

# COMPARISON OF LIFE EXPECTANCY AT BIRTH AND LIFE EXPECTANCY AT THE AGE OF 80 YEARS BETWEEN MALES AND FEMALES IN THE CZECH REPUBLIC AND SELECTED EUROPEAN COUNTRIES

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## ABSTRACT

Life expectancy is theoretical indicator calculated in life tables. It reflects characteristics of hypothetical stationary population with the same level of mortality as selected population in given year. Life expectancy  $e_0^x$  means expected number of years of life remaining at a given age  $x$ . Most often life expectancy at birth for males and females is presented, which means how many subsequent years of life on average can expect newly born person according to mortality experience.

In the paper, there are analyzed trends in life expectancy in selected European countries since 1950 with special attention to the Czech Republic. Common feature is growing life expectancy for both males and females that is one of the attribute of population ageing typical for all developed countries in Europe. Periods of slowly or fast growing trend and constant trend alternate. Trends of males' and females' life expectancies at birth prove process of convergence between genders, whereas the difference of males and females for the life expectancy at the age of 80 years increases. In all cases it is visible that selected countries are divided into two groups: Western countries (AT, GE, FR, IT, ES, SW) and Central and Eastern countries (CR, SK, HU, PL) with different patterns of trend.

## JEL CLASSIFICATION & KEYWORDS

■ J10 ■ J11 ■ LIFE EXPECTANCY ■ LIFE EXPECTANCY AT BIRTH ■ DIFFERENCE BETWEEN MEN AND WOMEN ■ COMPARISON OF EU COUNTRIES ■ CZECH REPUBLIC ■ SLOVAKIA ■ HUNGARY ■ POLAND ■ AUSTRIA ■ ITALY ■ FRANCE ■ GERMANY ■ SPAIN ■ SWEDEN

## INTRODUCTION

Life expectancy is an important hypothetical indicator calculated based on mortality characteristics of the population and assumption of stationarity. It says how many years of life remains to an individual at a given age  $x$ . Most often life expectancy at birth is presented, which means how many subsequent years of life on average can expect newly born person according to mortality experience in the population. Life expectancy reflects improvement of mortality conditions and shows prolongation of human life, which is called ageing of the population, ageing from the top of population pyramid.

Development of life expectancy in ten selected European Union countries is introduced in the article, always presented separately for males and females. Process of population ageing is reflected in the indicator life expectancy at birth and life expectancy at the age of 80 years.

## Definition of terms

Life expectancy  $e_0^x$  is an important indicator resulting from life tables that reflects mortality experience of studied population. "... the average number of years to be lived by a group of people born in the same year, if mortality at each age remains constant in the future. ... Life expectancy at

birth is also a measure of overall quality of life in a country and summarizes the mortality at all ages. It can also be thought of as indicating the potential return on investment in human capital ..." (The CIA World Factbook, 2011) For a person now aged  $x$  years it characterizes how many years of life he/she may further expect to live. This indicator changes over a time – usually improves both for males and females. In developed countries it is published usually on a yearly basis and still grows.

The most often used indicator is life expectancy at birth showing average number of years to be lived by a group of people in the age of 0 years. It is denoted by  $e_0^0$ .

In the article trend of life expectancy is compared and commented for following countries: Czech Republic (CR), Slovak Republic (SK), Hungary (HU), Poland (PL), Austria (AT), Germany (GE), France (FR), Italy (IT), Spain (ES) and Sweden (SW).

## Data

Data used for calculation were homogeneously downloaded from the Human Mortality Database (<http://www.mortality.org>), for methodology see Wilmoth et. al (2007). Data for Austria and Italy are available only till the year 2008; data for Poland are available since 1958; data for Germany are available since 1990 after union of West and East Germany. Otherwise time series from 1950 till 2009 are presented.

For comparison, data from the CIA World Factbook 2011 were used, where life expectancy at birth for males and females estimated

## Level of life expectancy

### Life expectancy at birth

Currently, Central European countries that joined the European Union (EU) in 2004 (CR, SK, HU, PL) occupy positions between 60<sup>th</sup> and 92<sup>nd</sup> place in the list of countries sorted according to the life expectancy at birth (The CIA World Factbook, 2011, estimates for total population), whereas Austria takes 32<sup>nd</sup> place in the world's life expectancy at birth' list, Spain 14<sup>th</sup> and Italy 10<sup>th</sup> position.

First three positions occupy Monaco (89.73 years), Macau (84.41 years) and San Marino (83.01 years), last three positions belong to Nigeria (47.56 years), Afghanistan (45.02 years) and Angola (38.76 years).

The following table presents life expectancy at birth for males and for females in 2009 (or in 2008, respectively).

All selected countries reach interval 70–80 years for males and 78–85 years for females. Women live on average longer than men in almost all countries in the world. Differences between males and females range from 4.0 years (Sweden) to 8.4 (Poland). Western countries report smaller difference, whereas countries from Central and Eastern Europe have higher difference between males and females' life expectancy at birth.

Table 1: Life expectancy at birth for males and females (selected countries, 2008/2009)

	males, 2009	females, 2009	difference between males and females	position in the CIA World Factbook, 2011 est.
CR	74,2	80,3	6,1	63
SK	71,4	79	7,6	79
HU	70,2	78,2	8	92
PL	71,5	79,9	8,4	76
AT*	77,6	83	5,3	32
GE	77,5	82,5	5,1	27
FR	77,8	84,5	6,7	13
IT*	79	84,2	5,2	10
ES	78,5	84,6	6,1	14
SW	79,6	83,6	4	16

\* as of 2008

Source: Human Mortality Database, 2011; The CIA World Factbook, 2011

European Union average is 76.4 years for males and 82.4 years for females (2008), which is exceeded by Western countries; the Czech Republic and SK, HU and PL remain under this threshold.

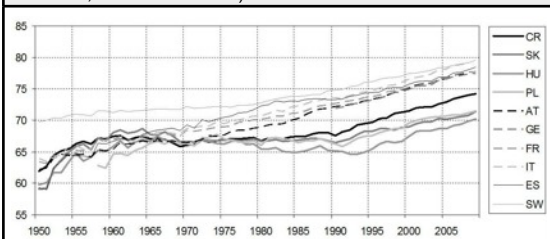
Trend of Life Expectancy at Birth

After the Second World War the life expectancy at birth increased dynamically. Currently, the life expectancy at birth for males increased from ages in the interval 60 to 65 years to the level of 70 to 79 years; the life expectancy at birth for females moved from interval 65 to 70 years to higher level of 78 to 85 years.

It could be recognized from two following figures that:

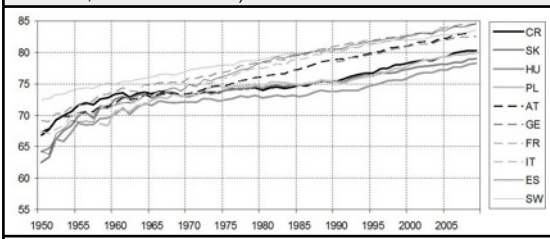
- Sweden has an exceptional position, both among males and females. In the period 1950–1980 are Sweden values above all other European countries,
- other selected countries have similar trend in 1950–1965, typical with significant increase after WWII. Since 1970 it is clear that trend in communist countries is rather

Figure 1: Trend of life expectancy at birth – males (selected countries, 1950–2008/2009)



Source: Human Mortality Database

Figure 2: Trend of life expectancy at birth – females (selected countries, 1950–2008/2009)



Source: Human Mortality Database

constant and these countries stay behind Western countries,

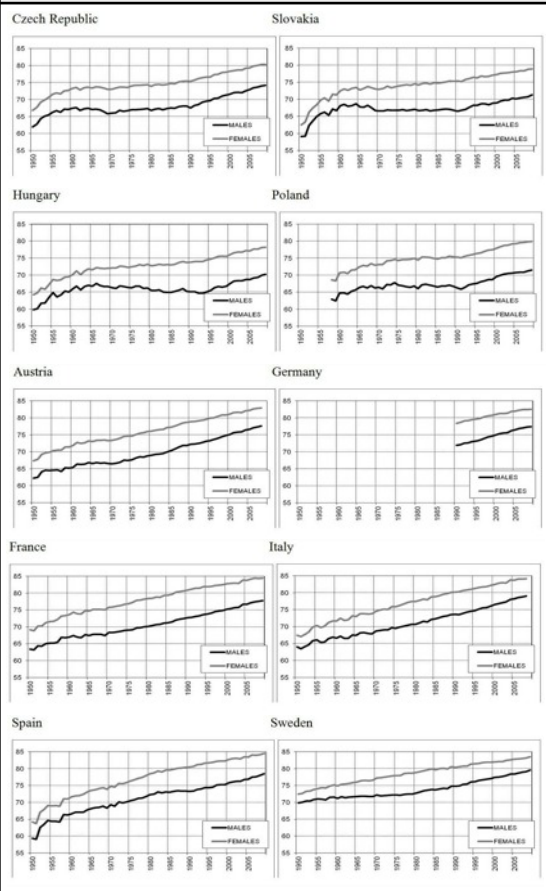
- in CR, SK, HU, PL: trend for males oscillated; in Slovakia and Hungary  $e_0$  even decreased by 2.36 % and 1.17 % between 1960 and 1990, respectively. After 1990 in connection with immense political and economical changes, the life expectancy at birth trend changed for males, it increased by 5 years of life within almost 20 calendar years. In case of females continues growth with lower intensity. The lowest level of life expectancy at birth reports Hungary for both genders,
- in Austria, life expectancy increased by 10 % between 1960 and 1990,
- western countries (GE, FR, IT, ES, SW) follow linear trend with positive increment approximately 0.25 years of life per calendar year. This group of countries includes Sweden that lost its leading position from 1950s, 1960s and beginning of 1970s,
- trend continues separately for two main groups of countries that are visible approximately since 1975. The group with the lower life expectancy at birth is formed by the Czech Republic, Slovakia, Hungary and Poland. The other group consist of Austria, Germany, France, Italy, Spain and Sweden. This distribution into two parts is valid both for males and females.

Difference between Males and Females

Life expectancy difference between males and females is displayed on following figures. It is in all cases lower for males compared to females.

- In the Czech Republic, difference between males and females increased from 5 years in 1950 to almost 8 years in 1990. After 1990, the difference has decreased quite fast to the level of 6.14 years (2009), which represents a decrease by 22 % within 19 years. It is reasonable to expect further decline.
- Difference between  $e_0$  for males and females increased in Slovakia from starting value 3.41 years in 1950 to almost 9 years in 1990, afterwards it fell down to the level of 7.59 years in 2009, which means fall 14.4 % within 19 years.
- Hungarian trend of difference between the life expectancy at birth of males and females started at 4.4 years and grew up the level of 9.46 years in 1994 with convex shape. After 1990, the difference decreased to the level of 8.02, i.e. by 15.2 % within 15 years.
- Maximal difference between males and females in Poland was reached in 1991 (9.22 years). Since that, difference of the life expectancy at birth declined within 18 years by 8.5 % only to the level of 8.44 years.
- In Austria, difference between males and females has parabolic shape with maximum of 7.21 years in 1978 and second local maximum 7.20 years in 1982. Consecutive decline to the level of 5.35 years in 2008 means decrease by 25.8 % within the period of 30 years.
- Partial data available for Germany prove decrease of the difference between males and females from 6.58 years (in 1992) to the level of 5.08 years in 2009.
- In France, one local maximum on parabolic curve could be found in 1992 (the difference 8.31 years) and second in 1980 (8.24 years). The difference decreased since 1992 by 19.3 % within 17 years.
- Very similarly developed the difference between males and females in Italy. One maximum was reached in

Figure 3: Trend of difference between life expectancy at birth of males and females (selected countries, 1950–2008/2009)



Source: Human Mortality Database

1979–1980 (6.75 years) and the second in 1991 (6.74 years). Last value available is the difference of 5.16 years in 2008.

- In Spain, the difference increased to the level of 7.40 years in 1992 and 7.39 years in 1996, after that decreased to the level of 6.07 years, which represents a decrease by 18 % within 17 years.
- The lowest difference between the life expectancy at birth of males and females represents Sweden. It started at 2.61 years in 1950 and reached its maximum in 1978 (6.23 years). Afterwards dropped down by 35.3 % within 31 years and was 4.03 years in 2009.

Table 2: Difference between life expectancy at birth of males and females (selected countries, 1950–2008/2009)

difference	CR	SK	HU	PL	AT	FR	IT	ES	SW
minimum	4,79	3,41	3,8	5,76	5,09	5,73	3,49	4,42	2,61
year of min	1953	1950	1954	1958	1949	1951	1950	1953	1950
maximum	7,87	8,87	9,46	9,22	7,21	8,31	6,75	7,4	6,23
year of max	1990	1990	1994	1991	1978	1992	1979	1992	1978
latest difference	6,14	7,59	8,02	8,44	5,35	6,71	5,16	6,07	4,03
decrease by	22,0 %	14,4 %	15,2 %	8,5 %	25,8 %	19,3 %	23,6 %	18,0 %	35,3 %
length of period	19	19	15	18	30	17	28	17	31

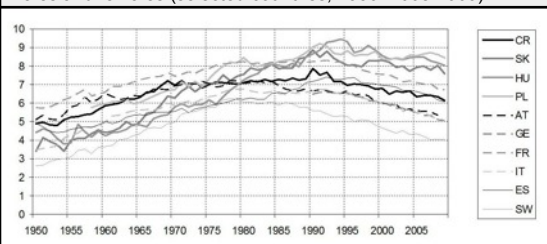
Source: Human Mortality Database, own calculation

Trend of difference has mostly concave parabolic shape with decreasing tendency. Maximum was reached between 1990 and 1994 (CR, SK, HU, PL, FR, ES) or earlier, around the year 1980 (AT, IT and SW). Germany is not assessed in this overview. Currently, Central and Eastern European countries have difference above 6 years, Western countries between 4.0 (Sweden) and 6.7 (France).

Decreasing trend of difference between males and females means that males' and females' life expectancies at birth converge together. This trend could be expected further. For example demographic projection prepared by EUROSTAT assumes in the 'convergence' scenario the convergence of males' and females' life expectancy at birth in 2150.

Together with a decrease in difference, increasing variance among selected countries since 1990 could be monitored. Life expectancy at birth for males converges to females' values but with different, shaking trend.

Figure 4: Trend of difference between life expectancy at birth of males and females (selected countries, 1950–2008/2009)

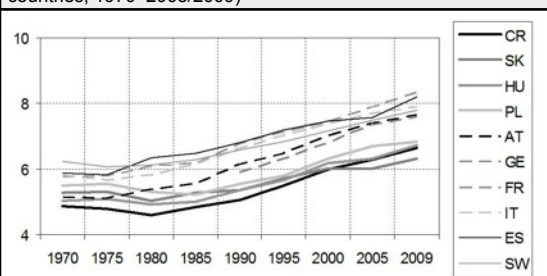


Source: Human Mortality Database, own calculation

### Effect of Ageing upon Life Expectancy

Life expectancy prolongs in all developed countries both for males and females. Rate of ageing process could be seen not only from  $e^0$  but from other life expectancies in higher ages as well. Here,  $e^0_{80}$  is presented as one of the possible indicator characterizing process of ageing of a population. Life expectancy at the age of 80 years has growing trend for all selected countries with higher values for Western countries.

Figure 5: Trend of life expectancy at the age 80 – males (selected countries, 1970–2008/2009)

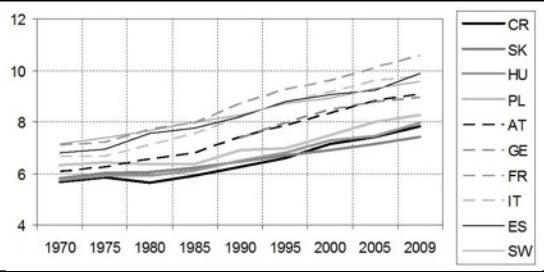


Source: Human Mortality Database

In the Czech Republic, the senior in the age of 80 years could expect to live another 6.65 years (male) or 7.83 years (female). Ageing process is fast in the Czech Republic; however this indicator belongs to the lowest from ten selected countries. The highest life expectancy at the age of 80 years report:

- for males: Sweden (1970, 1975), Spain (1980–2000) and France (2005, 2009), where 80 years old male could expect to live another 8.33 years,

Figure 6: Trend of life expectancy at the age 80 – females (selected countries, 1970–2008/2009)



Source: Human Mortality Database

- for females: Sweden (1970, 1975, 1985) and France (1980, 1990–2009), where 80 years old female could expect to live another 10.57 years.

The highest increase of the life expectancy at the age of 80 years between years 1970 and 2008/2009 reports

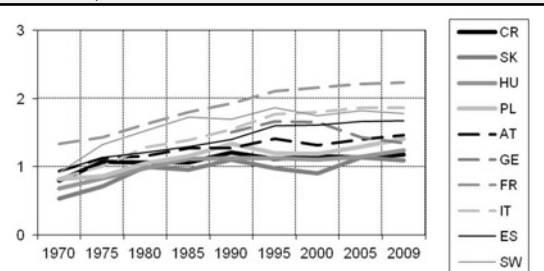
- for males Austria, where  $e_{80}^0$  increased by 48.5 %, and France (+44.4 %),
- for females also Austria (+49.8%) and France (+48.7 %).

The lowest increase could be seen in case of Slovakia, where males' life expectancy at the age of 80 years increased by 20.1 % only between 1970 and 2009, females' life expectancy increased by 27.9 %.

Trends described in development of  $e_{80}^0$  are different from those commented in previous chapters regarding the life expectancy at birth. For example, dissimilar dynamics for males and females could be proved by increasing difference among males and females – females' life expectancy at the age of 80 years increased faster compared to the characteristics of males. This is presented in the following figure.

On the other hand, similarity could be recognized in case of distribution of selected countries into two groups: the Czech Republic, Slovakia, Hungary and Poland in one group; Austria, Germany, France, Italy, Spain and Sweden in the second group.

Figure 7: Trend of difference between life expectancy at the age 80 years of males and females (selected countries, 1970–2008/2009)



Source: Human Mortality Database, own calculation

## Conclusion

Life expectancy reflects improving mortality conditions and prolongation of length of human life.

In the comparison of the Czech Republic, Slovakia, Hungary, Poland, Austria, Germany, France, Italy, Spain and Sweden, there was presented that the trend of the life expectancy differs among Western and Eastern countries.

Split into two groups is visible primarily in case of males: CR, SK, HU and PL form one group with lower life expectancy at birth and at the age of 80 years, higher difference between males and females of the life expectancy at birth and lower difference between males and females of the life expectancy at the age of 80 years. The group of Western countries (AT, GE, FR, IT, ES, SW) has favourable trend since 1950s growing all the time and smaller difference between males and females of the life expectancy at birth, which suggests advanced process of ageing and convergence between both genders.

Demographic processes are long-term processes; even 20 years from political changes in 1990 there are still visible distinctions between Western and Central and Eastern European countries.

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