REGIONAL DIFFERENCES OF MORTALITY AND LIFE EXPECTANCIES IN V4 COUNTRIES

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Abstract

Life expectancy at birth belongs to demographic indicators that give a good idea about the situation of health care, public health, living standard, life style or wellbeing in specific country or regions of a country. The decline of mortality is one of the basic pillars that lead to an increase of life expectancies (LE) at birth or at certain age. However not only the increase of LE should stay in focus of analysis, but also the status and development of other characteristics should be taken into consideration, for example the changes of healthy life years. The paper discusses the development of LE in Visegrad four countries and their regions at NUTS 2 level. The situation in life expectancies is completed by analysis of standardizes death rates development on country level and on regional levels. Besides the total standardized death rate some specific death rates were chosen to see how cause specific death rates are changing in V4 countries. The Czech Republic had the highest LE at birth for both sexes during the analyzed time span. In case of life expectancies at age 65 the Czech Republic get the best position for men while the highest levels of LE for older women belonged to Poland.

Key words: life expectancy, standardized death rates, region, Visegrad Group countries

JEL Code: J11, I18, G20

Introduction

Socio-economic indicators are often analyzed characteristics that give a picture of not only economic situation in a country in context of gross domestic product per capita, production or productivity per capita or hour worked. The economic characteristics and well-being, poverty and quality of life are connected issues (Zelinsky, 2014, Zelinky et al., 2018). Life expectancy at birth is the mean number of years a newborn child can expect to live if subjected throughout his or her life to the current mortality conditions (Statistics Explained, Key figure on Europe, 2017). To measure successes in the health care or wellbeing not only the LE at birth is used but also LE at certain age is an often-used indicator (Artlova et al. 2016). For

example, the LE at age 65 gives the total expected life span for population aged 65 as a sum of age 65 and the LE at that age (Statistics Explained, Kotzeva, 2017). The have a complete picture of health situation the death rates total and death rates on selected causes of death should be analyzed (Gavurova et al., 2017). Visegrad four countries are very close not only geographically, they had for many years a similar socialist regimes and they joined the EU in the same year. But we can expect that some socio-economic characteristics in these countries are different on the country level or on the regional levels too. The socio-economic indicators are used as a solo indicator or as a part of a group of variables to evaluate the situation in a country or region using some multivariate analytical tools (Loster 2015, Zelinsky&Stankovicova, 2012, Loster 2014). Aging and increase of life expectancies is in focus of analyses in all over the world (Artlova et al. 2013, Langhamrova et al., 2018,).

## 1   Life expectancy at birth and at age 65 in V4 countries

The life expectancy (LE) at birth and at age 65 increased steadily in last decades in V4 countries. Hungary had the lowest levels of LE at birth for men and women at the beginning of our analysis in 1997 and also in 2016 at the end of analyzed period (see Fig. 1 and Fig. 2). The highest LE were achieved on the other hand in Czech Republic. The highest relative an also absolute change of LE at birth for men were reached in Hungary and for women in Poland.

In Czech Republic the LE at birth for men increased from 70.5 years in 1997 to 76.1 years in 2016 (increase by 7.9 % or 5.6 years). In Hungary in the same time span the LE for men jumped from 66.7 to 72.6 years (increase by 8.8 % or 5.9 years). The LE at birth for men increased from 68.5 years to 73.9 years between 1997 and 2016 (increase by 7.9 % or 5.4 years) in Poland. And in Slovakia a man born in 1997 could expect to live 68.9 years while a man born in 2016 could expect to live 73.8 years (increase by 7.1 % or 4.9 years). The lowest relative and absolute growth in case of men were achieved in Slovakia.

The growth rates of LE for women were not so high compared with men. Due to this fact the gender gap closed slowly in V4 countries. In Czech Republic the LE at birth for women between 1997 and 2016 increased by 5.8 % or 4.5 years (from 77.6 years to 82.1 years). In Hungary in the same time span the LE for women grow by 5.6 % or 4.2 years, it means from 75.5 years to 79.7 years. In Poland the relative and absolute changes of LE for women were the highest ones, increase by 6.5 % or 5.0 years, from 77.0 years to 82 years. In Slovakia the LE for women increased from a starting level of 76.9 years in 1997 to 80.7 years
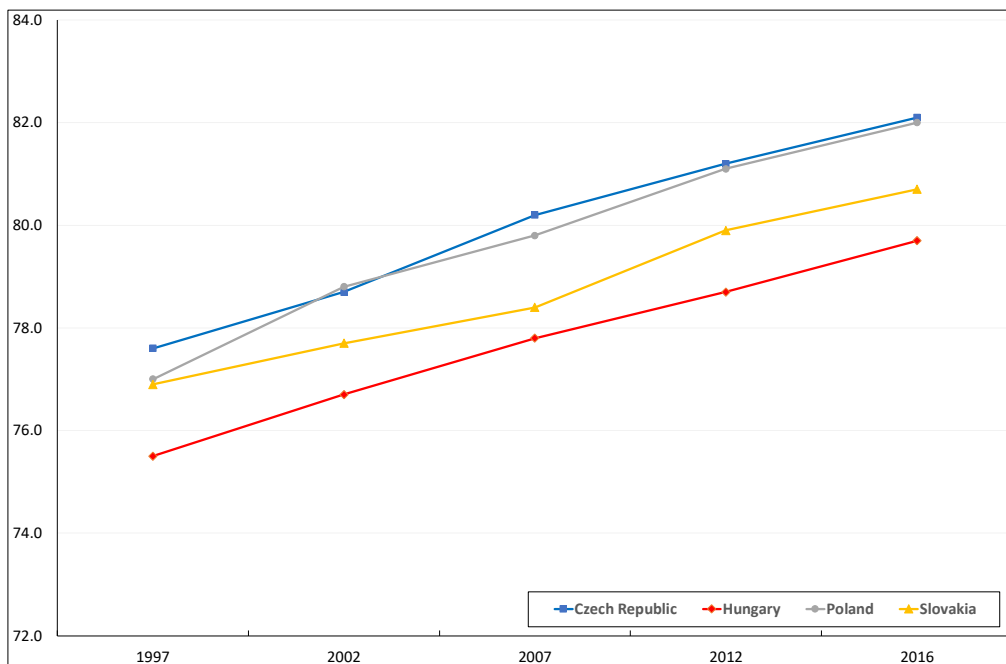
in 2016, which ended with the lowest relative (4.9 %) and also lowest absolute change (3.8 years) of LE for women between the V4 countries. The gender gap in favor of women ranged between 7.1 (Czechia) and 8.8 (Hungary) years in 1997 and between 6.0 (Czechia) and 8.1 (Poland) years in 2016.

Fig. 1: LE at birth, males
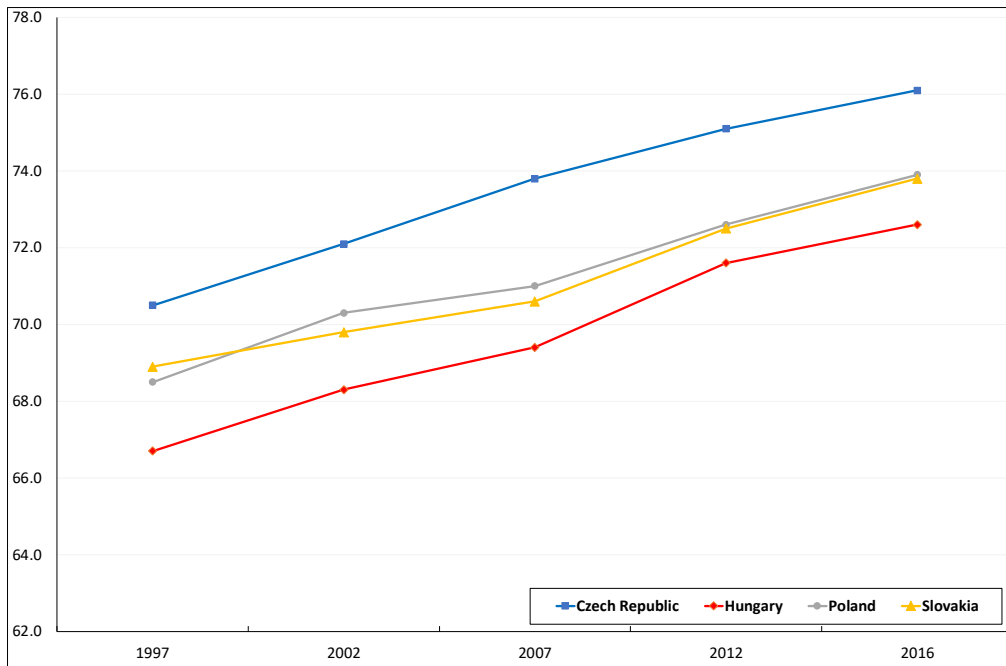
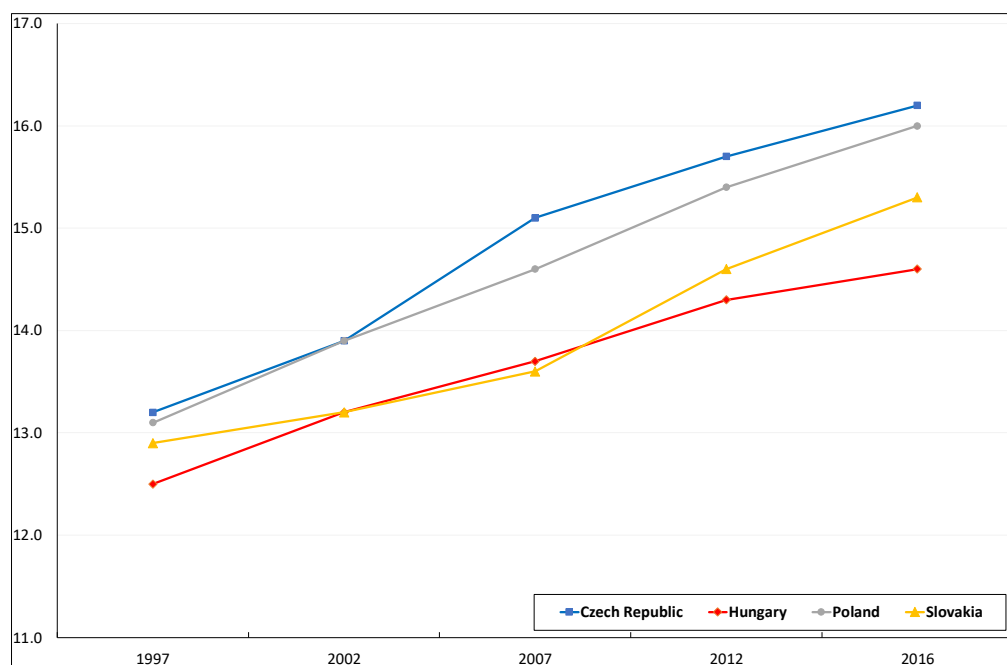
Source: Eurostat, own processing

Fig. 2: LE at birth, females

Source: Eurostat, own processing

The relative changes of the LE at 65 were much more intensive compared with the LE at birth. In Czech Republic the LE at 65 for men increased by a maximum level of 22.7 % or by 3.0 years. In Hungary the change was the lowest, with an increase by 16.8 % or by 2.1 years. In Poland the LE at 65 for men jumped from 13.1 years to 16.0 years (22.1 % or 2.9 years). In Slovakia the starting level of LE at 65 for men was 12.9 years and due to an increase by 2.4 years it ended at 15.3 years (see Fig. 3). The LE at 65 for women is presented at Fig. 4. The increase between 1997 and 2016 ranged from 14.7 % (Hungary) till 22.0 % (Poland), in terms of absolute values it ranged between 2.4 years (Hungary) till 3.7 years (Poland). A woman at age 65 in 2016 could expect to live an extra 20 years in Czech Republic, 18.7 years in Hungary, 20.5 years in Poland and 19.2 years in Slovakia. Compared with the declining gender gap in case of LE at birth the gender gap of the older population did not develop positively. The gender gap in 1997 was in all four countries lower than in 2016. In Czech Republic the gander gap increased in the mentioned time span from 3.5 years to 3.8 years, in Hungary it increased from 3.8 years to 4.1 years, in Poland from 3.7 years to 4.5 years and in Slovakia 3.6 years to 3.9 years.

Fig. 3: LE at age 65, males
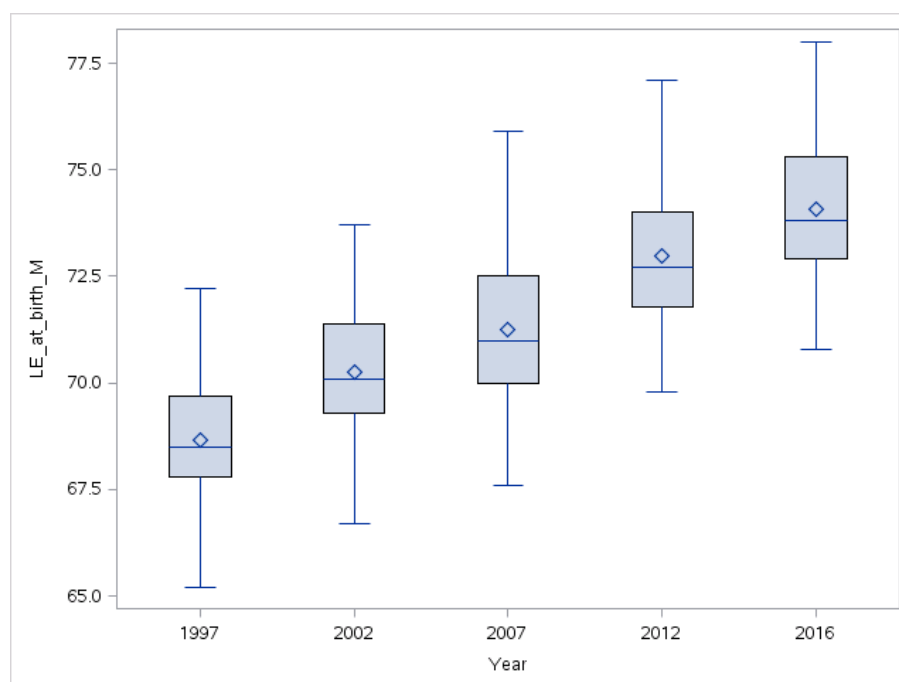

Source: Eurostat, own processing

Fig. 4: LE at age 65, females
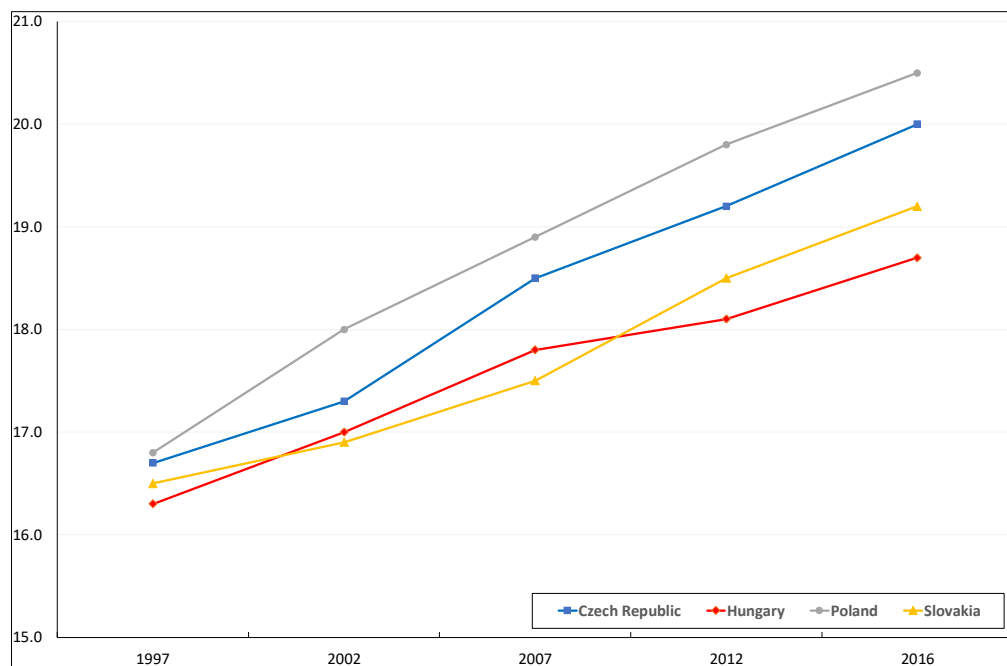
Source: Eurostat, own processing

1.1 LE at birth in regions of V4 countries

The LE at birth for men in 35 regions of V4 countries ranged between 65.2 years and 72.2 years in 1997 (see Table 1). The highest first six ranks belonged to the regions of Czech Republic. The worst four positions belonged to Hungary. Not only on country level reached the Czech Republic the best position of the analyzed variable but also on the regional level are the regions of Czechia the best ones. On the other side are the regions of the worst positioned Hungary between the V4 countries and its regions. Four of the seven regions of Hungary occupied the last ranks with the lowest LE at birth for males in 1997. The situation did not change a lot until 2016. Again, the best ranks with the highest LE for men were typical for Czech Republic and the worst ones for Hungary. The highest LE for men was achieved in Praha region (78.0 years) and the lowest in Észak-Magayrrország region (70.8 years). The unweighted average of LE at birth for male of the V4 regions increased from 68.7 years in 1997 to 74.1 in 2016 (see Fig. 5 and Table 1). On a country level the highest regional LE at birth for men were typical for the regions of capital city (Praha, Bratislavský kraj, Közép-Magyaroszág) with only one exemption for Poland, where the highest LE were achieved in the region Podkarpackie.

Fig. 5: Box-plot of LE at birth, NUTS 2 regions of V4 countries, males

Source: Eurostat, own processing

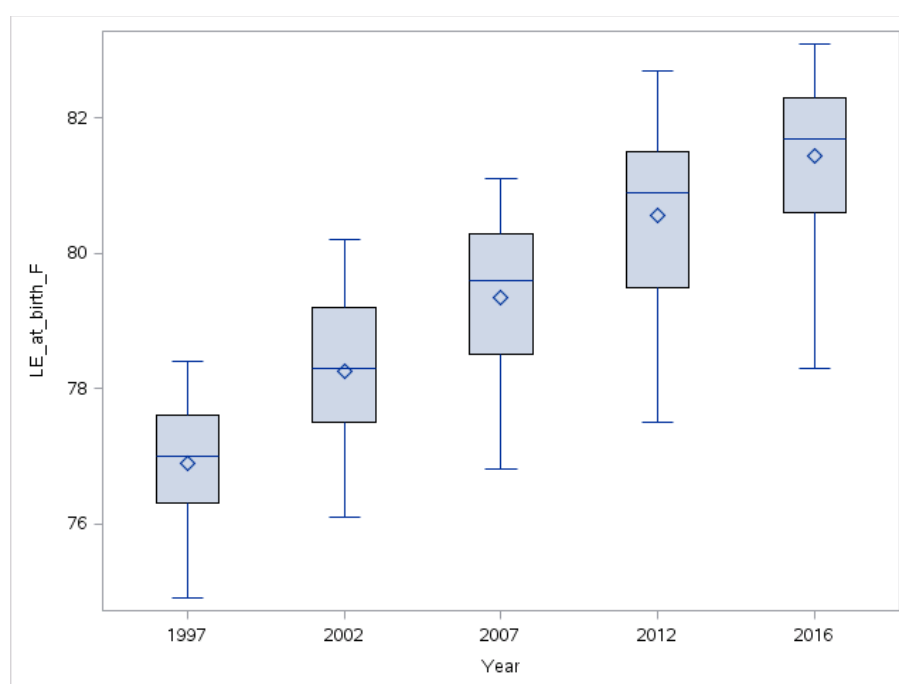**Tab. 1: Summary statistics, LE at birth, NUTS 2 regions of V4 countries, males**

Analysis Variable : LE_at_birth_M									
Year	**Mean**	**Std Dev**	**Minimum**	**Maximum**	**Range**	**Lower Quartile**	**Median**	**Upper Quartile**	**Coeff of Variation**
1997	68.66	1.52	65.20	72.20	7.00	67.80	68.50	69.70	2.22
2002	70.25	1.58	66.70	73.70	7.00	69.30	70.10	71.40	2.25
2007	71.27	1.89	67.60	75.90	8.30	70.00	71.00	72.50	2.66
2012	72.99	1.58	69.80	77.10	7.30	71.80	72.70	74.00	2.16
2016	74.06	1.61	70.80	78.00	7.20	72.90	73.80	75.30	2.17

Source: Eurostat, own processing

The LE at birth for women in NUTS 2 regions of V4 countries ranged between 74.9 years and 78.4 years in 1997 (see Table 2). Only first two best positions belonged to Czech Republic, followed by one region of Poland, the forth position belonged again to a region of Czechia, the fifth to Poland a sixth to Slovakia. It means that the best positions of LE at birth for female was not so strongly dominated by the regions of Czech Republic. Altogether six out of seven Hungarian regions occupied the last positions between the 35 regions of V4 countries in terms of the LE at birth for women. The situation changed till 2016 not only due to an overall increase of the LE at birth for women that ranged from 78.3 years to 83.1 years

but also in term of the positions of the 35 regions of V4 countries. In 2016 the first four positions with the highest LE at birth for women belonged to the regions of Poland. The best Czech region got only the fifth rank. The lowest levels of LE were again typical for the Hungarian regions. In this year the best positions of regions in a concrete country belonged usually to the region of the capital city only with exception of Poland. The unweighted average of LE at birth for female of the V4 regions increased from 76.9 years in 1997 to 81.4 in 2016 (see Fig. 6 and Table 2).

Fig. 6: Box-plot of LE at birth, NUTS 2 regions of V4 countries, females

Source: Eurostat, own processing

Tab. 2: Summary statistics, LE at birth, NUTS 2 regions of V4 countries, females
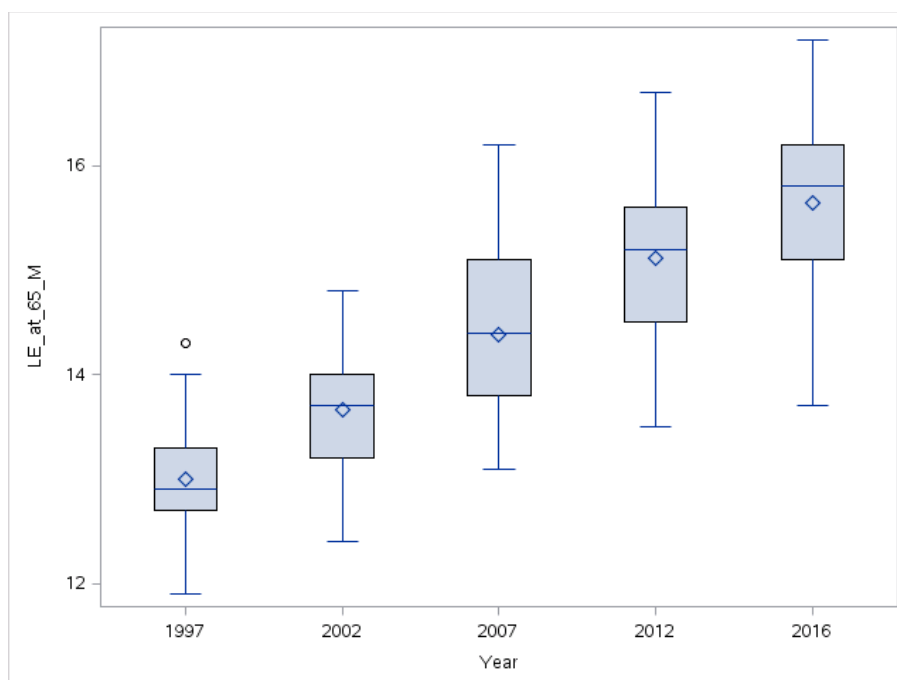
Analysis Variable : LE_at_birth_F									
Year	Mean	Std Dev	Minimum	Maximum	Range	Lower Quartile	Median	Upper Quartile	Coeff of Variation
1997	76.89	0.90	74.90	78.40	3.50	76.30	77.00	77.60	1.17
2002	78.25	1.03	76.10	80.20	4.10	77.50	78.30	79.20	1.32
2007	79.35	1.16	76.80	81.10	4.30	78.50	79.60	80.30	1.46
2012	80.56	1.26	77.50	82.70	5.20	79.50	80.90	81.50	1.56
2016	81.43	1.24	78.30	83.10	4.80	80.60	81.70	82.30	1.52

Source: Eurostat, own processing

1.2   LE at age 65 in regions of V4 countries

In 1997 the LE at 65 for men ranged from 11.9 year to 14.3 years (see Table 3). The highest LE was reached in Czech region Praha and the lowest one in Hungarian region Észak-Magyaroszág. Between the Poland´s regions the highest LE at 65 for men was achieved in region Podlaskie (14.0 years), from the Slovak´s region the highest level of LE was in the region of capital city Bratislavský kraj (13.5 years) and among the Hungarian regions the best one was again the region of capital city Közép-Magyaroszág (12.9 years).

Fig. 7: Box-plot of LE at 65, NUTS 2 regions of V4 countries, males

Source: Eurostat, own processing

Tab. 3: Summary statistics, LE at 65, NUTS 2 regions of V4 countries, males

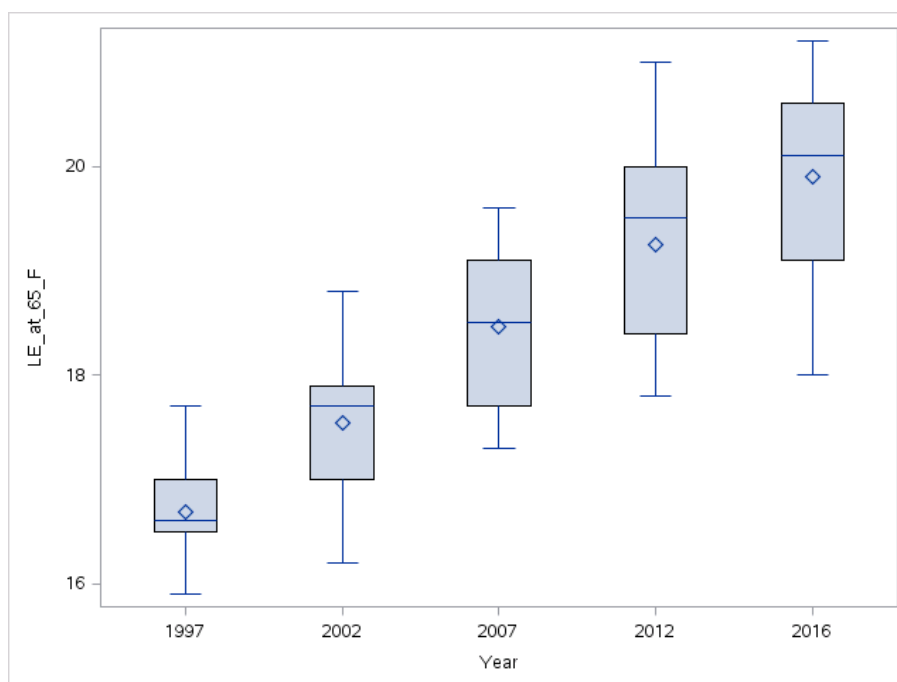| Analysis Variable : LE_at_65_M									
Year	Mean	Std Dev	Minimum	Maximum	Range	Lower Quartile	Median	Upper Quartile	Coeff of Variation
1997	13.00	0.49	11.90	14.30	2.40	12.70	12.90	13.30	3.81
2002	13.66	0.59	12.40	14.80	2.40	13.20	13.70	14.00	4.35
2007	14.38	0.77	13.10	16.20	3.10	13.80	14.40	15.10	5.33
2012	15.11	0.70	13.50	16.70	3.20	14.50	15.20	15.60	4.61
2016	15.64	0.80	13.70	17.20	3.50	15.10	15.80	16.20	5.11

Source: Eurostat, own processing

The relative measure of variability, the coefficient of variation stood at only 3.81 % in 1997 but due to a divergence of LE at 65 for men among the 35 regions of V4 countries the coefficient of variation increased to 5.11 %. The range between the minimal and maximal levels of LE at 65 for men increased too. The highest LE at 65 for men was reached again in Praha region (17.2 years) and the lowest one in the region Észak-Magyaroszág (13.7 years). The unweighted average of 35 regions jumped from 13.0 years to about 15.6 years (see Fig. 7 and Table 3).

The highest LE at 65 for women was achieved in 1997 in a Polish region (Podlaskie, 17.7 years), followed by Czech region (Praha, 17.4 years), rank three and four belonged again to Poland, while the fifth position was occupied by region of Slovakia (Bratislavský kraj, 17.2 years). Interesting is the position of the worst values. In case of LE at birth for men or women did not happen that between the last 5 ranks also a region of Czech Republic was positioned. Rank 31 belonged to Poland (Slaskie), rank 32 to Slovakia (Západné Slovensko), rank 33 to Czech Republic (Severozápad), rank 34 and 35 to Hungary (Észak-Alföld, Dél-Dunántúl). In Czech Republic, Slovakia and Hungary the best position of their regions with the highest LE at 65 for women belonged to the region of capital city. Remarkable is the position of regions in 2016. In this year the first five best positions of LE at 65 for women belonged to Poland´s regions. The highest level was achieved in Podlaskie region (21.2 years) and the lowest one in Hungarian region (Észak-Magyaroszág, 18.0 years). The unweighted average of all 35 regions increased from 16.7 years in 1997 to 19.9 in 2016 (see Fig. 8 and Table 4). Also, in case of LE at 65 for women the coefficient of variation increased from 2.4 % in 1997 to 4.3 % in 2016, the growth of relative measure of variability can be explained as a divergence of LE at 65 for women among 35 regions of V4 countries.

Fig. 8: Box-plot of LE at 65, NUTS 2 regions of V4 countries, females

Source: Eurostat, own processing

Tab. 4: Summary statistics, LE at 65, NUTS 2 regions of V4 countries, females

Analysis Variable : LE_at_65_F									
Year	Mean	Std Dev	Minimum	Maximum	Range	Lower Quartile	Median	Upper Quartile	Coeff of Variation
1997	16.68	0.39	15.90	17.70	1.80	16.50	16.60	17.00	2.35
2002	17.54	0.59	16.20	18.80	2.60	17.00	17.70	17.90	3.35
2007	18.46	0.68	17.30	19.60	2.30	17.70	18.50	19.10	3.70
2012	19.25	0.86	17.80	21.00	3.20	18.40	19.50	20.00	4.45
2016	19.91	0.86	18.00	21.20	3.20	19.10	20.10	20.60	4.34

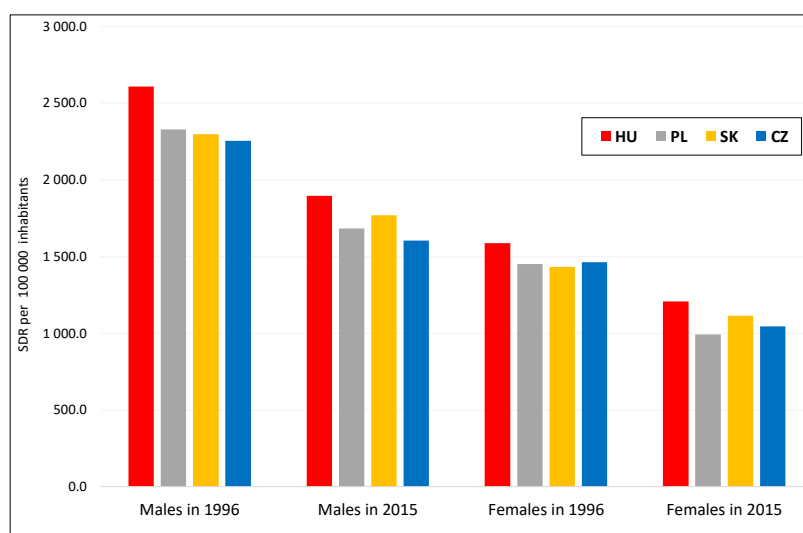Source: Eurostat, own processing

2   Standardized death rates in V4 countries

The LE is growing as it was declared in the previous chapter. The growth of LE is possible due to a decline of death rates. The overall standardized death rates (SDR) for men and women are presented in the Fig. 9. The death rates for men, as expected, are higher in all of the V4 countries compares to women. Positively can be rated the fact that the overall SDR declined rapidly between 1996 and 2015. These periods were chosen due to the accessibility of the regional specific mortality datasets. The worst situation in mortality was in Hungary where the SDR for both sexes was the highest one. The death rate for men started at 2 608.4 per 100 000 inhabitants in 1996 and dropped to 1 894.9 in 2015. The highest relative decline

of SDR was achieved in case of men in the Czech Republic (-28.8 %) and in case of women in Poland (-31.6 %). In each of the V4 countries the decrease of SDR for both sexes was higher than 20 %. The most important findings are that the coefficient of variation of the regional SDR did not change a lot in case of men but increased from 6.2 % to 10 % for women in the analyzed time span. In 1996 the lowest death rates were achieved in regions: CZ01, PL34, CZ05 (see NUTS classification for abbreviations) for men and PL34, SK01, CZ01 for women. The highest rates in the same year were a reality in: HU32, HU23, HU31 for men and CZ04, HU21, HU23 for women. In 2015 the lowest overall SDR for men were reached in regions CZ01, CZ06, SK01 and highest in Hungarian regions. In the same period the first three best ranks for females´ SDR were in Poland (PL34, PL32, PL21) and the worst in Hungarian regions.

To get a better picture about the development of the overall SDR we focused on changes of some cause-specific mortality rates. For this purpose, three causes of specific mortalities were chosen: death rates due to malignant neoplasms, death rates due to diabetes mellitus and death rated due to diseases of the circulatory system.

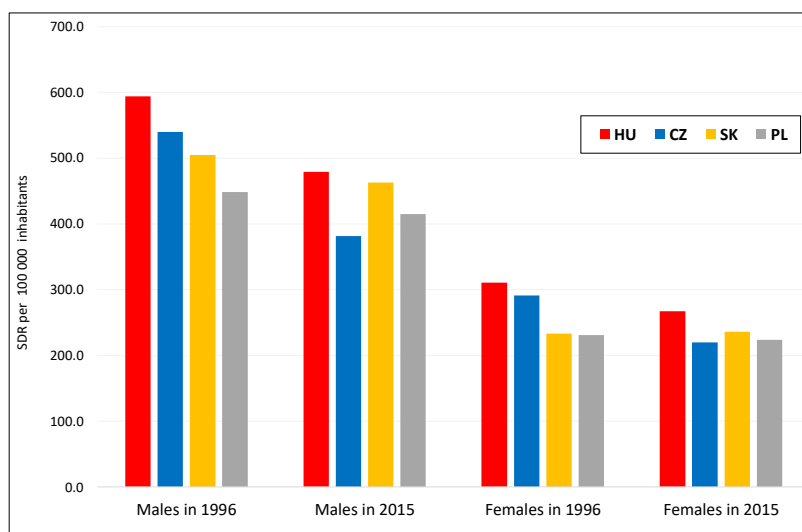**Fig. 9: SDR per 100 000 inhabitants – total (3 years average)**

Source: Eurostat, own processing

The SDR for men due to malignant neoplasms declined in all V4 Member States (see Fig. 10). The strongest relative decrease of SDR for men was achieved in Czech Republic, where the rate dropped from 539.9 to 381.6, by 29.3 % in analyzed time span. Very successful was the Czech Republic also in cutting-down the rates for women, from 291.4 to 219.8, it means a decrease by 24.6 %. In Hungary the decline was also strong and higher than 10 % for

both sexes. More negatively can we rate the very slow cut-down of SDR for malignant neoplasms in Poland. The the worst was the situation in Slovakia, where the SDR for malignant neoplasms for women grow by 1.2 %, from 233.3 in 1996 to 236.2 in 2015. It was the only one case when the SDR for malignant neoplasms increased. The regional variability measured by coefficient of variability declined between 1996 and 2016 from 13.7 % to 10.4 % for men and from 16.1 % to 10.6 % for women.

Fig. 10: SDR per 100 000 inhabitants - malignant neoplasms (3 years average)
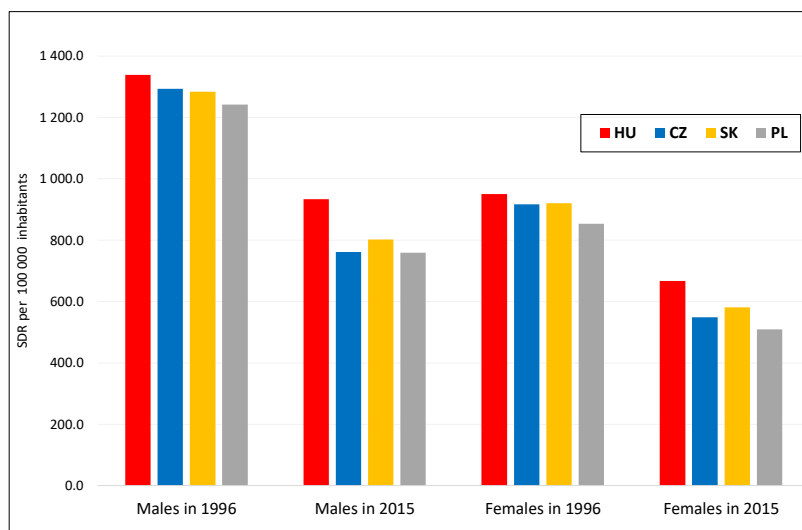

Source: Eurostat, own processing

Fig. 11: SDR per 100 000 inhabitants – diabetes mellitus (3 years average)
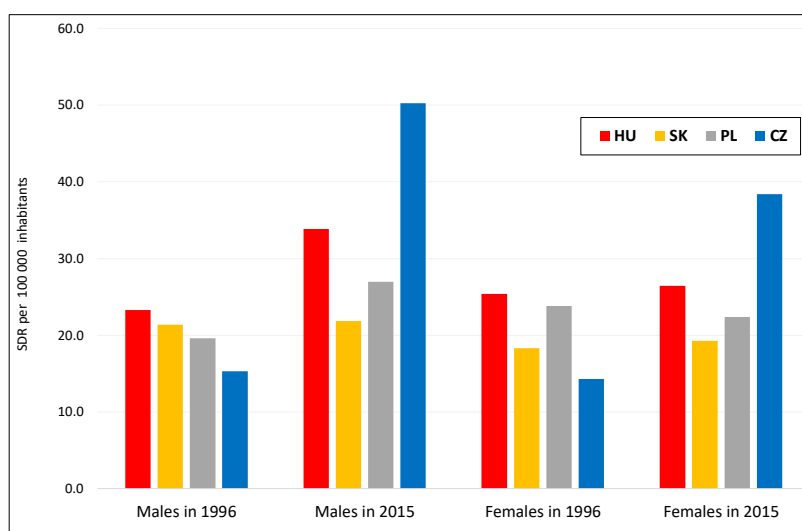
Source: Eurostat, own processing

The SDR for diabetes mellitus are not so high compared for example with the death rates for malignant neoplasms or with the death rates for diseases of the circulatory system. However, diabetes mellitus is a civilization disease and that is why we decided to analyze the development of the SDR of this illness. The SDR for diabetes mellitus was the highest in Hungary at the beginning of analyzed time span, the rate was higher for women (25.4 per 100 000 inhabitants) than for men (23.3). In 1996 also in Poland the rate was higher for women compared to men. As it was mentioned, the diabetes mellitus is a civilization disease associated with a high caloric food intake. And the picture of development of SDR for diabetes is not positive at all (see Fig. 11). Especially in Czech Republic, where the SDR increased between 1996 and 2015 by 228.4 % for men (from 15.3 to 50.25) and by 168.6 % for women (from 14.3 to 38.41). In Slovakia was the increase only moderate. In Poland and Hungary, the growth was significant for population of men. Female´s SDR for diabetes mellitus in Poland decreased by 6.1 % and in Hungary increased by only 4.1 %. Between analyzes SDR the death rates for diabetes mellitus had the highest regional variability. The coefficient of variation stood at 28.7 % in 1995 and jumped to 39 % in 2015 for men. The coefficient changed from 34.3 % to 36.9 % in the same time span for women. The lowest SDR for men in 1996 were achieved in regions: PL34, CZ06, CZ01 and the highest ones in regions: SK04, HU23, PL41. In the same year the best positions belonged to regions: SK01, CZ06, CZ07 and the worst positions were occupied by the following regions: HU23, PL22, PL41. At the end of the analyzed time span the lowest SDR for diabetes mellitus were reached in regions: PL33, PL32, PL21 for men and also for women. The highest death rates were on the other hand typical for Czech Republic and Hungary: CZ08, CZ04, HU23 for both sexes.

Fig. 12: SDR per 100 000 inhabitants – diseases of the circulatory system (3 years average)

Source: Eurostat, own processing

The SDR for diseases of the circulatory system were very high for men in 1996 (see Fig. 12), the rate ranged between 1241.4 (Poland) and 1338.5 (Hungary). The decline of the SDR for men from 1996 till 2015 was strong, it was higher than 30 % in Hungary, Slovakia and Poland and higher than 40 % in Czech Republic. The death rates for females developed also positively, it means that they dropped significantly in all V4 countries. In Poland the SDR for diseases of the circulatory system decreased by a maximal level of 40.3 %, from 853.4 to 509.7 per 100 000 inhabitants. The lowest SDR for diseases of the circulatory system in 1996 for men were achieved in regions: PL62, CZ01, PL22 and in 2015 in regions: CZ01, PL63, SK01. The highest death rates for men were in Hungarian and Czech regions in 1995: HU23, HU31, CZ02 and in Hungarian regions in 2015: HU33, HU32, HU31. Women had the lowest SDR for diseases of the circulatory system in regions: PL62, PL22, CZ01 in 1996 and regions PL34, PL63, PL62 in 2015. On the other side the highest rates in 1996 were achieved in regions HU21, CZ02, HU23 and in 2015 in three Hungarian regions (HU21, HU32, HU31).

Conclusion

The LE at birth increased in V4 countries more intensively for men. Due to this fact the gender gap (in favor of women) was in 2016 lower in each of the V4 countries than in 1997. Increase of the LE at 65 was significant. The increase ranged between 16.8 % till 22.7 % for men and between 14.7 % till 22.0 % for women. Unfortunately, the development of gender gap was not positive, it means that in each V4 country the gap increased instead of closing the

difference between both sexes. The highest LE at birth for men between 35 regions of V4 countries belonged to regions of Czech Republic and the lowest ones to regions of Hungary in 1997 and also in 2016. The best positions of Czech regions with the highest LE at birth for women in 1997 were replaced by regions of Poland. The worst positions belonged to Hungarian regions. The increase of the LE in V4 countries was caused by a decline of the overall death rates. The highest standardized death rates were reached in Hungary for both sexes. Hungary is the country with the lowest LE at birth and at age 65. The highest declined of SDR between 1996 and 2015 for men was in Czechia (28.8 %) and for women in Poland (31.6 %). The regional coefficient of variation of SDR did not change a lot for men but increased from about 6 % to 10 % for women. The best positions with the lowest SDR were typical for regions of Czech Republic, Poland or Slovakia and the worst positions belonged to Hungarian regions. The SDR for malignant neoplasms declined rapidly in Czech Republic and Hungary, in Poland the decline was moderate. Only in Slovakia the SDR for malignant neoplasms for women increased by 1.2 % between 1996 and 2015. The SDR for diabetes mellitus in analyzed time span dramatically increased in Czech Republic, for men by 228.4 % and for women by 168.6 %. SDR for diabetes mellitus had the highest regional disparity with the highest coefficient of variation among all of the selected variables. The decline of the SDR for diseases of the circulatory system was strong in all V4 countries, in Czechia it was higher than 40 %. The highest SDR for diseases of the circulatory system for men and women were reached in Hungarian regions.

Acknowledgment

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