THE USE OF DECOMPOSITION METHODS FOR THE EVALUATION OF THE DEVELOPMENT OF MORTALITY IN THE CZECH REPUBLIC IN 1920-2012

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Abstract

The number of deaths in the Czech Republic is dependent on the age structure of the population and the intensity of mortality. The intensity of infant mortality in the Czech Republic is at the level of the most developed countries in the world. Mortality and its level decreases over time and male excess mortality remains high. To assess the development of mortality is most commonly used life expectancy of exactly x-year-old person. With decomposition method will be for selected years analysed contributions of age groups to the difference in life expectancy between selected years to highlight the development in time. Further will be calculated contributions of age groups to the difference in life expectancy between women and men in selected years. The aim of the paper will be to show how mortality rates are improving over the time, and gradually are improving mortality rates in middle-aged groups and shift to higher age groups. Consequently the life expectancy at birth and 65-year-old people are prolonging. Differences between life expectancy of *x*-year-old person and modal age of death are reducing. There is a further ageing of population.

Key words: decomposition, life expectancy, mortality rates, male excess mortality, Czech Republic

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Introduction

21th century is from the demographic point of view mainly associated with the issue of population aging. This process is accompanied by an increasing rate of elderly persons, especially in economically developed countries. Mortality rates are improving and people live longer. The development of mortality in developed countries was neither linear nor logistic. Periods of faster or slower decline varied in time and some trends in mortality were unexpected. Currently, decrease in mortality in older age groups is mentioned as a major factor in the aging population. Trend of continuous aging of the European population will

continue in the next period. Demographic aging is defined as a shift of the age structure to older ages (Gavrilov - Heuveline, 2003).

The question of longevity - the individual's ability to survive and the average length of human life have always been the object of interest of human populations. Longevity is often incorrectly defined as the presence of a larger group of old aged people at some territory in a certain population. This term does not refer to the upper limit of human life, which we can reach. It reports that natural life expectancy is increasing for which we consider modal age at death (Pavlík, 2009). In studies of longevity the most often used indicators are life expectancy and modal age at death.

Life expectancy is also one of the indicators of mortality, which is often used as an indicator of maturity of the community or the state and health of the population. Life expectancy (e_x) is the average number of years to be lived by an x-year-old person while maintaining the mortality like in the pursued period.

Since the beginning of the 20th century we have been watching a significant improvement in the development of life expectancy. The increase of life expectancy is generally seen as a positive process. Primary impulse of the increase of life expectancy was caused by decline of infant mortality and consequently by decrease of mortality in older age groups.

Life expectancy is extending due to low child mortality and modal age at death is increasing due to the decline in mortality rates at high ages (Canudas-Romo, 2010). The differences in the trends over time of this indicator of longevity well reflect their orientation to various aspects of mortality (Cheung, Robine, 2009). Life expectancy is currently the most commonly used mortality indicator despite the fact that it includes disadvantages of mean.

It is well known fact that in developed countries there is a difference in life expectancy between men and women. Why are there differences between male and female mortality? This topic is dedicated not only to doctors. It is considered that in the absence of interference, which can shorten the life of men, should be the difference in life expectancy between men and women at birth of only one year to the detriment of men. In general, men are less well equipped in biological point of view; they have lower biological immunity than women. In these differences also has impact the social environment. Men and women have different roles in society and with this associated responsibility. Great influence has the lifestyle of a person; men are more exposed to risk factors (worse working environment, difficult physical work, greater proportion of smokers, higher alcohol consumption and poor eating habits). Women approach to their health more seriously. An interesting question that

the authors of these studies deal, can be: if in the future will not be reflected in the intensity of mortality of women that some of them take over the male patterns of behaviour?

In this paper we will be examine the development of life expectancy in 1920-2012 for men and women in the Czech Republic and compared the changes between the selected years using the decomposition the changes between the selected years using the decomposition. Using the decomposition method will be calculating shares of age groups that contribute to the total difference in life expectancy between men and women.

1 Calculation of life expectancy and method of decomposition

If we want to compare how different are mortality rates of men and women, the most frequently we encountered with comparison of life expectancies at exact age x years. Typically is used life expectancy at birth and life expectancy at the exact age of 65. In the construction of these indicators is based on a model life tables (see detailed method of calculation by Roubíček, 1997; Fiala, 2005). Due to extend of this paper will not be explained all calculations connected with life tables and models of balancing mortality in older ages. In this paper was for the calculation of life tables and life expectancy used procedure by (Fiala, 2005). For older ages was performed levelling by using the Gompertz-Makeham function.

Life expectancy of the person at the exact age x years can be described as the ratio of the number of remaining years of life (T_x) and the number of survivors to exact age (l_x)

$$e_x^0 = \frac{T_x}{l_x}. \qquad (1)$$

Calculation of life expectancy is most often used for 0- and 65-years-old persons.

Difference in development of life expectancies between years or both genders could be solved by methods of decomposition. If for example, life expectancy increases between selected years, this increase can be discussed and find out which age groups this increase in life expectancy involved. The contributions of each age group to the change in life expectancy can be calculated for example by using the one dimensional decomposition (Pressat, 1972)

$$\Delta_{x,x+n} = (e_x^A - e_x^B) * \frac{l_x^A + l_x^B}{200000} - (e_{x+n}^A - e_{x+n}^B) * \frac{l_{x+n}^A + l_{x+n}^B}{200000} \qquad (2)$$

where e_x, e_{x+n} is life expectancy at exact age x or $x + n$ in years A, B

and l_x, l_{x+n} is number of survivors to exact age x or $x + n$ in years A and B.

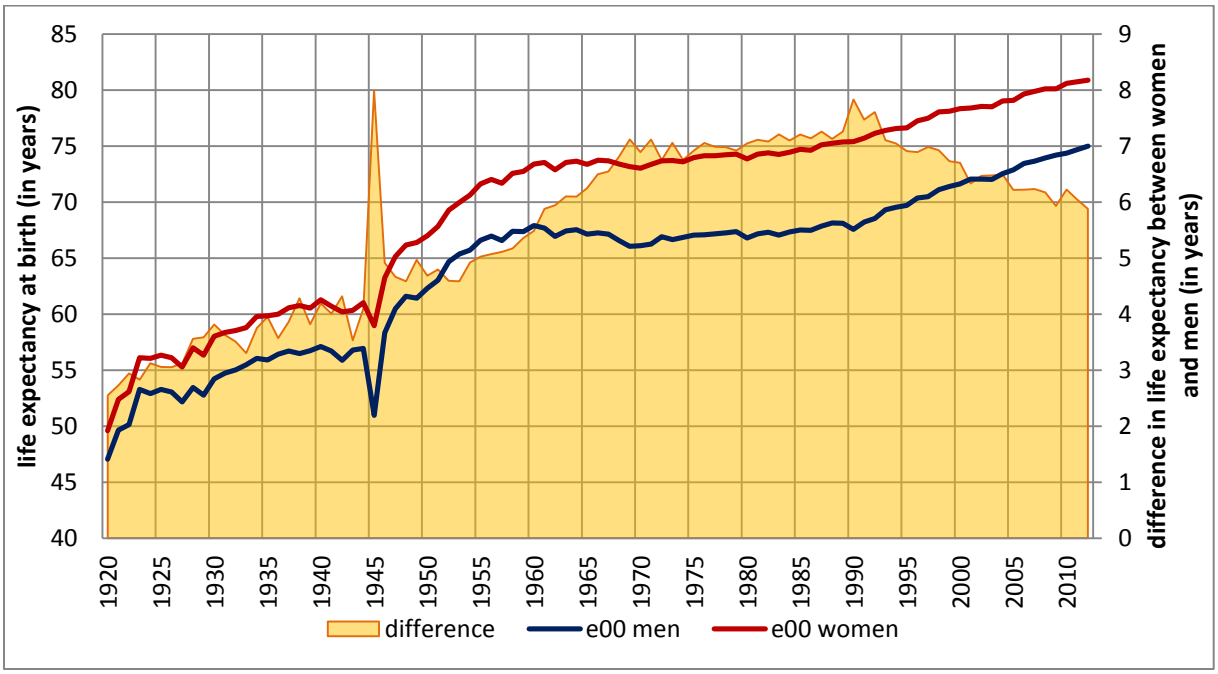
This decomposition method is most often used to express the change in time. In this paper, we determine by decomposition method how the different age groups participated in

difference in life expectancy between the reference years. But also methodologically the same method of calculation for decomposition will be used for findings difference between the life expectancy between women and men in selected years.

2 Development of life expectancy in Czech Republic in 1920-2012

The Czech Republic was at an earlier time in terms of mortality rates among demographically developed countries. Even before the Second World War, the value of life expectancy of men and women is comparable with developed countries. At the beginning of period, there was a difference of life expectancy at birth between women and men around two and half a year (Fig. 1). In 1945 decreased life expectancy rapidly, mainly due to worsened hygienic conditions at the end of the war. In fifties in the Czech Republic significantly decreased infant mortality, especially neonatal mortality, which resulted in more than 50 % increase in life expectancy at birth. The effect was attributed especially to a system in consultancy for mothers that was in this period in the Czech Republic, and they also began increasingly to give birth in medical facilities. The Czech Republic also introduced a global vaccination of children. There was a significant reduction in mortality from infectious and parasitic diseases. Until the early sixties, the Czech Republic was one of the countries with the lowest infant mortality rates in the world.

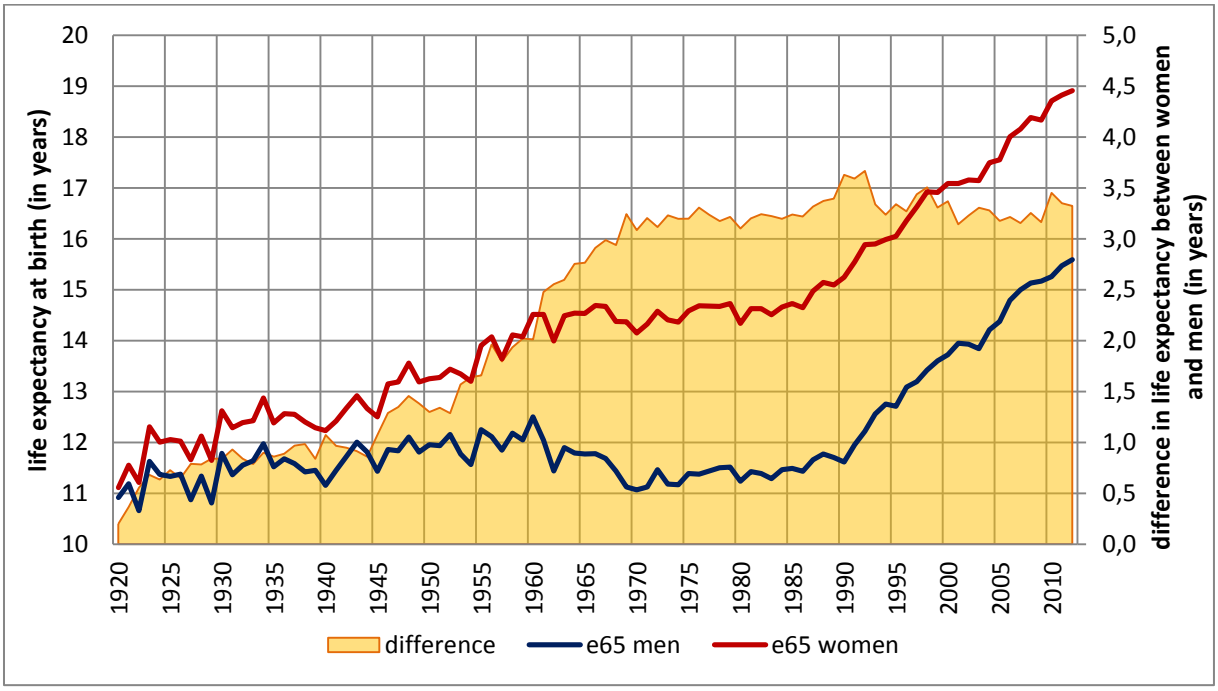
Fig. 1: Comparison of life expectancy at birth for men and women and difference of these life expectancies in 1920-2012



Source: data CZSO, own calculations

Since the mid-sixties up to the late eighties, however, the mortality rates compared with developed countries worsened and the Czech Republic began to lag in the evolution of life expectancy. In this period, then the political and demographic development assigned to the Eastern European socialist states. In terms of mortality is evident male excess mortality in middle- and older ages, there is also a worse mortality from diseases of the cardiovascular system. As a result of these changes in the development of mortality was observed even in certain periods to shortening of life expectancy for men and the stagnation of life expectancy for women. The differences in mortality between men and women are increasing in terms of life expectancy at birth (Fig. 1) and for other ages (Fig. 2). However, for older ages is generally accepted that there is less difference in life expectancy between men and women.

Fig. 2: Comparison of life expectancy for 65-year-old men and women and difference of these life expectancies in 1920-2012



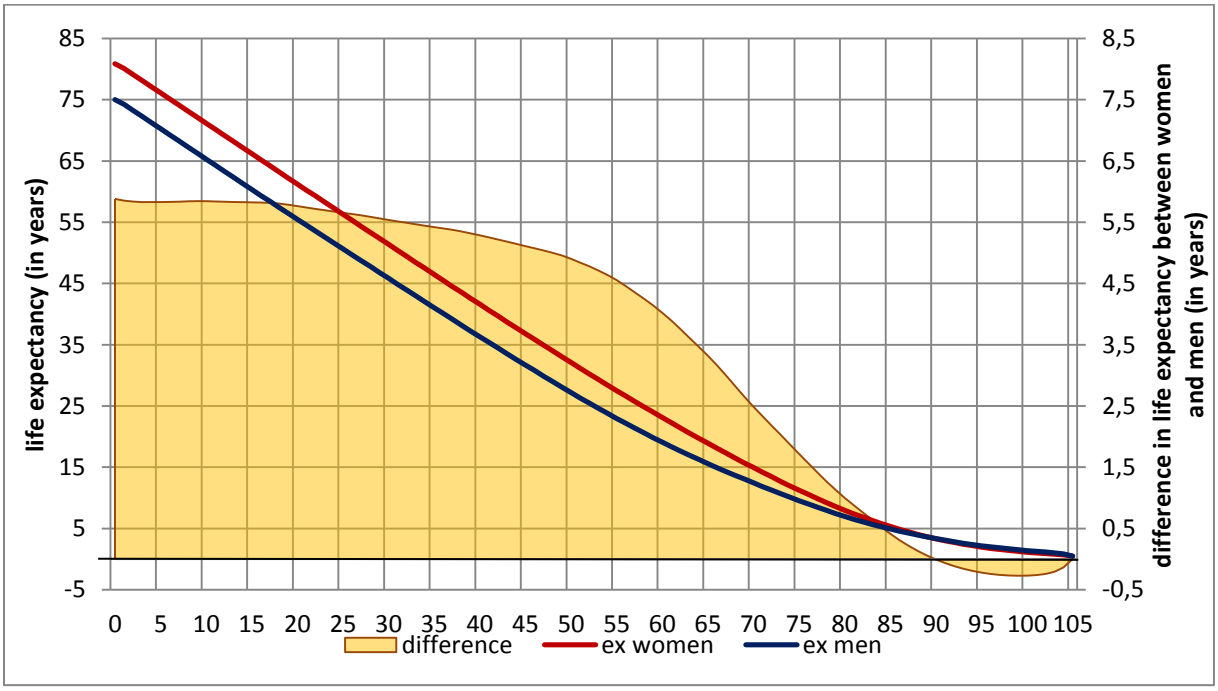
Source: data CZSO, own calculations

In the eighties are in the Czech Republic gradually introducing new techniques and methods in the treatment and prevention of diseases of the cardiovascular system. The changes that occurred later in the mortality ratios are associated with the cardiovascular revolution. There were also developing methods of ambulance in terms of its availability, improved the awareness of the population about prevention of diseases of the cardiovascular system and other diseases, and people were more aware of the need for investment in health and prevention. It was increasing emphasis on a healthy lifestyle, a better working and life

environment. Thanks to early diagnosis and new possibilities of treatment cardiovascular diseases has mortality decline in middle and older age to this cause. From this perspective, it reduces the difference in mortality between men and women. It was decreasing mortality from causes of death that were former irresistible. Despite these improvements the Czech Republic slightly lags behind the countries of Western Europe, between these countries could ranked still in the sixties.

Below in Fig. 3 is shown a comparison of life expectancy for all ages in 2010. It is clear that with the passing years, the differences between the life expectancy of women in given age and men in the same age reduced. And about the age of 90 years will even increase the length of life of men compared to women.

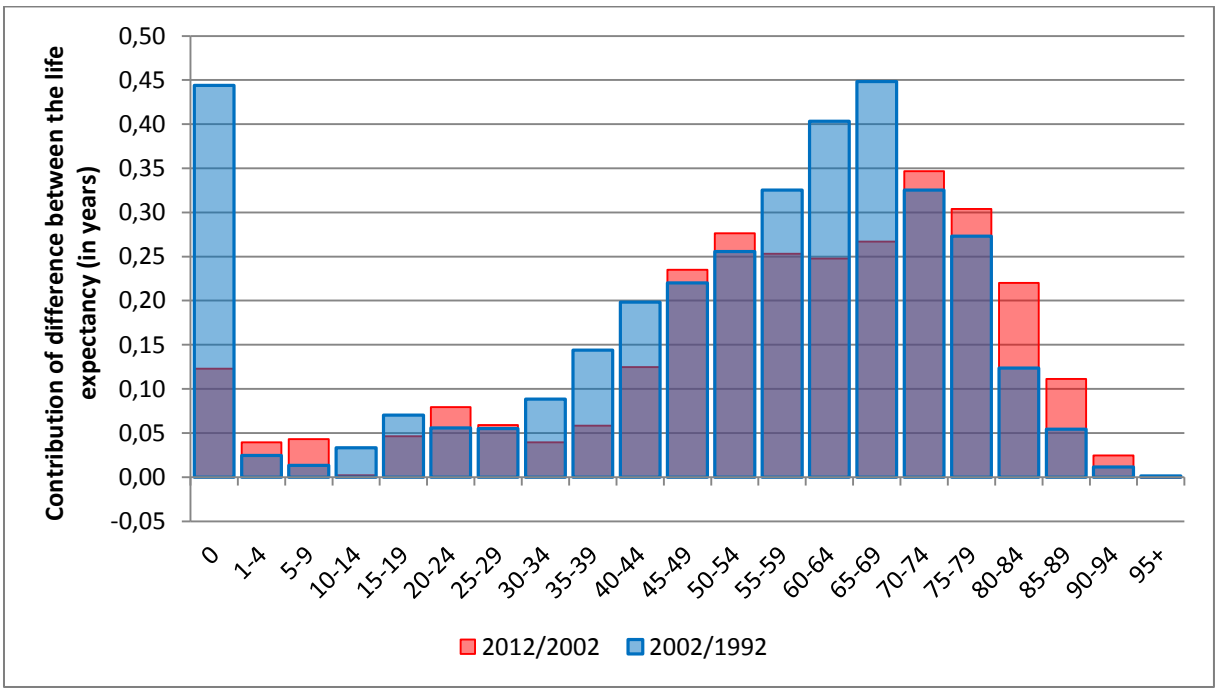
Fig. 3: Life expectancy for all ages for men and women and difference of these life expectancies in 2012



Source: data CZSO, own calculations

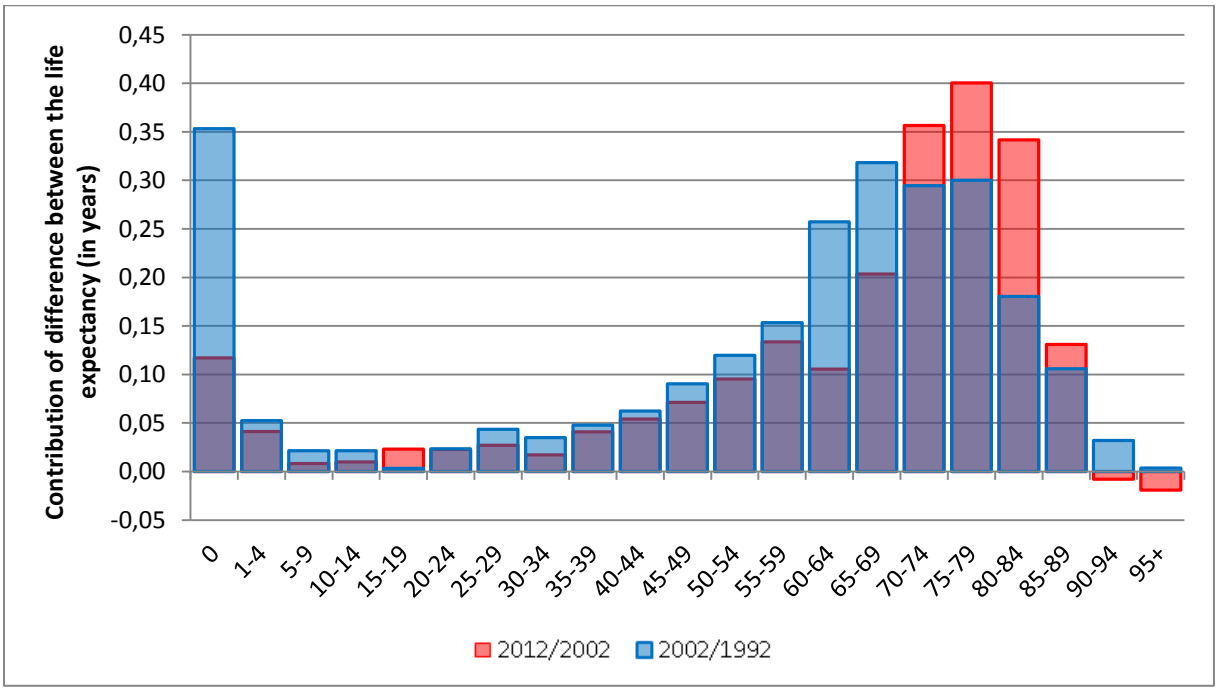
In Figures 4 and 5 are shown the results of decomposition of the difference between the life expectancy at birth of men and women. The results are shown on comparison between years 2012 to 2002 and 2002 to 1992 to see the difference between these years. It is obvious, that males life expectancy is distributed more to the lower age groups than females. In other words, on the total high of this indicator for men are more involved younger age groups. And is clearly visible that this trend moved during decade to the older age groups.

Fig. 4: The contributions of each age group to the difference in life expectancy at birth for men in 2012/2002 and 2002/1992



Source: data CZSO, own calculations

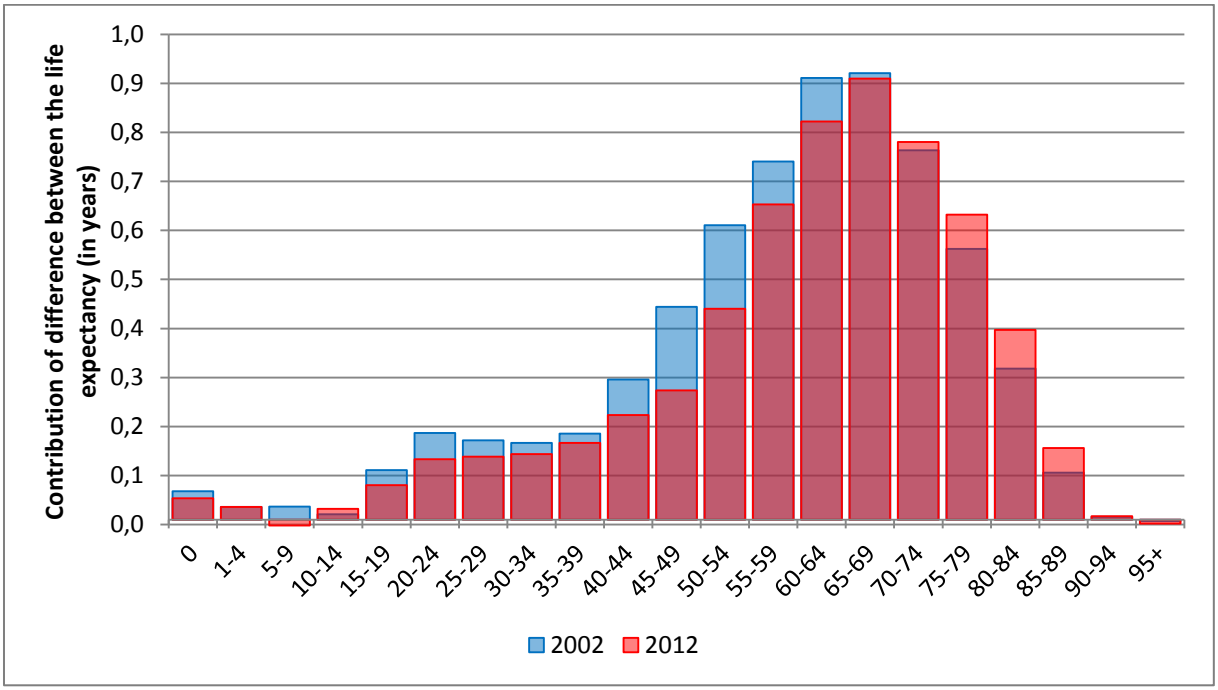
Fig. 5: The contributions of each age group to the difference in life expectancy at birth for women in 2012/2002 and 2002/1992



Source: data CZSO, own calculations

In Figure 6 is shown the result of decomposition of the difference between the life expectancy at birth of men and women. The results are shown on data from 2002 and 2012 in order to see a shift in the last decade. From Figure 6 it is clear that in 2002 the difference between women and men for this indicator participated for example age group of 20-24 years old persons of about 0.2 year. Until 2012 there was a gradual regrouping the influence of individual groups in the older ages.

Fig. 6: The contributions of each age group to the difference in life expectancy at birth between men and women in 2012 and 2002



Source: data CZSO, own calculations

Conclusion

In the early 20's of the last century was the difference between the life expectancy of men and women at birth of 2.5 years, and this difference gradually increased. In the early sixties the difference between men and women reached 5.5 and in the early nineties it was almost 8 years. At present difference stabilizes at a value of about 6 years. The biggest difference in life expectancy between men and women could we find at birth, this difference gradually decreases with age. For the oldest ages is difference between the sexes minimal. So, if men live to old age, there is no difference between mortality rates by sex or is it possible that men live longer than women.

For the future we can assume that life expectancy will be for both sexes continue to increase, not merely due to declining infant mortality (which is already at very low level if we

compared it with the world), but due to the decline in mortality and improvements in middle and higher ages. Differences in life expectancy between sexes then will be like consequences of these changes also slightly decrease.

From the results of decomposition is evident that during the period there is a bigger impact of the higher age groups, which participate on the overall level of the life expectancy.

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