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Inequality of macro-social factors determining health

Abstract: The root causes of health inequalities, according to Marmot [1] are the causes of various social determinants of health. The author used socio-economic factors shaping health analyzed with a breakdown into four categories, i.e.: demographic situation, labor market and education, economic situation, state of households.

The method of financing health care adopted in a given country is directly related to the health system model used in it [8]. The examined group of countries was divided into two subgroups according to the statistical importance of the surveyed private insurance population in health care financing

The objective of this article is statistical analysis of levels, their changes and forms of distribution of selected determinants of health status between two groups of countries where private insurance plays a greater role as a financing mechanism for benefits or is not a significant source of the available resources. The data distributed among the NUTS2 units for European countries provided by the EUROSTAT was used for the analysis. The measurement involved skewness coefficients, concentration coefficients (kurtosis, Herfindahl-Hirschman coefficient, Gini coefficient). The results confirmed lack of clear differences in inequalities between the socio-economic factors shaping health in two groups of countries with a different significance of private insurance.
Keywords: health, determinants of the state of health, health inequalities, concentration analysis.

Introduction

The determinants of the state of health include all the factors determining the state of our body, both physical and psychological. These factors, combined with one another or individually, may have a beneficial or negative impact on the health of individuals as well as of entire communities.

Among the determinants, socio-economic factors shaping health were analyzed, divided into four categories, i.e.: demographic situation, labor market and education, economic situation, and household status. Studies have confirmed that there is a statistically significant relationship between income and higher social status and health status [12], [13], [14], [15].

It is assumed that many other factors also affect the level of health, but their measurement, or just registration, are extremely difficult.

The level of individual determinants differs markedly between states even with their geographical or economic proximity.

The objective of this article is statistical analysis of the levels, their changes and shapes of selected determinants of the state of health in terms of two groups of countries where private insurance plays a greater role as a financing mechanism for benefits or is not a significant source of resources and selected countries with regard to regional diversity.

One of the questions posed by researchers is whether, and to what extent, individual determinants and their regional inequalities affect the level of health of a population. The measurement is possible by using basic methods in the field of correlation analysis, but also – which seems to be justified especially in spatial data – comparative analysis.

At the stage of designing the research, the following research hypotheses were put forward:

— *H1: there are no clear differences in the inequalities between socio-economic factors shaping health in two groups of countries with different significance of private insurance,*
— *H2: regional inequality of socio-economic factors shaping health affects the duration of life.*

The construction of the H1 hypothesis assumes that the estimated regional inequalities of the socio-economic factors surveyed in the period from 2013 to 2017, when compared between groups of countries with significant private insurance (Group A) and its minor role (Group B) are low and do not differ much between groups.

Whereas, the assumption of hypothesis 2 shows that health conditions in European countries are influenced by socio-economic factors that led to inequality visible in the level of average life expectancy.

1. Methodology of research

Among the measures of descriptive statistics characterizing indicators explaining a given factor in two groups of countries, special attention should be paid to the ones indicating the shape of the distribution of a given indicator in spatial terms. Such an approach makes possible first of all assessment of the diversity, indication of homogeneity or lack thereof in relation to a given factor, asymmetry, showing the grouping around the average, and concentration showing the existence of similarity in the approach to a given category in space.

The division into two groups of countries with a significant and insignificant influence of private insurance was applied. The studied group of countries was divided into two subgroups according to the criterion of significance of private insurance in financing health care in the surveyed population [9].

Therefore, the research sample consisted of two groups, i.e.

— **(Group A) – the states with a significant role of private insurance,** i.e.: Austria, Belgium, the Netherlands, Switzerland, Slovakia, France, Ireland[1]**, Slovenia, Germany and Portugal;
— **(Group B) – countries with an insignificant role of private insurance**, i.e.: the Czech Republic, Denmark, Estonia*, Finland, Greece, Hungary, Iceland*, Italy, Norway, Poland, Spain, Sweden, Turkey, the United Kingdom.

In this case, it is necessary to make use of some kind of variables, which, as reference points, will give the possibility of conducting comparative analysis. In this study, data from determinants of health status from four categories will be used as the main variables.

Table 1. Selected socio-economic factors determining the state of health in four categories

Edat 1	Population aged 25–64 by educational attainment level, (%) Population aged 25–64 by educational attainment level, 0–2, sex and NUTS 2 regions (%) (edat_lfse_04)
Edat 2	Population aged 25–64 by educational attainment level, (%)Population aged 25–64 by educational attainment level, 3–4, sex and NUTS 2 regions (%) (edat_lfse_04)
Edat 3	Population aged 25–64 by educational attainment level, (%)Population aged 25–64 by educational attainment level, 3–4, sex and NUTS 2 regions (%) (edat_lfse_04)
Actrt	Economic activity rates by NUTS 2 regions from 15 to 74 years (%)Economic activity rates by NUTS 2 regions (%) (lfst_r_lfp2actrt)
Pers	Unemployment by sex, age and NUTS 2 regions (1 000) Unemployment by NUTS 2 regions (1 000) (lfst_r_lfu3pers)
Rt	Unemployment rates by NUTS 2 regions (%)Unemployment rates by NUTS 2 regions (%) (lfst_r_lfu3rt)
GDP	Gross domestic product (GDP) at current market prices by NUTS 2 regions Gross domestic product (GDP) at current market prices by NUTS 2 regions (nama_10r_2gdp)
Gvagr	Real growth rate of regional gross value added (GVA) at basic prices by NUTS 2 regions – percentage change on previous year (nama_10r_2gvagr)
Hhinc	Income of households by NUTS 2 regions (nama_10r_2hhinc) EUR_HAB–euro per inhabitant in B6N. Available income, net.
Mddd	Severe material deprivation rate by NUTS 2 regions (ilc_mddd21)
Ilc	At–risk–of–poverty rate by NUTS 2 regions (ilc_li41)
Isoc	Households with access to the internet at home (isoc_r_iacc_h)

Source: my own research.

[1] * – a country with one NUTS 2 unit, ** – a country with two NUTS2 units.

The data is analyzed in two groups of countries where private insurance plays a greater role as a financing mechanism or they are not a significant source of resources as a whole, they cover the years 2008–2017 and are conditioned by their availability in the Eurostat sources.

The analysis of the distribution of the examined variables in two groups of countries was extended by measures, mainly asymmetry and concentration, in order to indicate the actual focus or shift of the centre of gravity. The determinants of health status were based on the skew factor, concentration coefficients (kurtosis, Herfindahl-Hirschman coefficient, Gini coefficient) and distribution variability index. The Herfindahl-Hirschman index, which is an indicator of the concentration of features was used in the study.

$$HHI = \sum_{i=1}^{n} \left(\frac{i}{n} \right)^2 = \sum_{i=1}^{n} \omega_i^2 \qquad (1)$$

where:

ω_i – participation of the i-th not meeting the needs of a medical examination among all the possibilities of not meeting the health needs.

This index is calculated as the sum of squares of shares of individual trait carriers in the total sum of features.

If HHI is less than 1500, the lack of concentration of the characteristic, and HHI from 1500 to 2500 is a moderate concentrated feature, and HHI of 2,500 or more is a highly concentrated feature [17].

Estimates of inequalities in health needs depending on education and income in the period from 2008 to 2017 were made with the Gini coefficient. The Gini index is a measure of concentration (inequality) of the distribution of the random variable used in statistics [11].

$$GIN(x) = \frac{\sum_{i=1}^{n} (2i - n - 1) x_i}{n^2 \bar{x}} \qquad (2)$$

where the symbols used denote:

x_i – unitary i-th value of the studied phenomenon,

$\bar{x}$ – arithmetic average,

i – position of the series,

n – sample size.

The Gini coefficient assumes values from the interval [0; 1], however, it is often expressed as a percentage. A convenient range of the Gini index from 0 to 1 is a relative measure, allowing easy comparison of the degree of inequality in populations with different numbers and different average health needs [2, 7]. Technically, dividing the interval [0; 1] into three parts: <0–0.3

(3)>, <0.3 (3) −0.6 (6)> and <0.6 (6) −1> , we can give the Gini coefficient values respectively: low, moderate and high level [4].

In the present study, a single-equation linear econometric model was used. As the method of estimation the least squares method was used using the Gretl software [16]. The model is linear with respect to parameters and the number of observations (n = 110) is greater than the number of estimated parameters, and there are no linear relationships between exogenous variables of the model [6].

In the last stage of the empirical study, the estimated econometric models were verified.

In the first step, using the *t*-Student's test, the significance of the influence of individual independent variables *Xj* on the dependent variable *Z* was evaluated. The suitability of the models was assessed using the F-Snedecor test. The degree of fit of the model was assessed using the corrected R2 determination coefficient. The normality of the residual component distribution was also tested (Doornik-Hansen test) [5].

2. Results and discussion

In the analysis of determinants of health, in the first stage, descriptive statistics were used and two groups (Group A) and (Group B) and countries from these groups were distinguished, in which the division into several regions was distinguished. The share of the mean in the maximum values of determinants of health status was calculated (Table 1.2).

Table 2. Share of the mean in maximum values for four categories of determinants of health in (**Group A**)

Countries / Variable	Gr. A	BE	DE	FR	IE	NL	AT	PT	SI	SK	CH
Edat 1	**38,04**	72,87	69,10	**47,31**	89,01	85,07	81,07	82,13	88,52	**65,12**	78,47
Edat 2	67,42	85,64	82,89	85,90	96,88	88,54	92,32	84,56	94,67	74,38	80,24
Edat 3	**74,75**	71,37	68,52	77,09	92,06	71,61	73,56	68,06	87,60	69,58	73,99
Actrt	88,20	**95,30**	**93,96**	**90,33**	.	**95,48**	**95,34**	**95,71**	**98,78**	**92,76**	**91,25**
Pers	**23,57**	33,19	17,49	27,99	.	25,99	28,23	25,71	92,08	60,02	52,53
Rt	70,11	48,48	51,87	43,88	.	68,84	47,68	83,96	97,06	64,79	45,55
GDP	57,05	55,40	59,82	48,82	.	71,49	81,66	74,79	.	50,28	.
Gvagr	**46,19**	40,60	33,59	24,45	.	64,87	51,39	50,57	.	71,35	.
Hhinc	71,35	85,35	82,62	77,70	.	.	95,11	82,16	.	.	.
Mddd	60,43	.	.	.	.	.	41,98	.	.	.	.
Ilc	82,57	.	.	.	.	.	68,69	.	.	.	.

* – country code.

Source: own calculations based on EUROSTAT data [18].

Table 3. Share of the mean in maximum values for four categories of determinants in (**Group B**)

Countries / Variable	Gr. B	CZ	DK	EL	ES	IT	HU	PL	FI	SE	UK	NO	TR
Edat 1	48,11	**50,50**	87,05	82,86	73,26	76,50	77,58	**57,03**	75,35	86,92	69,67	82,47	82,53
Edat 2	**64,62**	94,63	93,61	91,54	84,05	84,46	94,87	92,79	87,70	88,01	83,19	92,37	77,98
Edat 3	80,43	**51,78**	72,91	68,23	71,33	74,61	**58,46**	70,69	79,73	77,72	**58,55**	76,56	**56,30**
Actrt	**79,88**	92,57	93,27	94,15	92,67	84,92	95,06	93,05	93,06	93,79	90,74	94,00	87,24
Pers	27,06	67,45	55,95	27,89	25,69	22,83	36,88	41,93	39,99	42,46	21,77	49,40	17,69
Rt	**36,84**	61,70	92,79	73,17	61,64	54,08	60,51	61,16	91,25	78,79	59,75	74,45	36,11
GDP	**44,90**	48,20	72,09	62,53	70,15	63,83	57,20	56,96	77,36	67,44	17,43	.	.
Gvagr	54,10	46,88	56,00	100,78	75,23	15,26	50,98	60,14	47,62	68,18	20,46	.	.
Hhinc	53,47	76,77	94,26	75,00	74,24	74,01	92,03	78,37	89,60	86,70	45,14	91,25	.
Mddd	27,47	42,80	83,33	88,69	33,36	47,61	34,85	81,94	64,81	59,33	.	83,85	.
Ilc	72,21	66,13	88,92	86,36	54,11	48,40	81,48	69,72	76,67	76,30	.	81,39	.

Source: own calculations based on EUROSTAT data [18].

Comparing the share of the mean in the maximum value in the two groups A and B, the greater disproportion was estimated for the features of Edat 1 in group A. Whereas, the disproportion is the smallest for the Edat 3 feature in group B when compared with group A.

In the countries assessed in the division into NUTS 2 units, the largest disproportion of the Edat 1 feature, measured by the average share in the maximum value, concerns the Czech Republic 50.50% and Poland 57.03%. What is more, the disproportion of the professional activity index (Actrt) is slightly higher in the group B, whereas looking at the countries, there is clearly no difference in the value of this variable. The variable – unemployment according to regions (Pers) is characterized by a high level of disproportion, higher in group A. In this group, for example, Denmark is characterized by the highest level of disproportions (17.49%). In order to determine the level of concentration of individual variables, the Herfindahl-Hirschman coefficient was used (Table 4 and 5). Nominal data were used in calculations due to the determination of structure indicators.

Estimated socio-economic factors shaping health turned out to be low-concentrated in most countries in group A. The only country in group A, in which a strong concentration was noted is Slovakia. The reason for high concentration of Actrt, Pers, Rt, GDP, Gvagr variables is a large inequality of factors determining the health status of the population in the Slovak regions. The moderate concentration concerned countries such as Austria – for the Pers and Switzerland variables – for the Rt variables.

Table 4. Values of HHI coefficients designated for four categories of determinants of health in (**Group A**)

Countries / Variable	Gr. A	BE	DE	FR	NL	AT	PT	SK	CH
Edat 1	1350	810	240	350	630	840	1270	980	1140
Edat 2	1070	780	220	320	630	840	1270	950	1140
Edat 3	1040	790	230	320	640	850	1310	990	1160
Actrt	1000	770	200	290	630	830	1250	2510	1120
Pers	2570	1380	380	520	1140	1640	3070	3140	1350
Rt	1070	940	220	360	650	970	1270	2900	1600
GDP	1280	840	230	310	650	850	1280	3330	.
Gvagr	1430	940	490	430	850	1030	1620	2640	.
Hhinc	1210	720	220	300	630	0,0	1260	.	.
Mddd	1270	.	.	.	.	−0,287	.	.	.
Ilc	1130	.	.	.	.	−0,137	.	.	.

– moderate concentration, – strong concentration

Source: own calculations based on EUROSTAT data [18].

Table 5. Values of HHI coefficients designated for four categories of determinants of health in (**Group B**)

Countries / Variable	Gr. B	CZ	DK	EL	ES	IT	HU	PL	FI	SE	UK	NO	TR
Edat 1	900	1480	2040	640	430	400	1160	630	1710	920	200	1460	270
Edat 2	760	1260	2020	630	420	390	1110	590	1690	920	200	1450	280
Edat 3	750	1420	2070	640	430	390	1180	600	1710	930	200	1460	290
Actrt	720	1250	2000	630	420	390	1110	630	2000	910	200	1430	270
Pers	1800	1360	2420	1290	920	780	1650	780	3140	1360	330	1890	570
Rt	1040	1370	2010	640	460	470	1290	680	2010	920	210	1500	320
GDP	1100	1460	2090	650	430	410	1220	660	172	940	290	.	.
Gvagr	1230	1970	2450	3060	450	2440	1510	710	266	1010	590	.	.
Hhinc	1030	1270	2000	600	430	400	1000	630	1440	910	200	1430	.
Mddd	1550	1730	2080	2520	590	480	2020	1720	2070	1010	.	1480	.
Ilc	820	1360	2020	2560	480	480	1130	1740	1760	930	.	1460	.
Isoc	.	.	.	.	.	.	.	.	.	.	.	.	.

No shading – low concentration; – moderate concentration; – strong concentration.

Source: own calculations based on EUROSTAT data [18].

Whereas, moderate concentration was estimated in group B for Denmark for all variables tested, and Finland for the seven variables tested.

Moreover, the concentration of socio-economic factors shaping health in European countries in groups A and B is ambiguously possible to compare by using the Herfindahl-Hirschman coefficient. In order to verify hypothesis 1, it was decided to calculate the Gini coefficient, kurtosis, coefficient of variation and variability (Tables 6 and 7).

When analysing and measuring the Gini coefficient, a high concentration can be observed in group A for the Pers variable.

Table 6. Basic descriptive characteristics for European countries from group A with the highest number of NUTS2 units

		GR. A	**BE**	**DE**	**IE**	**FR**	**NL**	**AT**	**PT**	**SI**	**SK**	**CH**
Edat 1	kurtosis	6,15	−0,16	0,07	.	2,25	1,59	1,46	1,32	.	0,36	−0,88
	Gini coeff.	0,27	0,12	0,16	0,06	0,18	0,06	0,06	0,07	0,06	0,20	0,09
	skewness	2,30	−0,13	−0,91	.	**1,63**	−1,10	0,09	−0,56	.	−0,45	0,03
	variability	59%	22%	30%	12%	36%	11%	11%	13%	13%	36%	16%
Edat 2	kurtosis	−0,01	0,89	−0,13	.	1,80	−0,03	3,54	−1,26	.	3,37	−0,42
	Gini coeff.	0,15	0,07	0,05	−0,02	0,06	0,05	0,04	0,08	0,03	0,05	0,08
	skewness	0,06	−0,96	−0,08	.	**−1,27**	−0,51	−1,84	−0,33	.	−1,82	0,66
	variability	26%	12%	9%	3%	12%	8%	9%	14%	6%	11%	15%
Edat 3	kurtosis	−0,94	1,25	0,89	.	−0,77	1,10	3,75	2,76	.	3,99	−0,04
	Gini coeff.	0,12	0,09	0,09	0,04	0,10	0,08	0,06	0,11	0,07	0,16	0,12
	skewness	−0,06	1,18	0,93	.	**30,14**	1,14	2,00	1,21	.	2,00	−0,50
	variability	21%	17%	16%	9%	18%	16%	13%	21%	14%	37%	22%
Actrt	kurtosis	0,83	−0,13	−0,60	.	0,27	−0,75	−1,60	1,94	.	2,47	−0,36
	Gini coeff.	**0,04**	0,02	0,02	0,01	0,03	0,02	0,02	0,01	0,01	0,02	0,06
	skewness	0,47	−1,16	0,04	.	−0,62	−0,19	−0,06	0,74	.	1,36	−1,08
	variability	6%	5%	3%	2%	5%	3%	3%	2%	1%	5%	11%
Pers	kurtosis	4,05	0,87	10,14	.	1,49	5,01	2,66	3,99	.	0,89	0,07
	Gini coeff.	**0,56**	**0,46**	**0,45**	0,36	**0,46**	**0,45**	**0,49**	**0,58**	0,04	0,28	0,26
	skewness	2,12	1,36	2,68	.	**1,36**	2,00	1,70	1,94	.	−0,36	0,27
	variability	125%	89%	96%	71%	87%	91%	98%	121%	9%	50%	47%
Rt	kurtosis	−1,06	0,12	0,11	.	1,29	1,71	4,10	−0,19	.	−3,03	0,14
	Gini coeff.	0,15	0,26	0,20	0,04	0,23	0,10	0,19	0,07	0,02	0,22	0,33
	skewness	0,13	0,85	0,79	.	**1,59**	0,29	1,99	−0,19	.	0,32	1,32
	variability	27%	47%	36%	8%	47%	19%	40%	12%	3%	40%	67%
GDP	kurtosis	−0,17	2,59	1,62	.	10,96	−0,39	−0,79	3,80	.	3,71	.
	Gini coeff.	**0,22**	0,16	0,11	.	0,11	0,10	0,09	0,07	.	0,27	.
	skewness	0,24	1,39	1,07	.	**1,87**	0,65	−0,24	1,83	.	1,91	.
	variability	39%	30%	20%	.	24%	18%	16%	14%	.	58%	.

Table 6. Basic descriptive characteristics… (cont.)

		GR. A	BE	DE	IE	FR	NL	AT	PT	SI	SK	CH
Gvagr	kurtosis	0,80	6,84	11,83	.	11,30	6,79	–0,54	0,25	.	3,66	.
	Gini coeff.	**0,29**	0,22	**0,52**	.	0,32	0,27	0,00	0,30	.	0,11	.
	skewness	1,16	2,36	–2,41	.	**2,78**	–2,54	0,69	0,05	.	1,89	.
	variability	54%	48%	109%	.	69%	60%	3%	54%	.	23%	.
Hhinc	kurtosis	–1,19	–1,33	–0,16	.	7,48	–0,26	3,45	2,90	.	.	.
	Gini coeff.	0,17	0,05	0,05	.	0,07	0,02	0,29	0,05	.	.	.
	skewness	–0,54	0,41	–0,16	.	**–2,44**	0,76	1,68	1,40	.	.	.
	variability	30%	9%	8%	.	16%	4%	57%	10%	.	.	.
Mddd	kurtosis	0,02	.	.	.	.	.	–0,73	.	.	.	7,88
	Gini coeff.	0,21	.	.	.	.	.	0,14	.	.	.	0,69
	skewness	0,00	.	.	.	.	.	0,72	.	.	.	2,80
	variability	38%	.	.	.	.	.	25%	.	.	.	191%
Ilc	kurtosis	–0,75	.	.	.	.	.	.	.	.	.	–0,71
	Gini coeff.	0,06	.	.	.	.	.	.	.	.	.	0,21
	skewness	0,39	.	.	.	.	.	.	.	.	.	0,67
	variability	11%	.	.	.	.	.	.	.	.	.	37%

Source: own calculations based on EUROSTAT data [18].

Table 7. Basic descriptive characteristics for European countries from group B with the highest number of NUTS2 units

		Gr. B	CZ	DK	EL	ES	IT	HU	PL	FI	SE	UK	NO	TR
Edat 1	kurtosis	0,53	3,54	0,50	4,42	–0,65	–0,94	0,24	2,48	3,85	–0,19	–0,62	– 2,04	–0,10
	Gini coeff.	0,28	0,21	0,08	0,08	0,11	0,09	0,12	0,14	0,08	0,05	0,11	0,08	0,06
	skewness	0,97	1,35	–1,05	–1,70	0,00	0,59	–0,67	1,28	1,88	0,19	–0,12	0,12	–0,14
	variability	51%	43%	14%	16%	19%	17%	21%	26%	15%	9%	20%	15%	10%
Edat 2	kurtosis	0,69	7,06	4,39	0,09	0,66	–0,75	3,55	1,78	1,99	–0,52	5,03	5,73	–0,60
	Gini coeff.	0,14	0,04	0,05	0,04	0,06	0,06	0,02	0,03	0,06	0,06	0,07	0,05	0,11
	skewness	0,52	–2,62	–2,07	–0,64	–0,29	–0,26	–1,71	–1,06	–1,15	–0,63	–1,86	–2,35	–0,58
	variability	26%	10%	10%	6%	10%	10%	5%	6%	11%	10%	13%	11%	19%
Edat 3	kurtosis	–0,66	5,67	3,40	2,19	–0,72	–0,36	7,89	2,80	1,58	–0,23	2,44	3,17	1,36
	Gini coeff.	0,13	0,17	0,09	0,09	0,11	0,08	0,10	0,08	0,08	0,08	0,10	0,07	0,14
	skewness	–0,78	2,21	1,86	1,22	0,45	0,09	2,75	1,40	–0,04	0,70	1,40	1,62	0,92
	variability	23%	37%	19%	17%	19%	15%	26%	14%	15%	14%	19%	14%	26%
Actrt	kurtosis	0,95	5,14	2,53	–0,36	–0,27	–1,21	–0,74	0,30	2,30	1,32	–0,40	0,10	1,99
	Gini coeff.	0,06	0,02	0,02	0,02	0,02	0,06	0,02	0,02	0,02	0,02	0,02	0,02	0,04
	skewness	0,61	2,15	1,58	0,19	–0,14	–0,56	–0,11	0,50	1,49	1,03	0,32	0,60	–0,83
	variability	10%	3%	4%	3%	4%	11%	3%	3%	4%	3%	4%	3%	8%

Table 7. Basic descriptive characteristics… (cont.)

		Gr. B	CZ	DK	EL	ES	IT	HU	PL	FI	SE	UK	NO	TR
Pers	kurtosis	0,32	–1,16	0,86	1,20	1,67	3,08	3,56	2,48	4,80	0,13	5,58	–0,58	9,34
	Gini coeff.	**0,62**	0,17	0,25	**0,51**	**0,55**	**0,53**	0,35	0,27	0,33	0,38	0,41	0,31	**0,48**
	skewness	1,32	0,31	0,88	1,53	1,58	1,60	1,70	1,14	2,18	0,96	2,09	0,51	2,68
	variability	123%	30%	46%	103%	110%	102%	70%	50%	75%	70%	84%	57%	105%
Rt	kurtosis	1,71	0,59	–3,25	0,28	–0,92	–0,97	–1,64	–0,06	–0,30	1,16	0,39	–1,65	5,10
	Gini coeff.	0,35	0,17	0,03	0,09	0,17	0,26	0,23	0,15	0,04	0,06	0,12	0,12	0,23
	skewness	1,51	0,71	0,56	0,58	0,67	0,60	0,20	0,96	–0,47	1,01	0,38	0,13	1,59
	variability	68%	31%	6%	16%	31%	48%	40%	28%	8%	12%	22%	22%	45%
GDP	kurtosis	–0,09	7,49	2,82	5,41	–0,64	–1,10	2,40	4,52	–1,18	3,53	40,55	.	.
	Gini coeff.	0,31	0,16	0,11	0,09	0,11	0,15	0,16	0,12	0,10	0,09	0,03	.	.
	skewness	0,81	2,70	1,38	2,13	0,69	0,06	1,58	1,86	0,79	1,97	6,10	.	.
	variability	56%	41%	21%	19%	20%	27%	32%	25%	18%	18%	71%	.	.
Gvagr	kurtosis	–0,12	–0,96	0,87	8,98	0,34	0,53	–0,94	–0,67	1,86	–0,50	1,90	.	.
	Gini coeff.	0,26	**0,43**	0,26	0,61	0,14	1,38	0,34	0,21	**0,44**	0,19	0,38	.	.
	skewness	–0,59	0,31	0,55	–2,73	–1,00	0,47	0,05	0,01	–0,81	–0,48	–0,41	.	.
	variability	59%	76%	47%	–197%	26%	231%	60%	37%	77%	34%	141%	.	.
Hhinc	kurtosis	–1,38	4,97	2,39	1,11	–0,69	–1,34	–1,23	0,40	–2,32	3,09	20,49	1,23	.
	Gini coeff.	0,28	0,06	0,02	0,07	0,10	0,11	0,03	0,06	0,05	–0,02	0,09	0,03	.
	skewness	0,24	2,13	1,59	1,23	0,55	–0,19	0,11	0,88	0,23	1,82	3,84	1,20	.
	variability	49%	12%	3%	13%	17%	19%	6%	12%	9%	6%	21%	5%	.
Mddd	kurtosis	2,49	1,41	2,23	–0,97	2,69	–0,34	0,00	–0,52	2,96	–0,29	.	0,94	.
	Gini coeff.	0,49	0,31	0,10	0,05	0,34	0,26	**0,45**	0,10	0,25	–0,04	.	0,10	.
	skewness	1,73	1,48	–1,47	0,76	1,23	0,84	1,18	–0,37	–1,58	0,68	.	–1,19	.
	variability	101%	62%	20%	9%	64%	49%	90%	17%	49%	33%	.	19%	.
Ilc	kurtosis	–1,44	–0,40	–2,66	2,66	–0,99	–0,86	–0,65	3,90	–1,34	0,45	.	–0,51	.
	Gini coeff.	0,15	0,16	0,05	0,08	0,23	0,28	0,07	0,10	0,13	0,04	.	0,09	.
	skewness	0,01	1,06	0,08	–1,48	0,28	0,70	0,69	1,87	–0,15	0,12	.	–0,29	.
	variability	26%	30%	10%	16%	40%	51%	12%	21%	24%	15%	.	16%	.

* – or the last possible

Source: own calculations based on EUROSTAT data [18].

In the studied groups of countries, a relatively standardized concentration was estimated at a similar level, usually low for selected countries. The average value of the Gini coefficient in the A group of countries is 0.16 and in the B group of countries it is 0.15. In the A group of countries, only the Pers variables show moderate concentration. The concentration in group B for the Hhinc, Edat 3, Edat 2 variables – is also very low – we observe their even distribution the Gini coefficient does not currently exceed 0.15 level in these countries.

There are no unambiguous lowest levels of asymmetry characteristic for specific countries or variables. The asymmetry level is negative for Edat1, Edat2, except – France and Austria in group A, and – the Czech Republic, Finland, Sweden and Norway in group B.

It was noted that for some countries the regional skewness rate exceeds 1 for many countries of A and B group. Moreover, the level of asymmetry is above 1 for Slovakia and the Czech Republic for the majority of studied variables.

The average value of the coefficient of variability turned out to be the highest for Pers – Unemployment and, what is important, when compared to the countries in group A, it is higher in the countries of group B for the variables Edat3, Rt, GDP, Gvagr, Hhinc, Mddd, Ilc. Whereas for the Actrt feature, the average value of the coefficient is below 10% which means that the feature is not statistically significant.

The study uses a space-time model with decomposition of intercept [10] estimated using GRETL. EUROSTAT balanced data for 22 countries for 2013–2017 were used. In order to verify the H2 hypothesis, we estimate the model 1:

$$LE_t = a_0 + a_1 \times Edat_t + a_2 \times Edat2_t + a_3 \times Edat3_t + a_4 \times Actrt_t + a_5 \times Pers_t + a_6 \times Rt_t + \xi_t$$

Table 8. Model 1 (dependent variable LE = 30)

Variable	*Coefficient*	*Standard error*	*t-ratio*	*p-value*	
const	49,4671	0,560768	88,2131	<0,0001	***
Edat2	14,5461	4,7838	3,0407	0,0031	***
Edat3	−5,19005	2,90625	−1,7858	0,0776	*
Actrt	13,0798	3,47865	3,7600	0,0003	***
Pers	1,68015	0,721314	2,3293	0,0222	**
Rt	7,5514	1,07287	7,0385	<0,0001	***
du_BE	−1,09914	0,199025	−5,5226	<0,0001	***
du_CZ	−1,63605	0,381822	−4,2848	<0,0001	***
du_DE	−0,943691	0,193011	−4,8893	<0,0001	***
du_DK	0,657885	0,299082	2,1997	0,0305	**
du_EL	0,673887	0,205493	3,2794	0,0015	***
du_SE	1,59234	0,174897	9,1044	<0,0001	***
du_FI	0,843153	0,234011	3,6030	0,0005	***
du_FR	0,665218	0,159026	4,1831	<0,0001	***
du_HU	−5,03392	0,227508	−22,1263	<0,0001	***
du_IE	1,2959	0,261174	4,9618	<0,0001	***
du_IT	0,83944	0,164069	5,1164	<0,0001	***
du_NL	1,52751	0,243196	6,2810	<0,0001	***

Table 8. Model 1 (dependent variable LE = 30) (cont.)

Variable	*Coefficient*	*Standard error*	*t-ratio*	*p-value*	
du_NO	−2,68224	0,279845	−9,5847	<0,0001	***
du_PL	1,54474	0,200969	7,6865	<0,0001	***
du_SE	1,30926	0,422566	3,0984	0,0026	***
du_SK	−3,70515	0,300227	−12,3411	<0,0001	***
du_TR	−3,70654	0,214245	−17,3005	<0,0001	***

Source: own elaboration in the Gretl program.

The rating of the partial regression coefficient a_1 standing at the variable Edat2 – Population aged 25–64 by educational attainment level, (%) is equal to 14.546, and the error of this rating is 4.78. This coefficient can be given the following interpretation: if the average population aged 25–64 according to the level of secondary education increases by 1 (%), then the average life expectancy will increase by 14.546 (%), provided that the values of other variables do not change.

In case of the Actrt variable, the partial regression coefficient is equal to 13.08 with an error of ± 3.47, which allows the following substantive interpretation: when the professional activity rate increases by 1 (%), the average life expectancy increases by 13.08 (%) , provided that the values of other variables do not change.

Besides, the assessment of the partial regression coefficient a_5 standing at the Pers-Unemployment variable in (%) is equal to 1.68, and the error of this rating is 0.72. This coefficient can be given the following interpretation: if the unemployment rate on average increases by 1 (%), then the average life expectancy will increase by 1.68% (%), provided that the values of other variables do not change.

Normality of the random component distribution was checked. Null hypothesis: the random component has a normal distribution, Test statistic: Chi-square (2) = 1.92185, with a p value of 0.38254.

Table 9. Adaptation of model 1 (dependent variable LE = 30)

Residual sum of squares	107,8889	Residual standard error	1,113599
Coeff. determ. R-square	0,985811	Corrected R-square	0,982223
F(22, 87)	274,7570	p-value for the F test	7,65e-71
Logarithm of the likelihood function	−155,0174	Akaike Information Criterion	356,0348
Bayesian Inform. Criterion	418,1459	Hannan-Quinn Criterion	381,2274

Source: own elaboration in the Gretl program.

In the estimated model, the coefficient of determination takes the value of 0.99, which shows that 99% of the variability of the explained variable was successfully explained by the equation. Matching the model to the data is very good. The standard error of residuals or the residual variance element describes the behavior of the dependent variable and in the case of model 1 it is 1,114, which means that the estimated LE 30, will change on the average by ±1.114 unit. The null-neutral hypothesis: the empirical cumulative distribution has a normal distribution. The Doornik-Hansen Test (1994) – transformed skewness and kurtosis: Chi-square (2) = 1.922 with a p value of 0.38254.

The empirical and compensated values of the model 1 variable were checked on the graph (Chart 1).

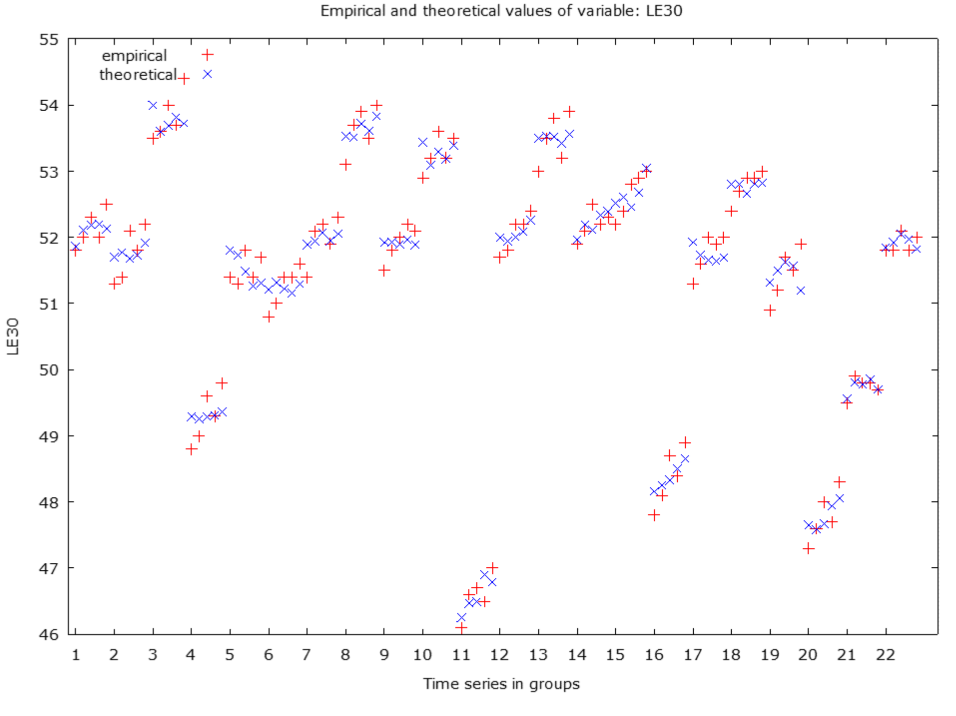

Chart 1. Empirical and aligned values of the variable (dependent variable LE = 30)

Source: own elaboration in the Gretl program.

For the model 2 with a dependent variable life expectancy at the age of 45 in the case of the Actrt variable, the partial regression coefficient is equal to 17.9 with an error of ±3.33, which allows the following substantive interpretation: with the increase in the professional activity rate by 1 (%), the average life expectancy will increase by 17.10 (%), provided that the values of other variables do not change.

Apart from that, the assessment of the partial regression coefficient a_5 standing at the Pers – Unemployment variable in (%) is equal to 1.71, and the error of this rating is 0.42. This coefficient can be given the following interpretation: if the unemployment rate on average increases by 1 (%), then the average life expectancy will increase by 1.71 (%), provided that the values of other variables do not change.

Table 10. Model 2 (dependent variable LE = 45)

Variable	Coefficient	Standard error	t-ratio	p-value	
const	35,8452	0,214896	166,8029	<0,0001	***
Actrt	17,1038	3,32992	5,1364	<0,0001	***
Pers	1,71282	0,421702	4,0617	0,0001	***
Rt	4,78714	0,659998	7,2533	<0,0001	***
du_BE	−0,823424	0,205819	−4,0007	0,0001	***
du_CZ	−2,32575	0,221644	−10,4932	<0,0001	***
du_DE	−1,04868	0,159897	−6,5585	<0,0001	***
du_DK	1,15374	0,122781	9,3968	<0,0001	***
du_EL	0,58267	0,142963	4,0757	<0,0001	***
du_SE	0,751539	0,11703	6,4218	<0,0001	***
du_FI	−5,41497	0,112808	−48,0016	<0,0001	***
du_FR	0,937754	0,145473	6,4462	<0,0001	***
du_HU	0,239815	0,111815	2,1448	0,0346	**
du_IE	1,10057	0,163603	6,7271	<0,0001	***
du_IT	−2,88264	0,1524	−18,9149	<0,0001	***
du_NL	1,14831	0,12782	8,9838	<0,0001	***
du_NO	0,533844	0,27228	1,9606	0,0530	*
du_PL	−4,04814	0,169692	−23,8558	<0,0001	***
du_SE	−3,23997	0,103955	−31,1671	<0,0001	***

Source: own elaboration in the Gretl program.

In the estimated model 2, the coefficient of determination takes the value of 0.99, which shows that 99% of the variability of the explained variable was successfully explained by the equation. Matching the model to the data is very good. The standard error for model 2 is 1.095, which means that the estimated LE 45 will change its average by ±1.095 units. Null hypothesis: an empirical distributor has a normal distribution. The Doornik-Hansen Test (1994) – transformed skewness and kurtosis: Chi-square (2) = 0.079 with a p value of 0.96109.

Table 11. Adaptation of model 2 (dependent variable LE = 45)

Residual sum of squares	109,2044	Residual standard error	1,095467
Coeff. determ. R-square	0,986047	Corrected R-square	0,983287
F(18, 91)	357,2667	p-value for the F test	3,29e-76
Logarithm of the likelihood function	−155,6840	Akaike Information Criterion	349,3679
Bayesian Inform. Criterion	400,6771	Hannan-Quinn Criterion	370,1792

Source: own elaboration in the Gretl program.

The empirical and compensated values of the model 2 variable were checked on the graph (Chart 2).

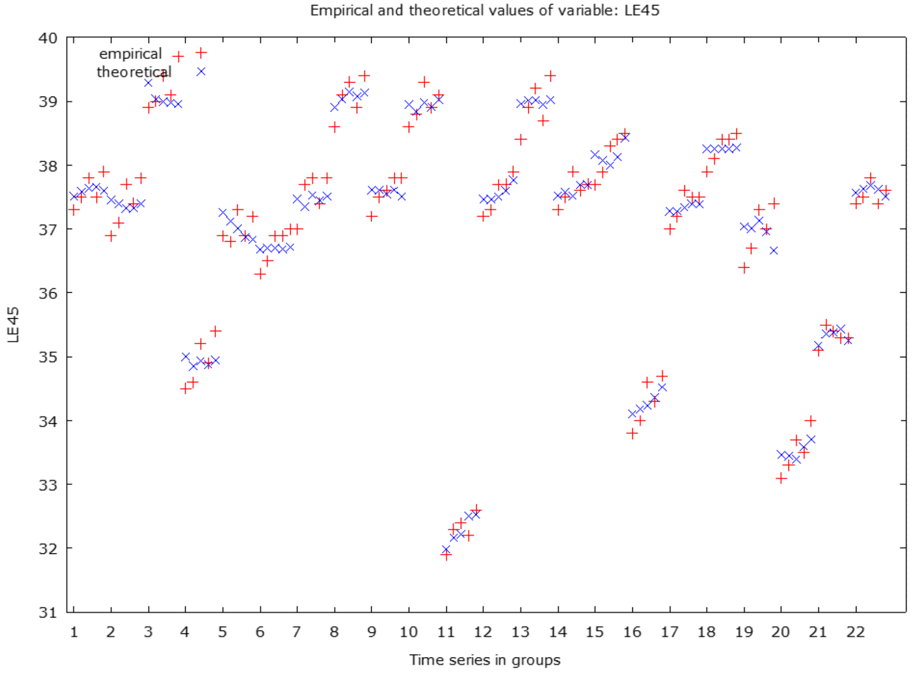

Chart 2. Empirical and aligned values of the variable (dependent variable LE = 45)

Source: own elaboration in the Gretl program.

Summary

In the analysis, health determinants were subjected to a regional analysis of the country in which the division into several regions is distinguished, which resulted in a very limited selection of variables in four categories, i.e.:

demographic situation, labour market and education, economic situation, state of households. The analysis of socio-economic determinants of health-shaping factors presented above clearly shows not only large discrepancies in this area within the European Union, but also at the regional level within selected countries. The existing division into two groups A and B is almost stable, although some symptoms of flattening of too concentrated distributions are observed. However, the level of asymmetry of determinants is strong and its clearly marked shifts towards symmetry are observed only in some cases. The H1 hypothesis was accepted in the course of the verification – *there are no clear differences in the inequalities between the socio-economic factors shaping health in two groups of countries with different importance of private insurance.* We can observe that there is a statistically significant relationship between socio-economic factors determining the state of health of Edat2, Edat3, Actrt, Pers, Rt and the expected life expectancy of the population. The socio-economic factors examined are important from the point of view of achieved health results. The results of the parameter estimation for the assessment model allow us to accept the H2 hypothesis – regional inequality of socio-economic factors shaping health affects the life span.

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Nierówność makrospołecznych czynników determinujących zdrowotność

Synopsis: Praprzyczynami nierówności zdrowia, według Marmota [1], są różne społeczne determinanty zdrowia. W pracy wykorzystano społeczno-ekonomiczne czynniki kształtujące zdrowie analizowane z podziałem na cztery kategorie, tj.: sytuacja demograficzna, rynek pracy i wykształcenie, sytuacja gospodarcza, stan gospodarstw domowych.

Przyjęty w danym kraju sposób finansowania służby zdrowia związany jest bezpośrednio ze stosowanym w nim modelem systemu zdrowotnego [8]. Badaną grupę krajów podzielono na dwie podgrupy według kryterium istotności w badanej populacji prywatnych ubezpieczeń w finansowaniu opieki zdrowotnej.

Celem niniejszego artykułu jest analiza statystyczna poziomów, ich zmian i kształtów rozkładów wybranych determinant stanu zdrowia pomiędzy dwoma grupami krajów, w których prywatne ubezpieczenia odgrywają większą rolę jako mechanizm finansowania świadczeń albo nie są istotnym źródłem zasobów. W analizie wykorzystano dane w podziale na jednostki NUTS2 dla krajów Europy pochodzące z EUROSTAT-u. W pomiarze wykorzystano współczynnik skośności, współczynniki koncentracji (kurtozę, współczynnik Herfindahla-Hirschmana, współczynnik Giniego). Wyniki potwierdziły brak wyraźnych różnic w nierównościach pomiędzy społeczno-ekonomicznymi czynnikami kształtującymi zdrowotność w dwóch grupach krajów o innym znaczeniu prywatnych ubezpieczeń.

Słowa kluczowe: zdrowie, determinant stanu zdrowia, nierówności zdrowia, analiza koncentracji.