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ECONOMIC GROWTH AND HEALTH: A COMPARATIVE STUDY OF THE EU COUNTRIES

ABSTRACT. The purpose of the presented study is the analysis of relations that occur between the economic development level of national economies and the health condition of the societies. Attention focuses on the existing dependences in this area, the ones observed in the European Union member states. An attempt was made to identify the differences that occur in this area on the level of the economies of the so-called “old” and “new” European Union. The research is based on the data available on the level of NUTS 1 that describes the health condition of society in individual states. Due to the assumed scope of the analysis, indices that define life expectancy (LE) and predicted healthy life years (HLY) were accepted as the dependent variables. The results presented point to separate patterns of dependences in individual groups of the member states.

Introduction

Over the last several decades, it has become common to emphasize the role of the intangible forms of capital as an economic development factor. By accepting the assumption that health condition constitutes an element of human capital, an analysis of interactions between health and economic growth has become the subject of theoretical and empirical research. In spite of potentially obvious dependences between health condition, living standards in society and the efficiency of production factors in the macroeconomic scale, there has still been no explicit explanation of this mechanism. In literature, the gravity of the so-called boundary (initial) conditions within the framework of which the mechanism is observed is indicated. By assumption, they determine the correlation level of variables in the model of interactions between health and economic growth, which varies for different research samples. No conformity of the reaction model that diverges from the commonly expected one is observed first of all in the countries with a high level of economic development, where the effect of the health condition improvement as a result of an increased level of national product is not so self-evident.

The purpose of the present study is the analysis of relations that occur between the economic development level of national economies and the health condition of societies. Attention focuses on indicating the existing dependences in this area, the ones which are

observed in the European Union member states. An attempt is made to identify differences that occur in this area on the level of the economies of the so-called “old” and “new” European Union.

The research was based on the data available on the level of NUTS 1 that describes the health condition of society in individual states. Due to the assumed scope of the analysis, indices that define life expectancy (LE) and predicted healthy life years (HLY) were accepted as the dependent variables. In the assessment of the impact of production capacities on “the capital of health” of the economies examined, an index of structure was used that determines the participation of predicted healthy life years in life expectancy. In the research into relations, a regression analysis was used, and an assessment was performed of the degree of correlation between the domestic per capita product level and the level of the dependent variables that describe the health condition of society in the EU economies examined. Due to the accepted scope of analysis, the empirical data used was obtained from the databases of the World Bank, the *World Health Organization (WHO)* and Eurostat.

1. Health and income: potential links

The results of theoretical and empirical analysis presented in the literature point to a bidirectional relation between health and the national income level. An increase of the health “resource”, similarly as an increase of human capital, constitutes both the cause and the consequence of the economic growth in a given state. The mechanism of the impact of economic growth on the health of population seems obvious: an increase of the national income level potentially determines a higher health spending level, greater possibilities of education and better food quality. Preston (1975) was one of the first ones to examine this relation. He acknowledged that the domestic per capita income is an index of the total value of final products manufactured in a given economy per capita in a specified period of time. As a consequence, there are no reasons to expect a direct influence of this parameter on the level of the health (mortality) of society. Income should be treated as a measure of the pace of an introduction of new products and services in the sector of households and enterprises. Its influence is indirect: a higher income offers a possibility of a real increase of the consumption of such elements that have an influence on health as food, accommodation, public and private healthcare, education, research connected with an improvement of health condition (Preston, 1975). The positive effects of the impact of a growing income on the health condition of population were confirmed in research by Martin *et al.* (2008), Weil (2005), Bloom, Canning (2008).

The multiple impact of health on the human capital productivity constitutes one of fundamental problems in the measurement of the impact (Jakubowska, 2016). An increase of the productivity human capital expenditures leads to a growth of incomes, and thereby it allows an improvement both of the quality of nutrition and an access to health care services. On the other hand, low employment rate among people with disabilities continues is still a significant problem (Kopycińska & Kryńska, 2016).

However, one needs to pay attention to the fact that an increase of income can also be accompanied by effects that have a negative impact on the level of health. These include the following: environmental pollution, addictives, improper nutrition and lack of physical activeness. As a consequence of this approach, an assumption is to be accepted that while meeting specified boundary conditions, a negative relation can be observed between the economic growth and the aggregated level of the health of society. The occurrence of a specified effect in the area of an improvement of the health condition of society (especially in the case of developed countries) is therefore determined by the way in which additional income is used. However, it is characteristic that in countries with relatively good initial health conditions, smaller additional health benefits are observed that result from an

improvement of economic conditions (Cutler *et al.*, 2006). If we recognize that there is a causal link here, one may talk about the activity of the law of the decreasing marginal productivity of the subsequent units of income in relation to additional benefits measured with an increase of the health potential.

Demonstrating the opposite causality, i.e. the mechanism of the impact of health on the level of national income, appeared to be a more complicated research objective. The literature of the subject provides contradictory evidence. Theoretically, health is an indicator of human capital and work productivity. Consequently, investments in health should be treated as investments in human capital, and so they should result in a higher income level. However, the results of the research conducted in this area do not provide explicit answers in this scope (Ashraf *et al.*, 2008; Aghion *et al.*, 2010).

Looking at the problem of interaction between health and economic growth points to several channels of impact. An approach based on endogenous growth models include the following main areas of impact: (1) increased productivity of employees as a result of an improvement of their health, (2) a reduction of the depreciation rate of aggregated abilities as an effect of lengthening of the average life expectancy, and (3) an increase of the effectiveness of teaching and a stimulation of innovative attitudes as a characteristic feature for healthy people (Howitt, 2005). However, in the case of many studies, there arises a problem of the endogeneity of this relation, the result being that the estimates presented are inaccurate and unreliable. Proving the causal effect of a positive correlation between the initial life expectancy value for the residents of a given state and its later economic growth is particularly troublesome (Bloom, 2009).

2. International perspective

An analysis of the current data related to the level of the economic development of states and the health level of their residents confirms the evident connection between these parameters which are considered in the global scale and presented in literature. Potentially higher income determines a higher average life expectancy. Using the “Preston curve” concept, a relation was presented between the level of domestic per capita income and the life expectancy of populations for 120 states in the world (*Fig. 1*).

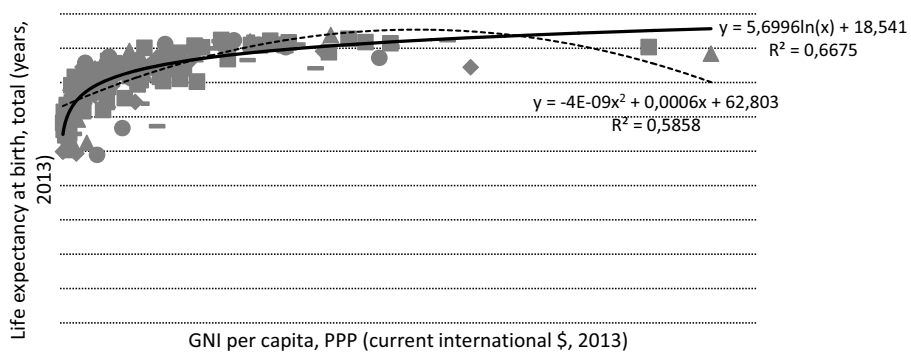


Figure 1. The relationship between gross national income (GNI) per capita on purchasing power parity (PPP) and life expectancy (LE), rich and poor countries, in 2013

Source: own study based on the data from Worldbank, <http://data.worldbank.org/indicator>, Access: 28.03.2016.

The so-called “Preston curve”, which was determined for the year 2013, confirms the continuing strong connection between the development level and the potential life expectancy in the case of countries with low income levels. An increased longevity is achieved here first of all by a reduction of the mortality of infants.

Based on an analysis of the course of the “Preston curve”, one may at the same time determine the point that indicates such a level of per capita income beyond which it is to be recognized that marginal benefits from an increase of income are decreasing (the life expectancy growth in relation to the increase of the income level is less than proportional). Going beyond such a level of income is hence to be treated as the so-called “epidemiological transition”. In those states which have gone beyond this point, a change is observed to the main causes of death: a high mortality of infants has been replaced with deaths connected with advanced age, and a high risk of contagious diseases is being outnumbered by chronic diseases. In developed countries, an improvement of the average life expectancy is the result of a reduction of the mortality of middle-aged people and seniors. However, an increase of life expectancy poses new challenges to national economies.

A change in the pattern of reactions observed in highly developed countries constitutes a separate aspect of the analysis. The determination of the “Preston curve” with the use of polynomial regression with only a slightly smaller degree of match ($R^2=0.59$) demonstrates that in the group of those states that achieve the highest levels of income, one may simply speak about a defined probability of the occurrence of a negative dependence between the higher income and the average life expectancy (*Fig. 1*). The dependences mentioned above were confirmed with an analysis of correlations between the variables examined. *Table 1* presents the calculated correlation coefficients for the countries under examination in the individual per capita income ranges.

Table 1. The correlation between income level (GNI per capita, PPP, 2013) and average life expectancy (LE, 2013), countries in the world by the level of income

	Correlation coefficients			
	Below 20.000	From 20.000 to 40.000	From 40.000 to 60.000	Above 60.000
GNI per capita (PPP)	0,62	0,63	-0,17	- 0,18

Source: own study based on the data from Worldbank, <http://data.worldbank.org/indicator>, Access: 28.03.2016.

Kiuiila and Mieszkowski (2007) claim that the biological deterioration of the health condition of society that is being observed in highly developed countries is a result of a significant increase of incidence rates for people aged over 65 years old. The deterioration of physical resistance in the old age period simultaneously reduces the impact of social and economic factors on the health condition and mortality. According to the estimates performed for the region of Europe (based on the index DALY – Disability Adjusted Life Years), it is chronic non-communicable diseases which are responsible for over 76% of all sicknesses that constitute most serious causes of the sickness load (Rudawska, 2013). Cardiovascular diseases, cancers, chronic respiratory system diseases and diabetes dominate in the group of these diseases (Topór-Mądry, 2011, p. 27).

Another question that requires a separate analysis is the relation of the growing number of the years of life in relation to the number of years lived in the so-called “health”. In the case of developed countries, it is to be accepted that it is not the absolute length of one’s life but the number of years lived in health that constitutes the actual determinant of the

labour market potential. An answer needs to be provided to the question as to whether in the case of individual economies an improvement of the health condition of society measured by the number of years lived in health is able to increase human capital productivity to level out the economic consequences of the increase of the number of people beyond retirement age and the resulting increased demand for expenses connected with healthcare. The effects of the impact of prosperity on the level of health measured with the expected number of healthy life years that are observed on the level of poor and rich world economies are presented in *Fig. 2*.

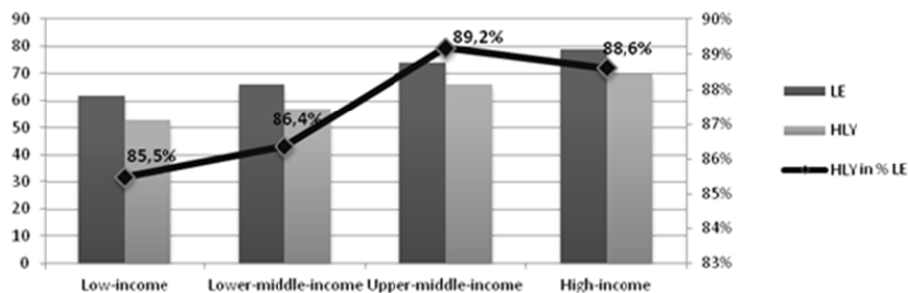


Figure 2. Life expectancy (LE), *Healthy Life Years (HLY)* in countries of different income groups, by World Bank (in 2013)

Source: own study based on the data from WHO, <http://apps.who.int/gho/data/view.main.700>, Access: 28.03.2016.

As it can be observed from *Fig. 2*, in spite of the statistically higher life expectancy in subsequent income groups, a declining percentage of healthy life years (in the group of countries with the highest income levels) is becoming problematic. For these economies, this means a smaller labour resource potential than it could be expected on the one hand, while on the other hand, this means growing treatment costs of the increasing number of seniors and an increasing share of people who are unfit for work in potential labour force reserves.

3. Research results: prospects for EU member states

The question of the impact of the economic development level on the condition of health has not been explicitly defined on the level of the European Union. Research conducted in this area focuses chiefly on an analysis of the degree of the impact of social and economic factors on the health condition of society (Or, 2000; Chłóń-Domińczak *et al.*, 2011). The results obtained confirm in relation to the group of EU states that higher risks of sickness and death concern people from groups with lower incomes and lower levels of education. The results presented contain no references concerning the patterns of reactions on the macroeconomic level, ones which would allow one to define benefits (or lack of these) following from the aggregated economic increase of the individual EU economies. It is to be assumed that in the case of these states, there will be no simple translation of the national income increase into a statistically longer healthy life of an average citizen.

The aim of the analysis presented below is to assess the effect of the impact of the economic development level of EU countries on the health condition of society. Particular attention was drawn to the identification of the reaction model of countries from the so-called “new” Union, which will allow one to define the convergence degree of the EU area in this scope. The study used variables such as Gross Domestic Product per capita (GDP per capita, PPP), Life Expectancy (LE), *Healthy Life Years (HLY)* and *Healthy Life Years at birth* in

INTERDISCIPLINARY APPROACH TO ECONOMICS AND SOCIOLOGY

percentage of the total Life Expectancy (HLY in % LE). Taking into consideration a high diversity of the variables examined considering the sex, it was justifiable to carry out the analyzes assumed individually for the groups of men and women. *Table 2* presents selected statistical data that describes the parameters examined in a group of the EU Member States.

Table 2. Selected statistics for the EU Member States (in 2013)

	Selected statistics						
	<i>GDP per cap. (PPP)</i>	<i>LE</i>		<i>HLY*</i>		<i>HLY in % LE</i>	
		man	woman	man	woman	man	woman
Average	25 125	76,5	82,5	61,1	61,7	79,9%	74,8%
Standard deviation	10 549	3,6	2,2	4,4	4,3	4,2%	4,9%
Interval	55 900	11,8	7,5	19,9	18,5	16,5%	19,8%
Min.	12 000	68,5	78,6	51,7	54,2	73,5%	66,8%
Max.	67 900	80,3	86,1	71,6	72,7	90,0%	86,6%
Q25	19 025	73,0	81,2	57,8	58,8	76,8%	71,4%
Mediana	22 400	78,2	83,2	61,6	61,9	80,4%	74,8%
Q75	30 875	79,3	84,0	64,1	64,5	82,3%	77,4%
Coefficient of variation	42%	4,8%	2,6%	7,1%	6,9%	5,2%	6,6%
N	28	28	28	28	28	28	28

* date for Finland, in 2012

Source: own study based on the data from Eurostat, <http://ec.europa.eu/eurostat>, Access: 20.02.2016.

The presented results of a descriptive characterization demonstrate that in spite of the conducted social and territorial cohesion policy, there is still a significant level of diversification in the EU area both in relation to the level of the gross per capita domestic product (GDP) obtained and the statistical life expectancy and healthy life years. In the group examined of member states, the level of the GDP obtained fluctuated from 12 thousand (Bulgaria) to 67.9 thousand USD (PPP) per capita (Luxembourg). The average life expectancy is also characterized by high diversification. It accepted values from 78.6 (Bulgaria) to 86.1 (Spain) of potential life years in the case of women, and from 68.5 (Lithuania) to 80.3 (Italy) in the case of men. The expected number of healthy life years fluctuated from 54.2 (Latvia) to 72.7 (Malta) years in the case of women and from 51.7 (Latvia) to 71.6 (Malta) in the case of men respectively. The relatively high level of diversification is also presented by the index that determines the share of healthy life years in relation to the overall expected number of the years of life. This index spanned from 66.8% (Finland) to 86.6% (Malta) for women and from 73.5% (Finland) to 90% (Malta) for men.

For the needs of the research foreseen aimed at an assessment of the convergence degree of the "old" and "new" European Union in the area of the reactions of national economies to an increase of income, two groups of states were distinguished: (1) states admitted to the EU before the year 2004 that represent highly developed economies with market traditions, and (2) countries accepted into the EU structure after the year 2004 that represent the economies of Middle and East Europe with political transformation experiences. Considering the specificity of the analyzes assumed, states were excluded with high deviations from the average in the parameters observed (Luxemburg: 245% of the average per capita GDP: was excluded from group 1) or those that failed to meet the substantive criterion (Cyprus and Malta were excluded from group 2). The results of an analysis of dependences

between the life expectancy including healthy life years, and the level of the per capita domestic product for the distinguished groups of EU economies are presented in *Fig. 3* and *Fig. 4*.

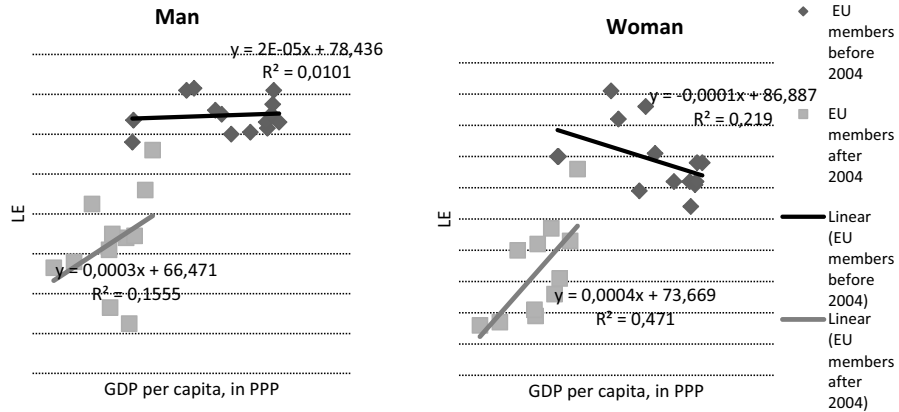


Figure 3. The relationship between the Gross Domestic Product (GDP) per capita (PPP) and the Life Expectancy (LE) in the examined EU countries

Source: own study based on the data from Eurostat, <http://ec.europa.eu/eurostat>, Access: 20.02.2016.

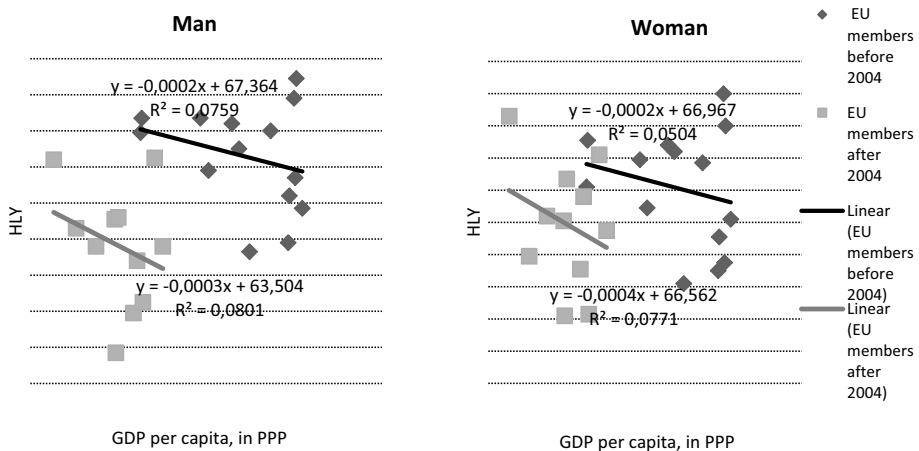


Figure 4. The relationship between the Gross Domestic Product (GDP) per capita (PPP) and the *Healthy Life Years (HLY)* in the examined EU countries

Source: own study based on the data from Eurostat, <http://ec.europa.eu/eurostat>, Access: 20.02.2016.

The results presented point to separate patterns of dependences in the individual groups of member states. Statistically significant relations occur in the case of the impact of GNP on the life expectancy of EU residents. However, they are fundamentally different in both groups examined. In the case of the countries of the so-called “old” European Union, a clear negative dependence is observed between the level of per capita domestic product and life expectancy. However, we observe other types of reactions in the group of the “new”

European Union countries, where a higher level of the potential length of life corresponds to a higher GDP level. At the same, we can see in *Fig. 3* the path of “catching up with” highly developed EU economies by Middle and East European countries.

The analysis of dependences between the level of income and the statistical number of potential healthy life years, which is presented in *Fig. 4*, demonstrates that in the case of both groups examined there occurs a negative dependence between these variables. Due to a relatively low adjustment of the linear regression model to the variables observed, it can be stated that there are a number of other factors that determine the healthy life years of EU residents. The fact is worrying that there is no positive translation of the high level of the domestic product achieved into a better health condition of society. In the case of both groups examined, no essential correlations between life expectancy and the estimated number of healthy life years (*Table 3*) were observed.

Table 3. The correlation between selected coefficients

	EU members before 2004			
	LE man	LE woman	HLY man	HLY woman
GDP per capita (PPP)	0,10	-0,47	-0,28	-0,22
	EU members after 2004			
	LE man	LE woman	HLY man	HLY woman
GDP per capita (PPP)	0,39	0,69	-0,28	-0,28

Source: own study based on the data from Eurostat, <http://ec.europa.eu/eurostat>, Access: 20.02.2016.

The unfavourable relation presented above between the domestic product level and the estimated number of healthy life years demonstrates that the so-called post-communist countries begin experiencing the negative effects of economic prosperity that translate into a biological deterioration of the condition of their populations. In the literature of the subject, it is emphasized that the sources of an intensification of negative effects are to be directly sought in an increased level of social inequalities (Marmot & Bobak, 2000; Deaton, 2003). From the perspective of the aggregated values, an answer is required to the question as to how much higher life expectancy translates into additional healthy life years. In an assessment of the macroeconomic effect, the so-called structural index that defines the percentage share of healthy life years in relation to life expectancy will be of a key significance. *Fig. 5* presents the distribution of this index for both groups examined.

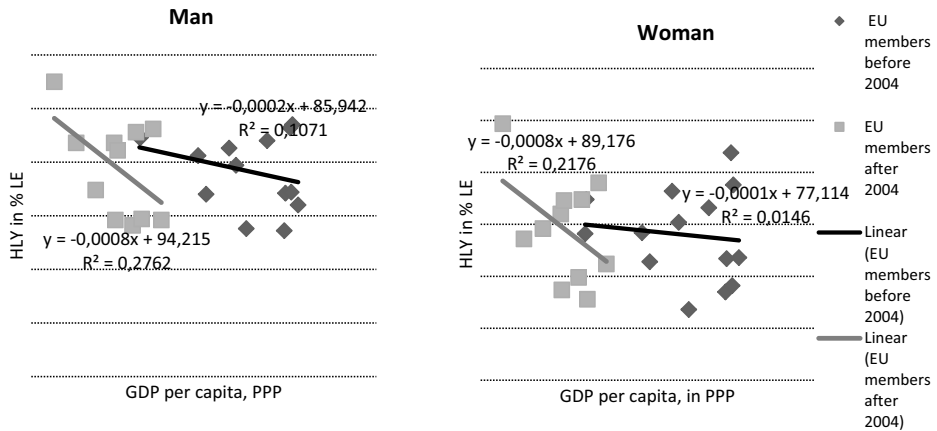


Figure 5. The relationship between the Gross Domestic Product (GDP) per capita (PPP) and the percentage share of Healthy Life Years in relation to Life Expectancy (HLY in % LE) in the examined EU countries

Source: own study based on the data from Eurostat, <http://ec.europa.eu/eurostat>, Access: 20.02.2016.

The dependences presented in the chart above confirm the unfavourable tendencies observed in the group of “new European Union” countries. Countries with higher domestic product levels statistically report a lower percentage share of healthy life years in the overall life expectancy number both in the case of women and men. As a consequence of this model of development, one may expect a decrease of the potential of “healthy” labour force resources in national economies, as well as a dynamic increase of budgetary burdens resulting from growing healthcare costs. In the case of the “old” European Union states, there is no statistically significant connection between the level income and the percentage of healthy life years (Table 4).

Table 4. The correlation between selected coefficients

	HLY in % LE			
	EU members before 2004		EU members after 2004	
	man	woman	man	woman
GDP per capita (PPP)	-0,33	-0,12	-0,53	-0,47

Source: own study based on the data from Eurostat, <http://ec.europa.eu/eurostat>, Access: 20.02.2016.

Conclusions

The analysis performed demonstrates that in the case of the richest countries, no existence of a dividend can be found in the form of a spectacular lengthening of the average life expectancy as a reaction to higher income levels. It becomes evident that these countries are currently facing a problem not so much of life expectancy as that of healthy life. The increasing living standard of society, which is forced by the growing level of income, is

contributing to the escalation of the so-called chronic diseases. They constitute the cause of absence from work and lead to premature deaths. Research conducted in this area estimates that chronic diseases constitute in the global scale ca. 75% of the overall causes of the incapacity to work of people in an economically productive age, and they determine a loss of ca. 10% of the potential healthy life years. The results presented in the study demonstrate that the process aimed at an improvement of the health condition of society requires a change of the attitude to the issues of health level determinants in developed states. A critical approach needs to be adopted to the social structure. Results indicate that an absolute improvement of living standards in societies which have achieved a specific level of affluence does not translate into any significant improvement in the average level of health.

From the point of view of the mechanism of interactions between economic effects and the level of health, it is necessary to recognize both the initial conditions of a given economy and the pattern of its reactions to improved income conditions. With a change of the income level in a given country, both the structure of diseases in society and the opportunities of an effective treatment of these will change.

The fact of the observed negative relation between the national product level and the number of statistical healthy life years constitutes a negative aspect of the transformation of the economies in the Middle and East Europe. However, it should be emphasized that the analysis performed is of a static nature. It assumes that specified paths are duplicated of social and economic development for those countries which have completed their political system transformations. However, accepting a dynamic perspective and finding of positive model: a state which breaks the unfavourable patterns that observed on the EU level, would require a separate analysis.

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