PENSION AGE BASED ON RELATIVE PROSPECTIVE AGE CONCEPT

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Abstract

To ensure appropriate pension for seniors is a very important task for social policy. A very frequent discussed consequence of the population aging is the financial sustainability of the pension system, especially, if it is based on PAYG principle. One of the possible measure supposed is logically increase of the retirement age. There naturally arises an important question of the appropriate linkage of the retirement age with the level of mortality. Alternative threshold can be based on the concept of so-called prospective age (the age in which the remaining life expectancy is the same as the remaining life expectancy of a person in given age and standard mortality pattern). However this threshold does not reflect well the actual age of the person and it would cause that the period of expected economic activity would rise while the period of pension receipt would remain constant. A possible compromise of these both definitions may be the concept of so-called "relative" prospective pension age based on the relative remaining life expectancy (the ratio of remaining life expectancy and the total expected life span – the sum of age reached and remaining life expectancy at this age). The pension age can be thereafter defined e.g. as the relative prospective age corresponding to the age of 65 years and mortality pattern of European Union in 2016. The paper presents the computation of proposed pension age in the Czech Republic, Slovakia, Poland and Spain until 2080 based on the relative prospective age concept and corresponding old age dependency ratios. The baseline scenario of the population projection of Eurostat 2015 has been used for mortality projection.

***Keywords**: population aging, prospective age, pension age, old-age-dependency ratio…*

***JEL Codes:** J11, H55, J26*

1. Introduction

Demographic ageing is often called one of the most important phenomena of the present century (e.g. Gavrilov and Heuveline, 2003). It is a natural result of the demographic development in the last decades. The main reasons for population ageing are not only permanent increase in life span but also decrease of fertility rates, in many countries below the replacement level. In some countries or regions the third not so often mention cause of ageing is a massive emigration of young adult people in reproductive age.

Population ageing is very often regarded as a serious threat to the sustainability of national welfare system (mainly of the pension and health care systems) because of expected increase of population of retirees and decrease of productive population. But most such concerns are based on standard assumption of the fixed threshold between productive and postproductive age (usually equal to 65 years of age).

The idea of re-examination of the concept of fixed threshold of old age has been first published by Ryder. *"We measure age in terms of the number of years elapsed since birth. This seems to be a useful and meaningful index of the stages of development from birth to maturity. Beyond maturity, however, such an index becomes progressively less useful as a clue to other important characteristics. To the extent that our concern with age is what it signifies about the degree of deterioration and dependence, it would seem sensible to consider the measurement of age not in terms of years elapsed since birth but rather in terms of the number of years remaining until death."* (Ryder, 1975, p. 16.) He suggested that the age to be considered the point of entry into old age can be defined as the value of age at which the life expectancy is equal to a given value, say, e.g. 10 years.

In the 70th the population ageing has not been considered to be a serious threat and so the Ryder's idea was mentioned very rarely. Fuchs (1984) also suggested the idea of flexible old age depending on the life expectancy. Siegel (1993) proposed the idea of the old-age threshold defined as the age when the life expectancy equals to 15 years.

The idea of new indicators of human's age and of population ageing based of forward-looking conception was treated by Sanderson and Scherbov in several papers. They introduced a new forward-looking definition of age and argued that its use, along with the traditional backward-looking concept of age, provides a more informative basis upon which to discuss population aging (Sanderson and Scherbov, 2005). Their concept of prospective age was defined as the age in which the remaining life expectancy is the same as the remaining life expectancy of a person in given standard year. (Sanderson and Scherbov, 2007). The indicators of ageing based on prospective age instead of biological age show that the increase of the ratio of older persons will not be so dramatically increasing in comparison with standard indicators (Sanderson and Scherbov, 2010, 2013). Computations of indicators of this type for Czech population are presented e.g. by Klapková, Šídlo and Šprocha (2015).

The aim and own contribution of this paper is to introduce the concept of *relative* prospective age where not the absolute but the relative value of remaining life expectancy with respect to the total life span is used for defining of the old age threshold. This idea is very important especially in the old-age pension system because the retirement age threshold based on the concept of (absolute) prospective age usually used would mean, that, assuming a rise in the length of life, the retirement age would rise and thus also the expected length of economic activity, but the period of receipt of the pension would remain the same and the relative period of receipt of the pension would drop. On the other hand pension age threshold based on the concept of relative prospective age means increase not only in time of economic activity but also in time of pension receipt with stable value of the ratio of the length of pension receipt and the lengths of economic activity.

Proposed pension age based on this concept for Czech Republic, Poland, Slovakia and Spain until 2080 has been computed as well as the values of corresponding old-age-dependency ratio. The unisex period life tables for European Union for 2016 have been used as standard mortality pattern and the mortality of each year of the period investigated has been supposed to correspond the baseline mortality scenario of the latest Eurostat population projection (Eurostat, 2017b).

2. Prospective age

The concept of prospective age is based on the assumption that for adult people living in different periods it can be more important not their chronological age (i. e. lengths of the time interval they already lived) but their remaining life expectancy (i.e. average lengths of their remaining life). Sanderson and Scherbov recommended to use the attribute *remaining* life expectancy to emphasize the difference between the life expectancy at births usually used and

the life expectancy at higher ages. (In fact the remaining life expectancy means life expectancy at ages higher than zero defined by standard way.) *"Using chronological age, we are lead implicitly to think that people of the same age in different years would behave similarly, but because of life expectancy increases there are aspects of behavior where this might not be the case. For example, a 45 year old in 2050 might well behave in many ways like a 35 year old in 2000 if they had the same remaining life expectancy. It is precisely because many behaviors depend on the number of years left to live that it is important to supplement the usual backward-looking definition of age with a forward-looking one"* (Sanderson and Scherbov, 2007, p. 28.).

Let us denote by $e_x^{(t)}$ the remaining life expectancy at the age *x* in the year *t*. Choosing some standard mortality pattern, the prospective age *y*(*x*,*t*) of a person of (retrospective) age *x* in the year *t* means the age for which the remaining life expectancy in the year *t* is the same as the remaining life expectancy e_x^* at the age *x* in the standard mortality pattern. The prospective age should thus fulfill the equation

$$e_{y(x,t)}^{(t)} = e_x^*. \tag{1}$$

In the example mentioned above if we choose standard mortality pattern as of the mortality in 2000, then the prospective age of a 45 year old age person in 2050 would be 35 years.

Usually there exist no integer value *y*(*x*,*t*) fulfilling (1). Let us find the (unique) integer value of age $y_0(x,t)$ for which $e_{y_0(x,t)}^{(t)} \geq e_x^*$, while $e_{y_0(x,t)+1}^{(t)} < e_x^*$.
The prospective age would subsequently be found by the linear interpolation formula

$$y(x,t) = y_0(x,t) + \frac{e_{y_0(x,t)}^{(t)} - e_x^*}{e_{y_0(x,t)}^{(t)} - e_{y_0(x,t)+1}^{(t)}}. \tag{2}$$

For measuring the expected number of years of remaining life it would be natural to use cohort life expectancy. Nevertheless cohort life tables are not as widely available as period ones. It was proved that in some cases the cohort and period prospective ages are almost identical or with minor differences only (Sanderson and Scherbov, 2007, Chapter 3 and 4). Of course almost identical value of prospective age *does not mean* identity of values of the remaining life expectancy which is in cohort tables usually higher in comparison with period tables.

The concept of biological ages characterizes the lengths of years lived, the prospective age takes into account the expected lengths of remaining life. More informative to analyze aging and its economic and social consequences would be combining both a backward-looking and a forward-looking age measure. Possible indicator of such a type could be remaining *relative* life expectancy defined as a proportion of the remaining life expectancy of the expected total life span

$$re_x^{(t)} = \frac{e_x^{(t)}}{x + e_x^{(t)}}. \tag{3}$$

This indicator characterizes the length of remaining life not absolutely (the expected *number of years* left) but relatively (the expected *proportion of life* left).

Relative prospected age can be than defined by an analogous way to prospective age (2). The relative prospective age $ry(x,t)$ of a person of (retrospective) age *x* in the year *t* is defined as the value for which the remaining *relative* life expectancy in the year *t* is the same as the remaining *relative* life expectancy re_x^* at the age *x* of the standard mortality pattern

$$ry(x,t) = ry_0(x,t) + \frac{re^{(t)}_{y_0(x,t)} - re^*_x}{re^{(t)}_{y_0(x,t)} - re^{(t)}_{y_0(x,t)+1}}, \quad (4)$$

where $y_0(x,t)$ is the integer value of age for which $re^{(t)}_{y_0(x,t)} \geq re^*_x$, while $re^{(t)}_{y_0(x,t)+1} < re^*_x$.

3. Pension age determined by prospective age

In many countries the pension age is fixed, very often equal to 65 years of age. In such case the growth of life expectancy results in increase the proportion of pensioners and at the same time the proportion of labor force drops because of low fertility. One of the main measurements in most pension reforms is the idea of the increase of retirement age. The adjustment of the age limit for retirement in the Czech Republic was one of the most important themes dealt with in 2014 by the Expert Committee on Pension Reform of the Czech Republic. The Council of the European Union, recommends the Czech Republic to *"ensure the long- term sustainability of the public pension scheme, in particular by accelerating the increase of the statutory retirement age and then by linking it more clearly to changes in life expectancy."* (European Council, 2014, p. 15).

Proposals have appeared, for example, which envisaged selecting the retirement age in such a way that the average duration of the receipt of the old-age pension would be roughly constant, say 20 years. This would mean, however, that, assuming a rise in the length of life, the retirement age would rise and thus also the expected length of economic activity, but the period of receipt of the pension would remain the same and the relative period of receipt of the pension would drop. The Expert Committee on Pension Reform therefore finally approved the recommendation that the value of the retirement age should be determined so that people reaching senior age should receive an old-age pension on average for the last quarter of their lives (Expert Committee, 2015). Cohort life tables should be used for computations (Fiala, Langhamrová, 2015).

Similar idea is not to determine the pension age by exact determination of the lengths of the average relative period of pension receipt but by the requirement that this period should not change in time and be the same for all countries. The pension age in the year *t* can be then determined to be equal to relative prospective age in the year *t* – according to the formula (4) –corresponding to standard pension age and standard mortality pattern. Prospective life tables can be used for computations in such a case.

4. Proposal of pension age for the Czech Republic, Poland, Slovakia and Spain

The pension age in many European countries at present time equals to 65 years of age. The proposal of pension age in the future has been chosen as the relative prospective age of 65 years using latest available unisex period life tables for European Union (2016) as standard mortality pattern. It means that the proportion of average time of the pension receipt should be approximately the same as the proportion of average time of the pension receipt of people in EU28 who retired in 2016 at the age of 65. The relative remaining life expectancy at this age is about 23.5 %. Taking into consideration the expected continuing decrease of mortality in the future, the real time of pension receipt may be about 25 % of the total average life span of people surviving to senior's age.

The values of relative prospective age for countries mentioned above for each year until 2080 were computed by the formula (4) using the mortality scenario of the baseline variant of the Eurostat population projection 2015 (Eurostat, 2017b). The prospective age for the Czech

Republic, Poland and Slovakia is compared with Spain which is the country with the highest level of life expectancy at births.

The mortality scenario assumes continual increase in life expectancy at births. Life expectancy in Spain in 2015 was about 4 years higher than in the Czech Republic and 6 years higher in comparison with Slovakia. The scenario is of convergence type: the differences in life expectancy between countries are expected to diminish during the projection period to less than 2 years (Fig. 1).

For the trend development of relative prospective age corresponding the age of 65 years in 2016 more important is the expected development of the remaining life expectancy at the age of 65. Similarly like at births there is a relative great difference between Spain and other countries but unlike the life expectancy at birth, at the age 65 Poland has a little bit higher values than the Czech Republic (Fig. 2).

At present time the mortality rates in the Czech Republic, Poland and Slovakia still remain higher than the average mortality rates of the European Union, on the other hand mortality in Spain is one of the lowest in Europe. It is than logical that relative prospective age corresponding the age 65 years of the mortality pattern of EU 2016 is several years higher than 65 in Spain and several years lower in other countries analyzed. The projection mortality scenario assumes for all countries continual drop in mortality therefore the relative prospective age is increasing to approximately 70 years in 2080 (Fig. 3).

Further increasing the pension age above 65 years would bring of course diminishing of the financial burden of the pension system. For the pension system based on so called PAYG (pay-as-you-go) principle a very rough indicator of its financial burden is the old-age-dependency ratio (OADR) defined as the ratio of people of postproductive and productive age. For fixed retirement age at the level 65 years the value of the ratio would reach in the second half of this century more than 55 %, about 2060 even more than 60 %. The value for Poland would be even about 70 % at the last decades of the period projected, for Slovakia it would be about 60 % (Fig. 4).

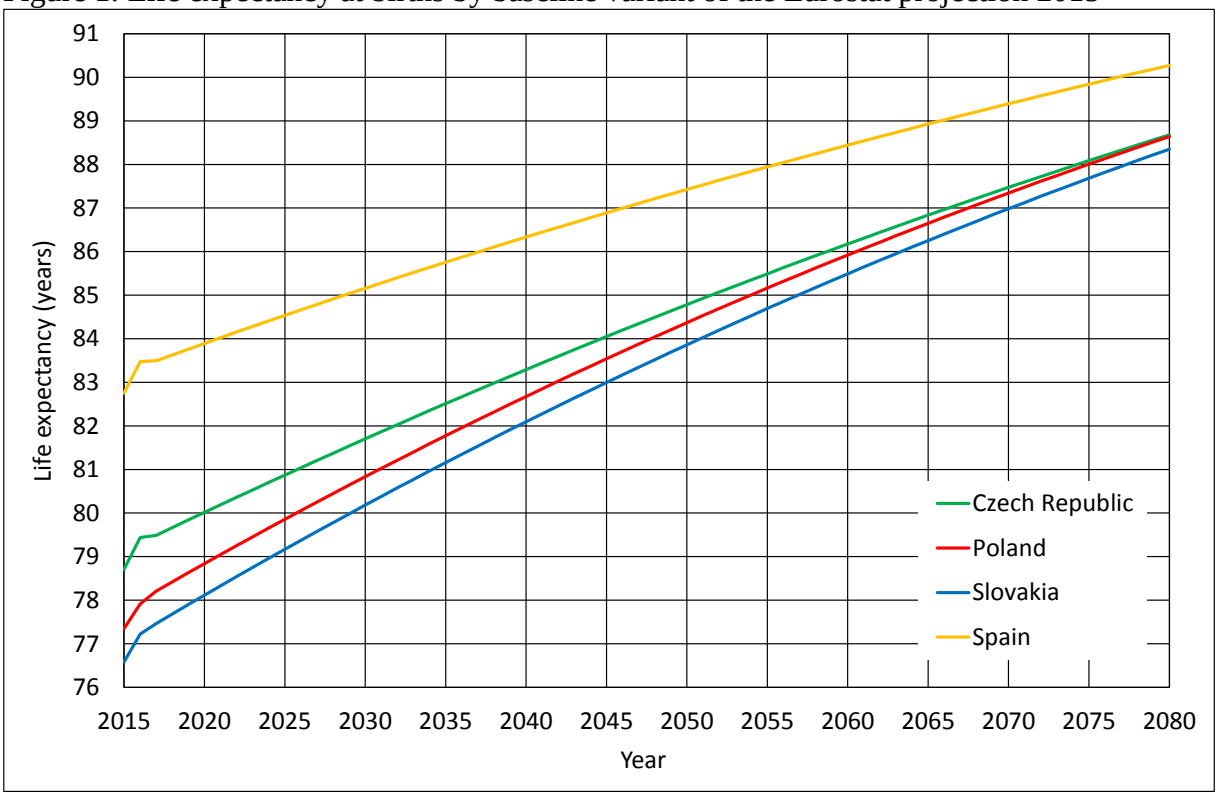
On the other hand if the retirement age would be equal to relative prospective age (and so continually growing until 2080 to almost 70 years, the maximal value of the index for the Czech Republic would be only about 50 % for a short time and then it would gradually go down to 40 % which would be the value of 2030. Trends for other countries would be similar.

In the late 70^{th} the number of persons in post-productive age per 100 persons in productive age is in the case of growing pension age about 15 lower than while maintaining the usual pension age 65 years. The relative difference is about 25–30 %, which indicates the idea that the proposed definition of pension age could bring old-age expenses more than 25 % lower. These calculations are of course very simplified, in fact the burden of pension system will be affected not only by the proportion of pensioners and economic active population but also by many other factors, e.g. rate of economic growths, employment rate, etc.

5. Conclusion

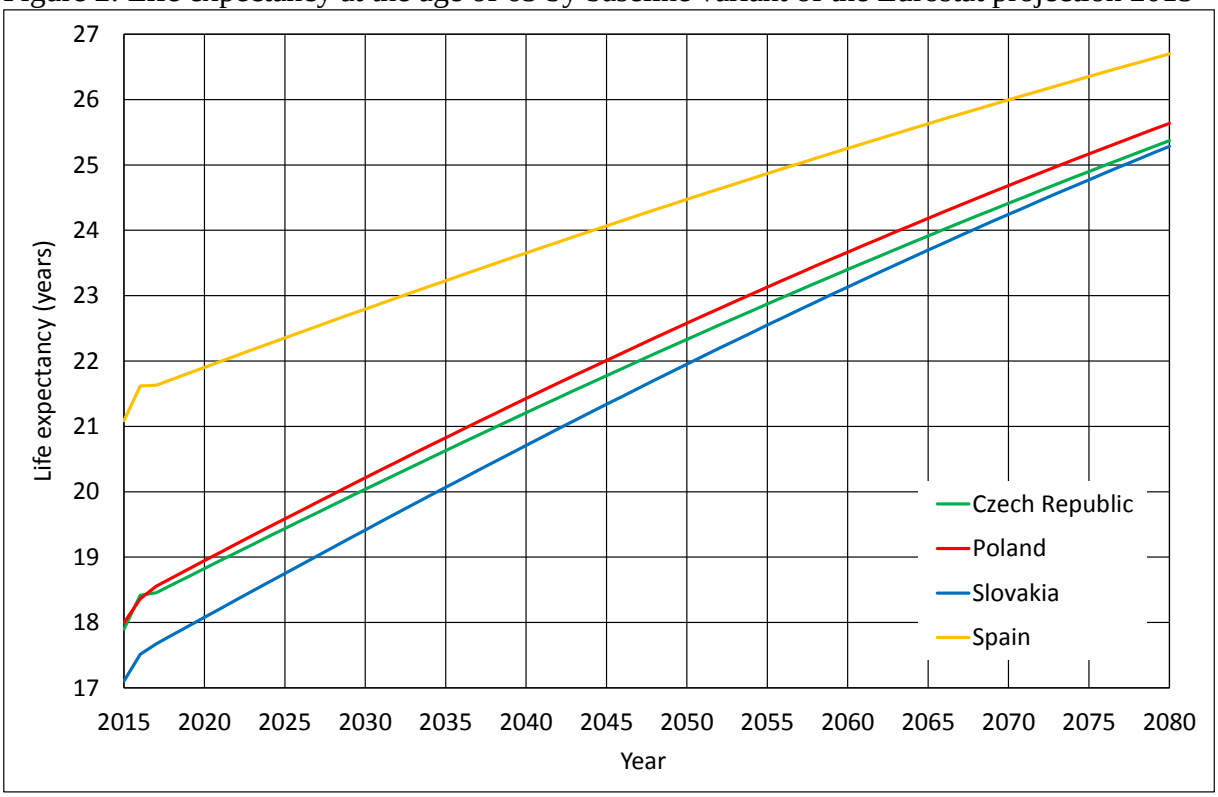
The idea of applying the concept of relative prospective age (corresponding to the age of 65 and mortality pattern of the European Union 2016) for determining the pension age would be “fair” in the sense that pensioners in countries or years with different mortality have had approximately the same average proportion of the time spent in pension. More precisely: the average relative period of old-age pension receipt with respect to the average total life span of the pensioners would be in all countries and years investigated approximately the same and equal to the value for people of the EU who would retire in 2016 at the age of 65.

Figure 1: Life expectancy at births by baseline variant of the Eurostat projection 2015



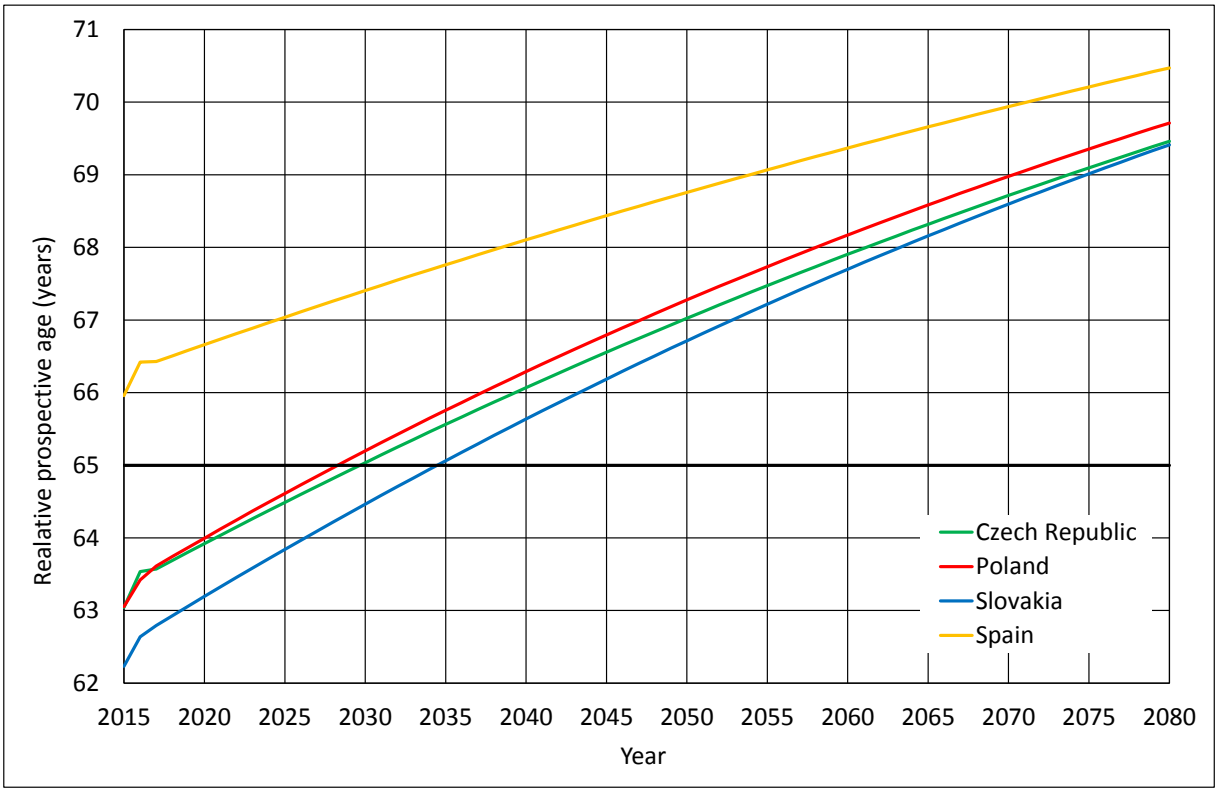
Source: Data Eurostat, author's computation and graph

Figure 2: Life expectancy at the age of 65 by baseline variant of the Eurostat projection 2015



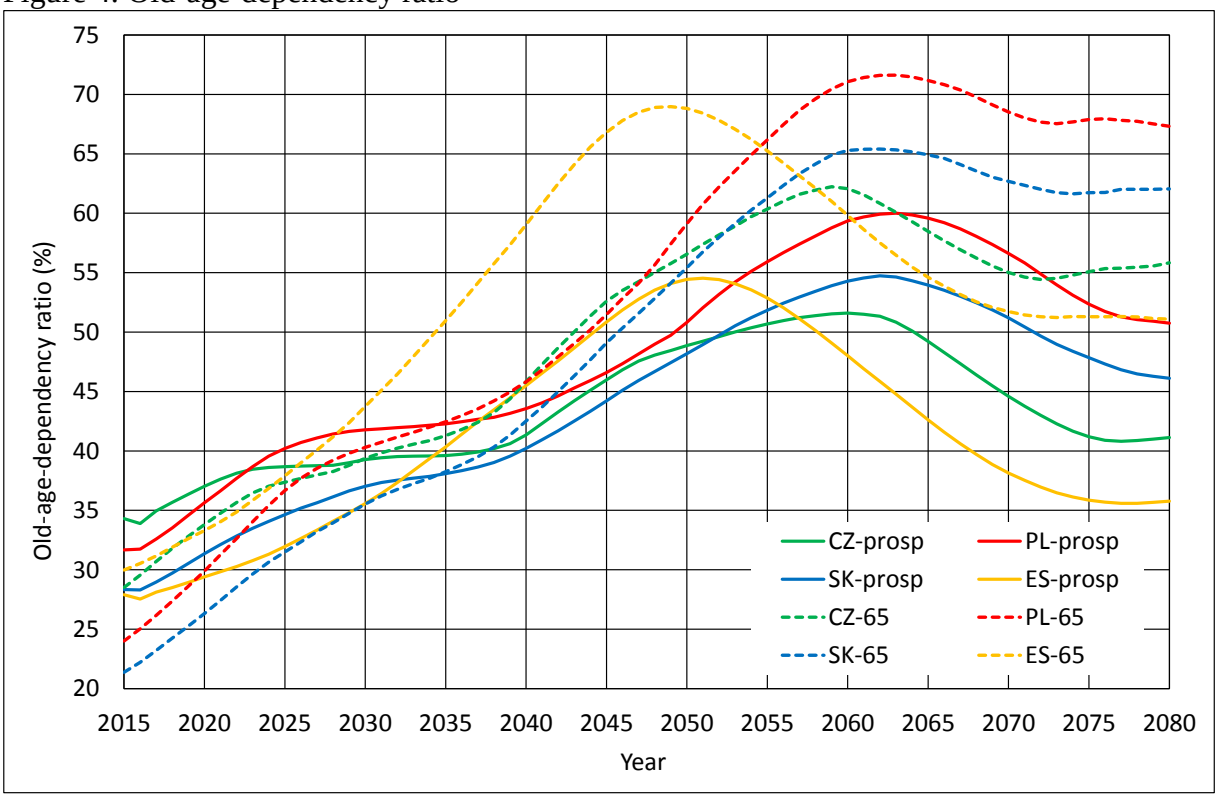
Source: Data Eurostat, author's computation and graph

Figure 3: Relative prospective age corresponding to the age 65 according to mortality pattern EU2016



Source: Data Eurostat, author's computation and graph

Figure 4: Old-age-dependency ratio



Source: Data Eurostat, author's computation and graph

This way of defining the retirement age would (according to the latest population projection of Eurostat) mean, that for the Czech Republic and Poland about 2030 and for Slovakia about 2035 the pension age should be equal to 65 years for both males and females. In Spain, which has the lowest mortality in Europe, its value should be about 66 years at present. Until 2080 the pension age in all countries mentioned should gradually grow to roughly 70 years. The average period of pension receipt would be in such case equal to about one quarter of the expected lengths of life of people, who will survive until senior's age.

The expected continual increase of retirement age would significantly decrease the financial burden of the pension system in the future in comparison with maintenance the usual value 65 years during the whole projection period.

First and foremost, however, it is necessary that there should be sufficient suitable jobs for persons of higher age groups, especially those over 60. Especially in some regions of many countries, it may be a little complicated issue. Apart from this, it will be essential to resolve the pension security of persons in professions where the raising of the retirement age over 65 years is not realistic.

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