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Charles University in Prague
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Branislav Šprocha
INFOSTAT Demographic Research Center
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Comenius University in Bratislava
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Prospective Dimension of Population Ageing and Potential Use in Pension Security in the V4 Countries[1]

Luděk ŠÍDLO – Branislav ŠPROCHA** – Pavol ĎURČEK****

Abstract

The main aim of the paper is to highlight the importance of remaining years of life in relation to demographic ageing. We use the V4 countries as our case study and analyse demographic ageing using the concept of prospective age and the relevant indicators to consider whether statutory retirement age should be readdressed given the rise in remaining life expectancy among seniors. The classic indicators show ageing is increasing in the V4 countries. Using prospective indicators we can see that not only is the level of ageing significantly lower but that it is progressing more slowly, and in some cases reversing. The prospective approach could also be important in setting pension age as it reflects changes in life and the principle of equitability. The results also show that the way pension age is fixed in the V4 countries may pose a risk to the sustainability of pension systems.

Keywords: *prospective ageing, equitable normal pension age, old-age dependency ratio, V4 countries*

JEL Classification: J11, J18, J26

Introduction

Demographic ageing has become an unprecedented, irreversible 21st century phenomenon (Gavrilov and Heuveline, 2003; Lutz, Sanderson and Scherbov, 2008b) unseen thus far in the history of human populations (UN, 2001). It affects

* Luděk ŠÍDLO, Charles University, Faculty of Science,Department of Demography and Geodemography, Albertov 6, 128 43 Prague 2, Czechia; e-mail: ludek.sidlo@natur.cuni.cz

** Branislav ŠPROCHA, Institute for Forecasting CSPS, Slovak Academy of Sciences, Šancová 56, 813 64 Bratislava 1, Slovak Republic; e-mail: branislav.sprocha@gmail.com

*** Pavol ĎURČEK, Demography and Territorial Development, Department of Economic and Social Geography, Mlynská dolina, 842 15 Bratislava, Slovak Republic; e-mail: pavol.durcek @uniba.sk

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all countries (UN, 2017). As Lutz, Sanderson and Scherbov (2008a) have stated, population ageing is becoming an important social, economic, health, and even cultural phenomenon, given the scale of the incidence and impact. It is one of the most important challenges facing advanced economies, particularly because it is has the potential to impact on fiscal stability and economic growth (Cuaresma, Lábaj and Pružinský, 2014). All population forecasts and analyses (e.g. Lutz, Sanderson and Scherbov, 2008a,b) show that the world population is entering a period of accelerated ageing. Lutz, Sanderson and Scherbov (2008a,b) think this is very likely to affect the former Eastern Bloc countries in particular. According to probability forecasts, there is an almost 98% chance that the proportion of the population aged 60 and over will increase to more than one third by the beginning of the 2050s (Lutz, Sanderson and Scherbov, 2008a,b). The results of the latest EUROSTAT – EUROPOP2018 population projection confirm this. Countries that are likely to have the largest proportion of elderly persons (aged 65 and over) by the mid-2000s are found in southern Europe (a third or more) and former Eastern Bloc countries that are now EU member states. The forecast indicates that, given the speed of ageing, Slovakia will change from being one of the youngest EU-28 populations (along with Poland) to one that is older than average. Given the proportion of the working age population and rising number and proportion of over 65s, policymakers think a greater burden will be imposed upon the productive part of the population. By 2050 the old-age dependency ratio will increase substantially in all EU member states, and to higher than average in the V4 countries, with the exception of Hungary (51 – 55 elderly persons per 100 working age persons). As a result, these countries (and especially Slovakia and Poland) should be counted among the countries with the fastest growing old-age dependency ratio.

The impact of population ageing on the economy, future economic growth, public finances, and so on has been the subject of detailed analysis and prediction (e.g. Cuaresma, Lábaj and Pružinský, 2014; Bloom, Canning and Fink, 2010; Börsch-Supan, 2003). The most frequently identified problems include (Shaw, 2002):

1. the rising number of dependent elderly people per worker;
2. the increasing burden on the productive population and rising cost of social security and welfare systems to working taxpayers;
3. the growing number of elderly people will lead to more costly health and social systems, and a rise in morbidity and disabilities (Doyle et al., 2009; Dyer, 2006; Polder et al., 2002);
4. as the productive population ages and is replaced by smaller younger generations, there is an increasing risk that innovation, experimentation, risk-taking and general dynamism will slow;

5. an ageing population will lead to the political system being increasingly oriented towards the needs and interests of elderly people (and voters);

6. these trends appear to be irreversible, as a further decline in mortality (accompanied by extended lifespans) is generally expected.

Paradoxically, the greatest success of the past century – longer life expectancy among people of all ages – is now seen as a problem (Spijker and MacInnes; 2013, p. 57).

The impact of population ageing on various aspects of society is largely analysed using retrospective (chronological) indicators beginning from age reached. These indicators reflect the number of years lived. However, chronological ageing involves other dimensions of ageing, and when these are included, a broader and more comprehensive view of ageing is obtained. They include, for example, remaining life expectancy, state of health and morbidity, degree of disability and cognitive function (Sanderson and Scherbov, 2013). The elderly population differs in key characteristics, such as medical care costs, retirement, consumption, accumulation of human and capital assets, which means the number of years lived is less important than the number of remaining years of life (Sanderson and Scherbov, 2005).

Population ageing cannot simply be seen in terms of the greater number and representation of old people above a certain chronological age (e.g. 65 years). Longer lifespans must be taken into consideration as well (Lutz, Sanderson and Scherbov, 2008a).

Another important aspect is the fact that chronological indicators do not take account of the relatively significant gender differences and national and regional differences in life expectancy. Having a fixed old age threshold, or pension age, fails to reflect the reality as there is enormous variability in life expectancy at old age between populations and over time, and lifespan is increasing among older age groups (Sanderson and Scherbov, 2008). Populations are also healthier, more active, working and have different education levels, interests, consumer preferences and so on. Linking ageing to chronological age alone means focusing on only one of the changing aspects of population ageing, which limits our understanding and often distorts and restricts the ability to make constructive political decisions (Sanderson and Scherbov, 2013).

The main aim of this paper is to point out the new analytical possibilities that arise when a prospective approach to demographic ageing is used, especially in the context of discussions on pension age, and fixing it at a certain chronological age in the V4 countries. The V4 countries have been selected as all exhibit dynamic ageing as measured by the chronological approach, and have made significant changes to statutory retirement age in recent years.

Another aim is to highlight the differences in the level and trend in population ageing and the demographic burden on the productive population using selected conventional and prospective indicators, and to show how an equitable normal pension age can be constructed based on the prospective approach and selected α-age.

A further aim is to use the results of the revised EUROSTAT population projection (EUROPOP2018) to highlight differences in the level and change in population ageing, the extent of the demographic burden on the productive population using selected conventional and prospective indicators, and to show how an equitable normal pension age can be constructed based on a prospective approach and selected α age.

The study is divided into four consecutive blocks. In the first part, the importance of a perspective approach in the analysis of pension age and its advantage in comparison with the classical chronological view of aging will be pointed out. In the second part, we present in more detail the data sources, methodological constructions and a brief summary of the assumptions of the EUROPOP2018 population projection. The third part empirically points out how the different level, development and dynamics of the aging process can be achieved using selected perspective and conventional chronological indicators. Following these findings, in the fourth part, we point out through the equitable normal pension age (ENPA) how important it is to take life extension into account when setting the pension age.

Theoretical Concept of Prospective Age – Why a New Approach to Population Ageing is Important in Economic Analyses

Population ageing is most frequently presented and analysed in terms of the number and proportion of elderly people and the impact of population ageing on various aspects of society. The focus is on the economic aspects, such as public spending, the burden on the productive population, the sustainability of the social and healthcare system, pension age, and economic growth. In the vast majority of cases, these analyses rely on classical (conventional) chronological age – number of years lived since birth; 65 (or 60) years is used as an approximation of the threshold of old age. This focus on chronological age presupposes that the characteristics of the elderly population do not change over time and space. But given that lifespans are continually lengthening, this is far from the reality. The improvement in mortality ratios entails changes to both the composition of the population age structure and the distribution of potential years of life (Spijker, 2015). Sanderson and Scherbov (2005; 2007), Lutz, Sanderson and Scherbov

(2008b), Spijker and MacInnes (2013) and others have pointed out that the chronological approach is appropriate for definitions of the elderly population. In adulthood, most characteristics linked to the ageing process depend on remaining years of life (Ryder, 1975). Therefore, in the long term, years of remaining life has a greater effect on a person's life than number of years lived (Sanderson and Scherbov, 2015a,b; 2016). In an attempt to shift the focus towards prospective age, new work (e.g. Sanderson and Scherbov, 2016; Spijker, 2015) has focused on finding new definitions of the old age threshold and the elderly population. The main message is that alpha ages are far more appropriate than chronological age for setting both the old age threshold (e.g. at 65 years) and pension age. These are the ages at which certain population-age-related characteristics can be observed (Sanderson and Scherbov, 2016). In other words people of the same alpha age share an observed characteristic to the same extent. One of these important characteristics is remaining life expectancy. Alpha ages based on life expectancy values are known as prospective ages, and ageing indicators based on prospective age are known as prospective ageing indicators (Ediev, Sanderson and Scherbov, 2016).

One of the most important alpha ages relevant to this study is pension age. Pension systems based on fixed pension ages are becoming unsustainable in the face of rising average life expectancy (Sanderson and Scherbov, 2013, p. 676). Using appropriately selected alpha ages, we can specify a simple alternative public pension system in which the person-years claim to an old-age pension remains constant across generations. Such a system is equitable in the sense that the number of years spent in retirement relative to the number of years spent at working age remains fixed, even when lifespans increase (Sanderson and Scherbov, 2013). Sanderson and Scherbov (2013) term this ratio the "life-course ratio".

Prospective indicators are rarely used in economic research. As Cuaresma, Lábaj and Pružinský (2014, p. 56) have shown, there is clear empirical evidence that prospective ageing measures are better indicators of economic growth at long horizons. On the other hand, the conventional old age dependency ration (OADR) is a robust determinant of economic growth, but only for relatively short intervals (Cuaresma, Lábaj and Pružinský, 2014). Cuaresma et al. stressed that monitoring prospective indicators of ageing should become the priority in policymaking designed to counter the negative impacts of ageing on sustainable economic growth in Europe (Cuaresma, Lábaj and Pružinský, 2014, p. 57).

There are other signs that a shift is urgently needed in the perception of age and population ageing. Using a fixed chronological age to determine who is elderly and using that threshold when planning public spending, for example on social care and particularly healthcare for the elderly, could lead to a number of inaccuracies or produce misleading results, which could in turn distort decision-making processes and public policymaking (Sanderson and Scherbov, 2015b). Healthcare expenditure has been rising rapidly, especially in relation to those in the last years of life (Sanderson and Scherbov, 2005), and it is tied not to the number of years lived, but to the number of remaining years of life. This needs to be taken into account in public spending forecasts relating to the elderly population, and we should note that with longer lifespans, the expenditure is incurred at an older chronological age (e.g. Miller, 2001; Yang, Norton and Stearns, 2003; Stearns and Norton, 2004). The opposite is also true: public expenditure forecasts based solely on retrospective age can result in an unrealistically high burden of public finances and lead to unfortunate political choices (Sanderson and Scherbov, 2015a,b).

Data and Methods

Although there has been some formalization[2] in the construction of models showing the future directions of components of population trends (fertility, mortality, and migration), we rely on the latest revised results of the EUROSTAT EUROPOP2018 population projection. We used 2018 as the threshold year for our calculations, and at the time of writing we had real data and a horizon of 2050. As the authors of EUROPOP2018 point out, the accuracy of the projection deteriorated in 2018 and so the projected population trend for 2100 should be interpreted at the "what-if" projection level. In our calculations we use the baseline scenario. The EUROSTAT projection sensitivity test uses a zero migration scenario, but that seems unlikely in the V4 countries. Moreover, the results of the EUROSTAT projection and some national population projections (e.g. Bleha, Šprocha and Vaňo, 2013; 2018) show that the parameter setting of the individual parameters in the scenarios (most often low, medium and high) is not important for the expected ageing trend.

The input data required for the calculations was:[3]

1. Population on 1 January by age and sex,
2. Assumptions for mortality rates by age and sex (m_x),
3. Assumptions for life expectancy by age and sex (e_x).

[2] A deeper analysis and comparison with some of the available national population projections has shown that the formalizations in development models have no significant impact on the results obtained.

[3] Available for each V4 country at: <https://ec.europa.eu/eurostat/data/database> under Population and social conditions – Population projections – EUROPOP2018 Population projections at national level.

The assumptions for mortality rates by age and sex were derived from the probability (q_x) that someone aged exactly (x) will die before reaching age (x + 1). The following exponential function was used for this purpose:

$$q_x = 1 - exp^{-m_x}$$

The other functions of the life tables were constructed as follows:

l_x: Number of living persons at the beginning of the age interval (the radix of the life table l_0 set at 100,000)

$$l_{x+1} = l_x - d_x$$

d_x: Number of persons dying during the age interval,

$$d_x = q_x \; . \; l_x$$

L_x: Person-years of life in the age interval,

for $x = 0$ $$L_0 = l_0 - 0{,}9 \; . \; d_0$$

for $x > 0$ $$L_x = l_x - 0{,}5 \; . \; d_x$$

T_x: Total person-years of life contributed by the population after attaining age (x)

$$T_x = \sum_{x}^{100+} L_x$$

As mentioned above, most analyses of population ageing and its impacts rely on an old age threshold defined as the chronological age of 65 years. We use this to construct the conventional indicators, which we then compare with the ageing indicators that take account of changes in mortality rates. Several scholars (e.g. Sanderson and Scherbov, 2014; 2016; Spijker, 2015) have proposed that a remaining life expectancy value could be used instead of a fixed old age threshold. A remaining life expectancy of 15 years is perhaps most often used for this purpose. It was empirically derived in the 1960s as the old age threshold from remaining life expectancy of 65 in many low mortality countries (Basten, Scherbov and Sanderson, 2015). Since significant differences in mortality levels persist between sexes in the V4 countries, we adjusted the original design procedures of each prospective ageing indicator and take account of this.

The simplest and perhaps most frequently discussed indicator is the number (or proportion) of elderly people in the population. When setting the old age threshold at 65 years, for the classical indicator of the proportion of elderly people $prop.\,65+^{c}$ in a given country (c), we can introduce the following formula:

$$prop.\ 65+^{c} = \frac{P_{x65+}^{m,c} + P_{x65+}^{f,c}}{P_{0-\omega}^{m,c} + P_{0-\omega}^{f,c}}\ .\ 100$$

where

$P_{x65+}^{m,c}$ – the number of men in country (c) aged 65 and above,

$P_{x65+}^{f,c}$ – the number of women in country (c) aged 65 and above,

$P_{0-\omega}^{m,c}$ – the total number of men in country (c)

$P_{0-\omega}^{f,c}$ – the total number of women in country (c).

When applying the prospective proportion elderly $prop.\ RLE-15^{c}$, we use the following formula:

$$prop.\ RLE-15^{c} = \frac{P_{x(RLE-15)}^{m,c} + P_{x(RLE-15)}^{f,c}}{P_{0-\omega}^{m,c} + P_{0-\omega}^{f,c}}\ .\ 100$$

where

$P_{x(RLE-15)}^{m,c}$ – the number of men in country (c) at ages with a remaining life expectancy of 15 years or less,

$P_{x(RLE-15)}^{f,c}$ – the number of women in country (c) at ages with a remaining life expectancy of 15 years or less,

$P_{0-\omega}^{m,c}$ – the total number of men in country (c),

$P_{0-\omega}^{f,c}$ – the total number of women in country (c).

The old-age dependency ratio is used as a rough approximation of the burden the elderly population place on the productive population. The lower working age threshold was changed to 20 years for time spent in education and vocational training. For the conventional $OADR^{c}$ indicator for country (c) we can use the following formula:

$$OADR^{c} = \frac{P_{x65+}^{m,c} + P_{x65+}^{f,c}}{P_{20-64}^{m,c} + P_{20-64}^{f,c}}\ .\ 100$$

where

$P_{x65+}^{m,c}$ – the number of men in country (c) aged 65 and above,

$P_{x65+}^{f,c}$ – the number of women in country (c) aged 65 and above,

$P_{20-64}^{m,c}$ – the number of men in country (c) aged 20 – 64 years,

$P_{20-64}^{f,c}$ – the number of women in country (c) aged 20 – 64 years.

With regard to the established constant prospective age, prospective old-age dependency ratio $POADR^{c}$ for country (c) be expressed as:

$$POADR^{c} = \frac{P^{m,c}_{x(RLE-15)} + P^{f,c}_{x(RLE-15)}}{P^{m,c}_{20-x(RLE>15)} + P^{f,c}_{20-x(RLE>15)}} \, . \, 100$$

where

$P^{m,c}_{x(RLE-15)}$ – the number of men in country (c) at ages with a remaining life expectancy of 15 years or less,

$P^{f,c}_{x(RLE-15)}$ – the number of women in country (c) at ages with a remaining life expectancy of 15 years or less,

$P^{m,c}_{20-x(RLE>15)}$ – the number of men in country (c) aged between 20 and the age at which remaining life expectancy is still greater than 15 years,

$P^{f,c}_{20-x(RLE>15)}$ – the number of women in country (c) aged between 20 and the age at which remaining life expectancy is still greater than 15 years.

The POADR has been criticized (see Spijker, 2015) because it arbitrarily assumes that people in the denominator are productive and therefore pay social security contributions. Spijker and MacInnes (2013) defined a new, more precise indicator: the Real Elderly Dependency Ratio (*REDR*). It is based on the ratio between men and women with a remaining average life expectancy of 15 years or less and those in paid employment. For our purposes, we define this relationship as follows:

$$REDR1 = \frac{P^{m,c}_{X(RLE-15)} + P^{f,c}_{X(RLE-15)}}{\sum_{x=15}^{x(RLE>15)} er^{m}_{x} \, . \, P^{m,c}_{15-X(RLE>15)} + \sum_{x=15}^{x(RLE>15)} er^{f}_{x} \, . \, P^{f,c}_{15-X(RLE>15)}}$$

where the denominator, in contrast to the preceding ratio, is the weighted employment rates of men er^{m}_{x} and women er^{f}_{x} aged 15 years and above. The employment rates for each V4 country were derived from the Labour Force Survey. These can be found in the Eurostat database.[4] Indicator REDR1 can be affected by population change, mortality ratios, and the projected employment rate for both sexes. We forecasted these using the recent trend, and expected changes to statutory pension age.

As the current and projected employment rates show, *REDR*1 captures some people still in employment. When we deduct this category, we obtain a slightly

[4] Available at: <https://ec.europa.eu/eurostat/data/database?p_p_id=NavTreeportletprod_WAR_NavTreeportletprod_INSTANCE_nPqeVbPXRmWQ&p_p_lifecycle=0&p_p_state=normal&p_p_mode=view&p_p_col_id=column-2&p_p_col_pos=1&p_p_col_count=2>; Population and social conditions – Labour market – Employment and unemployment (Labour Force Survey) – LFS series – detailed annual survey results – Employment rates – LFS series – Employment rates by sex, age and citizenship (%) (lfsa_ergan).

adjusted version, REDR2. It takes into account possible changes to the retirement age (closely linked to the legislation on the future retirement age in the V4 countries) of older employed workers.

If we expect those in employment to enter retirement at an older age, then *REDR*2 can be expressed as:

$$REDR2 = \frac{P^{m,c}_{x(RLE-15)} \cdot \left(1 - er^{m}_{x(RLE-15)x}\right) + P^{f,c}_{x(RLE-15)} \cdot \left(1 - er^{f}_{x(RLE-15)x}\right)}{\sum_{x=15}^{x(RLE>15)} er^{m}_{x} \cdot P^{m,c}_{15-x(RLE>15)} + \sum_{x=15}^{x(RLE>15)} er^{f}_{x} \cdot P^{f,c}_{15-x(RLE>15)}}$$

The prospective approach to population ageing is important when considering pension reforms and, in particular, changes to retirement age. The work of Sanderson and Scherbov (2014; 2015a,b), referred to in our paper, confirms this. Their approach involves selecting a specific alpha age denoted as the ex-ante equitable normal pension age (Sanderson and Scherbov, 2014). It should represent a simple, transparent and equitable pension age, which unlike the normal statutory pension age, is based on a fixed chronological age and so varies in differing mortality conditions (Sanderson and Scherbov, 2014, p. 5).

It is determined using three basic criteria:

1. members of each cohort receive as much in pension payouts as they pay into their pension plan,

2. the generosity of the pension system, measured as the ratio of average pension receipt to the incomes of people paying into the pension system,

3. the pension tax is the same for all cohorts (Sanderson and Scherbov, 2015b, p. 700).

The authors then derive the relationship between the number of person-years lived from the age of 20 years until equitable normal pension age (ENPA) is reached, and the number of years that the person lives from this age until their death. Where α represents equitable normal pension age, we can express the above as:

$$\frac{T_{\alpha}}{T_{20} - T_{\alpha}}$$

This respects the division of the adult life-cycle into two phases: a pre-pension phase and a pension phase. The start of the first phase is defined using a simplification (as in, for example, OECD, 2017): 20 years of age. This is the age at which young people start economic activity. The calculation of the alpha age is simple and based on publicly available demographic models of mortality tables. The ratio is equitable because it remains stable over time and space for all population cohorts years regardless of their mortality rates (Sanderson and Scherbov, 2014).

Assumptions of Population Change in the V4 Countries

The decline in mortality and fertility rates combined with the age structure of the V4 countries and the significant intergenerational differences in the number of population cohorts is accelerating population ageing.

When considering longer lifespans and the mortality parameters of EUROSTAT population projection, growing life expectancy is a long-term phenomenon in most advanced countries (see Oeppen and Vaupel, 2002; Bongaarts, 2006). As Christensen et al. (2009) have pointed out in the countries with the lowest mortality rates, life expectancy values have shown an almost linear increase at birth for more than 150 years and there is no indication of a slow-down. We are still not hitting the upper limits and so continued growth in life expectancy values is very likely. Other organisations (for example UN, IIASA, VID) use these assumptions in their projections. In order to project the survival probabilities of men and women in the V4 countries, we need to know the previous trends and improvements in mortality ratios, and to identify the age- and sex-specific potential for further reductions in mortality.

Insofar as fertility is concerned, several projections show a gradual increase in the birth rate in V4 countries. This is supported by the recent recuperation in deferred births. Significant changes in the timing of first birth, reflecting changes in reproductive behaviour, have dramatically affected cross-sectional intensity indicators (see, for example, Kohler, Billari and Ortega, 2002). Assumptions regarding the expected growth in fertility are based on the diminishing effect of timing changes and the upturn in recuperation. This is likely to be accompanied by changes in the distribution of fertility rates by age, and the ageing of the age profile. Given the delayed onset of deferred fertility in the V4 countries (compared to Western European countries), these changes should be dynamic in the next few years. The V4 countries could well rise significantly above the threshold of lowest-low (1.3 children per woman and below; see Kohler, Billari and Ortega, 2002) or very low fertility (1.5 children per woman and less; see Lesthaeghe and Willems, 1999), which would indicate a demographic downward spiral forming in relation to the emergence of a low fertility trap (see Lutz, Skirbekk and Testa, 2006).

The most uncertain factor has generally been migration. It is generally assumed that the existing situation will persist, with Czechia and Hungary reporting the highest migration gains of all the V4 countries, Slovakia seeing only minimal migration gains, and Poland a slight migration loss. The distribution of the migration balance by age for both sexes will not change significantly, since it reports all the main features of the age distribution of migration probabilities.

Retrospective and Prospective Approaches to Population Ageing

The results of the EUROPOP2018 population projection confirm population ageing will accelerate in the V4 countries over the coming decades. The number of elderly people, aged 65+ years, could rise by 892 000 people (42%) by 2050 in Czechia, by 606 000 people (67%) in Slovakia, by 605 000 (38%) in Hungary and by 3.44 million (almost 50%) in Poland. In all the V4 countries the proportion of elderly people will rise to the 28 – 30% threshold. The biggest changes will occur in Slovakia, where the growth in the proportion of elderly will represent almost 13 p.p. and in Poland at 11.5 p.p. In these two countries the elderly population (almost 30%) will be the largest proportionally of the V4 countries. The projection also shows a rise in the old-age dependency ratio. There are currently 26 – 34 elderly persons per 100 working age persons (20 – 64 years) and that will increase to 53 – 57 elderly persons. The most significant changes will be in Slovakia (an increase of 30 p.p.).

However, as several European and non-European analyses show (e.g. Sanderson and Scherbov, 2005; 2013; Basten, Scherbov and Sanderson, 2015), applying the prospective approach produces a completely different picture of the current and future state of population ageing.

As the basis for our analysis we used constant prospective age defined as a remaining life expectancy of less than 15 years. This is already above the conventionally established threshold of 65 years. For men, it currently ranges from around 65 years (Hungary) to 67 years (Czechia). However, better mortality rates mean the threshold is at a significantly higher (chronological) age for women (from 70 years in Hungary to 72 years in Poland).

As mentioned above, all the population projections (including EUROPOP2018) expect further growth in life expectancy and so the prospective threshold rises to a higher chronological age. Therefore, by 2050, with a remaining life expectancy of 15 years, the male population threshold should be reached at approximately 71 (in Hungary) or 72 years of age. Women should reach the same level of life expectancy at 75 – 76 years.

Determining the fixed old-age limit for 65 years requires us to consider factors other than changes in population ageing. Only if life expectancy remains constant at 65 years will the chronological and prospective indicators show the same level of ageing. If we accept that constant prospective age is an alternative to the conventional old-age threshold, then population ageing in the V4 countries takes on a completely different appearance.

When mortality rate changes and the consequent shifts in the old-age threshold are taken into account, growth in the number of elderly persons in the V4 countries is far less dynamic (see Table 1).

T a b l e 1

Retrospective and Prospective Approach to Population Ageing in V4 Countries, Selected Indicators

Indicator	Country	2020	2025	2030	2035	2040	2045	2050	Country	2020	2025	2030	2035	2040	2045	2050
Persons 65+ (thous.)	**Czechia**	2 131	2 285	2 387	2 472	2 661	2 912	3 022	**Hungary**	1 974	2 109	2 170	2 254	2 418	2 647	2 731
Persons RLE15- (thous.)		1 435	1 528	1 670	1 623	1 618	1 570	1 779		1 542	1 669	1 613	1 536	1 488	1 509	1 633
Prop. 65+ (%)		20.0	21.3	22.2	23.1	25.0	27.4	28.5		19.6	20.9	21.6	22.7	24.5	26.9	28.0
Prop. RLE15- (%)		13.4	14.2	15.6	15.2	15.2	14.8	16.8		15.3	16.6	16.1	15.4	15.1	15.4	16.7
OADR		33.5	36.9	38.8	40.5	44.9	51.4	55.0		32.6	35.8	37.2	39.3	43.6	50.1	53.3
POADR		20.4	22.0	24.3	23.4	23.2	22.4	26.4		24.0	26.2	25.2	23.8	23.0	23.6	26.3
REDR1		26.8	28.3	30.5	30.1	30.7	30.9	36.2		32.0	33.9	32.0	31.0	31.0	32.9	36.7
REDR2		25.4	26.7	28.6	28.0	28.9	29.2	34.2		30.8	32.4	30.4	29.8	30.0	31.8	35.5
Persons 65+ (thous.)	**Poland**	6 924	7 979	8 486	8 720	9 090	9 682	10 368	**Slovakia**	903	1 039	1 141	1 205	1 293	1 414	1 509
Persons RLE15- (thous.)		4 196	4 878	5 530	5 702	5 724	5 401	5 658		628	694	742	799	824	807	854
Prop. 65+ (%)		18.2	21.1	22.7	23.7	25.1	27.3	29.7		16.6	19.0	21.0	22.5	24.6	27.3	29.7
Prop. RLE15- (%)		11,1	12.9	14.8	15.5	15.8	15.2	16.2		11.5	12.7	13.7	14.9	15.6	15.6	16.8
OADR		29.6	36.2	39.6	41.5	44.6	49.9	57.3		26.3	31.6	35.8	38.7	43.0	49.8	56.7
POADR		16.1	19.4	22.7	23.7	24.1	22.8	24.8		16.9	19.1	20.9	22.9	23.7	23.4	25.7
REDR1		23.6	27.8	31.7	33.5	34.9	34.7	38.6		23.7	26.1	278	30.8	32.8	33.9	38.0
REDR2		22.6	26.5	30.1	32.4	34.0	33.7	37.5		22.9	24.9	26.1	29.3	31.7	32.8	36.9

Note: Persons 65+ persons aged 65 and over; Persons RLE15 – persons with a life expectancy of 15 years and less; OADR – old-age dependency ratio; POADR – prospective old-age dependency ratio; REDR1 – real elderly dependency ratio type 1; REDR2 – real elderly dependency ratio type 2, see above.

Source: Authors' calculations.

In Hungary, improved mortality rates could contribute to a slight decline in the number and proportion of elderly people. In the other V4 countries, these increases would represent growth of 24 – 36% in the number of elderly people, which presents a very different picture of ageing. The proportion of elderly people and population growth in the V4 countries will be quite different. At present it is 11 – 15% and projected to rise to 16 – 17% by 2050. Similarly, the prospective old-age dependency ratio indicates a significantly lower rate and dynamic once the decline in mortality is taken into account. Up to the forecast horizon, the number of elderly people per 100 working age persons is expected to rise by only 2 (Hungary) – 9 p.p. against the current state (Table 1).

Recent changes to statutory retirement age have had a significant impact on the employment rate of older men and women. The real change in employment rates among men and women aged 60 and over shows this. Czechia and Hungary have the highest employment rates for men in this age group. The retirement age ceiling is set at 65 so further growth is expected. We can expect this trend to affect men aged 60 – 64, but also older people who want to continue working even after reaching retirement age. This can be seen in the recent trend. Slovakia has the lowest employment rate and lowest retirement age so we can expect it to have the lowest level of actively employed older men of all the V4 countries. Based on the current situation, current retirement age and recent trends, the employment rate among men aged 60 – 64 could rise from around 40 – 60% to 75 – 90%.

The situation for those aged 65 – 69 is similar. The employment rate for this group is highest in Czechia (over 17%) and lowest in Slovakia and Hungary (around 10%). Given the existing differences in retirement age and change in employment rate, these differences could remain in the future. However, the active participation of people aged 65 – 69 is expected to increase in all the V4 countries. The employment rate could slightly exceed 20% in Hungary and Slovakia, and reach 25% in Poland and especially Czechia.

The male employment rate among the oldest age group has not yet crossed the 10% threshold, and is no higher than 5% in Hungary and Slovakia. Based on recent trends and assuming a rise in employment, it could reach 14 – 17%.

The female employment rate is expected to rise at age 60 and over, but also at age 55. In Poland (60%) and Hungary (68%) especially, it is still relatively low at this age. Poland has the least dynamic growth in the employment rate. This is mainly because women retire at a younger age (60 years). We cannot therefore expect any dynamic change in the Polish employment rate for women aged over 60. We assume that the rate will not exceed 30% (currently 20%) among those aged 60 – 64 and that it will not exceed 10% among those aged 65 – 69 (6% in 2018). With the rise in the official retirement age, the female employment rate could rise to two-thirds in Slovakia and up to three-quarters in Czechia and Hungary. The female employment rate among 65 – 69 year olds could rise from its current level of less than 10% to 15 – 23%. Even in the oldest age category, slight growth is expected, but the rate will not exceed 10%.

When we account for these changes in employment rates, the REDR1 and REDR2 values indicate a slightly higher level of dependency than the POADR does. But using this approach rather than conventional approaches (the OADR) enables us to identify different trends. In Hungary, the real elderly dependency ratio remains approximately the same, and in Czechia there is a slight increase (Table 1). Only in Poland do we see any real growth. This is primarily because the pension age is capped at a lower level, particularly for women (see below), and that will cause smaller changes in the over 60s employment rate.

Pension Age in the V4 Countries Using the Prospective Approach

The OADR quickly became the best well-known and frequently used indicator of the pressures the unproductive population places on the productive population, and it is recorded and analysed by key organisations (e.g. the OECD, Eurostat, World Bank, UN). As noted by Sanderson and Scherbov (2015a,b), the old-age dependency ratio and its "information force" is also used to approximate the effects of population ageing on pension costs. This is particularly important in the context of efforts to redefine pension systems in the most developed countries (e.g. OECD, 2015). Several have adopted explicit demographic pension indexation. However, as the latest OECD report (2017) highlights, the dynamics of reform are gradually slowing. Furthermore, although several countries have recently taken measures to raise statutory pension age (e.g. OECD, 2017), the analysis shows that in some 17 OECD countries no further statutory pension age raises are planned (fixed at 60 – 67 years, depending on the country, usually 65 years). Perhaps the most progress in designing pension age reforms has been achieved in Denmark, Finland, Italy, the Netherlands and Portugal, according to the OECD (2017). In these countries the increases are linked to changes in life expectancy. Until recently, Slovakia could be included in this category (see below).

OECD calculations (2017, p. 22) show that in these countries the retirement age for persons entering the labour market (at the age of 20) in 2016 will progressively shift to 68 years (Portugal, Finland, Portugal) or to over 70 years (Italy, the Netherlands 71, Denmark 74).

In Slovakia the system for calculating pension age was linked to changes in life expectancy at reference age for both sexes (at the pension age for the respective calendar year) in two 5-year reference periods beginning 12 and 13 years before the respective calendar year (for details, see Act no. 461/2003 Coll. § 65a). At the beginning of 2019 the pension age was set in years and calendar months and has to be known five years in advance. In July 2019 a fundamental change was made. A constitutional law was passed setting the retirement age ceiling at 64 years. In addition the number of children raised is taken into account when determining retirement age. From 2019 onwards the pension age (for childless persons) will increase each year by two months. After 2024 the increase will depend on changes in life expectancy at the reference age. From 2030 (for generations born in 1966 or earlier), the retirement age will be 64 years.

In Czechia, the retirement age was continually raised with no limit from 2011, by 2 months for men and 4 months for women. However, in 2018 a new reform was introduced, which assumes continual growth in the pension age, but sets a cap in 2030 at 65 years. However, the law also stipulates that further changes to pension age will be considered in relation to demographic change, based on pension system reports drawn up at 5-year intervals by the Czech Statistical Office in collaboration with the Ministry of Labour, Social Affairs and the Family. In addition the law stipulates that persons must have a quarter of their life in the period of entitlement to the old-age pension.

In Poland planned increases in retirement age are completely different. Two reforms were enacted in 2009 and then in 2013 that progressively raised men's retirement age to 67 years by 2020 (average annual growth should have been 4 months) and women's retirement age to 67 years by 2040. But by the end of 2016, Poland had abandoned this plan to become the only OECD country to reduce retirement age, beginning in 2017, from 66 years to 65 years for men and from 61 years to 60 years for women (OECD, 2017).

In Hungary pension age increases progressively (by 6 months per year) and an age cap for both sexes at 65 years was introduced, due to be reached in 2022 (OECD, 2017).

Given these changes and drawing on the work of Sanderson and Scherbov (2014; 2015b), we are attempting to design an equitable normal pension age for the V4 countries and show how it might change based on projected changes in mortality ratios up to 2050. The calculation is derived from basic characteristics, so the ratio between the number of years spent in retirement and at working age remains fixed. For it to be intergenerationally stable, a benchmark level is required. We have selected the last available data from 2018 to set this threshold. The value of the equitable normal pension age will represent pension age so the ratio of person-years will remain equal for all those entitled to a pension from 2018 onwards. We then compare the results obtained with the statutory pension age in the V4 countries up to 2050. Here we should note that our aim is not to find a pension system that is stable over the long term but to show how pension age may change (regardless of the financial aspects) if the ratio between productive years, when pension contributions are made, and retirement years, when the pension is drawn down, are equal over the long term.

As mentioned above, Poland is the only country surveyed to have reduced its pension age and fixed it at 65 years for men and 60 years for women. As the ENPA values show, if we set the pension age so it is equitable, as defined above, and maintain the current ratio between years spent in retirement and years spent at working age, it should gradually increase to approximately 70 years for men and 63 years for women by 2050. This relatively large difference between the sexes is primarily a consequence of the hitherto setting of the pension system and, to a lesser degree, a reflection of the expected trend in number of person-years spent at working and post-working age.

Hungary is another country to have fixed its pension age at 65 years from 2022. But the current progressive increase in retirement age is relatively dynamic, and the difference between the statutory threshold and the ENPA threshold could have been relatively small in the next decade. For women, the real increase in pension age has been found to outstrip the upward trend of the ENPA indicator. After 2030, however, thanks to the further improvement of mortality rates, we will witness a relatively rapid deepening of these differences, which should be taken into account in the pension age threshold.

Czechia indexed its pension age at 65 years until 2030 for both sexes. It should exhibit a continual linear increase, with the male and female pension ages ending up the same. When we compare this with the forecasted ENPA values until 2030, we find a slight lag in men's real pension age and, conversely, more dynamic growth in women's pension age. In the next two decades, the differences between the male pension ages will widen quite significantly, while for female the dynamic extension of the retirement age will copy the development of ENPA values relatively well.

Slovakia was the only V4 country to use the real longer lifespan to calculate its increase in pension age. Even in this case, the results obtained clearly indicate that the continuous changes in life expectancy need to be reflected (and especially in terms of a longer time horizon).

When setting systems to raise the retirement age in the OECD countries, Sanderson and Scherbov (2014) note that there is no inherent equitability in increasing pension age certain number of years. There also remains the question of why this given time segment changes the retirement age (Sanderson and Scherbov, 2014, p. 9). Using life expectancy in pension age reforms (as in Slovakia for example) is a step in the right direction, according to Sanderson and Scherbov (2014), but even this fails on equitability.

T a b l e 2

Change in Real Pension Age (Under Current Legislation) and Equitable Pension Age by Sex in the V4 Countries

Country	Sex	2020	2025	2030	2035	2040	2045	2050
Real pension age								
Czechia	Males	63.3	64.2	65.0	65.0	65.0	65.0	65.0
Hungary	Males	64.0	65.0	65.0	65.0	65.0	65.0	65.0
Poland	Males	65.0	65.0	65.0	65.0	65.0	65.0	65.0
Slovakia	Males	62.7	63.4	63.4	63.4	63.4	63.4	63.4
Czechia	Females	61.7	63.3	65.0	65.0	65.0	65.0	65.0
Hungary	Females	64.0	65.0	65.0	65.0	65.0	65.0	65.0
Poland	Females	60.0	60.0	60.0	60.0	60.0	60.0	60.0
Slovakia	Females	62.3	63.2	63.3	63.3	63.3	63.3	63.3
Equitable normal pension age								
Czechia	Males	63.8	64.4	65.0	65.6	66.2	66.7	67.3
Hungary	Males	63.9	64.8	65.6	66.5	67.2	68.0	68.7
Poland	Males	65.9	66.7	67.4	68.1	68.8	69.5	70.1
Slovakia	Males	62.8	63.6	64.3	65.0	65.7	66.3	67.0
Czechia	Females	61.6	62.1	62.5	63.0	63.4	63.8	64.2
Hungary	Females	63.8	64.4	65.0	65.7	66.2	66.8	67.3
Poland	Females	60.7	61.2	61.6	62.1	62.5	62.9	63.3
Slovakia	Females	61.8	62.3	62.8	63.3	63.8	64.2	64.7

Note: Slovakia* – Pension age is the result of our projection of life expectancy since 2025.

Source: Authors' calculations.

We should not that the ENPA is simplified and is only one possible means of defining pension age so as to take account of longer lifetimes and an intergenerationally stable ratio between years paid into the pension system and years drawn down. As there are various systems of pension entitlement, automatically setting pension age in this way would lead to problems setting the differently structured systems (and not just in V4 countries). Moreover the ENPA should help achieve a financially balanced system in which the ratio between person-years is normalised to achieve a balanced pension system.

Conclusions

Ageing is a multidimensional process and chronological age is one of many characteristics. If we define old age and old-age pension entitlement using chronological age, we encounter a number of stumbling blocks. We should note that elderly people are living longer and will continue to do so, and as numerous studies have shown their health is improving as well. Moreover, we live in a period of active ageing in which elderly people engage in an increasing number of leisure and non-leisure activities. In the long run, forecasts of population ageing better reflect reality when the number of remaining years of life is taken into account rather than overestimating the importance of number of years lived.

One of the most important characteristics in terms of population ageing is median length of remaining life. In some of the most advanced countries, this is becoming important in pension systems and pension age reform. For a number of important issues, such as the sustainability of public pension systems, it is important to know both the chronological age of people and how many years they still have to live. In an era when lifespans are lengthening we need a more comprehensive picture of population ageing based on both the conventional retrospective approach and the prospective approach to age and ageing.

Our findings for populations in the V4 countries confirm that using a prospective approach paints a significantly different picture of population ageing. Our main finding was a lower level of ageing (e.g. in terms of the number and proportion of elderly people in the population) and a slower growth rate, and in some cases even the opposite trend.

Our study also confirmed that the conventional chronological age-based old age dependency ratio shows the level of ageing is increasing in all V4 countries, while the prospective approach, and especially the real elderly dependency ratio, shows it has stagnated or even declined.

By applying the equitable normal pension age based on the life-course ratio, we were able to highlight the need to include changes in mortality and life expectancy ratios among elderly people in discussions on setting pension age in the V4 countries. This method also revealed problems with pension age indexation and with linear extension by a certain constant value. The study contributes to the debate on whether changes in life expectancy among elderly people should be used when setting an equitable, intergenerational pension age.

The prospective approach and the indicators based upon it could prove useful in empirically based debates about the mechanisms for setting pension age. But it is also necessary to consider the demographic aspects and the pension policy and the pension system in place. Our results show that the answer to this question is not straightforward and that far greater attention should be paid to the prospective approach in economic research than has been the case to date.

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