Analysis of mortality convergence on sub-national level – regional inequalities as a reason for persisting national differences: case study on the Czech Republic from 1991 to 2010

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1. Introduction, goals and theoretical framework of the study

In Europe during the 2nd half of the 20th century, it is possible to observe different periods of mortality convergence and divergence. Although according to mortality levels the European countries formed a relatively homogeneous group during the 1960s, in following decades the mortality development was again significantly different. The mortality gap was formed above all between the socialist countries and the rest of Europe. After the end of the 1980s again a rather convergent trend was started, so as the Eastern and Central European countries developed rapidly according to mortality and life style or health status of the population. However, more differences occurred that time within the post-socialist countries (Meslé, Vallin, 2002; Meslé, Vallin, 2011; Grigoriev et al., 2010; Hulíková et al., 2015).

However, as relatively much space in demographic research is devoted to the analysis of mortality level on the national level in Europe, less attention is paid to the sub-national level. Logically, it could be supposed, that the mortality development observed on the national level is in fact the result of the developments on the sub-national levels.

This paper aims to describe the specifics of the sub-national mortality analysis with the focus on convergence/divergence tendencies and to present possible analytical tools usable for this type of analysis. So as it is not possible to describe the mortality development within all the European countries, in the paper one specific case study is presented. Regional mortality data for the Czech Republic are used for the introduced detailed analysis. The Czech Republic was selected as a representative of rapidly developing (according to mortality level) post-socialist country which is often taken as a rather homogeneous one. The area of the Czech Republic is not large and the population density is nearly similar in all its parts (without any significantly remoted regions). Also the socio-economic situation and living standards are similar in all parts of the republic, however, of course, not exactly unified. Briefly said, on average worse socio-economic situation could be observed in north-western part ("Severozapad" – see Fig. 1) of the republic (consequence of specific development after the World War II when many families originally from eastern less developed regions of Slovakia or from inland were moved into this region) and in north-eastern part near the Polish border ("Moravskoslezsko" – see Fig. 1), where the region is traditionally strongly industrially oriented what brought many problems after the 1980s when the economy of the country started to be restructured. On the other side, bigger cities could be characterized by rather higher socio-economic status of the

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inhabitants, higher population density and on average better (more rapid) accessibility of the health care.

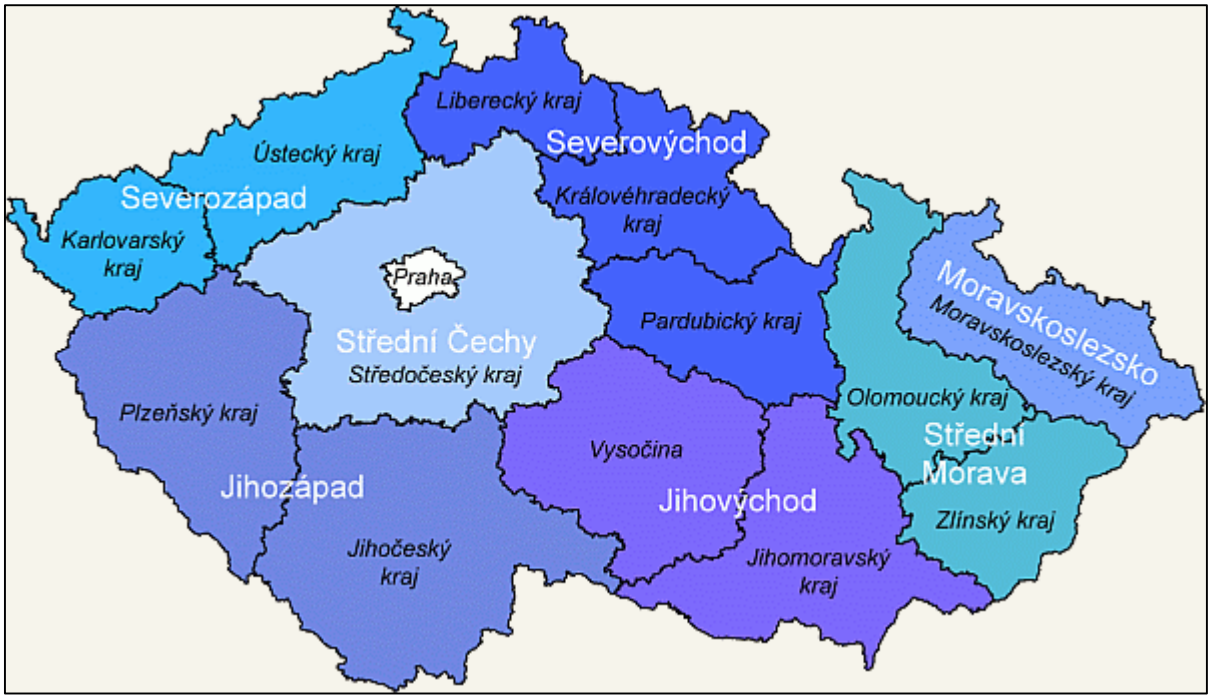

Figure 1: Division of the Czech Republic into regions NUTS 2

Source of the map: https://www.euroskop.cz/8642/sekce/spravni-cleneni-system-nuts/

Around 1960 the Czech Republic ranked 11th position in the World according to life expectancy[3] at birth (Rychtaříková, 1987, p. 193; Vallin, Meslé, Rychtaříková, 1988, p. 193). However, as a part of so called Eastern Bloc the Czech Republic recorded stagnation or only slow improvement of mortality since mid-1960s till late 1980s (Meslé, Vallin, 2002, p. 160; Burcin, Kučera, 2008, p. 112; Rychtaříková 2004, p. 108). The reasons could be found above all in the level of health care and health care services as well as in the general life style of population. This affected negatively especially the mortality level from cardiovascular diseases in Central and Eastern European countries (Meslé, Vallin, 2011, p. 21; Luy et al., 2011, p. 51; Rychtaříková, 2004, s. 108), including the Czech Republic.

It is important to note that the Czech Republic has recorded a stable and one of the fastest mortality improvements of the post-socialist countries since the beginning of 1990s (Human Mortality Database, 2015; Meslé, Vallin, 2011, p. 21; Vallin, Meslé, 2004, p. 24). However, still the mortality progress in Central Europe, or for this paper more specifically in the Czech Republic, was not much faster than in most of the Western European countries. In some of them the speed of mortality reduction was even higher in comparison to the Czech Republic, although their initial mortality level was lower. As a result of this development, still the significant differences between the current mortality level in the Czech Republic and in many countries of the Western Europe could be observed (Hulíková et al. 2015, p. 41; see Fig. 2 and 3).

For both sexes, the Czech Republic is (together with Slovenia) a leader of the group of post-socialist countries according to life expectancy values. However, still all the other analyzed

[3] Average remaining years of life for person at age x under the condition of constant age-specific mortality rates in the future (Siegel, 2012, p. 945). If not specified, we consider life expectancy at birth throughout this paper.

European (non-post-socialist) countries reach higher values of life expectancy. The closest values are reached in Portugal, Finland and Denmark for males and in Denmark, United Kingdom or Ireland in case of females. The relative position of the Czech Republic within Europe is the same for both the sexes (Fig. 2, Fig. 3). **However, the research question of this paper could be stated, what is the inner development of mortality in the Czech Republic – are there any districts or regions on mortality level comparable to the most developed European countries, or vice versa, are there any regions on the lowest European level, which in fact could stand behind the not enough rapid mortality improvement on the national level? The presented study aims to answer these questions.**

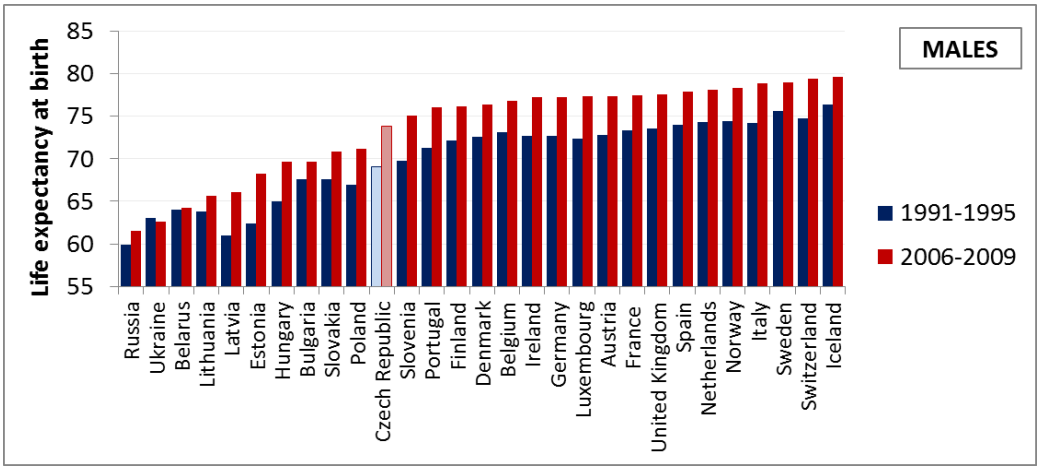

Figure 2: Life expectancy at birth, selected European countries, average values for periods 1991–1995 and 2006–2009, males

Source of the data: Human Mortality Database; sorted according to life expectancy values in 2006–2009

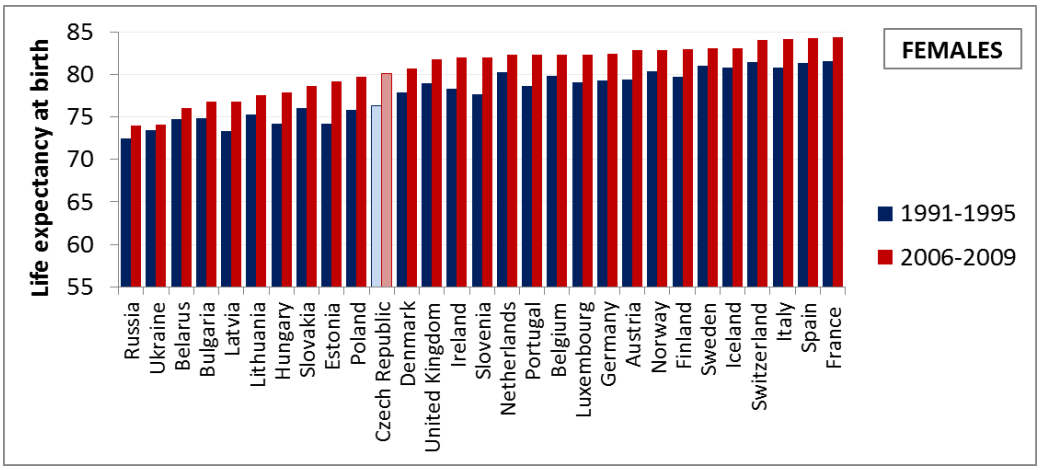

Figure 3: Life expectancy at birth, selected European countries, average values for periods 1991–1995 and 2006–2009, females

Source of the data: Human Mortality Database; sorted according to life expectancy values in 2006–2009

Taking into account, that the general national mortality trend is, mathematically expressed, just a weighted average of various trends of development in particular sub-populations, then the regional mortality development in fact express the possibilities of the overall growth. The above stated research questions are even more crucial considering that:

(1) "Assessment of spatial patterns at larger geographic units tends to mask underlying spatial patterns that would otherwise be evident at a finer/smaller geographic unit" (Odoi, Busingye, 2014, p. 120). And on the contrary, evaluation of spatial patterns at smaller geographic unit provides more comprehensive information than results of analysis at large geographic units (Kibele et al., 2015, 243; Novotný, 2010, p.166). In other words, understanding of regional specifics of mortality development could help us to better understand the general national trend, possibilities of reaching the mortality level of developed Western European countries as well as conditions forming the observed mortality development of the Czech Republic.

(2) "All modern states, explicitly or otherwise, have policies aimed at minimizing mortality, in the motivation of which international comparisons figure prominently" (Coleman, 2002, p. 321). It is also important to note that inequality in death is judged "as more inequitable than others" (Vallin, 2013, p. 139) inequalities in human well-being. As Vallin (2013, p. 139) pointed out "even if, very probably, perfect equality in length of life could never be achieved between individuals because of a certain number of irreducible biological differences, it is generally considered that inequalities among populations can, for their part, be reduced, if not eradicated, by appropriate policies."

For these reasons, identification of regional mortality disparities and its development can reveal unique synthesizing information about welfare of specified population in space and time. This information is desirable not only for policymaker or scientist but also for society as a whole.

Following the above-mentioned points, the main goal of this paper is to analyze and discuss regional inequalities in mortality in the Czech Republic in the period 1991–2010 together with possible demographic tools of analysis suitable to the sub-national level. The studied period was selected as a period of post-revolutionary rapid development, i.e. period of relatively stable and rapid mortality improvement**. Through the more detailed regional mortality analysis, the regional inequalities in mortality within the Czech Republic are presented and convergence or divergence tendencies within the country together with stating the most important conditions standing behind the regional differences are summarized. Mortality conditions within the country are evaluated also in the overall European context.** That could help to answer the above stated research question whether there are any districts or regions on mortality level comparable to the most developed European countries, or vice versa, whether there are any regions on the lowest European level, which in fact could stand behind the not enough rapid mortality improvement on the national level.

2. Data and methods

In this paper, the development of regional mortality inequalities based on data for Czech districts (LAU 1) is presented. We used data about the life expectancy at birth according to sex. Data for four 5-year periods (not individual years) were used (1991–1995, 1996–2000, 2001–2005, 2006–2010) so as the data were not influenced by random fluctuations. The analyzed area of the Czech Republic was divided into 76 districts in the first period (1991–1995) and into 77 districts in the following periods (one district was established newly as an independent one in 1996 – district "Jesenik"). Regional mortality data were acquired from the Czech Statistical Office (CSO, 2015a) as well as the population size of districts (CSO, 2015b, 2015c). Data for an international comparison are from the Human Mortality Database (HMD, 2015).

Many different methods of analysis are available for the description of the development of inequalities of any indicator among more (sub-)populations. In this paper two types of approaches are used:

First, the descriptive statistics of variability were calculated. These statistics provide useful basic insight into convergence/divergence mortality trends (see e.g. Coleman, 2002, Mackenbach, 2013). The box-plots were constructed as a suitable graphical tool. However, neglecting of the population size of the districts is important disadvantage of these simple statistics. Thus, even the most and least populous districts enter the analysis with the same weight.

Second, measures of inequalities considering the population size were included. In this case, variability of mortality conditions among the regions is illustrated by the distribution functions. This approach was inspired by the work of Wilson (2001 and 2004). In this case, the distribution function ($F_{e_0}(y)$) represents the proportion of population living in regions of the Czech Republic where the level of life expectancy is on the particular level (y) or below it, i.e. $F_{e_0}(y) = P(e_0 \leq y)$, where e_0 is the actual level of the life expectancy at birth in an selected particular region (SAS Institute Inc. 2015: 5120, authors' symbols in the equation).

Moreover, description of variability based on the distribution functions is accompanied by several bar plots showing the changes in distribution of the Czech population according to various levels of life expectancy (NUTS 2 classification is used in this part of the analysis - this provides the possibility of simple comparison of the results with result from different countries). This graphical presentation could be taken as another way of illustration of convergence/divergence tendencies development of a selected process (Wilson 2001) on regional level.

"Dispersion Measure of Mortality ($_tDMM$) in time period t" (Moser et al., 2005, p. 203) is the last indicator used in this paper. This measure is a summary indicator of variability of mortality among different regions or populations. From mathematical perspective, the measure is constructed as an average inter-population difference which is weighted by the population size. The difference is calculated for each pair of populations (districts in our case). Decreases in values of the $_tDMM$ signalize rather convergence in mortality; increases represent divergent tendencies (Moser et al., 2005, p. 203). We applied the $_tDMM$ in the analysis based on the life expectancy at birth ($_te_0$) measured for different time periods (t):

$$_tDMM = \frac{1}{2\times(_tW^z)^2} \times \sum_{h=1}^{n}\sum_{k=1}^{n}\left(\left|_te_0^h - {}_te_0^k\right| \times {}_tW^h \times {}_tW^k\right),$$

h and k ($h = 1 .. n$, $k = 1 .. n$) represent particular districts of the Czech Republic, $_tW^h$ and $_tW^k$ stands for weights, i.e. relative population sizes of districts h and k resp., and $_tW^z = \sum_{h=1}^{n}(_tW^h) = \sum_{k=1}^{n}(_tW^k) = 1$ (Moser *et al.*, 2005, p. 203, authors' symbols in the equation). Moreover, population weights were adjusted so that $\sum_{h=1}^{n}\left(_tW^h \times {}_te_0^h\right) = {}_te_0^{CZE}$ (Moser *et al.*, 2005, p. 203, authors' symbols), where $_te_0^{CZE}$ is the life expectancy at birth for the Czech Republic as a whole.

Using more methods of analysis and more various measures, it is possible to describe the regional mortality development in more detail and from various points of view. The simple descriptive statistics were selected for their clearness and understandable description of the development. On the other hand, the summarizing indicator, $_tDMM$, provide a synthetized information about regional differences together with the overall trend of their development in time.

3. Results

Starting point of analysis should be the brief description of main differences in life expectancy among the Czech districts. Values of life expectancy at birth for all the four 5-year periods for males (Fig. 4) and females (Fig. 5) are displayed in maps. For the purpose of the description of the overall variability within the country, the districts are grouped according to the level of life expectancy into eight groups out of ten districts[4]. Hence, the maps show not just the level of mortality in each district, but also the relative position of particular districts among within the Czech Republic. Furthermore, we can also follow the development of this relative position in time.

The maps elucidate overall division of the Czech Republic according to the level of mortality. It is clear, that there exist "gap in the survival chances of people" (Kibele et al., 2015, p.242) among Czech districts (Fig. 4, 5). The highest mortality was recorded in the north-western part of the Czech Republic ("Severozapad" – see Fig. 1) for both males and females during the whole period, high mortality was observed also in eastern part ("Moravskoslezsko" and "Stredni Morava" – see Fig. 1) in case of males. This result was highly expected because of the reasons briefly stated above – above all the industrial character of the regions affected by the economic transformation and on average lower socio-economic status of the inhabitants.

On the other hand, the lowest mortality level among the Czech districts is reported in districts of "Vysocina" Region, most of the districts of region "Pardubicky kraj", "Kralovehradecky kraj" (see Fig. 1), and in big cities like Prague ("Praha"), Brno ("Jihomoravsky kraj" in Fig. 1) and Plzeň ("Plzensky kraj" in Fig. 1).

There is also striking difference between the relative position of male and female mortality in some regions ("Zlinsky kraj" in "Stredni Morava") and some districts of "Jihovychod" Region (see Fig. 1 for locations). While female life expectancy in these districts is relatively high, males recorded relatively low values of this indicator in these districts. The reasons could be found in the average life style of the population, typical local economies and main economic sectors. The south-eastern part of the republic is typical by many relatively small villages (except for the second biggest city of the Czech Republic – Brno), vineyards, and in general higher proportion of population working in agriculture or industry sector. This is typical above all for males. These more physically demanding works probably affected also the health and mortality conditions of the regions.

If we consider changes of the relative position of regions within the country, we can state that the regional mortality pattern was rather stable during studied period for both the sexes (Fig. 4, 5).

[4] Except for the group of districts with the highest life expectancy, which consists of 6 or 7 districts.

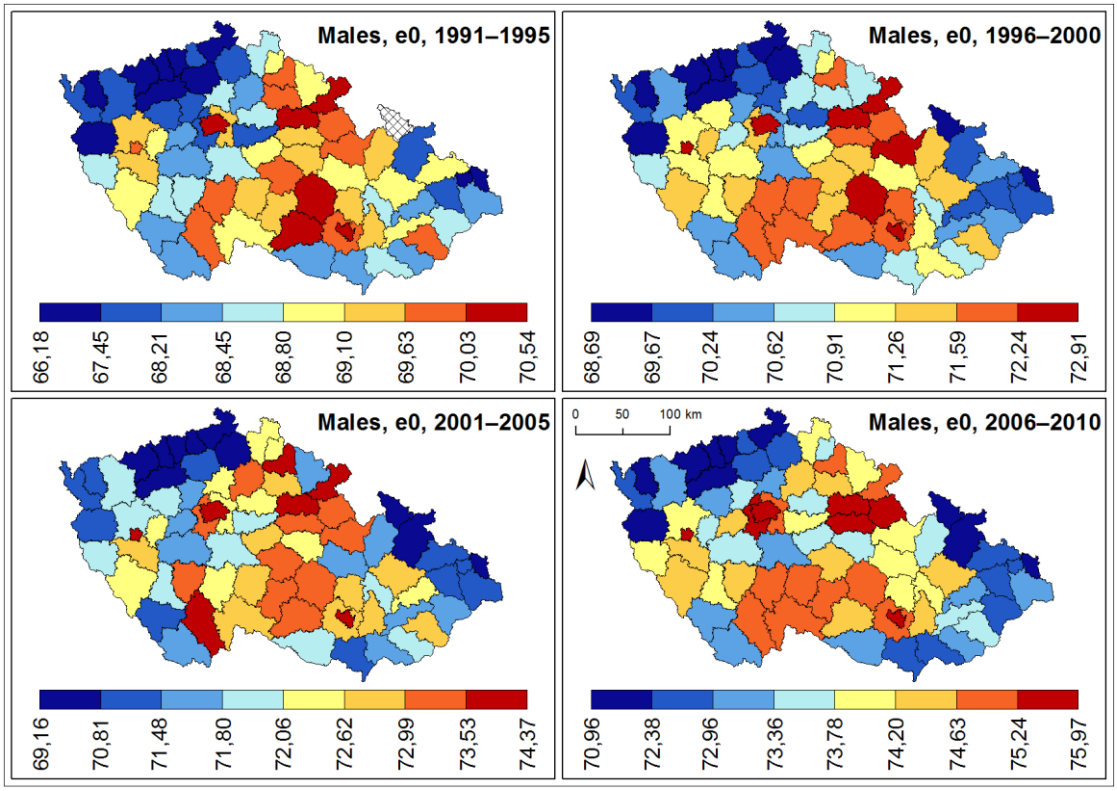

Fig. 4: Life expectancy at birth in districts of the Czech Republic, males, 1991–1995, 1996–2000, 2001–2005, 2006–2010

Source of the data: Czech Statistical Office (CSO, 2015a)

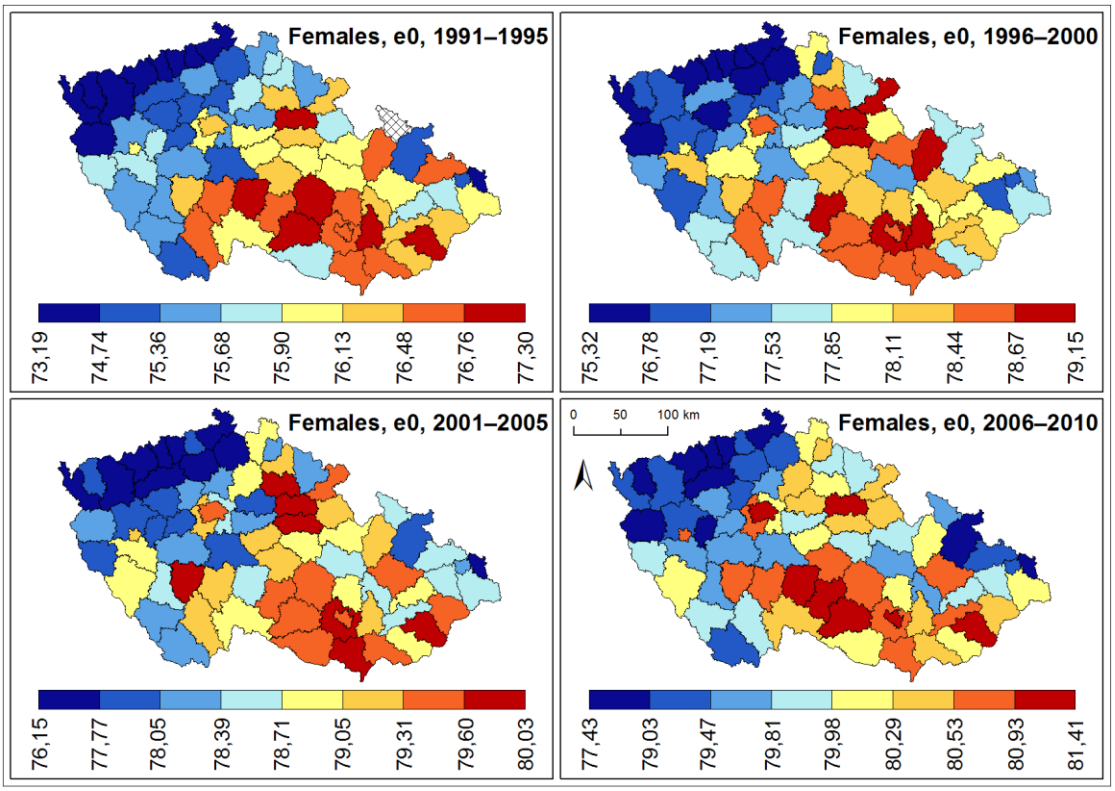

Fig. 5: Life expectancy at birth in districts of the Czech Republic, females, 1991–1995, 1996–2000, 2001–2005, 2006–2010

Source of the data: Czech Statistical Office (CSO, 2015a)

The overall mortality development of inequalities and general convergence/divergence tendencies could be evaluated by simple descriptive statistics or box-plots (Fig. 6, 7). At the end of the studied time period the maximal values of life expectancy reached almost 76 years for males (by 4.5 years higher maximal value in comparison to the beginning of the studied period) and 81.4 years for females (for females the maximal value increased during the studied period by 4.1 years).

On the other hand, the less favorable district for males reached at the end of the studied period value slightly below 71 years, what was by 3.8 years more in comparison to the beginning of the studied period. For females the lowest values among districts reached 77.4 years, what was by 4.2 years more than at the beginning of the period.

Already from these values it is clear, that tempo of improvement of the most and the least favorable districts is different in case of males. That leads us to the assumption that for males the divergent mortality tendencies could be expected and that for males some "lagging behind" districts could be detected in further analysis. For females the improvement of mortality in all the districts was almost the same (measured by the increase of the life expectancy at birth).

Changing variability of mortality among the districts could be observed also from the series of box-plots. For males until the year 2000 there is visible tendency to homogeneity (evident e.g. from decreasing value of the range, Fig. 6). After the year 2000 the trend changed significantly, the value of range increased as well as values of interquartile range (difference of the lower and upper quartile). This tendency was not reversed until the end of the studied period. On the other hand, for females, as expected, there is rather a tendency to homogeneity, with only a small stabilization in the middle of the studied period (Fig. 7).

However, it has to be pointed out, that these descriptive basic statistics work with all the districts of the Czech Republic as with equal ones – there are not considered any population weights taking into account also the shares of population living under certain mortality conditions in these districts.

In all the following analyses the population weights were used. Thanks to that it is possible to work with the districts not as with equals entities but as different populations – characterized by different population sizes as well as different mortality levels.

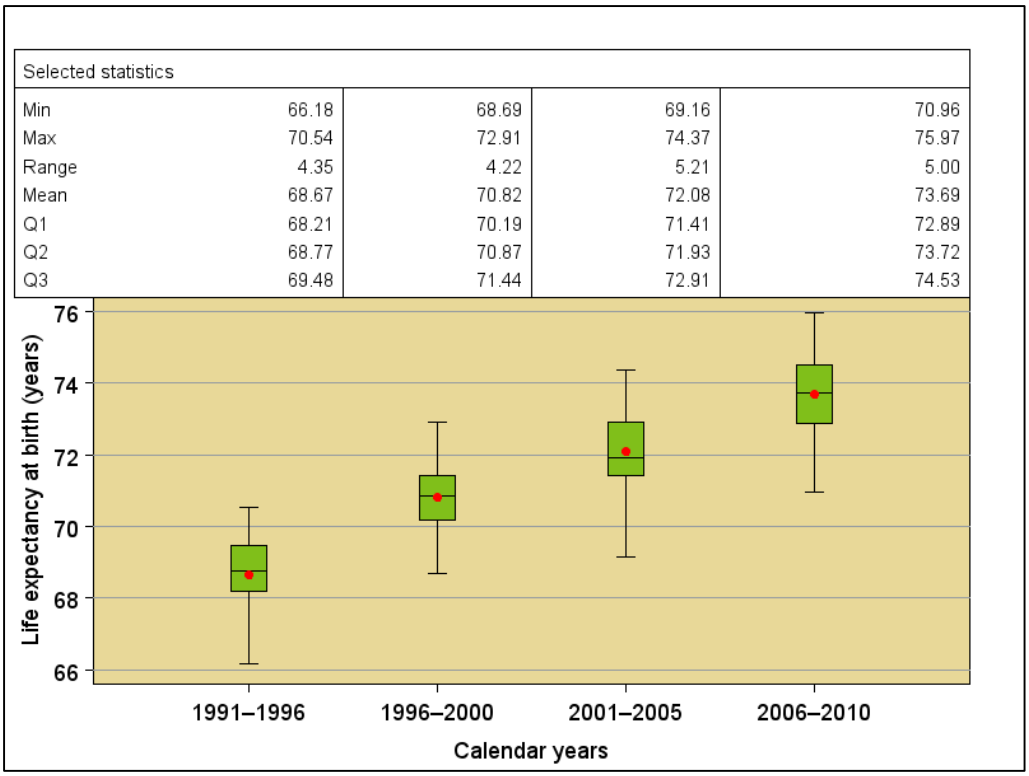

Fig. 6: Box plots and selected statistics of life expectancy at birth in regions (LAU 1) of the Czech Republic, males, 1991–1995, 1996–2000, 2001–2005, 2006–2010

Source of the data: Czech Statistical Office (CSO, 2015a)

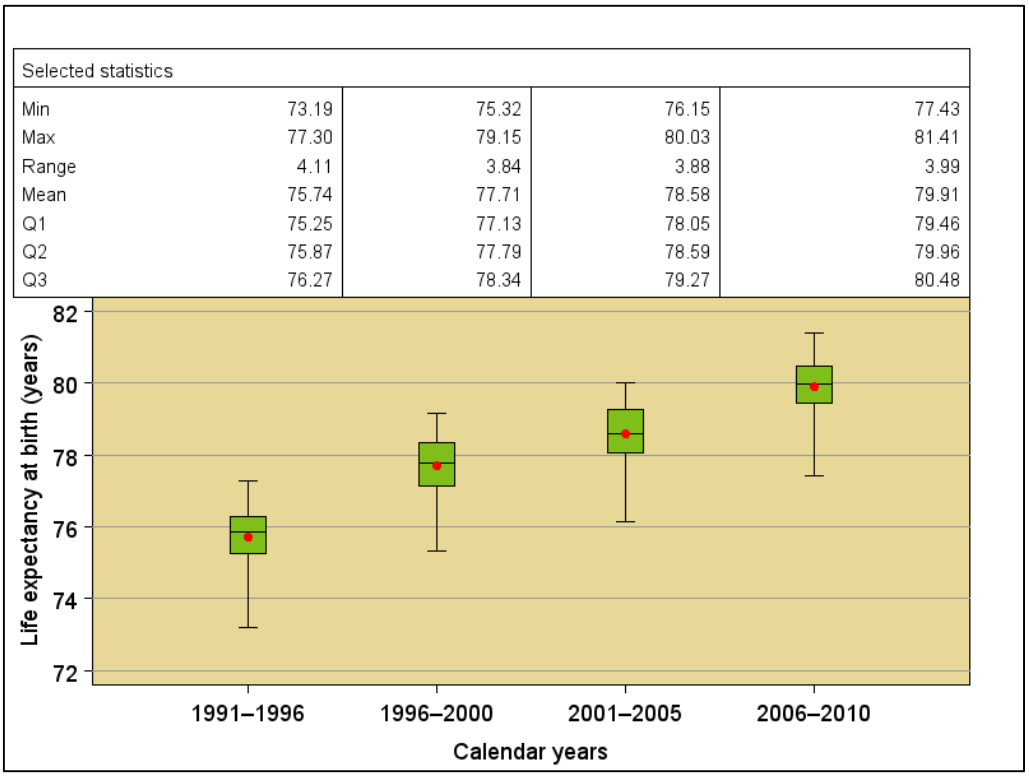

Fig. 7: Box plots and selected statistics of life expectancy at birth in regions (LAU 1) of the Czech Republic, females, 1991–1995, 1996–2000, 2001–2005, 2006–2010

Source of the data: Czech Statistical Office (CSO, 2015a)

We use the cumulative distribution function for a brief characteristic of the population distribution among the districts according to their mortality levels. From the figures (Fig. 8, 9) one can read the proportion of population living at particular levels of life expectancy within the Czech Republic. For example, for males during the period 1991–1995 half of the population lived in districts with the life expectancy reaching values slightly below 69 years or lower. Five years later, already only a marginal part of the population lived in districts with such a low level of life expectancy. Half of the population that time lived in districts with the life expectancy level reaching at least 71 years. The curve representing the period 2001–2005 helps to explain the change in convergence tendency in mortality of males mentioned above. The increase of variability of life expectancy values among the districts was caused above all by a relatively small proportion of population living in the less favorable districts. In those districts (districts Chomutov, Most, Teplice, and Karviná – all located in "Severozapad" or "Moravskoslezsko" area – see Fig. 1; all of the mentioned districts are traditionally industry oriented ones, except for the social consequences of recent economic transformation represented e.g. by the rise of unemployment rate, those districts are also environmentally damaged) the level of mortality decreased only slightly in comparison to majority of the Czech districts from the second to the third analyzed time periods. This could be illustrated by almost parallel shift of the curves in Fig. 8, except for their bottom tail (representing the population living in districts with the lowest values of life expectancy). The shape of the curve changed only slightly by the end of the studied period.

For males, considering the 25 % of population living in the most favorable districts (upper quartile of the curves in Fig. 8), it is obvious, that life expectancy of this group of population increased during the studied time period. Moreover, values of life expectancy of those 25 % of population are during the whole studied period concentrated into a relatively narrow interval (circa 1 year). At the beginning of the studied period this interval was between 69.5 to 70.5 years, at the end of the period between 75 and 76 years. On the other hand, the 25 % of population living in districts with the highest mortality level is much more variable. At the beginning of the studied period the values of life expectancy for this group of districts was between circa 66.2 years and 68.2 years (i.e. interval of two years). This interval was even wider in 2001–2005, when it reached nearly 2.5 years. As was mentioned earlier, this led to the overall increase of variability of male's life expectancy in the Czech Republic. In other words, the overall mortality decrease in the Czech Republic at the beginning of the 21st century was slowed down by the increase in variability of life expectancy among the Czech districts caused by a relatively small group of districts significantly lagging behind the rest of the country according to mortality development. At the end of the studied period, the interval of life expectancies for the bottom 25 % of population (according to mortality level) reached values from 71 years to nearly 73 years, i.e. again around 2 years (Fig. 8).

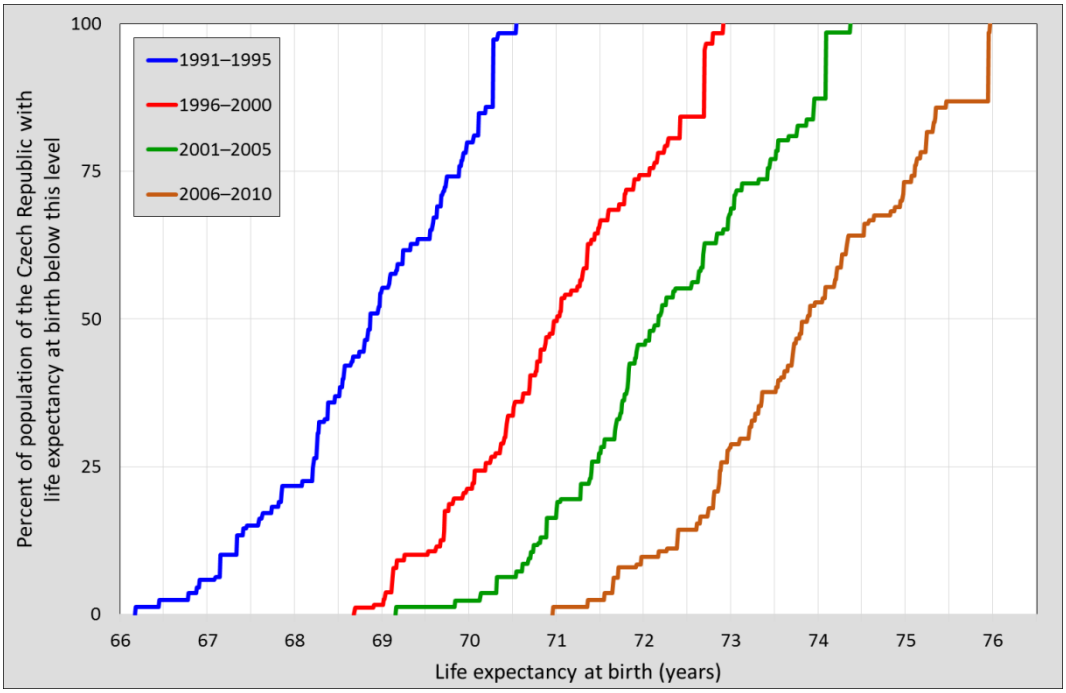

Fig. 8: Cumulative distribution of population of the Czech Republic by life expectancy at birth, males, 1991–1995, 1996–2000, 2001–2005, 2006–2010

Source of the data: Czech Statistical Office (CSO, 2015a; CSO, 2015b; CSO, 2015c)

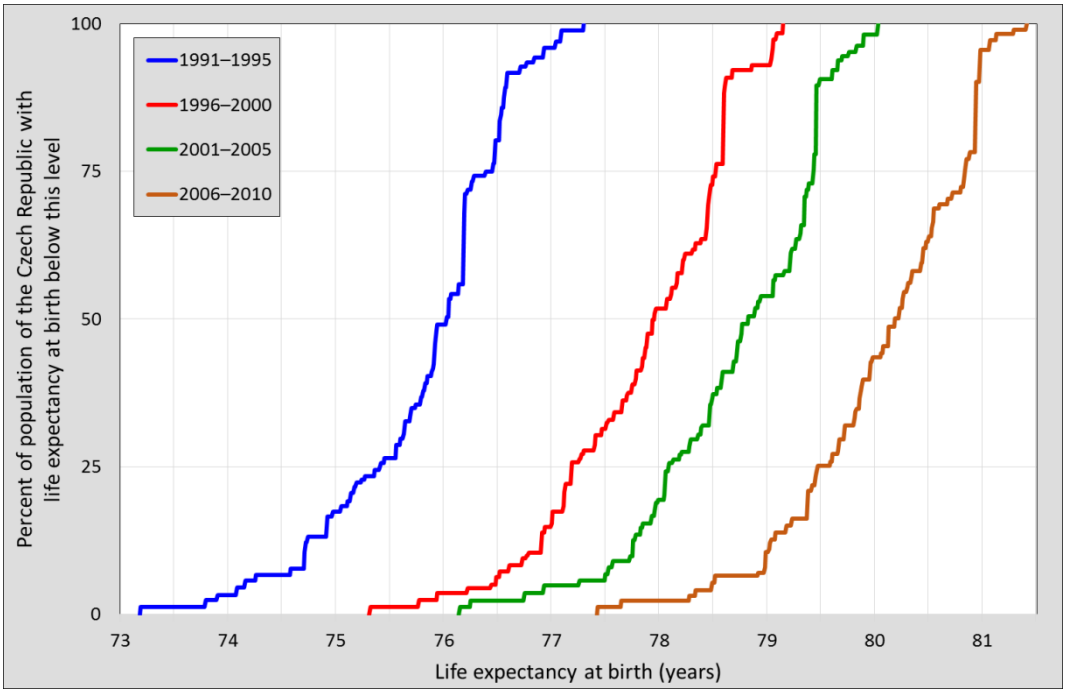

Fig. 9: Cumulative distribution of population of the Czech Republic by life expectancy at birth, females, 1991–1995, 1996–2000, 2001–2005, 2006–2010

Source of the data: Czech Statistical Office (CSO, 2015a; CSO, 2015b; CSO, 2015c)

For females the situation is similar to the figure of males, the only exception is a relative stability of the differences during the studied time period (Fig. 9). 25 % of females living in the most favorable districts (according to life expectancy) reach values of life expectancy within a nearly 1 year wide interval, for the later time periods the width of this interval is even shorter – slightly above 0.5 years. This represents high level of homogeneity of this most

favorable group of districts. On the other side, variability of the bottom 25 % of women (living in districts with worse mortality conditions) is again much higher (even in comparison to males). Values of life expectancy of this group of population reached 73.2–75.5 years at the beginning of the studied period and 77.4–79.5 at the end of the period, i.e. in all the 5-year periods this intervals was at least around 2 years and exceeded the interval of the rest 75 % population. That means that variability of mortality among women is led above all by the bottom 25 % of population. For females the lagging behind districts are even more differing from the average than in case of males.

The described development and above all the convergence/divergence tendencies could be summarized by values of Dispersion Measure of Mortality, ${}_tDMM$. For females, only a small increase of the value of ${}_tDMM$ could be seen in the period 1996–2000 and rather a stagnation during the rest of the studied period (Fig. 10). This indicate the almost unchanging overall pattern of inequalities among the Czech districts in terms of females mortality. Moreover, as was showed above, the inequalities are above all among the population living in the less favorable districts. On the other hand, development for males shows a clear divergence trend in mortality during the whole studied period 1991–2010.

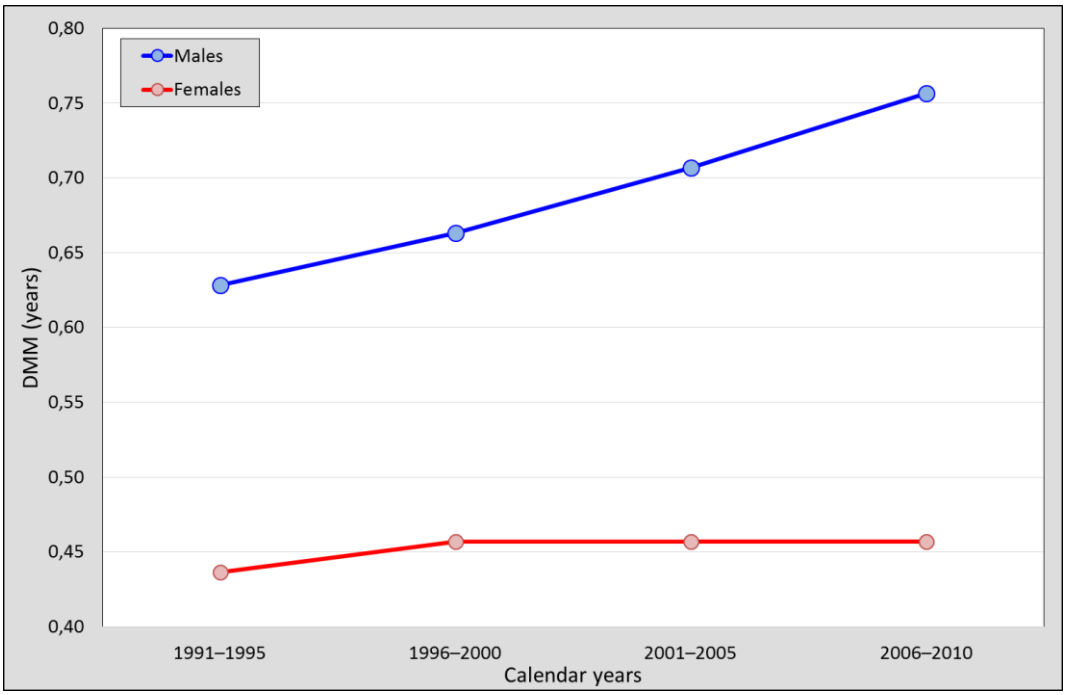

Fig. 10: Trends in the dispersion measure of mortality (${}_tDMM$) for life expectancy at birth, regions (LAU 1) of the Czech Republic, males, females, 1991–1995, 1996–2000, 2001–2005, 2006–2010

Source of the data: Czech Statistical Office (CSO, 2015a; CSO, 2015b; CSO, 2015c)

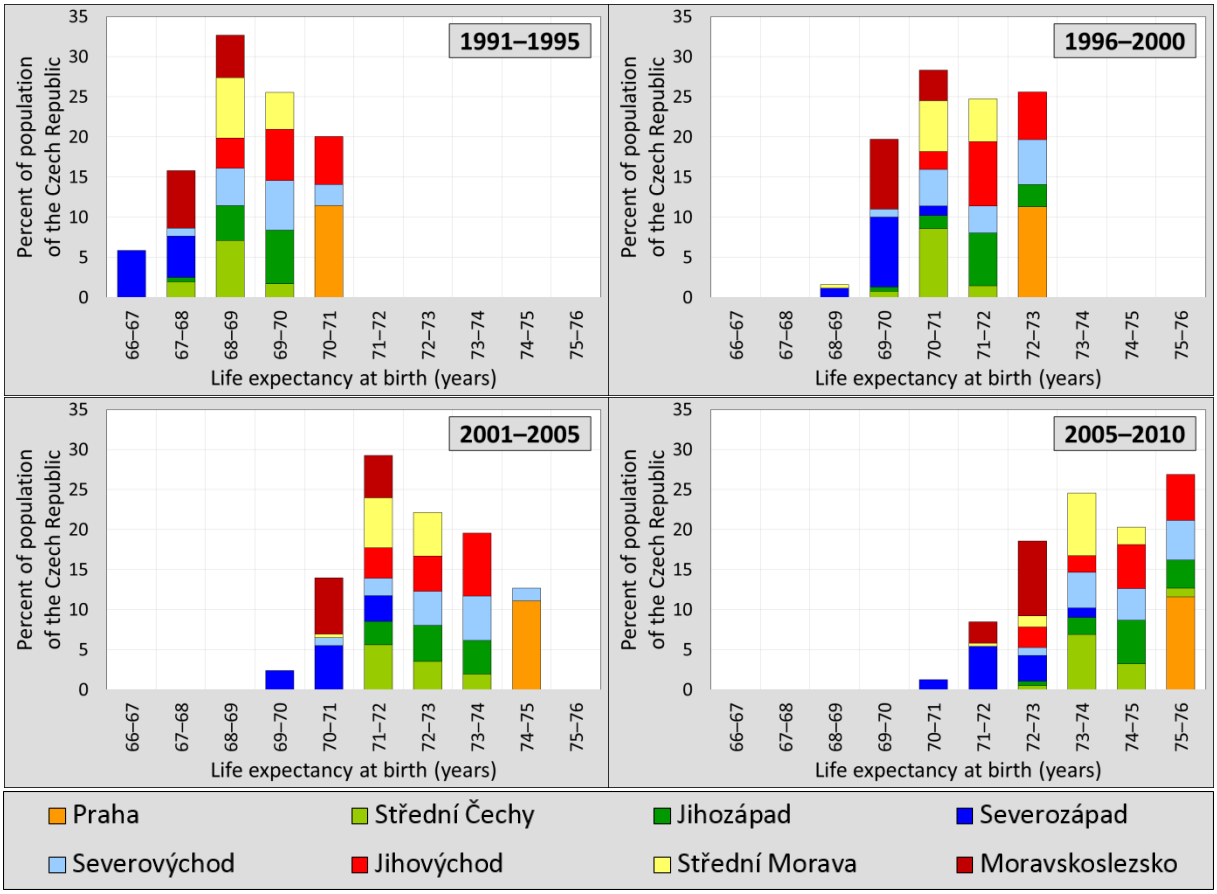

Fig. 11: Structure of population of the Czech Republic according to the levels of life expectancy at birth, by regions (NUTS 2), males, 1991–1995, 1996–2000, 2001–2005, 2006–2010

Source of the data: Czech Statistical Office (CSO, 2015a; CSO, 2015b; CSO, 2015c)

In summary, it is possible to describe the overall development of values of life expectancy in districts as well as changes of mortality inequalities in one set of graphs (Fig. 11 for males, Fig. 13 for females). From Fig. 11 it is clear that for males the overall variability slightly increased, above all for the two last time periods. The leading districts are above all the capital city, Prague, districts in the south-eastern part of the country and some districts of the "Severovýchod" Region (above all districts formed around middle-sized cities – Hradec Králové, Pardubice, Náchod, Rychnov nad Kněžnou). In the latest period there are the most favorable districts located also in the south-western part of the country, in the "Jihozápad" Region (again above all the districts formed around middle-sized cities like Tábor, Plzeň, České Budějovice). The range of values of life expectancy is wider at the end of the studied period in comparison to the beginning of the period, again this represents the above illustrated rising mortality inequalities for males. As expected, the most lagging behind districts could be found above all in the north-western "Severozápad" Region and partly also in the north-eastern "Moravskoslezsko" Region.

For males, if at the beginning of the studied period the whole Czech Republic had reached values of its most favorable region, than it could have been comparable to the level of Portugal or Slovenia (HMD, 2015; Fig. 12). If in the same time the overall level of life expectancy for the Czech Republic had been the same as in the less favorable district, it would have been on level of Poland or Hungary. This comparison would be nearly the same during the whole studied period for males. That means that the overall mortality development for males was nearly comparable to the development in the whole Europe. The best districts are

near the values of Portugal during the whole period, i.e. bellow all the Western or Northern European countries. The worst Czech district according to mortality level reached life expectancy similar to other Central European countries (Hungary, Poland or Slovakia). However, during the years 2001–2005 the worst Czech district for males reached values almost as low as was the average for Bulgaria.

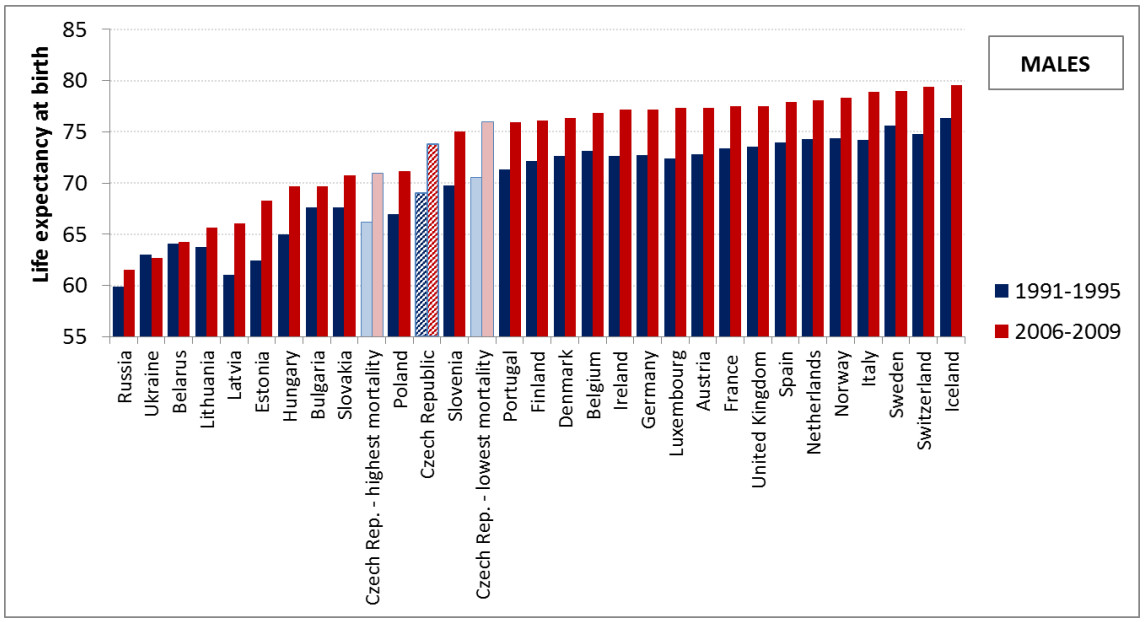

Figure 13: Life expectancy at birth, selected European countries and Czech regions with the lowest and highest mortality levels, average values for periods 1991–1995 and 2006–2009, males

Source of the data: Human Mortality Database; sorted according to life expectancy values in 2006–2009

For females the whole range of values corresponding to particular districts are rather shifting to higher values, higher variability of values of life expectancy among the worse (according to mortality level) districts is obvious from the skewness of the distribution in Fig. 13. The districts lagging behind mostly lie (during the whole studied period) in north-eastern "Severozápad" Region (mostly industrial districts affected by ecological damage and on average worse socio-economic status of the inhabitants). The leading districts are not the same during the whole studied period. At the beginning of the studied period the most favorable districts could be found in southern part of Moravia ("Jihovýchod" Region) or in central part of Moravia ("Střední Morava" Region). Five years later they were located in south-eastern part of the country ("Jihovýchod" Region, above all in districts around the 2nd most populous Czech city Brno) or "Severovýchod" Region (districts around middle-sized cities like Hradec Králové or Náchod). In 2001–2005 the most favorable district was located again in the central part of Moravia ("Střední Morava" Region) and at the end of the studied time period they could be found in "Jihovýchod" Region and again in "Severovýchod" Region (with middle-sized cities). These results confirm common assumptions that the life conditions are not necessary in big cities, but rather in middle-sized cities which are quieter, less polluted and less stressful. This could hold, however, only for non-industrial districts (and in case of males also for agricultural district where the working conditions could be often harder).

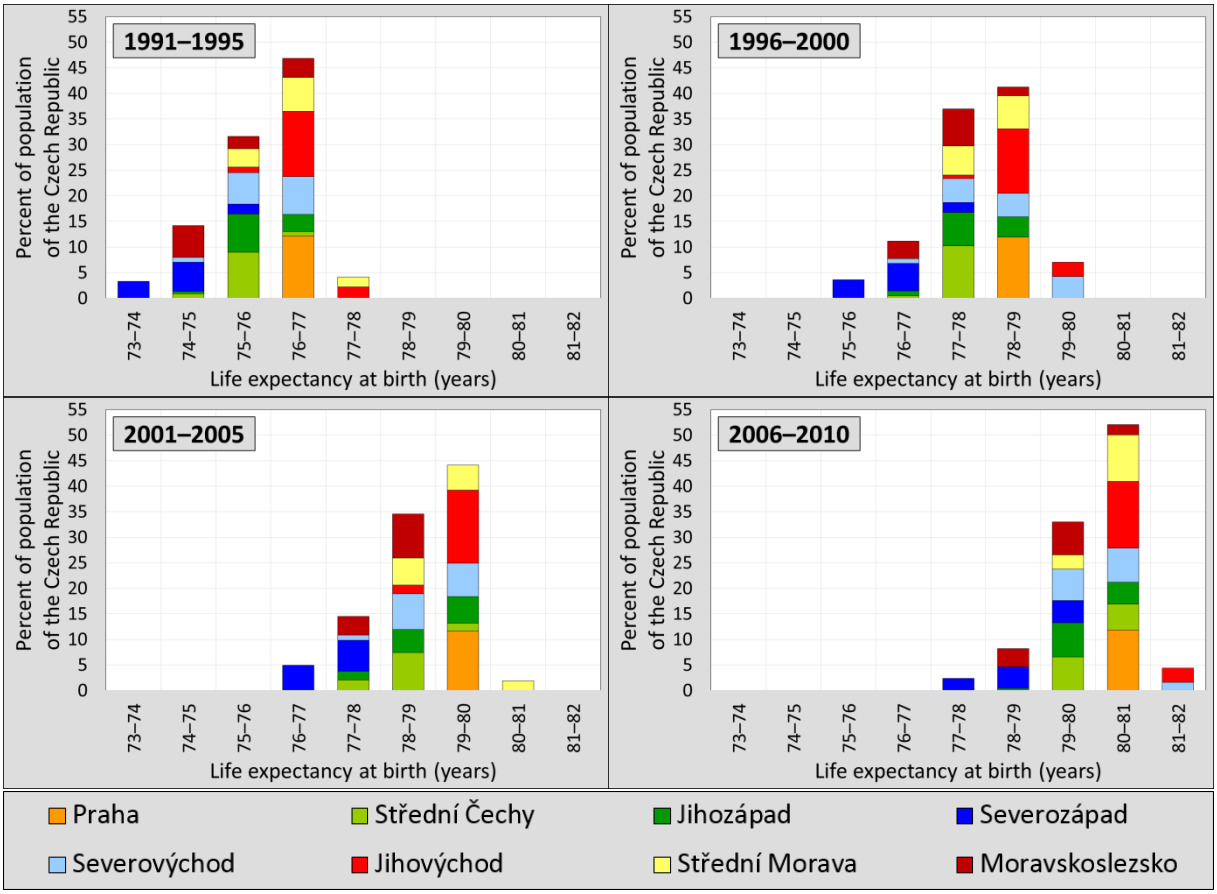

Fig. 13: Structure of population of the Czech Republic according to the levels of life expectancy at birth, by region (NUTS 2), females, 1991–1995, 1996–2000, 2001–2005, 2006–2010

Source of the data: Czech Statistical Office (CSO, 2015a; CSO, 2015b; CSO, 2015c)

For females the most favorable district according to mortality level was at the beginning of the studied period similar to Slovenian mortality level and its values of life expectancy were not far from Denmark (HMD, 2015; Fig. 14). After 1996 the best mortality district in the Czech Republic reached on average higher values of life expectancy than Denmark. However, other Western or Northern European countries still reach significantly higher values. The least favorable district (according to mortality level of females) could be at the beginning of the studied period compared even to the worst European countries – Russia or Latvia. Although the worst mortality districts from the Czech Republic "moved" upwards in the European scale, still their values are comparable only to the average values of life expectancy for females in Hungary, Latvia, Lithuania or even Bulgaria.

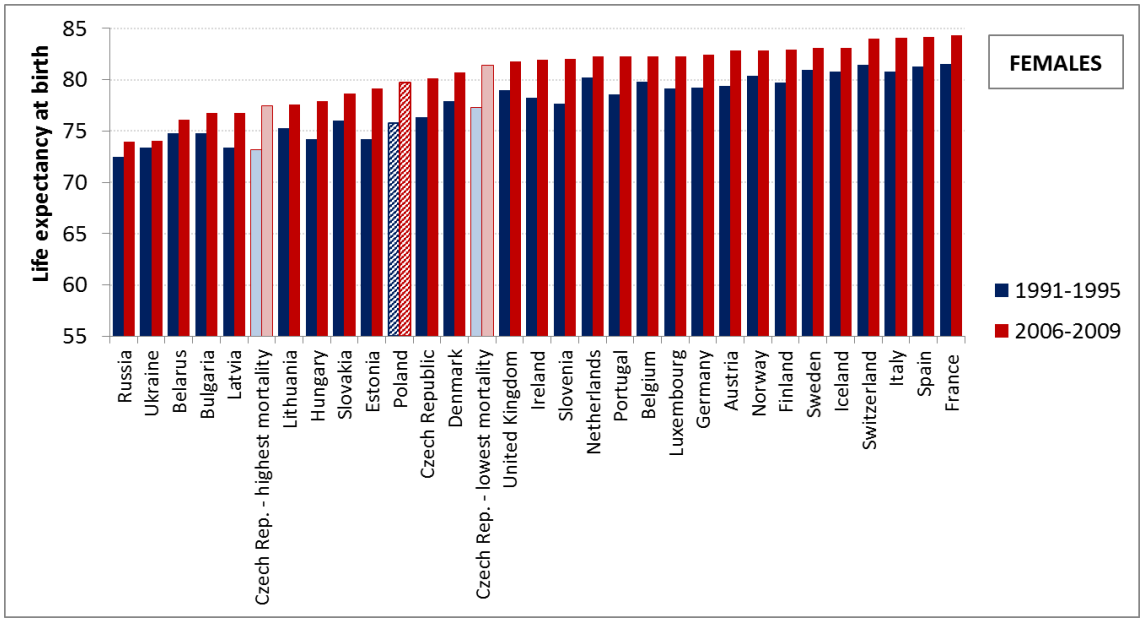

Figure 14: Life expectancy at birth, selected European countries and Czech regions with the lowest and highest mortality levels, average values for periods 1991–1995 and 2006–2009, females

Source of the data: Human Mortality Database; sorted according to life expectancy values in 2006–2009

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