CHANGES IN THE AGE STRUCTURE AND THE AGEING OF THE POPULATION OF CZECHIA AFTER THE YEAR 1989

Tomáš Fiala[1] – Jitka Langhamrová[2]

Abstract

The aim of this paper is to present a brief analysis of population ageing in Czechia in the last three decades, a time when very important political and socio-economic changes occurred in the aftermath of the Velvet Revolution in 1989. Population ageing accelerated owing to a rapid increase in life expectancy and a deep decline in fertility caused by the postponement of maternity to a later age. The ageing process was partly slowed by a relatively high rate of immigration. The paper shows the development of mean age and changes in the age structure of the population using broad age groups defined by reproductive age and by productive age. It also presents the ageing indexes and old-age dependency ratio. Besides these standard indicators the trends in alternative indicators based on remaining life expectancy and the concept of prospective age are also analysed.

INTRODUCTION

Population ageing is a logical consequence of the demographic trends of previous decades in which there is a decrease in mortality (i.e. an increase in the length of life) usually accompanied by a decrease in fertility. Almost every country in the world is facing population ageing now or will face it in the near future. The main consequence of this phenomenon is the rising cost of old-age pensions and health and social care. For this reason, population ageing is being observed and analysed by the United Nations, the European Union, and other international institutions as well as by the governments of many countries.

Demographic development in Czechia after WW II was considerably influenced by the Communist regime. The increase in life expectancy in the 1950s was followed by a period of stagnation in mortality during the 1960s, 1970s, and 1980s. At the same time the post-war period was characterised by a relatively high level of fertility due to the pro-natality measures of the communist regime, especially in the early 1970s. The pace of population ageing was relatively slow at that time (*Rychtaříková*, 2018).

After 1989, rapid changes occurred in the political and economic system in Czechia, which also resulted in changes in demographic behaviour. Life expectancy began to increase quickly. At the same time, there

1) Department of Demography, Faculty of Informatics and Statistics, Prague University of Economics and Business, W. Churchill Sq. 4, 130 67 Prague 3, Czech Republic. Contact: tomas.fiala@vse.cz.

2) Department of Demography, Faculty of Informatics and Statistics, Prague University of Economics and Business. W. Churchill Sq. 4, 130 67 Prague 3, Czech Republic. Contact: jitka.langhamrova@vse.cz.

was a sharp decline in fertility, mainly owing to the fact that many young women who had not yet had children postponed starting a family until an older age, a trend that had already been observed in previous years in Southern, Western and Northern European countries. This led to an acceleration of population ageing. Unlike some other post-Communist countries, Czechia attracted immigrants, which partly slowed the ageing process.

The standard indicators of population ageing usually suppose a constant old-age threshold of 65 years. This assumption is more and more problematic given the continuing increase in life expectancy and the improvement of the health of the population. Almost 50 years ago, Ryder (1975) suggested an alternative approach: to measure old age according to the number of years remaining until death. Sanderson and Scherbov (2005, 2007, 2010, 2013) further developed the idea of measuring the old-age threshold based on remaining life expectancy.

This paper contains a simple analysis of population ageing in Czechia in the 1989–2019 period using standard and alternative indicators of ageing.

GENERAL CHANGES IN POPULATION SIZE AND STRUCTURE

Czechia had more than 10,360,000 inhabitants in 1989. The age structure was very significantly influenced by the alternating periods of higher and lower birth rates in previous decades because international migration in the Communist era was relatively low. The most numerous age groups were people around the age of 15, born in the 1970s at the time of a major pro-natalist policy, and people around the age of 45 born right after World War II. On the other hand, the number of persons between the ages of 70 and 74 was significantly lower (owing to the very low birth rate during World War I) and so was the number of persons between the ages of 50 and 54 (owing to a drop in the birth rate during the economic crisis in the 1930s). The lower number of persons between the ages of 20 and 29 and children under 10 reflects the drop in the birth rate that occurred during the 1960s and 1980s (Figure 1).

In the period between 1989 and 2019 the total population of Czechia increased by more than 300,000, mainly as a result of a relatively high level of international migration. Since there were

Figure 1 **Age and sex structure of population 1989 and 2019 (mid-year)**

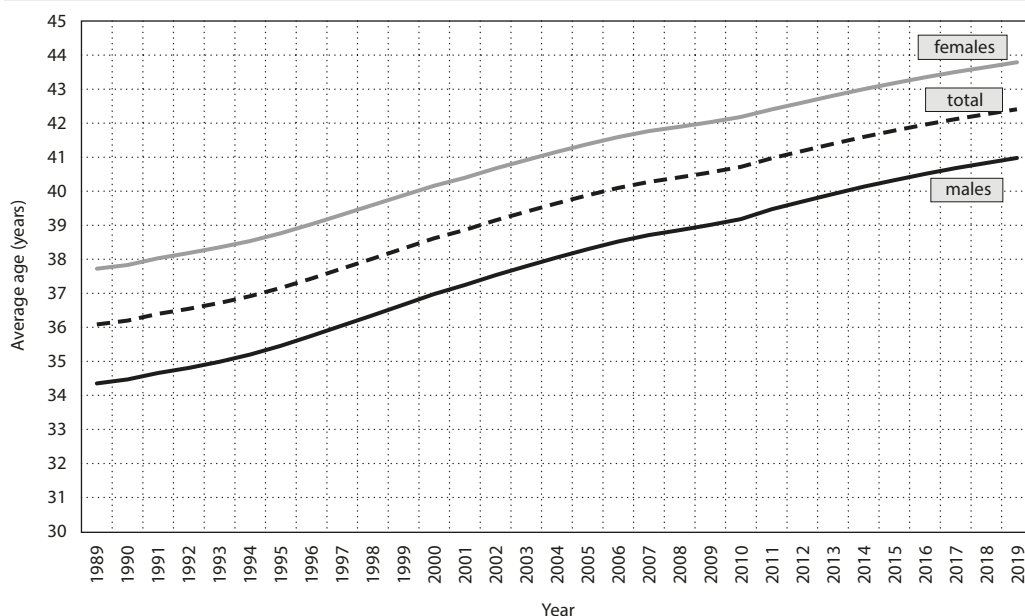**Source:** Czech Statistical Office (2020a).

269
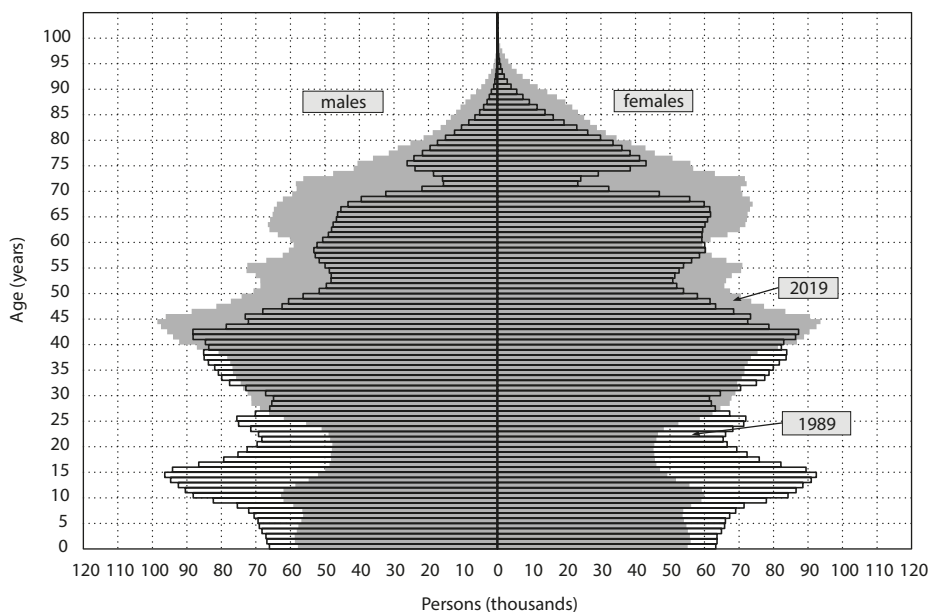
considerably more male immigrants, the increase in the number of men was over 220,000, while the number of women increased by only around 85,000. The age structure changed very significantly. The size of the population increased in all the older age units, starting at age 39 and over in the case of men and starting at age 40 and over in the case of women (with the exception of a slight decrease in the number of those aged 59). The number of persons aged 40 and over increased by about 1.5 million. On the other hand, there was a decrease in the number of younger persons, with the exception of a slight increase in the number of men aged 27–31 and women aged 27–30. The total number of persons under the age of 40 decreased by almost 1.2 million, within which category the number of persons under the age of 20 decreased by more than 900,000.

During the analysed period the average age of the population began to increase at a much faster rate than in the previous decades. While the average age of the Czech population between 1979 and 1989 increased by only 0.68 years (from 35.40 to 36.08), it went up to 38.32 years in 1999, to 40.55 years in 2009, and to 42.41 years in 2019. The increase

in the average age after 1989 was thus about three times higher than what it was in the 1980s. The average age of men increased slightly faster than the average age of women owing to a faster increase in life expectancy. The difference between the average age of women and men diminished by more than 0.5 a year (from 3.37 to 2.81) – see Figure 2.

The share of persons under the age of 20, which until 1989 had accounted for around 30% of the total population for a long time, kept dropping over the next 20 years until it reached 20%. The number of young people thus dropped by almost one-third. The main reason for this, besides low fertility, was the fact that the numerically large generation born in the 1970s gradually transitioned out of this age group. The share of persons aged 20–39 decreased from 28.3% to 24.8% over the same time period, i.e. by only 3.5 percentage points. On the other hand, the share of the population represented by the 40–59 age group, which the above-mentioned numerically strong generation gradually entered, increased by 4.5 percentage points, from 24.3% to 28.8%. The share of persons aged 60–79 increased quite significantly (from 15.2% to 21.9%) because the large generation(s)

Figure 2 **Average age of the population**

Source: Czech Statistical Office (2020a), authors' calculations.

Figure 3 **Age structure of the population**
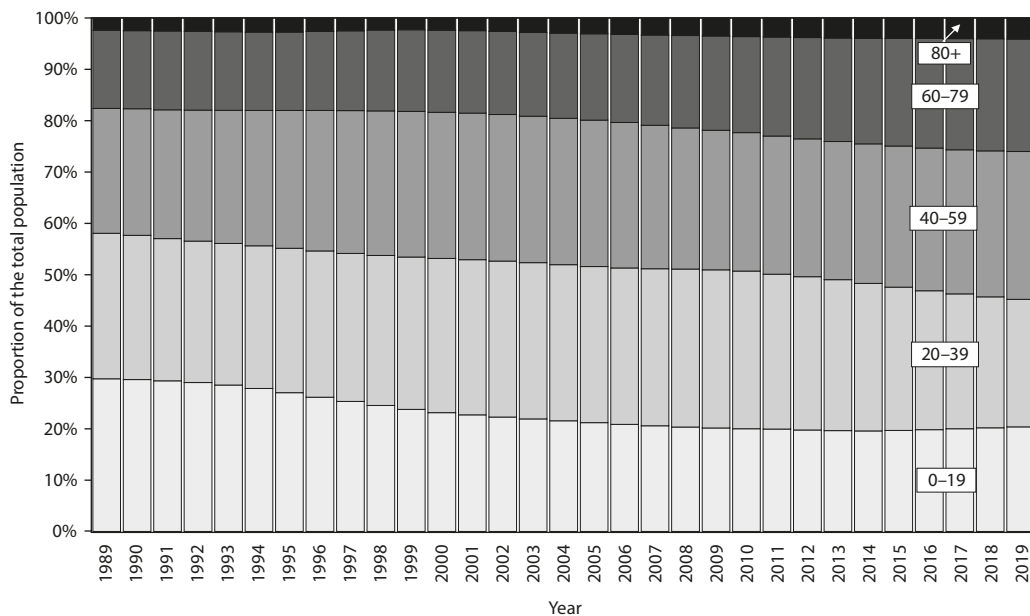
born after World War II gradually entered this age group. The number of persons in this age group increased by almost half. The share of the oldest age group (80+) also increased, from 2.4% to 4.1%. Although this increase represents only 1.7 percentage points, it means that the number of people in the oldest age group increased by more than three-fourths during the observed period (Figure 3).

The trend in the shares of the population represented by broad age groups defined by reproductive age (0–14, 15–49, 50+) after 1989 was very significantly influenced by the coincidence of a sharp decline in birth rates and the fact that the numerically strong generations born in 1974 and later gradually entered the parental age group. The child age group (0–14 years) saw a decrease in the share of the population from 22% to 14% over 20 years. During the last 10 years of the analysed time period, the percentage of the child age group slightly increased thanks to a rise in the birth rate – when postponed reproduction later took place. In 2019, the child age group represented almost 16% of the population. The number of children in the population thus decreased by more than one-fourth during the entire analysed time period.

The share of the parental generation (15–49 years old) slightly increased during the first years of the analysed period from 50% to over 52% because, as mentioned above, the numerically strong generation born in the 1970s entered this age group. Over the following years, however, the influence of the gradual transition of the numerically strong post-war generation from the parental to the grandparent age group (50+) began to prevail. By 2019, the share of the parental age group gradually decreased all the way to 45.6%. The share of the grandparent group during the analysed period increased more or less evenly from 27.8% to 38.5%, i.e. by more than 10 percentage points. The number of grandparents increased by more than 40% (Figure 4).

This trend, of course, resulted in a significant increase in the biological age index (the ratio of the number of persons aged 50 and over to the number of children under 15). The index increased from the initial 1.26 (1989) to 1.88 in 1999 and to 2.54 in 2009. Over the next 10 years, the index continued to gradually decrease because of higher birth rates, and by 2019 it had dropped to 2.41.

Figure 4 **Broad age groups defined by reproductive age**
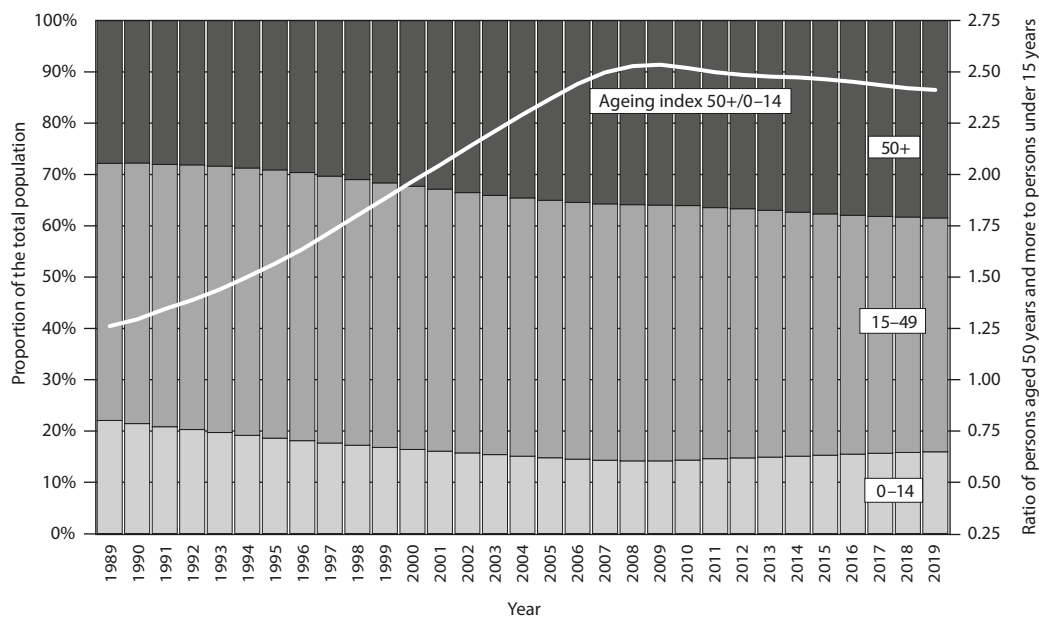
Source: Czech Statistical Office (2020a), authors' calculations.

The trend in the shares of the population represented by broad age groups defined by productive age (0–19, 20–64, 65+) was of course similar, but with certain differences. We considered the age of 20, and not the previously used age of 15, to be the lower limit of productive age. This is consistent with the fact that most youth, after finishing primary school at the age of about 15, go on to high school or vocational school. Based on the last census, the share of economically active persons in the 15–19 age group represented only around 10% of the total number of persons in this age group. We will consider the age of 65 as the upper limit of productive age, although the retirement age in Czechia will not reach this upper limit until 2031.

The coincidence of a sharp decline in birth rates and the gradual transition of the numerically strong generations born in 1974 and later into the productive age population had a very significant impact on lowering the percentage of the pre-productive age population. While in 1989 persons of pre-productive age represented almost 30% of the total population, in 2014 they amounted to only 20%, which is a decrease of 10 percentage points. Thanks to higher birth rates during the last years of the analysed

time period, the share of persons of pre-productive age increased to slightly above 20%. The number of persons of pre-productive age in 2019 was 30% lower than what it was in 1989.

By contrast, the percentage of persons of productive age increased during the first 20 years of the analysed time period; the largest increase occurred in the last years of the 20th century, when the numerically strong generation born in the mid-1970s gradually reached productive age and the significantly smaller generation born during the economic crisis of the 1930s gradually left this population group. Also, the majority of immigrants coming to Czechia were of productive age. The share of persons of productive age in the total population increased from less than 58% in 1989 to almost 65% in 2008, which was one of the highest percentages in the EU. However, the impact of low birth rates in the 1990s and the fact that the numerically strong generation born in the 1940s gradually reached post-productive age became apparent in the following years. In addition, immigration from abroad diminished as a result of the economic crisis. This is why the share of persons of productive age gradually fell below 60% between

2008 and 2019. However, the number of persons of productive age in 2019 was still about 2% higher than the number in 1989.

The percentage of persons of post-productive age increased during the analysed time period. While in 1989 the share of persons of post-productive age was only slightly above 12%, it rose to more than 15% over the next 20 years. The biggest growth occurred during the last decade of the analysed time period; in 2019, people of post-productive age accounted for almost 20% of the total population. In addition to a permanent reduction in mortality rates, the main reason for this trend was that the numerically strong generation born after World War II gradually entered post-productive age. Throughout the analysed time period, the number of persons of post-productive age increased by about 65%, i.e. by almost two-thirds (Figure 5).

The economical ageing index (the ratio of the number of persons aged 65 and over to the number of persons under 20) grew much more smoothly than the biological age index, but it doubled nonetheless. While in 1989 there were more than two persons of

pre-productive age per person of post-productive age (index 0.47), in 2019 this ratio was almost balanced (index 0.97).

A much more important characteristic from an economic point of view is the old-age dependency ratio, defined as the ratio of the number of persons of post-productive age to the number of persons of productive age. Unlike the old-age index, this index slightly increased between 1989 and 1997 (from 0.214 to 0.222) and then it decreased slightly to 0.217 in 2003. This is a result of the fact that the increase in the number of people of post-productive age was offset by the increase in the number of persons of productive age because the numerically strong generation born in the 1970s gradually moved into this group. The index started growing steadily and faster after 2004, amounting to 0.330 in 2019. While there were about 4.7 persons of productive age per person of post-productive age in 1989 and still 4.6 persons of productive age per person of post-productive age in 2003, this ratio had dropped by 2019 to only three persons of productive age per person of post-productive age.

Figure 5 **Broad age groups defined by productive age**
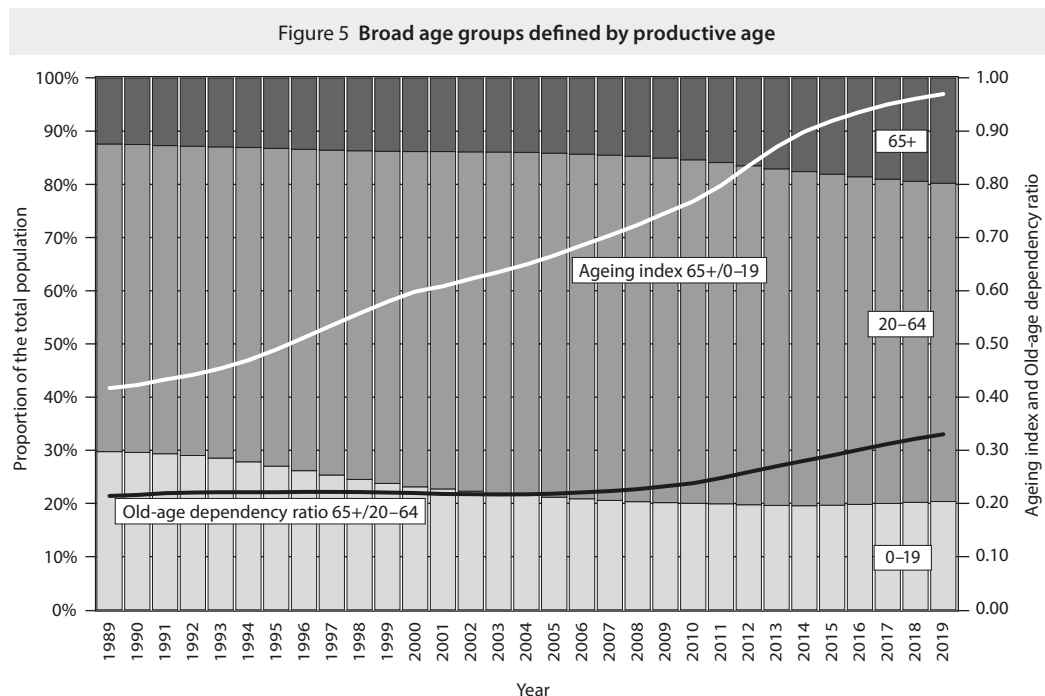
This index is often used as a gross indicator of the financial burden represented by a retirement system that is based on PAYG funding. However, this indicator is not entirely correct for Czechia. While the age of 20 can be considered a relatively good estimate of when economic activity starts, the age when economic activity ends (or at least the age when people start to collect their old-age pension) is generally below 65 years. Up until the end of 1995, men retired at the age of 60 and women with two children at the age of 55. Since the year 1996, the retirement age has been increasing, based on the year of birth, by two months (in the case of men) and four months (in the case of women) for each subsequent year of birth. People in Czechia are not expected to retire as late as the age of 65 until 2031 (*Zákon* 155, 1995). Thanks to this gradual increase in retirement age, the actual ratio of the number of persons at retirement age to the number of persons of productive age was higher than the aforesaid index, but it was relatively stable throughout the analysed time period.

The total number of persons aged 65 and over continued to increase throughout the analysed time period. However, while the number of senior citizens was increasing on average by 10,000 persons a year during the 1990s and even by less at the beginning of this century, the number of senior citizens after 2010 was increasing by about 50,000 persons a year because the numerically strong generation(s) born after World War II became seniors. Overall, the number of senior citizens increased from almost 1.3 million to more than 2.1 million, i.e. by 64%.

The uneven age structure in 1989 resulted in an uneven increase in the number of persons in individual five-year senior groups. The number of persons aged 65–69 and 75–84 in 2019 was only about 30–40% higher than that in 1989. On the other hand, the number of persons aged 70–74 and the number of persons aged 85 and over increased about 2.5 times over the same time period (Figure 6). The number of persons aged 90–94 increased more than 3.7 times and the number of persons aged 95 and over increased more than 5 times.

Prospective age indicators

The aforesaid indicators of population ageing work on the assumption that the old-age threshold is constant at 65 years, which is the retirement age

Figure 6 **Trend in the number of persons aged 65 and over**
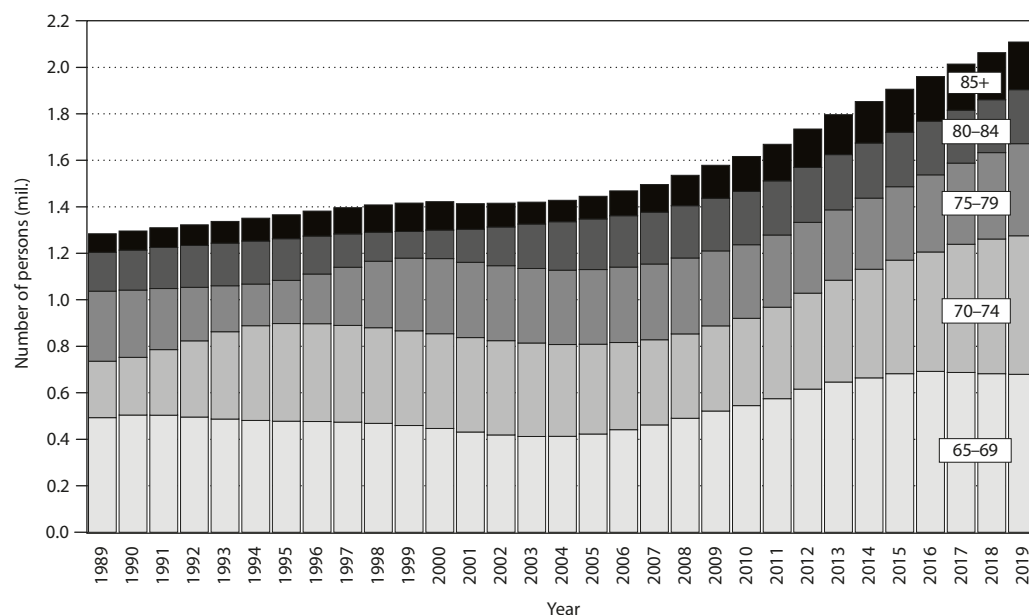
Source: Czech Statistical Office (2020a), authors' calculations.

in many European and other countries. However, this assumption is somewhat one-sided and problematic, given the continuing increase in life expectancy and the continuing improvement of the health of the population. Ryder (1975) was already arguing 45 years ago that the commonly used chronological measurement of age, such as the number of years elapsed since birth, was appropriate only from birth to adulthood and after that chronological age is no longer important as a guideline for other socioeconomic characteristics. Ryder suggests measuring old age in terms of the number of years remaining until death, replacing the commonly used fixed old-age threshold of 65 with the age at which the given tabular population has a remaining life expectancy of 10 years and considering this age as the old-age threshold. Thus, as mortality decreases and life expectancy increases, the old-age threshold increases as well. Many other authors followed up on this idea later on, such as Fuchs (1984). At the end of the last century, Siegel (1993) suggested that a remaining life expectancy of 15 years should be the old-age threshold. Sanderson and Scherbov further developed the issue of measuring the old-age threshold based on remaining life expectancy. They

proposed adjusting a number of ageing indicators so that they take into account not only chronological age but also the expected remaining years of life (so-called prospective age). Some indicators based on prospective age for Czechia were published by Klapková, Šídlo and Šprocha (2016).

When for the population of Czechia we use the remaining life expectancy of 15 years (calculated as the average life expectancy of men and women based on the mortality tables for the relevant calendar year) as the old-age threshold instead of the age of 65, we see a rather sharp increase in this old-age threshold after 1989 due to the relatively fast decrease in mortality in Czechia. This newly defined old-age threshold was only about 62 years and 8 months in 1989, but it was over 65 years in 1998 and almost 69 years and 3 months at the end of the analysed time period. The old-age threshold thus increased by more than 6.5 years over the entire analysed time period (Figure 7).

As already mentioned, people in Czechia will not be retiring at age 65 until 2030. Since 1996 the retirement age of men has increased somewhat more slowly than the old-age threshold mentioned above; the retirement age of men is about one year higher than the age

Figure 7 **Prospective old-age threshold and retirement age**
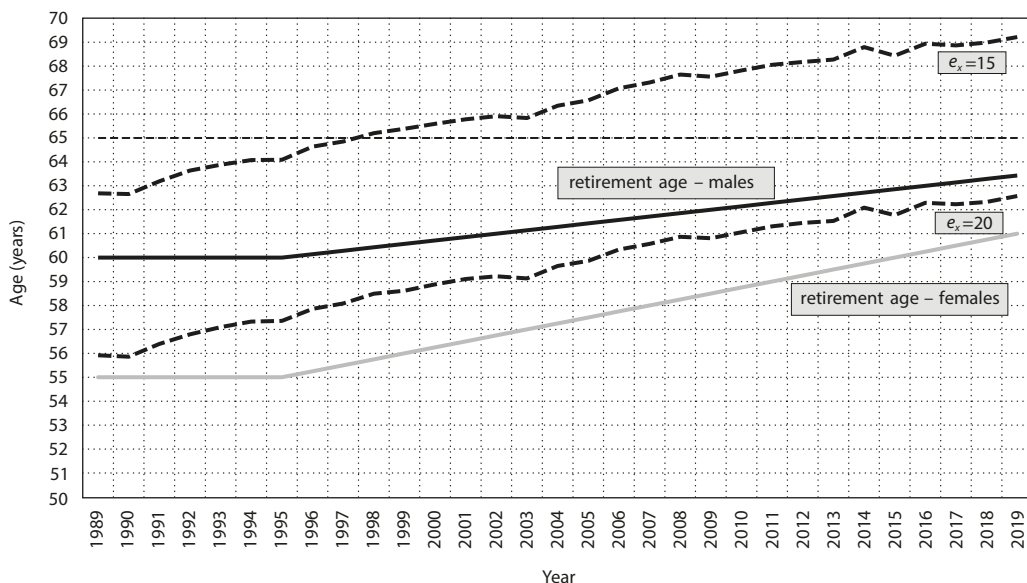
at which the remaining life expectancy is 20 years and the retirement age of women with two children is still more than one year lower than this age.

When using a tabular remaining life expectancy of 15 years and not the age of 65 as the upper limit of productive age to calculate broad age groups and relevant indices, we get a completely different picture of the trend in Czechia than when using standard indicators. The percentage of persons of productive age defined in this way continued to increase during the first 20 years and slightly decreased only in the last decade of the analysed period. However, the number of persons of productive age in 2019 was still more than 20% higher than what it was in 1989. The number and percentage of persons of post-productive age defined prospectively (i.e. persons with a life expectancy of 15 years and less) continued to slightly decline during the first 20 years, only to rise again during the last decade of the analysed period and almost reach the level it was at in 1989 (Figure 8).

The prospective old-age index (the ratio of the number of persons with a life expectancy of 15 years or less to the number of persons under 20) continued to grow much more slowly than the standard index. The index was around 0.5 during the first half of the 1990s and gradually increased, reaching 0.6 in the year 2003. An additional increase all the way to 0.7 occurred during the last decade of the analysed time period.

On the other hand, the prospective old-age dependency ratio (the ratio of the number of persons with a life expectancy of less than 15 years to the number of persons aged 20 and over with a life expectancy of more than 15 years) continued to slightly decrease during the first 20 years of the analysed time period. This is because life expectancy was constantly going up while the numerically strong generation born during the 1970s moved from pre-productive age to productive age. This index started to increase slightly during the last decade of the analysed time period. This is because the numerically weak generation born in the 1990s entered productive age, while the numerically strong generation(s) born at the end of and especially after World War II gradually moved to the group of persons with a life expectancy of less than 15 years. However, the index was still lower in 2019 than it was in the first half of the 1990s.

Figure 8 **Prospective broad age groups, economic ageing index and old-age dependency ratio**
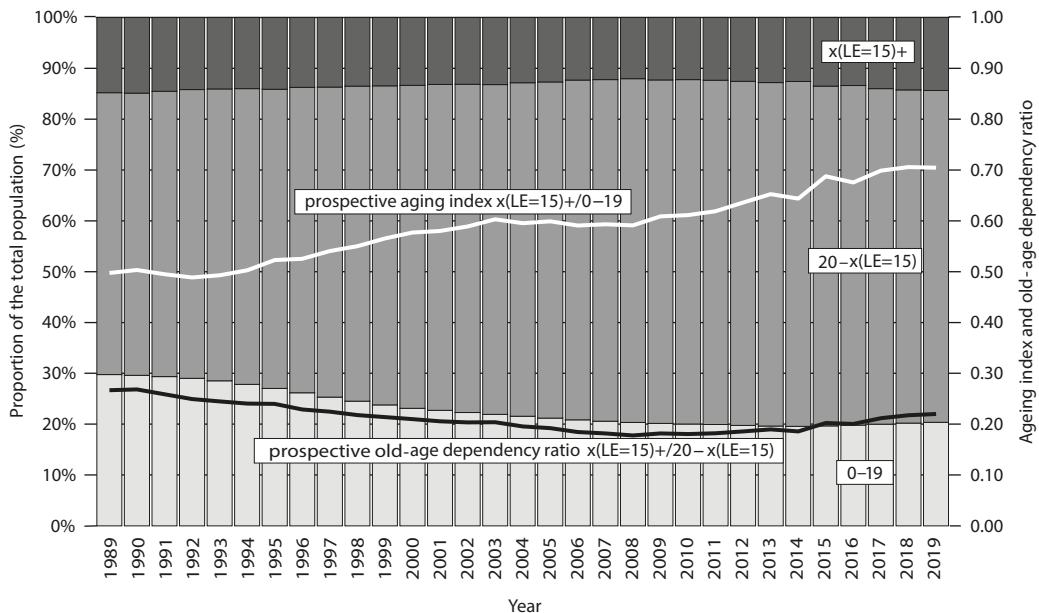
Figure 9 **Distribution of the oldest persons by prospective age**
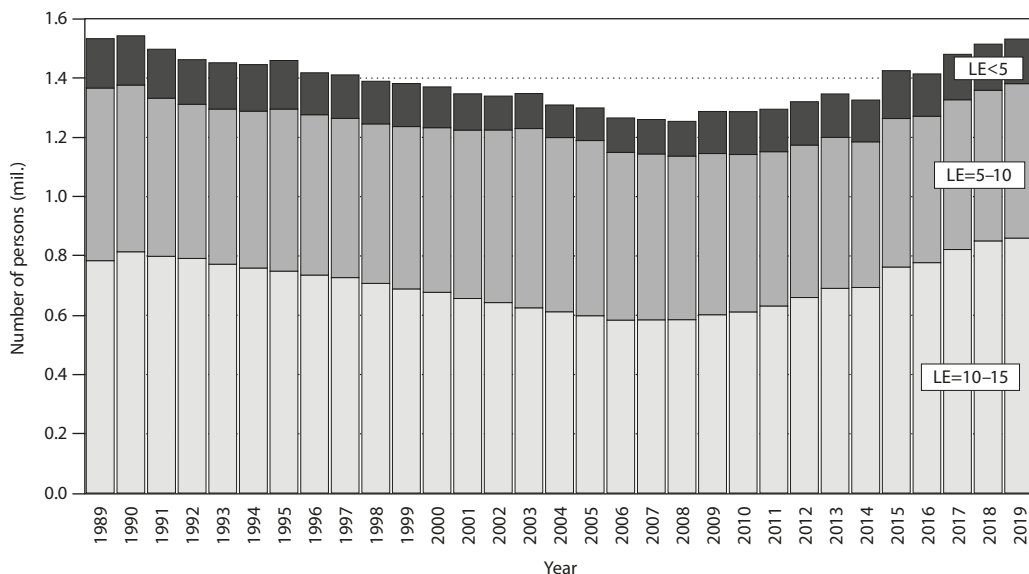
While the number of persons aged 65 and over continued to increase during the analysed time period, the number of persons with a life expectancy of less than 15 years continued to decrease until 2008 – from more than 1.5 to less than 1.3 million. After that, this number started going up and by 2019 reached almost the same level as it was in 1989. The number of persons with a remaining life expectancy of between 10 and 15 years increased by about 10%. Conversely, the number of persons with a shorter remaining life expectancy (between 5–10 years and up to 5 years) decreased by approximately 10% (Figure 9).

CONCLUSION

The ageing of the Czech population accelerated after 1989 because of a relatively rapid increase in life expectancy and a drop in fertility, especially in the last years of the 20th century. This was partly offset by international migration. The biggest increase in the mean age of the population was observed in the years around the turn of the millennium, when the number of births was very low. Conversely, the ageing slowed down a little bit in the late 2000s when net migration and natality were relatively high. The highest increase in the proportion of older persons was observed in the oldest-old age group (85+ years of age).

Because of the retirement age in Czechia is below 65 years the actual ratio of the number of persons of retirement age to the number of persons of productive age is still higher than the standard old-age dependency ratio (65+/0–19) and will remain so until 2031.

The financial impact of the increase in the proportion of older persons on the old-age pension system has been offset by the continuous increase in the statutory retirement age since 1996, especially in the case of females. Because of this measure to increase the retirement age, the pension system remained relatively stable during the period analysed.

Alternative indicators of population ageing based on the concept of prospective age (i.e. on remaining life expectancy) offer another picture of population ageing. While the number of persons aged 65 and over grew throughout the period analysed, owing to the relative rapid improvement of mortality even in senior age, the number of persons with a remaining life expectancy that is less than 15 years had a slowly decreasing tendency until 2008, and despite a later increase its present values are approximately the same as they were in the initial year of this analysis in 1989.

Acknowledgment

References

- Fiala et al. 2018. Population Development of Czechia and Slovakia after 1989. *Demografie*, Vol. 60, No. 3, pp. 202–218, Prague: Czech Statistical Office.

- Fuchs, V. R. 1984. Though Much is Taken: Reflections on Aging, Health, and Medical Care. Milbank Memorial Fund Quarterly [online]. *Health and Society*, Vol. 62, No. 2, pp. 142–166, Special Issue, Financing Medicare: Explorations in Controlling Costs and Raising Revenues, Springer, 1984, Wiley on behalf of Milbank Memorial Fund. Available at: <http://www.jstor.org/stable/3349821>.

- Klapková, M. – Šídlo, L. – Šprocha, B. 2016. Koncept prospektivního věku a jeho aplikace na vybrané ukazatele demografického stárnutí [The Concept of Prospective Age and its Application to Selected Indicators of Demographic Ageing]. *Demografie*, Vol. 58, No. 2, pp. 126–141, Prague: Czech Statistical Office.

- Rychtaříková, J. 2018. Demographic trends and patterns in Czechia and Slovakia during the socialistic era. *Demografie*, Vol. 60, No. 3, pp. 184–201, Prague: Czech Statistical Office.

- Ryder, N. B. 1975. Notes on Stationary Populations [online]. *Population Index*, Vol. 41, No. 1, pp. 3–28, Office of Population Research. Available at: <http://www.jstor.org/stable/2734140>.

- Sanderson, W. C. – Scherbov, S. 2005. Average Remaining Lifetimes Can Increase as Human Populations Age [online]. *Nature*, 2005, Vol. 435, No. 7043, p. 811–813. DOI: 10.1038/nature03593. Available at: <http://www.nature.com/doifinder/10.1038/nature03593>.

- Sanderson, W. C. – Scherbov, S. 2007. A New Perspective on Population Aging. *Demographic Research*, Vol. 16, pp. 27–58. DOI: 10.4054/DemRes.2007.16.2

- Sanderson, W. C. – Scherbov, S. 2010. Remeasuring Aging. *Science*, Vol. 329, No. 5997, pp. 1287–1288. DOI: 10.1126/science.1193647

- Sanderson, W. C. – Scherbov, S. 2013. The Characteristics Approach to the Measurement of Population Aging. *Population and Development Review*, Vol. 39, No. 4, pp. 673–685. DOI: 10.1111/j.1728-4457.2013.00633.x

- Siegel, J. S. 1993. *A Generation of Change: a Profile of America's Older Population*. New York: Russell Sage Foundation, 1993, xxxvi.

- *Zákon 155/1995 Sb.* [Law No. 155/1995 Coll.]. O důchodovém pojištění, aktuální znění, příloha.

Sources of data

- Czech Statistical Office. 2020a. *Demografické ročenky – pramenná díla* [Demographic Yearbooks] [online]. Prague: CZSO. Available at: <https://www.czso.cz/csu/czso/casova_rada_demografie>.

- Czech Statistical Office. 2020b. *Life tables for the Czech Republic* [online]. Prague: CZSO. Available at: <https://www.czso.cz/csu/czso/life_tables>.

TOMÁŠ FIALA

Studied at the Faculty of Mathematics and Physics of Charles University in Prague. He is currently a lecturer in the Department of Demography at the Faculty of Informatics and Statistics of the Prague University of Economics and Business. He specialises in research on population projections and population ageing.

JITKA LANGHAMROVÁ

Studied at the Prague University of Economics and Business. She is currently head of the Department of Demography at the Faculty of Informatics and Statistics of the Prague University of Economics and Business. She specialises in research on population ageing, social demography, and regional demography.