectancy]							
		$\frac{\min}{\max}$	$\frac{\min}{\max}$	Countries of $\frac{\min}{\max}$ value	Countries of $\frac{\min}{\max}$ value	mean	mean	coefficient of variation %	coefficient of variation %
		F	M	F	M	F	M	F	M
Low development	12	34.8	34.9	Malawi	Burkina Faso	44.13	42.93	13.60	14.27
		52.3	54.2	Pakistan	Pakistan				
Medium development	34	44.8	41.1	Cameroon	Cameroon	61.52	57.98	10.50	9.04
		66.8	64.2	Estonia	Jamaica				
High development	31	67.5	58.0	Lithuania	Bolivia	71.97	67.18	3.80	5.64
		77.7	72.3	Japan	Japan				

F – females, M – males

Source: based on [4; 8].

It was observed (Table 3) that mean values of the HLE index grow. In the countries of low level of human development the HLE(F) is 44.13 years and the HLE(M) is 42.93 years. In medium human development, the HLE(F) is (61.52 years) and the HLE(M) is (57.98 years). In the countries of high level of human development, the average HLE(F) is 71.97 years and the average HLE(M) is 67.18 years. The highest coefficient of variation occurs in the countries of low human development.

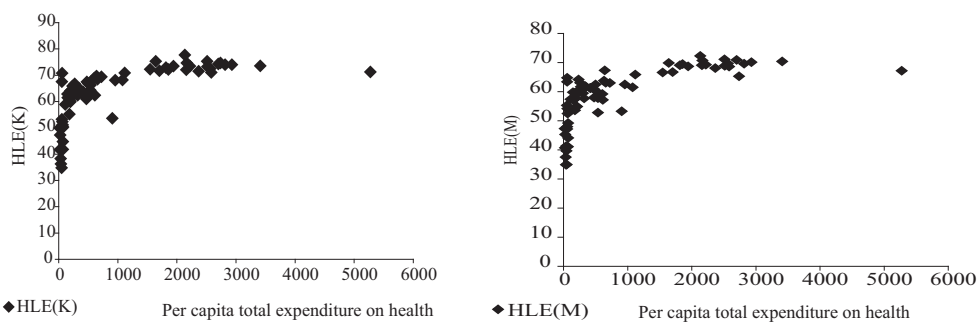

Fig. 5. HLE(F) and HLE(M) indexes and health expenditure in 2002

Source: based on [4; 8].

The relation between HLE and health expenditure (Fig. 5) seems to be subject to the law of decreasing income, which means that up to a certain level (it appears from Fig. 5 that the threshold value is c. 2800 USD *per capita*) the increase of health expenditure is accompanied by high increase of HLE. Above that level the growth of HLE is weak – the growth of health expenditure above 2800 USD *per capita* has little influence on the healthy life expectancy in a given population.

5. Econometric models of national HLE(F) and HLE(M) indexes

For the econometric models, illustrating relation of the healthy life expectancy for women HLE(F) and healthy life expectancy for men HLE(M), the following explanatory variables[3] were proposed:

ILE – the index of an Infant's Life Expectancy at birth e_x,

EI – educational index, measured by an adult literacy rate and a combined gross enrolment for primary, secondary and tertiary schools,

IGDP – standard of living measured with the value of GDP *per capita* [purchasing power parity (PPP) in United States dollars],

GDP – Gross Domestic Product *per capita* [(PPP in USD],

HDI – Human Development Index,

WZ – total health expenditure (PPP in USD).

Due to non-linear character of the relations between the endogenous variable and the exogenous variables, the power regression model was applied:

$$Y_i = \alpha_0 \cdot X_{1i}^{\alpha_1} \cdot \ldots \cdot X_{ki}^{\alpha_k} \cdot e^{\xi_i}.$$

In the first step the following models were constructed:

– for women

$$\begin{matrix} \mathrm{HLE(F)} = 39{,}804 * \mathrm{ILE}^{0{,}440} * \mathrm{EI}^{0{,}155} * \mathrm{GDP}^{0{,}069} * \mathrm{WZ}^{-0{,}006} * \mathrm{IGDP}^{-0{,}086} * \mathrm{HDI}^{-0{,}093} \\ (16{,}835)\quad (4{,}870)\quad (1{,}490)\quad (3{,}049)\quad (-1{,}051)\quad (-0{,}737)\quad (-0{,}312) \end{matrix} \tag{10}$$

$\overline{R}^2 = 0{,}977,$

– for men

$$\begin{matrix} \mathrm{HLE(M)} = 23{,}896 * \mathrm{ILE}^{0{,}549} * \mathrm{EI}^{0{,}193} * \mathrm{GDP}^{0{,}106} * \mathrm{WZ}^{0{,}001} * \mathrm{IGDP}^{-0{,}232} * \mathrm{HDI}^{-0{,}327} \\ (10{,}352)\quad (4{,}339)\quad (1{,}325)\quad (3{,}344)\quad (0{,}055)\quad (-1{,}415)\quad (-0{,}780) \end{matrix} \tag{11}$$

$\overline{R}^2 = 0{,}949,$

In the next step the model with variables of statistically significant parameters was estimated. As expected, the variable IGDP – which was basically a transformation of the GDP, as well as HDI – which was a compilation of some other variables – were eliminated from the set of explanatory variables. Also the variable WZ (total health

expenditure) turned out to be of no statistical significance. The final form of the model was as follows:

$$\begin{matrix} \mathrm{HLE(F)} = 53{,}570 * \mathrm{ILE}^{0{,}392} * \mathrm{EI}^{0{,}120} * \mathrm{GDP}^{0{,}036} \\ (70{,}073) \quad (18{,}524) \quad (8{,}230) \quad (6{,}264) \end{matrix} \tag{12}$$

The coefficient of determination adjusted for d.f., was equal to $\overline{R}^2 = 0{,}978$, which means that goodness of fit of the estimated model to the empirical data was high.

The final form of the model for men is:

$$\begin{matrix} \mathrm{HLE(M)} = 51{,}839 * \mathrm{ILE}^{0{,}389} * \mathrm{EI}^{0{,}076} * \mathrm{GDP}^{0{,}031} \\ (48{,}408) \quad (12{,}807) \quad (3{,}645) \quad (3{,}850) \end{matrix} \tag{13}$$

The coefficient of determination adjusted for d.f., was equal to $\overline{R}^2 = 0{,}946$, which also means that goodness of fit of the estimated model to the empirical data was high.

It can be seen that if ILE grows by 1%, then the mean growth of HLE(F) is 0.392% and the mean growth of HLE(M) is 0.389%. Whereas, if EI grows by 1%, then the mean growth of HLE(F) is 0.120% and the mean growth of HLE(M) is 0.076%. Growth of the GDP by 1% results in mean growth of HLE(F) by 0.39% and in the mean growth of HLE(M) by 0.031%.

6. Conclusion

The relation between HLE, GDP *per capita* and health expenditure *per capita* turned out to be strong at low levels of income, whereas it was less evident at higher levels of income. There is a strong correlation between HLE and HDI (0.94), but the correlation was weaker between the HLE and GDP (0.77) and between the HLE and WZ [Health Expenditure] (0.67). In the obtained econometric models (12) and (13) reflecting formation of the HLE(F) and HLE(M) the applied explanatory variables are statistically significant. The results are also in compliance with the existing economical theory.

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Annex

Table 4. Human Development Index (HDI) and its three components

Country	Human Development Index HDI	Life Expectancy Index LEI	Education Index EI	GDP Index GDPI
1	2	3	4	5
Albania	0.781	0.81	0.89	0.65
Algeria	0.704	0.74	0.69	0.68
Argentina	0.853	0.82	0.96	0.78
Australia	0.946	0.90	0.99	0.94
Austria	0.934	0.89	0.96	0.95
Bangladesh	0.509	0.60	0.45	0.47
Belgium	0.942	0.90	0.99	0.94
Bolivia	0.681	0.64	0.86	0.53

1	2	3	4	5
Brazil	0.775	0.72	0.88	0.73
Bulgaria	0.796	0.77	0.91	0.71
Burkina Faso	0.302	0.35	0.16	0.40
Cameroon	0.501	0.36	0.64	0.50
Canada	0.943	0.90	0.98	0.95
Chad	0.379	0.33	0.42	0.39
Chile	0.839	0.85	0.90	0.77
China	0.745	0.76	0.83	0.64
Columbia	0.773	0.78	0.84	0.69
Congo	0.494	0.39	0.71	0.38
Croatia	0.830	0.82	0.90	0.77
Czech Rep.	0.868	0.84	0.92	0.84
Denmark	0.932	0.86	0.98	0.96
Dominican Rep.	0.738	0.70	0.82	0.70
Egypt	0.653	0.73	0.62	0.61
Ecuador	0.735	0.76	0.85	0.60
Estonia	0.853	0.78	0.98	0.80
Ethiopia	0.359	0.34	0.39	0.34
Finland	0.935	0.88	0.99	0.93
France	0.932	0.90	0.96	0.93
Germany	0.925	0.89	0.95	0.94
Ghana	0.568	0.55	0.65	0.51
Greece	0.902	0.89	0.95	0.87
Guatemala	0.649	0.68	0.65	0.62
Hungary	0.848	0.78	0.95	0.82
India	0.595	0.64	0.59	0.55
Indonesia	0.692	0.69	0.80	0.58
Ireland	0.936	0.86	0.96	0.98
Italy	0.920	0.89	0.93	0.93
Jamaica	0.764	0.84	0.83	0.61
Japan	0.938	0.94	0.94	0.93
Kenya	0.488	0.34	0.74	0.39
Korea Rep.	0.888	0.84	0.97	0.86
Lithuania	0.842	0.79	0.96	0.77
Latvia	0.823	0.76	0.95	0.75

Table 4, cont.

1	2	3	4	5
Macedonia	0.793	0.81	0.87	0.70
Madagascar	0.469	0.47	0.60	0.33
Malawi	0.388	0.21	0.66	0.29
Malaysia	0.793	0.80	0.83	0.75
Mali	0.326	0.39	0.21	0.37
Morocco	0.62	0.72	0.53	0.61
Mexico	0.802	0.81	0.85	0.75
Nepal	0.504	0.58	0.50	0.44
Netherlands	0.942	0.89	0.99	0.95
New Zealand	0.926	0.89	0.99	0.90
Nigeria	0.466	0.44	0.59	0.36
Norway	0.956	0.90	0.99	0.99
Pakistan	0.491	0.60	0.40	0.49
Peru	0.752	0.74	0.86	0.65
Philippines	0.753	0.75	0.89	0.62
Poland	0.85	0.81	0.96	0.78
Portugal	0.897	0.85	0.97	0.87
Romania	0.778	0.76	0.88	0.70
Russia	0.795	0.69	0.95	0.74
Saudi Arabia	0.768	0.79	0.71	0.81
Slovakia	0.842	0.81	0.91	0.81
Slovenia	0.895	0.85	0.96	0.87
Spain	0.922	0.90	0.97	0.90
Sudan	0.505	0.51	0.52	0.48
Sweden	0.946	0.92	0.99	0.93
Thailand	0.768	0.74	0.86	0.71
Tunisia	0.745	0.79	0.74	0.70
Turkey	0.751	0.76	0.80	0.69
Ukraine	0.777	0.74	0.94	0.65
United Kingdom	0.936	0.88	0.99	0.93
USA	0.939	0.87	0.97	0.98
Venezuela	0.778	0.81	0.86	0.67
Viet Nam	0.691	0.73	0.82	0.52
Yemen	0.482	0.58	0.50	0.36

DYWERSYFIKACJA OCZEKIWANEJ DŁUGOŚCI ZDROWEGO ŻYCIA I CZYNNIKI JĄ OKREŚLAJĄCE

Streszczenie

Średnia długość życia w dobrym zdrowiu (HLE – *Healthy Life Expectancy*) jest jednym z podstawowych wskaźników służących do szacowania stanu zdrowia populacji.

Celem artykułu jest odpowiedź na pytanie, jak HLE jest związane z rozwojem gospodarczym. Wzrost dobrobytu pociąga za sobą istnienie dobrych warunków życia, które wpływają na dłuższe HLE badanej populacji. Sporządzono wykres wartości HLE w zależności od wydatków na ochronę zdrowia; związek ten jest spójny z poglądem, że wydatki na ochronę zdrowia podlegają prawu malejących przychodów. Związek ten jest silny do pewnego poziomu wydatków per capita, dalsze zwiększanie tych wydatków ponad ten poziom ma znikomy wpływ na wartość HLE.