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Labor Market Participation and Postponed Retirement in Central and Eastern Europe

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Abstract: This paper shows that as the educational composition in the 55–64-year-old age bracket improved between the mid-1990s and the mid-2010s, the effective retirement age rose rapidly in the Central and Eastern European region. This increase was fast enough to keep life expectancies at the effective retirement age practically unchanged. In effect, the labor market absorbed all improvements in life expectancies in older working ages. The paper also shows that maintaining the current life expectancies at retirement over the next 30 years requires less effort in terms of further raising the effective retirement age than what the region achieved in this respect in the last 15 years.

Key words: Effective Retirement Age, Expansion of Education, Period and Cohort Life Expectancy, Central and Eastern Europe

JEL codes: H55, J18

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Abbreviations and Acronyms

CEE8	Estonia, Latvia, Lithuania, Poland, the Czech Republic, Slovakia, Hungary, and Slovenia
EU	European Union
ISCED	International Standard Classification of Education
NDC	Nonfinancial Defined Contribution
OECD	Organisation for Economic Co-operation and Development

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1. Introduction

The last phase of the demographic transition brings low fertility and low mortality. The resulting age structure loses its pyramid shape, and more resembles a cylinder. The population ages. The median age person of the eight Central and Eastern European countries discussed in this paper (from north to south Estonia, Latvia, Lithuania, Poland, the Czech Republic, Slovakia, Hungary, and Slovenia, referred to hereafter as CEE8) will grow 9.0 years older, from 39.4 years to 48.4 years, between 2015 and 2045.[1] This paper's focus is one of the two drivers of this aging process: falling mortality.

Whereas in the past gains in life expectancy were concentrated in infancy and childhood, resulting in higher youth dependency, recent improvements are skewed to older ages (Eggleston and Fuchs 2012). Such a development would raise the old-age dependency ratio should the demarcation age between the active section of the lifecycle and old age be fixed. This paper demonstrates that this is not the case, at least not in the CEE8. It shows that the effective age of retirement, a key driver of the demarcation age in question, increased fast enough throughout the region to keep life expectancy at the effective retirement age constant.

Perhaps unusually for an analysis of pension developments, the potential causes are not sought in pension policies but in past investments in human capital. Empirical evidence is used to make a case for connecting recent developments in pensions with historical developments in education. Section 2 supports the following statements with empirical evidence:

- The average age of leaving the labor market (the effective retirement age or exit age) increased over the last two decades in the CEE8 region as a whole and separately in its constituting countries.

[1] Population-weighted regional averages based on the baseline population projection of Eurostat.

- Over the same period, life expectancies at the effective retirement age remained practically unchanged. Consequently, general gains in life expectancies in higher active ages were absorbed almost fully by the labor market.
- This improvement was made possible by a replacement process. The educational composition, and the resulting labor market durability, of the 55–64-year-old population changed during the period discussed here. New retirees today are different from the then-new retirees two decades ago.
- This development was preceded by the spread of secondary education in the CEE8 nations in the 1960s and 1970s.
- A simple projection of completed education of cohorts currently in active age predicts further improvements in the educational composition of future retirees. This in turn suggests room for increasing the standard pensionable age and consequently the effective retirement age. Even if the speed of growth of the exit age slows down from the annual 2.8 months seen in the last 15 years to 1.7 months per year over the next 30 years, the increase will be enough to keep life expectancies at the effective retirement age constant.

Section 3 discusses the robustness of the results in light of key methodological choices. Section 4 presents a wider context, showing that the CEE8 region is not unique in its increasing effective retirement age and stagnating life expectancies at that age. It briefly discusses the method of characteristic ages applied here versus the widely used prefixed demarcation ages, such as the age of 60 or 65, between the active age and old age. Also, the approach is embedded in related research on the causes and effects of mortality decline. The conclusions are optimistic but realizing the outcome is far from automatic. Section 5 lists some potential obstacles, such as misguided policies that would retrench the growth of the effective retirement age even for better-educated cohorts, as well as the margins of the educational hierarchy and the formal labor market. Even if the average level of education increases, those with poor education and those evading contribution payment will face poverty in old age.

2. Life expectancy at the effective retirement age

2.1. Increased effective retirement age over the last 20 years

This section discusses developments in the CEE8 countries. It first demonstrates that the effective retirement age (the average age of leaving the labor market, or the exit age) increased over the last 20, and indeed mostly the last 15, years.

Based on five-year age group data of the Organisation for Economic Co-operation and Development (OECD) on population and labor market participation, the estimation follows a formula by Latulippe (1996).[2] Estimates for five-year intervals between 1996 and 2016 are presented in Figure 2.1 (and the complete yearly time series in the Appendix), separately for the Central European and the Baltic nations. For convenience, the Central European group is split by the geographical position of each capital city (i.e., whether it is east or west of Vienna).[3]

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[2] The Latulippe formula calculates the number of retirees by age group from period differences in participation weighted by population data. The estimated number of new retirees then serves as a weight for the age of the age group in the weighted average exit age. To assign a single age to a five-year age group, the formula applies the assumptions of identical cohort sizes (within an age group) and a linearly decreasing participation rate (also within an age group). This makes members of a single-year cohort who leave the labor market in the next five years do so at a steady pace, and it also makes the distribution of the exit age within an age group symmetric and centered around the lower age limit of the next age group. Accordingly, the average exit age is given by the following formula:

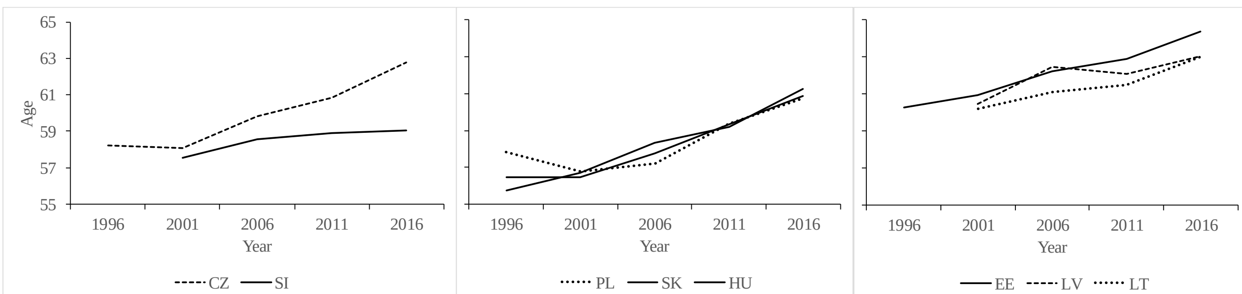
$$\overline{RA} = \frac{0.5 \cdot {}_5R^z_{40,44} \cdot 47{,}5 + \sum_{x=45,50\ldots}^{75} {}_5R^z_{x,x+4} \cdot (x+5)}{0.5 \cdot {}_5R^z_{40,44} + \sum_{x=45,50\ldots}^{75} {}_5R^z_{x,x+4}}$$

The function ${}_5R^z_{x,x+4}$ represents the number of people in year *z* of a given age group, *x* to *x*+4, expected to retire within the next five years. ${}_5R^z_{x,x+4}$ equals $(A^z_{x,x+4} - A^z_{x+5,x+9}) \cdot P^z_{x,x+4}$, where $P^z_{x,x+4}$ is the number of individuals of cohort *x* to *x*+4 alive in calendar year *z*, and $A^z_{x,x+4}$ is the average participation rate in cohort *x* to *x*+4 in calendar year *z*. Retiring 40–44-year-olds are assumed to retire at age 47.5 on average. Useful as it is, the Latulippe formula is not without its flaws, as discussed in section 3.

[3] The OECD publishes labor force data only up to the age of 60–64 for the Czech Republic and Poland for the calendar years of 1996 to 2001. Based on the assumption that the proportion of the participation rates of the 65–69 and 60–64 age brackets, those of the 70–74 and 65–69 age brackets, and those of the 75+ and 70–74 age brackets are the same as in 2002, the right-hand tail of the participation age profile is estimated for these two countries for the years between 1996 and 2001.

In the five countries for which data are available for the entire period of two decades (the Czech Republic, Poland, Slovakia, Hungary, and Estonia), the growth of the average effective retirement age was 4.3 years over 20 years. The process started to accelerate around the turn of the millennium. In the last 15 years, for which data for all countries discussed here are available, the exit age increased 3.5 years, or 2.8 months per year, indeed rather quickly.

Figure 2.1: Average age of leaving the labor market in the CEE8 region countries, 1996–2016



Source: Authors' calculations from OECD data on population and labor market participation.
Note: Country codes: CZ: Czech Republic, SI: Slovenia, PL: Poland, SK: Slovakia, HU: Hungary, EE: Estonia, LV: Latvia, LT: Lithuania.

2.2. Unchanged life expectancies at exit age

The estimated age distribution of people leaving the labor market can also be used as weights, this time not for exit ages but for life expectancies. The weighted average of life expectancies of people retiring at various ages can be used to estimate the duration of retirement (Figure 2.2).[4] The estimates show that during the same period when the effective retirement age grew rapidly, life expectancies at retirement remained practically

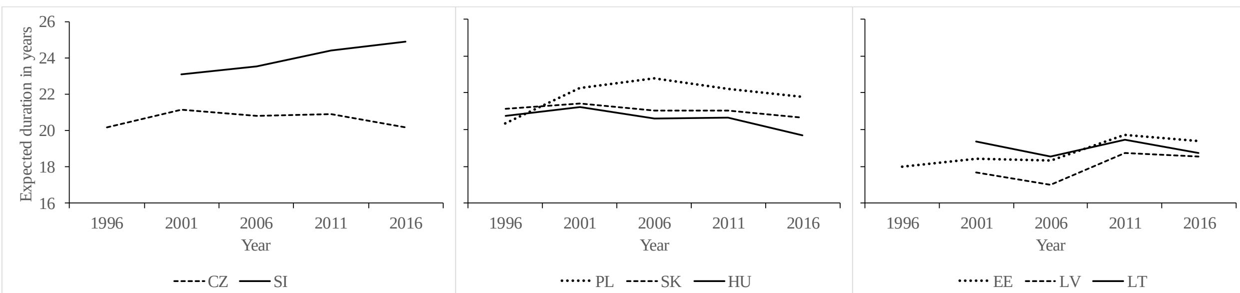
[4] Formally (also by Latulippe 1996):

$$\overline{RD} = \frac{0.5 \cdot {}_5R^z_{40,44} \cdot e_{47.5} + \sum_{x=45,50\ldots}^{75} {}_5R^z_{x,x+4} \cdot e_{x+5}}{0.5 \cdot {}_5R^z_{40,44} + \sum_{x=45,50\ldots}^{75} {}_5R^z_{x,x+4}}$$

where *e* stands for life expectancy. $\overline{RD}$ can be interpreted as the life expectancy at retirement.

unchanged. In the five countries for which information is available for all five points in time, the average retirement duration was 20.1 years in 1996 and 20.3 years in 2016. This hides an increase in the beginning, between 1996 and 2001, to 20.9 years and a decline after 2011. For the region as a whole, data are available only from 2001 (2002 in Latvia). In 2001 the eight-country average was 20.6 years versus 20.5 years in 2016. Gains of growing life expectancies in older working ages were absorbed by the labor market.

Figure 2.2: Expected duration of retirement in the CEE8 countries, 1996–2016



Source: Authors’ calculations from OECD data on population and labor market participation.
Note: Country codes: CZ: Czech Republic, SI: Slovenia, PL: Poland, SK: Slovakia, HU: Hungary, EE: Estonia, LV: Latvia, LT: Lithuania.

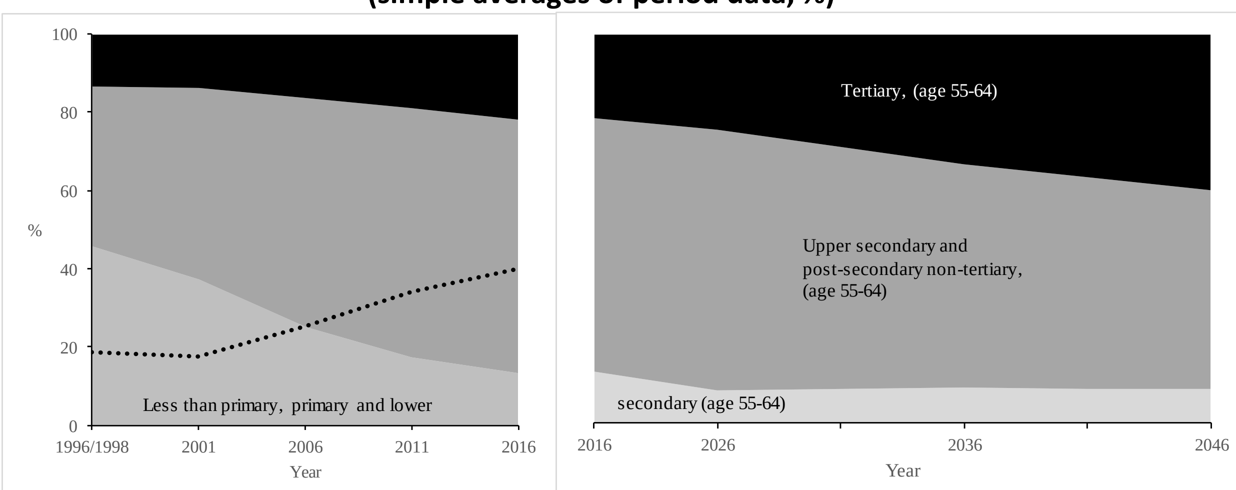
2.3. Improved educational composition of new retirees

One reason for the ease with which the retirement of older working-age people could have been postponed is the rapid improvement in the educational composition of new retirees. The left-hand panel of Figure 2.3 shows how this process took place between the second part of the 1990s and the mid-2010s. Simple instead of population-weighted averages are used because the focus is institutional systems rather than populations. At the first timepoint for which data are presented by Eurostat, 1996 to 1998, 46 percent of the 55–64-year-old age group had lower secondary education or less (code 0 to 2 by the International Standard Classification of Education, ISCED). This group contains those who had no education at all, or started but never finished primary school, or finished only that, as well as those who completed lower vocational school. By 2016 the rate of such people among the 55–64-year-old age group decreased to 13 percent. Over the same period the rate of upper secondary and postsecondary nontertiary degrees (ISCED 3–4) (that is, people holding more or less an equivalent of a *matura,* an *abitur,* or a *baccalauréat)* grew from 41 percent to 65 percent and the rate of tertiary degrees (ISCED 5+) nearly doubled, from 13 percent to 22 percent.

The figure makes a strong case for the connection between changing educational composition and higher exit age. Accordingly, people retired later because they were better educated than those who left the labor market two decades before. Especially important is the decrease in the share of the group with the lowest education. Recent retirees preserved better health up to a higher age and they possessed employable skills – so they could more easily stay longer in the labor market.

Figure 2.3: Composition of the 55–64-year-old age group by highest level of education in the CEE8 region, actual values for 1996/1998–2016 and projections for 2026–2046

(simple averages of period data, %)



Source: Eurostat (edat_lfse_03).

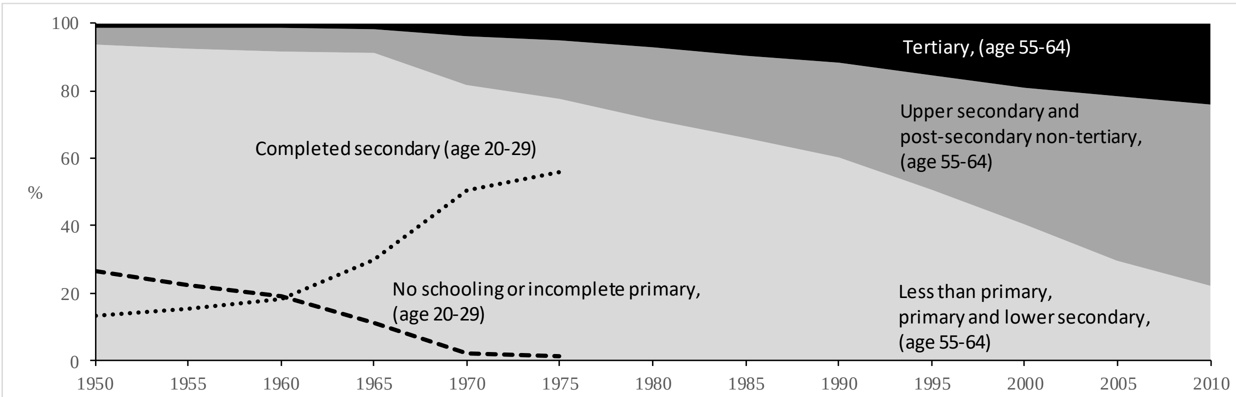
Note: The first timepoint is 1996 for Slovenia, 1997 for Hungary and Poland, and 1998 for the Czech Republic, Estonia, Latvia, Lithuania, and Slovakia. Educational composition of the 55–64-year-old age group in 2026, 2036, and 2046 is based on the actual educational composition in 2016 of the 45–54-year-old, 35–44-year-old, and 25–34-year-old age groups, respectively.

2.4. Improved educational composition of new retirees established by human capital investments decades before

The improvement in the average effective retirement age was preceded by investments in human capital many decades before (Figure 2.4). Figure 2.4 is an extension of Figure 2.3 to the left; that is, back in time to the 1950s. Two curves are added to show how the share of selected levels of education of the retiring age groups (presented as shaded areas) looked when they were still young, in their twenties. Developments in the shaded areas (as well as in the left-hand panel of Figure 2.3) are mirrored by the two curves. In particular, the dashed line shows how the problem of no schooling or incomplete primary schools almost disappeared during the quarter-century between 1950 and 1975 but especially after 1960. Its rate started at 26 percent of the then 20–29-year-old age group in 1950; it was still 19 percent in 1960, but dropped to 1 percent by 1975. People with no schooling or incomplete primary school are a subgroup of the ISCED 0–2 category shown in the shaded area. As mentioned before, the latter also includes those who completed primary or even a lower vocational school. The subgroup was nevertheless included to make the point that at the time the transitional crisis hit the CEE8 economies between 1990 and 1995, the cohorts then in older working age still included many who were unprepared for the skilled-biased technological change the crisis brought forward. However, 10 or 15 years later such people were no longer among the new retirees.

Figure 2.4: Composition of the 55–64-year-old age group by highest level of education, 1950–2010, and share of the 20–29-year-old age group by selected educational attainments, 1950–1975, in the CEE8 region

(simple averages of period data, %)



Source: Authors' based on Barro and Lee 2013 for 1955–1965 and Lutz, Butz, and KC 2014 for 1970–2010.

In contrast, the share of people with completed secondary education almost quadrupled in the 20–29-year-old age bracket between 1950 and 1975. Among people in their twenties, twice as many did not complete primary school than those who finished secondary education in 1950. By 1975 the latter group reached 56 percent of the relevant population. This development is displayed by the dotted line in Figure 2.4. In short, the effective retirement age could increase between the mid-1990s and the mid-2010s because the educational composition of the cohorts reaching retirement age improved, established by educational investments made in the 1960s and 1970s. The expansion of education produced a retirement-age premium long decades later.

2.5. Room to raise the effective retirement age given recent educational investment

Figure 2.4 extends the left-hand panel of Figure 2.3 to the left, or back in time. The right hand panel of Figure 2.3 makes a similar extension but this time to the right, to the future. The projection is based on observed educational attainment by age group in 2016 and an assumption that the achieved level will not change in the future. Accordingly, the composition of the 55–64-year-old age bracket by education in 2026 is supposed to be the age composition of the 45–54-year-old age group in 2016 and so on. The assumption of constant educational composition of an age group over time once the age group in question entered the labor market is conservative with respect to the point here. The educational composition usually increases during the active age of a cohort partly because a minority improve their educational level (whereas the individual level of highest education does not decrease) and partly because of education-specific mortality (survival rates of better-educated people are higher on average).

The projection shows a further decrease in the share of less-educated people (completing lower vocational school at most) from the current 13 percent to just below 9 percent by the mid-2020s and a stabilization beyond that point. The proportion of people with upper secondary education, whose spread among new retirees fed the increase of the exit age in the last decades, will peak in the mid-2020s and then start declining. However, this decrease will be more than compensated for by the growing share of tertiary-educated people. As above, the left-hand panel of Figure 2.3 adds in the rate of people with a tertiary degree among the 25–34-year-old age group between the mid-1990s and 2016. It more than doubled, starting at 18 percent and reaching 40 percent, which will be mirrored in the educational composition of new retirees decades later. Recent investments in human capital can be expected to pay back in terms of extended labor market careers in the future.

The analysis stops short of trying to predict how high the effective retirement age could grow in the future as a consequence of the recent expansion in human capital investments. That would require an explanatory model of the exit age, which is not presented here. Instead, Table 2.1 shows how much the effective retirement age should grow by 2045 to keep life expectancies at exit age at the 2016 level.

Table 2.1: Increase in effective retirement age required to keep retirement duration in 2045 at the 2016 level

	CZ	EE	HU	LT	LV	PL	SI	SK
Retirement duration (years), 2016	20.2	19.4	19.7	18.7	18.5	21.8	24.9	20.6
Effective retirement age, 2016	62.8	64.3	61.2	63.0	63.0	60.8	59.1	60.9
Required effective retirement age, 2045	66.5	67.7	66.4	68.0	67.8	64.9	62.2	65.5
Required increase in years	3.7	3.3	5.2	4.9	4.7	4.2	3.1	4.6
Months per year	*1.5*	*1.4*	*2.1*	*2.0*	*2.0*	*1.7*	*1.3*	*1.9*
Growth in months per year, 2001–2016	*3.7*	*2.7*	*3.6*	*2.3*	*2.0*	*3.2*	*1.2*	*3.5*

Source: Authors' calculation based on Eurostat population projections (proj_15npms and proj_15nalexp).
Note: Country codes as in Figure 2.1.

On average an annual 1.7-month increase over three decades would keep retirement durations (that is, life expectancies) at the effective retirement age in 2045 at the 2016 level. This compares to the yearly 2.8-month increase between 2001 and 2016 actually achieved by the region. The regional average hides significant country variations. Around one-half of the speed or even less of the last 15 years would be enough in the Czech Republic, Estonia, Slovakia, and Poland; less than two-thirds is enough in Hungary; and about the same growth should continue in Latvia and Lithuania. Only in Slovenia should the growth of the effective retirement age accelerate.

3. Robustness of the results

The results are comparable to similar calculations of the OECD and Eurostat. Both institutions publish figures on effective retirement ages and length of working lives as well as expected retirement duration (OECD 2017; Eurostat 2017). Regular reports, such as OECD's *Pensions at a Glance* series and the European Union's *Pension Adequacy Reports*, contain analyses similar to those presented above. This section briefly discusses (i) a methodological issue (the use of static instead of dynamic estimation of the effective retirement age) that distinguishes this paper's results from those of the above institutions, and (ii) the use of period instead of cohort life expectancies in the calculation of expected retirement duration.

3.1. Static estimation of the effective retirement age

The Latulippe formula, described in the text and endnotes 3 and 5, is applied to estimate the effective retirement age and the expected duration of retirement. The method is static in that the estimation is based on period values, meaning each entry in the time series is based on cross-sectional age profiles of participation rates. Scherer (2002) points out that a static indicator like Latulippe's is misleading as it mixes up genuine labor market trends with changing labor force composition. He uses demographic analogies, such as life expectancy or the reproduction rate, to prove his point. For instance, the reproduction rate describes period fertility, which is not informative about the expected completed fertility of cohorts currently in childbearing age.[5] Its variation indicates changes in cohort fertility as well as changes in timing of births. In the same vein, the actual Latulippe estimate of the effective exit age is exposed to developments other than retirement, such as labor market participation growing instead of decreasing by age in older working ages, which is not infrequent among women in some countries. Also, period fertility condenses information about 35 female cohorts whose lifetime fertility behavior may well prove to be very different in the end, for example, due to different labor market activities of the cohorts involved. Such a composition effect also distorts the Latulippe estimate because retirement behavior depends among other factors on the education of cohorts directly through skills and employability and indirectly through health status. Instead, based on recommendations by Scherer (2002), the OECD and Eurostat publish dynamic estimates of the effective

[5] See Sobotka and Lutz (2010) on the total fertility rate, a related indicator.

retirement age, which are based on cohort activity measured at two consecutive timepoints (Keese 2012; OECD 2017; Eurostat 2017).[6]

Nevertheless, the static measure is used here for two reasons. First, the argument herein directly applies the changing composition of retirees – as the educational composition of the age group close to retirement changes so does the effective retirement age. A dynamic measure would filter out the very effect sought, as demonstrated by Figure A1 in the Appendix, which compares static and dynamic indicators by country and calendar year. In most cases the linear trend fitted to the dynamic time series of the OECD is flatter than the trend of the static one. This also suggests that a regression analysis of a time series of period measures of the exit age would probably find education an important explanatory variable.

The other reason for not working with the dynamic indicator is its volatility and the occasional difficulty of its interpretation. As Figure A1 shows, some developments are indeed hard to read in terms of effective retirement age, such as a 6.5-year increase in the course of only six years between 2003 and 2009 in Estonia (which in fact hides even more hectic but asynchronous shifts by gender, such as an 8.4-year increase in five years between 2005 and 2009 among men and a 7.5-year increase in an even shorter four-year period between 2001 and 2006 among women). The Estonian and the Latvian panels show similarly sharp decreases in the effective exit age. This is mostly due to the data source (Vogler-Ludwig and Düll 2008). The dynamic indicator is based on broadly independent samples of repeated labor force surveys, which are not designed for such direct time comparisons. The confidence interval around single-year age groups created from the sample is too large; and the five-year interval for comparison is too long in such surveys. In

[6] Some differences arise between data of the two international agencies. OECD uses five-year grouped data; Eurostat calculations are based on single-year age groups. The latter has a wider confidence interval but it can cover withdrawals in one year against the five-year interval in the OECD estimates. This makes the OECD time series more volatile. The retirement process starts at age 40 in the OECD but at 50 in the Eurostat. In principle, that should make Eurostat exit ages higher. The Eurostat time series is shorter, covering 2001–2010. Even for that shorter period, one-quarter of the data points are not available for the CEE8 group.

addition, the OECD dynamic indicator is more exposed to migration, especially temporary migration, than the static indicator (Keese 2012). Participation rates are gained from different types of data sources: population data come from censuses and activity data are from surveys. Surveys are conducted with higher frequency and reflect rapid changes in reality that are more difficult to follow by administrative population data that have no proper input on migration. This could be one reason why the curves of the Central European countries of Figure A1 are less hectic than those of the three Baltic states, which were more affected by migration during the period discussed here.

3.2. Period estimates for life expectancies at the effective retirement age

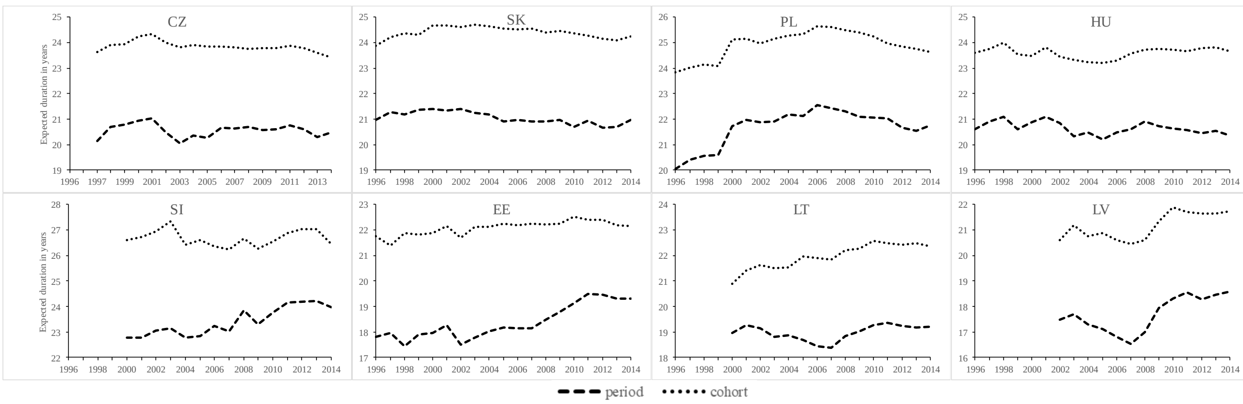
The Latulippe measure for retirement duration (that is, life expectancy at the effective retirement age) is based on period figures. In this respect the static method does not differ from similar estimates of the OECD and Eurostat. As in the name, period life expectancy sums up information of one period of time, usually a year. It gives the expected remaining average lifetime of an age group as if its future mortality patterns over the years ahead are a perfect replica of mortality patterns of older age groups in the base year. In the age of falling mortality, such an approach systematically underestimates cohort life expectancies. Goldstein and Wachter (2006) found that in industrial countries period estimates of life expectancy at birth follow cohort estimates with a lag of 40–50 years: today's cross-sectional values are about the same as the cohort values were a half-century ago. In another study, period life expectancies at birth are 8–15 years shorter than cohort life expectancies in Australia, the United Kingdom, the United States, Portugal, and Spain; and even at the age of 65 the difference remains 2–4 years (Ayuso, Bravo, and Holzmann 2018).

Similar results are found here by comparing period and cohort life expectancies[7] at the effective retirement age (see the dashed and dotted lines, respectively, in Figure 3.1) in the

[7] Eurostat publishes complete life tables including period life expectancies by age (demo_mlexpec) for a large number of countries. However, no comparable cohort life expectancies were found for the CEE8 countries. This paper's own calculation is based on the assumptions on future mortality rates of the 2015 population

CEE8 countries. Cohort life expectancies are consistently higher by an average margin of 3.3 years, varying between the range of 2 and 4 years across countries, or 10–25 percent of the period values.

Figure 3.1: Period and cohort estimations for the expected duration of retirement in the CEE8 countries, 1996–2014



Source: Period estimates: Eurostat (demo_mlexpec); Cohort estimates: authors' calculations based on mortality rates of the Eurostat population projection (proj_15naasmr).
Note: Country codes as in Figure 2.1. The ranges captured by the vertical axes are different but the scales are the same so the country panels can be directly compared.

The deviation of cohort and period life expectancies has serious repercussions for the pension system. Since retirement is usually an absorbing state from which there is rarely a way back to the labor market, life expectancy at retirement can be considered the average duration of retirement, as assumed throughout this paper. If retirement duration is based on period mortality data and consequently underestimated by 2–4 years, financial defined contribution (FDC) schemes collapse. Nonfinancial defined contribution (NDC) schemes, being based on the pay-as-you-go principle, would not literally go bankrupt but become unsustainable and require major reform at the cost of future pensioners. Ayuso, Bravo, and Holzmann (2018) find that a benefit formula based on period instead of cohort life

projection of Eurostat (proj_15naasmr). To capture all relevant cohorts, the estimation starts with l_x=100,000 at the age of 55.

expectancies can transfer as much as 30 percent of the pension wealth of the working-age population to current pensioners as an implicit subsidy.

However, devastating as it could be in a benefit formula, the period–cohort discrepancy does not directly affect this paper's conclusions. The findings do not include reference to the financial sustainability of the current length of retirement durations (an underestimation of this length would then be crucial, indeed), but to its relative invariability. This paper does not assert that the CEE8 pension systems are sustainable because life expectancy at retirement is *k* years. Rather, it indicates that since life expectancies at the effective retirement age have not grown, falling mortality did not contribute to sustainability problems if there were any. It is not the difference between period and cohort estimates that affects these conclusions but potential changes in the difference. The use of period estimates would be misleading only if the gap between the results of the two types of mortality analyses diverged. If the gap is constant or grows narrower, these conclusions would remain unaffected or prove to be even stronger.

The empirical relationship between time series of period and cohort measures is not obvious. On a sample of industrialized countries Goldstein and Wachter (2006) found that while the lag with which period life expectancy follows cohort life expectancy grew as mortality fell, the actual gap between the two measures first grew and then declined. As the country panels of Figure 3.1 show, the gap remained the same or even narrowed in most countries of the CEE8 region through the two decades between 1996 and 2014. The only place where the scissors somewhat opened is Lithuania.

4. A wider context

This section offers a wider context to the findings. It first shows that in most old member states of the European Union (EU), similar developments took place with growing effective retirement age and stagnating or even declining life expectancies. It then demonstrates how the results, based on the method of characteristic ages instead of the widely used prefixed demarcation ages, rewrite conventional wisdom on the effects of falling mortality.

In addition, the outcome of the calculations is embedded in related research on the causes and effects of falling mortality.

4.1. The CEE8 region vis-à-vis the old member states of the EU

The paper has shown that so far, the CEE8 countries were successful in fending off the potential threat of declining mortality in older ages on the pension system by postponing retirement from the labor market. In this respect the region is not unique, although it has done better than some other countries in Europe. Figure 4.1's upper panels show how the 15 old member states of the EU (EU15 hereafter) scored in terms of effective retirement age and expected duration of retirement. For convenience the countries are split into three groups: quick improvers (2.7-month increase or more per year of the effective retirement age over the period 2001–2016); average responders (within the range of a 1.8–2.3-month increase per year); and laggards (less than a 1.2-month increase, including two countries, Portugal and Greece, where the effective retirement age fell).[8] The lower panels present life expectancies at the effective retirement age, which almost perfectly mirror developments in the exit age: countries that produced rapid increases in the effective retirement age saw receding life expectancies at retirement, 0.6 months per year or more; countries with average exit age increments had stagnating life expectancies; and in the group of laggards life expectancies at the exit age increased. All in all, the expected retirement duration stagnated in the EU15, too, with an annual increase of about five days per year between 2001 and 2016 (versus a two-day decrease in the CEE8 region).

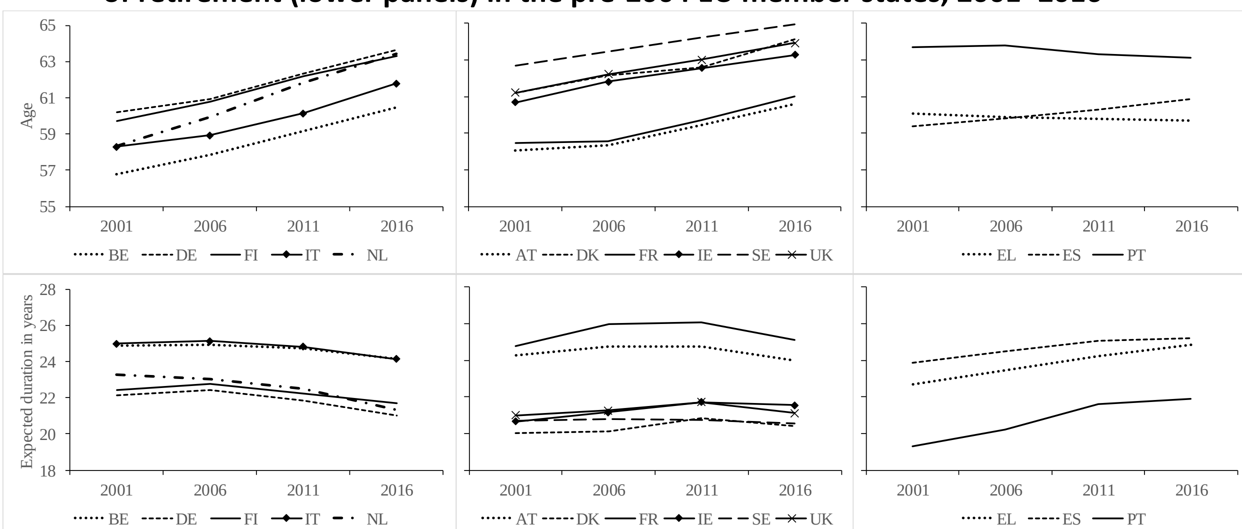
Against this background the CEE8 countries are not extraordinary. They increased their effective retirement age somewhat faster than the EU15 average but not as fast as the frontrunners of that group. Also, their stagnating or indeed slowly receding retirement

[8] Due to data problems, Luxemburg is missing from the comparison. In the OECD dataset, the labor force in the 75+ age group is zero in Finland and Sweden, possibly distorting the estimation in a conservative way, leaving the conclusions unaffected or even strengthened. In Belgium, Denmark, Germany, Greece, and Italy the number of active workers in the 75+ age group is calculated as the difference between the total and the 15–74-year-old workforce.

duration decreased more rapidly than in the EU15 as a whole, but lagged behind the drop in the quickly improving countries, especially the Netherlands.

The actual values of the ages of exiting the labor market make the frequently used indicator of the proportion of the 65-year-old and older population among adults an unreliable proxy for measuring the effects of the aging process on the pension system. More importantly, their tendency to change over time renders any prefixed demarcation age, should it be 60, 65, or 70 years, dubious in cross-country comparisons as well as in longitudinal analyses.

Figure 4.1: Average age of leaving the labor market (upper panels) and expected duration of retirement (lower panels) in the pre-2004 EU member states, 2001–2016



Source: Authors' calculations from OECD data on population and labor market participation.
Note: Country codes: AT: Austria, BE: Belgium, DE: Germany, DK: Denmark, EI: Ireland, EL: Greece, ES: Spain, FI: Finland, FR: France, IT: Italy, NL: the Netherlands, PT: Portugal, SE: Sweden, UK: United Kingdom. Luxemburg is not included.

4.2. Prefixed demarcation ages versus characteristic ages

Instead of referring to old-age dependency ratios, which are based on prefixed demarcation ages between working age and old age, Table 2.1 applied a measure based on the length of expected retirement duration as a fixed timespan. The analysis looked for the effective retirement ages carved out by this measure assuming further fall in mortality. In light of growing life expectancy among the old, the effective retirement age should be 4.2 years higher on average in the CEE8 region in 2045 to keep retirement duration constant at the

2016 level. The measure is based on the concept of characteristic age (Sanderson and Scherbov 2010, 2017), which is a general framework translating various characteristics of people to years of age. Such characteristics can vary over a wide range of frequently used measures of population aging, including: (i) variants of remaining life expectancy, such as prospective old-age thresholds for the entire population or various social groups (the average age of a social group at which remaining life expectancy is a given threshold of years, usually 15 years) or the prospective median age (the age of a person in a population who sees as many people with higher and as many people with lower life expectancy than his/her own); (ii) survival probabilities, such as the probability of surviving the next five years; or (iii) health conditions of the population as a whole (such as the proportion of self-reported good/bad health) or that of various social groups (such as average hand-grip strength). The translation procedure requires two characteristic schedules. Average chronological ages of various social groups in a fixed age-specific characteristic schedule are related to chronological ages, called alpha ages, in another, variable characteristic schedule. With some simplification, this remapping creates iso-age contours by selecting the age equivalents of chronological ages in the variable characteristic schedule. Fixed schedules can be as different as some demographic characteristic of a reference group, such as one of the two sexes, a nation, a group with a given level of education, or a group in a given year; or a preset remaining life expectancy (such as a country-specific life expectancy at the average effective retirement age, as in this paper). Variable schedules can be cross-country differences; changes over time; differences by age within one social group; or variation by the level of education.

The measure applied here, life expectancy at retirement as the fixed characteristic schedule, is a variant of the prospective age introduced by Sanderson and Scherbov (2013), except the country-specific retirement duration is employed instead of a preset length of time, 15 years. It is used as a reference point not because it is a necessary or a sufficient condition of fiscal sustainability but for its salience in measuring the impact of falling mortality in older ages on the pension system. Nevertheless, it has a policy value, too.

Linking the standard pensionable age to life expectancy is an increasingly frequent practice in the EU. Cyprus, Denmark, Finland, Italy, the Netherlands, Portugal, and the United Kingdom all apply it; in the CEE8 region Slovakia has introduced it and the Czech Republic will follow suit in the future.[9] However, not all arrangements are designed to keep retirement duration constant. The Danish solution is (although the standard retirement age is linked to life expectancy at age 60, not at the effective retirement age), but Finland's incorporation of demographic change in the pension regulation will result in the standard pensionable age absorbing about two-thirds of the improvements in life expectancy (at the age of 62), keeping the proportion of retired and active careers, not the retirement duration, more or less constant (Lassila, Määttänen, and Valkonen 2014).

In fact, constant proportions of the active and retired sections of the lifecycle are potentially more intergenerationally fair than the constant length of retirement if life expectancies are growing. Indeed, the proportion of life sections is the key issue of research on budgetary consequences of population aging. If declining mortality will extend the inactive period of life due to misguided policies or to bad health or unemployability of older cohorts, aging will render the interage transfer system, and within that pensions, unsustainable at the cost of the future old. If instead the length of the healthy and productive period of life keeps up with longer life expectancies, population aging will not threaten budgetary balance.

4.3. Population aging and the proportion of active and inactive lifecycle sections

This paper's analysis found that falling mortality has not proved harmful for the CEE8 region's pension systems in the last 15 years, and linked this to past investments in human capital. This result fits well with other researchers' findings. As for the more general relationship, the positive effect of education on mortality (that is, better education decreases mortality and leads to longer lives), there seems to be a general consensus in the literature.

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[9] See the MISSOC collection of social protection rules at https://www.missoc.org/missoc-database/comparative-tables/.

Table 4.1: Life expectancies at birth and at the average effective age of retirement by level of education in selected CEE8 countries, 2016

	CZ	EE	HU	PL	SI	SK
At birth						
Less than primary, primary, and lower secondary (levels 0–2)	74.6	72.6	70.7	72.3	79.0	69.9
Upper secondary and postsecondary nontertiary (levels 3–4)	79.3	77.4	77.6	77.6	81.1	77.5
Tertiary (levels 5–8)	80.4	80.9	80.2	82.3	83.7	80.8
Difference between highest and lowest as % of lowest	*8*	*11*	*13*	*14*	*6*	*16*
At average effective retirement age						
Less than primary, primary, and lower secondary (levels 0–2)	19.4	18.5	17.2	20.9	24.2	18.8
Upper secondary and postsecondary nontertiary (levels 3–4)	20.0	18.9	20.5	21.4	24.7	20.7
Tertiary (levels 5–8)	20.3	20.1	21.2	23.7	26.1	22.2
Difference between highest and lowest as % of lowest	*5*	*9*	*23*	*13*	*8*	*18*

Source: Authors' calculation based on Eurostat data (demo_mlexpecedu).
Note: Country codes as in Figure 2.1.

In some of the CEE8 countries the connection is particularly strong, as demonstrated in a simple cross-sectional design (Table 4.1). Life expectancies at birth and at the effective retirement age are presented for the countries where data are available. In Slovakia, mortality rates draw a life expectancy of less than 70 years for a person with lower secondary education or less, 16 percent shorter than someone with a tertiary degree. Such differences, or even more (in Hungary as much as 23 percent), can be observed at the effective retirement age.

However, no consensus exists about whether the effect of education on mortality is causal or if it could be explained with other factors. Several studies argue that income is the primary determinant of current mortality trends (Preston 1975; Bloom and Canning 2007; Mackenbach and Looman 2013). Based on this logic, education is associated with health mostly because richer people can afford both better life conditions and health care and attain higher education. Another stream of research emphasizes the causal effect of education on mortality (Baker et al. 2011; Lutz and Skirbekk 2014). Lutz and Kebede (2018) even state that education could be more important in understanding mortality than the health care system. Quasi-experimental studies are also inconclusive. Although most demonstrate that education indeed has a causal effect on mortality (Gathmann, Jürges, and Reinhold 2012; Lager and Torssander 2012; Lleras-Muney 2005; Silles 2009), some found no significant effect (Albouy and Lequien 2009; Clark and Royer 2010). Despite the conflicting results, most studies agree that education helps individuals to access resources (such as better life conditions and health care systems) or gain information how to follow a healthier life (Caselli et al. 2014). Lutz and Kebede (2018) emphasize that the healthier life style of more educated people is the reason for their lower mortality.

As for the more specific relationship between education and timing of retirement, the evidence is scarcer, although the hypothesis outlined in this paper has been tested before, and found support. Several researchers argue that higher retirement age is associated with education expansion (Loichinger and Weber 2016; Rehkopf, Adler, and Rowe 2016; Schirle 2008). This is due to higher work capacity, which makes higher educated people more competitive in the labor market even in higher ages than their less educated peers (Monteiro, Ilmarinen, and Filho 2006; Boissonneault 2018), although Coile, Milligan, and Wise (2017) can support employability increasing with education only among women. The gap in work capacity between education groups can be mostly attributed to the fact that higher educated people have better health, better work conditions, and less physically demanding jobs (Monteiro, Ilmarinen, and Filho 2006; Boissonneault 2018; Freedman and Martin 1999). However, no study establishes a causal relationship between education expansion and effective retirement age or working-life expectancy by using experimental or quasi-experimental design. Nevertheless, the association between having higher education and working longer is rather consistent across observational studies, which apply different sets of control variables in various countries.

Finally, another stream of research on the consequences of declining mortality on the proportions of life sections is the literature on healthy versus unhealthy aging: whether the healthy or the unhealthy periods of life will grow faster; and whether the people who live longer remain healthy enough to work in the labor market. The first scenario, when healthy life expectancy follows life expectancy, is called compression of morbidity (Fries 1980); the second scenario is often referred to as the relative expansion of morbidity (Robine and Mathers 1993). Empirical research in this topic has produced mixed evidence so far. The results mostly depend on the choice of health measure applied (Ahacic et al. 2007; Parker and Thorslund 2007). Severe disability measures are found improving most of the time (Christensen et al. 2009), but the incidence of chronic disease and functional impairments often seems to be increasing (Chatterji et al. 2015; Crimmins and Beltrán-Sánchez 2010; Parker and Thorslund 2007). Also, results differ across countries. The review by Chatterji et al. (2015) found that the compression of morbidity hypothesis is supported in high-income countries, which provide good-quality data on disability or impairment. In contrast, the paper by Salomon et al. (2012) on multimorbidities concluded that the number of unhealthy years has increased in most countries, which supports the expansion of morbidity hypothesis.

Concluding this short review of related research, there seems to be a general support of the view that the demarcation line between active age and old age is moving and can be affected by policies, such as health care and education. However, no general consensus exists whether the line can be shifted fast enough to keep the proportion of active and retired sections of the lifecycle unchanged.

5. Limitations

This paper showed that the effective retirement age rose in the last decades in the CEE8 countries and connected it with the expansion of secondary education starting in the 1960s. The relationship between human capital investments and retirement is suggestive and supported by the available evidence. Yet reasons for concern arise even if retirement can be further postponed in the future. This section identifies three such issues. First, even if the average exit age increased given the recent expansion in tertiary education, an uncomfortably wide section of the working-age population still has only a basic education. Second, the relationship between higher effective retirement age and past investments in human capital, convincing as it is, is not a one-way connection. The section shows that improving education can coincide with falling exit age, too. Finally, low contribution density, that is the extent of tax evasion, is still a threat to future old-age income even if people can stay longer in the labor market.

5.1. At the lower end of the educational hierarchy

To make the first point, Table 5.1 presents the educational composition of the 25–34-year-old age group in the CEE8 region in 2017. Sizeable segments of people still at the beginning of their labor market career, and 30–40 years from retirement, have only a lower vocational school education at most, which may prove insufficient to keep them working longer years. The Polish, Slovenian, Lithuanian, and Czech rates are among the lowest in the EU, but the Estonian, Latvian, and Hungarian rates (respectively 12 percent, 13 percent, and 14 percent) are relatively high, even if such levels are still below the EU average (16 percent), which is pushed up by the Spanish, Maltese, and Portuguese rates (above 30 percent).

Table 5.1: Educational composition of the 25–34-year-old population in the CEE8 region, 2017

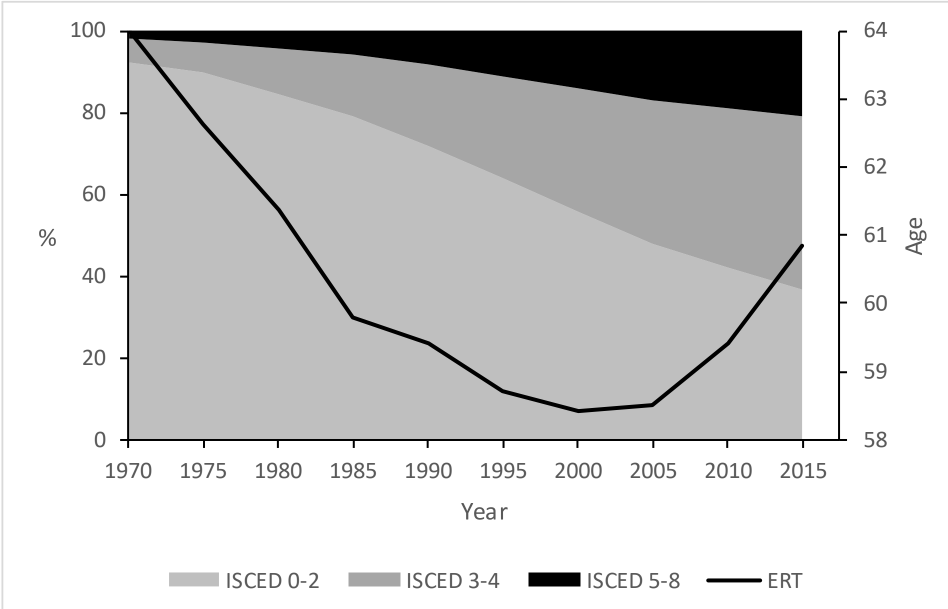
	CZ	EE	LV	LT	HU	PL	SI	SK
Less than primary, primary, and lower secondary	6	13	12	6	14	6	6	9
Upper secondary and postsecondary nontertiary	60	44	46	39	56	51	50	56
Tertiary	34	43	42	56	30	44	45	35

Source: Eurostat (edat_lfse_03).
Note: Country codes as in Figure 2.1.

5.2 When the effective retirement age falls despite improving education

Another reason for caution is that the positive effect of improving education on the effective retirement age is far from automatic. So far, the focus has been limited to the last one or two decades. However, even if recent increases in the exit age can be traced back to past expansions in education, previous decreasing periods of the exit age are not associated with downward changes in the education level. This is illustrated on French data since no sufficiently long time series is available for the countries of the CEE8 region. As Figure 5.1 shows, between 2000 and 2015France went through a development similar to that of the CEE8 countries. The educational composition of the 55–64-year-old age group changed for the better and the effective retirement age grew by 2.5 years over 15 years. However, the figure also reveals educational improvements among older working-age people between 1970 and 2000 (the rate of people with secondary education quintupled in the 55–64 age group during these years), and yet the effective retirement age decreased by 5.6 years over this period. Clearly, human capital investment is not a sufficient condition for postponing retirement. Misguided practices, such as the open-gate pension policies of the 1970s, inspired by the false expectation that the retirement of older workers would create employment opportunities for the young, cut the effective retirement age while the educational level of the relevant age groups kept increasing.

Figure 5.1: Composition of the 55–64-year-old age group by highest level of education (%, left hand axis), and the effective retirement age (years, right-hand axis), 1970–2015, France



Source: Education: Lutz, Butz, and KC 2014; Effective retirement age: authors' calculations from OECD data on population and labor market participation.
Note: ISCED codes: 0–2: lower secondary education or less; 3–4: upper secondary and postsecondary nontertiary; 5–8: tertiary; ERT: effective retirement age.

The CEE8 region is not immune to such policies, which could offer short-term political gains but are costly and difficult to reverse. Poland cut the standard pensionable age in 2016, reversing its gradual increase as it was foreseen by previous legislation. The new measure will increase retirement duration (European Union 2018, 109). Hungary introduced a service length-dependent component to its retirement process, which is otherwise solely based on age. Since 2011 women are allowed to retire without restrictions if they collected 40 service years (which are not necessarily contributory). The provision deviated the effective retirement age of women from that of men, breaking a convergence process. More importantly, both the Polish and the Hungarian measures will reduce future benefits despite the institutional differences between the two pension systems. Poland operates an NDC system and the benefit formula takes into account life expectancies at the age of retirement, so a lower pensionable age cuts benefits already at the start. In the Hungarian defined benefit scheme, the consequences are not felt at the entry to retirement. However, since indexation is price-based, the longer the benefit duration the wider the gap between real wages and pensions. Since the preferential retirement applies only to women, whose pensioner career is longer on average, the service length-based retirement option will increase the poverty risk in old age and widen the pension gender gap.

5.3 Contribution density

Another threat to pension adequacy in the CEE8 region is low contribution density (Holzmann, Robalino, and Winkler 2019). Even if the expansion of education will allow people to work longer, their sufficient old-age income will not be guaranteed unless they contribute to social security. Table 5.2 presents calculations of an indicator of contribution density, wage coverage, which is the rate of the covered wage bill and the actual wage bill. The covered wage bill is the actual amount of contributions collected over the official contribution rates and it gives how large the total wage bill would be if every cent of labor income paid contributions according to rules.[10] Wage coverage is an indicator of the reach of the pension administration to the taxable labor income of workers. The figures illustrate the difficulties administrations face: in Slovakia they cannot tax about 15 percent of the wage bill; in the Czech Republic and Slovenia about 20 percent; in Hungary and Lithuania 25 percent; and in Latvia as much as 40 percent (up from 20 percent in 2010).

In some cases, tax evasion means complete informality in transactions, which generate no eligibilities at all. In other cases, part of the wage (most often the mandatory minimum wage) is taxed, while the rest is informal. Long-term consequences for old-age income depend on the distribution of such informal arrangements among workers. If labor market

[10] The gov_10a_taxag dataset of Eurostat distinguishes between pension and nonpension contributions for households but not for employees (so the figure on pension contribution includes amounts paid by the self-employed and the nonemployed). Data on employee-level contributions are available but they include health care and other payments, too. To separate pension contributions for employees from their other contributions, the household-level pension/nonpension rate is applied. Further data limitations arise, too. Estonian contributions are not split by function; Polish contributions are but not in the Eurostat dataset; so, these two countries are missing from Table 5.2. Hungarian data were collected from local sources. The estimation on the covered wage bill can be slightly distorted by potential ceilings on the tax base. The national regulations on such ceilings were added to the table.

careers are clearly distinguishable by spells of informality, and tax evasion is limited to cohorts, industries, or workers with poor education, poverty and inequalities in old age will be a real threat in economies.[11]

Table 5.2: Wage coverage in selected CEE8 countries, 2016

	CZ	LV	LT	HU	SI	SK
Contribution rate (%)	6.5+21.5	23.86	3+23.3	10+21	15.5+8.85	4+14
Contribution ceiling	4 times AW	None	None	None	None	5 times AW
Pension contributions (€ millions)	12,534	1,432	2,625	9,858	3,293	3,999
Covered wage bill (€ millions)	44,765	6,004	9,980	31,345	13,522	22,214
Wages and salaries (€ millions)	55,230	10,160	13,258	41,723	17,204	25,869
Wage coverage (%)	81	59	75	75	79	86

Source: Contribution rates: MISSOC; Pension contributions: HU: Central Administration of National Pension Insurance, rest: Eurostat (gov_10a_taxag); Wages and salaries: HU: Central Statistical Office national accounts, rest: Eurostat (nasa_10_nf_tr).
Notes: AW: average wage; Covered wage bill: pension contributions/contribution rate; Wage coverage: covered wage bill/wages and salaries.

6. Conclusions

This paper showed that in the eight countries of Central and Eastern Europe, the effective retirement age (the average age of labor market exit) grew rapidly between 2001 and 2016, from 58.4 years to 61.9 years. The speed was more than three months per year on average in Slovakia, Poland, Hungary, and the Czech Republic; between two and three months per year in Estonia, Latvia, and Lithuania (starting from a higher base in all three Baltic republics); and somewhat faster than one month per year in Slovenia. In the region as a

[11] In addition, wage coverage is a measure of tax evasion (which is illegal) but not tax avoidance (which is legal). Undercontributing wages that legally circumvent taxation by exploiting regulatory loopholes can be found in the category of mixed income, too, in the national accounts, not only among wages and salaries.

whole, the increment was 2.8 months per year, or 7.1 days a month, or 5.6 hours a calendar day. Every day an average worker got closer to the effective retirement age by only 18.4 hours, instead of 24, because the effective retirement age was moving.

Retirement was so successfully postponed that in most observed countries life expectancies at the effective retirement age stagnated or even decreased. In 2001 the average life expectancy at the effective retirement age was 20.6 years; in 2016 it was 20.5 years. More or less mirroring developments of the exit age, it slightly decreased in the four Visegrad countries and in Lithuania, and it grew a little in Estonia, Latvia, and Slovenia. The effects of falling mortality were absorbed by the labor market, not the pension system. People could stay longer in the labor market as they stayed alive longer.

One possible reason for such a development is a replacement process. The cohorts in the age of retirement, the 55–64-year-old age bracket, were better educated in 2016 than those who reached that age in 2001, let alone the years before. The rate of those who had lower vocational school as their highest level of education was nearly trisected (from 37 percent to 13 percent); the share of people with secondary education (holding more or less an equivalent of a *matura*, an *abitur,* or a *baccalauréat*) reached about two-thirds by 2016 (from 41 percent in 1996/98 and 49 percent in 2001). The wave of the expansion of secondary education of the 1960s and 1970s has reached the pension system. The CEE8 region invested in human capital and its pay-as-you-go schemes benefited decades later.

As a next step, the analysis fixed life expectancies at the effective retirement age at the 2016 level, looked for the effective retirement ages characterized by such life expectancies three decades later, and found that those who will still have 20.5 years left will be 66.1 years old in 2045. In terms of life expectancies at the current effective retirement age, 66.1 will be the new 61.9. This gives reasons for optimism. Whereas in the course of 15 years between 2001 and 2016 the effective retirement age grew by 3.5 years across the region, it should increase only somewhat more, 4.2 years, in practically twice as many years between 2016 and 2045. In light of the expectable consequences of the rapid expansion of tertiary education, keeping life expectancies unchanged at the effective retirement age does not seem unattainable.

Falling mortality does not have to undermine the stability of the pension system if working life expectancies grow, and the latter can be extended if older workers are better trained and more easily employable. Yet more education is not necessarily sufficient. Using French time series data that were long enough to cover the 1970s and 1980s, the paper found that even in times of improvement in the level of education of older working-age cohorts the effective retirement age could fall. The recent derailment of the process of raising the pensionable age in Poland and to some extent and indirectly in Hungary is menacing, with the prospect of upsetting the proportion of active and retired sections of the lifecycle. Also, if the working life of better-educated cohorts is extended but the region's widespread tax evasion and tax avoidance are not contained, the CEE8's pension schemes will be ineffective in preventing old-age poverty in the future.

References

Ahacic, Kozma, Ingemar Kareholt, Mats Thorslund, and Marti G. Parker. 2007. "Relationships Between Symptoms, Physical Capacity, Activity Limitations in 1992 and 2002." *Aging Clinical and Experimental Research* 19(3):187–193.

Albouy, Valerie, and Laurent Lequien. 2009. "Does Compulsory Education Lower Mortality?" *Journal of Health Economics* 28: 155–68.

Ayuso, Mercedes, Jorge Bravo, and Robert Holzmann. 2018. "Getting Life Expectancy Estimates Right for Pension Policy: Period versus Cohort Approach." *IZA Discussion Paper Series* 11512, Bonn. Access https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3177388

Baker, David P., Juan Leon, Emily G. Smith Greenaway, John Collins, and Marcela Movit. 2011. "The Education Effect on Population Health: A Reassessment." *Population and Development Review* 37: 307–332. https://doi.org/10.1111/j.1728-4457.2011.00412.x.

Barro, Robert J., and Jong Wha Lee. 2013. "A New Data Set of Educational Attainment in the World, 1950–2010." *Journal of Development Economics* 104: 184–198.

Bloom, David E., and David Canning. 2007. "Commentary—The Preston Curve 30 Years On: Still Sparking Fires." *International Journal of Epidemiology*, 36: 498–499. https://doi.org/10.1093/ije/dym079.

Boissonneault, Michael. 2018. "Measuring the Impact of Health on Work in a Context of Delayed Retirement." Dissertation, Groningen: University of Groningen. Access https://www.rug.nl/research/portal/files/62756519/Title_and_contents.pdf

Caselli, Graziella, Sven Drefahl, Christian Wegner-Siegmundt, and Marc Luy. 2014. "Future Mortality in Low Mortality Countries." In *World Population and Human Capital in the 21st Century,* ed. Wolfgang Lutz, William P. Butz, and Samir KC, pp. 226–272. Oxford: Oxford University Press.

Chatterji, Somnath, Julie Byles, David Cutler, Seeman Teresa, and Emese Verdes. 2015. “Health, Functioning, and Disability in Older Adults—Present Status and Future Implications.” *The Lancet* 385(9967): 563–575.

Christensen, Kaare, Gabriele Doblhammer, Roland Rau, and James W. Vaupel. 2009. “Ageing Populations: The Challenges Ahead.” *The Lancet* 374(9696): 1196–1208.

Clark, Damon, and Heather Royer. 2010. “The Effect of Education on Adult Health and Mortality: Evidence from Britain.” Working Paper No. 16013, National Bureau of Economic Research, Cambridge, MA.

Coile, Courtney, Kevin S. Milligan, and David A. Wise. 2017. “Health Capacity to Work at Older Ages: Evidence from the United States.” In *Social Security Programs and Retirement Around the World: The Capacity to Work at Older Ages*, ed. David A. Wise, pp. 359-394. Chicago: University of Chicago Press.

Crimmins, Eileen M., and Hiram Beltrán-Sánchez. 2010. "Mortality and Morbidity Trends: Is There Compression of Morbidity?" *The Journals of Gerontology: Series B* 66(1): 75-86.

Eggleston, Karen N., and Victor R. Fuchs. 2012. “The New Demographic Transition: Most Gains in Life Expectancy Now Realized Late in Life.” *Journal of Economic Perspectives* 26(3): 137–156.

European Union. 2018. “The 2018 Pension Adequacy Report: Current and Future Income Adequacy in Old Age in the EU.” Luxembourg: Publications Office of the European Union.

Eurostat. 2017. “Average Exit Age from the Labour Force - Annual Data (lfsi_exi_a)” (see http://ec.europa.eu/eurostat/cache/metadata/en/lfsi_exi_a_esms.htm) and Duration of working life – Annual Data (lfsi_dwl_a) (see https://ec.europa.eu/eurostat/cache/metadata/en/lfsi_dwl_a_esms.htm). Last retrieved on January 6, 2018.

Freedman, Vicki A., and Linda G. Martin. 1999. "The Role of Education in Explaining and Forecasting Trends in Functional Limitations Among Older Americans. *Demography* 36(4): 461–73.

Fries, James F. 1980. "Aging, Natural Death, and the Compression of Morbidity." *New England Journal of Medicine* 303: 1369–1370.

Gathmann, Christina, Hendrik Jürges, and Steffen Reinhold. 2012. "Compulsory Schooling Reforms, Education and Mortality in Twentieth Century Europe." SSRN Scholarly Paper No. ID 2020246, Social Science Research Network, Rochester, NY.

Goldstein, Joshua R., and Kenneth W. Wachter. 2006. "Relationships between Period and Cohort Life Expectancy: Gaps and Lags." *Population Studies* 60(3): 257–269.

Holzmann, Robert, David Robalino, and Hernan Winkler. 2019. "NDC Schemes and the Labor Market: Issues and Options." Social Protection and Jobs Discussion Paper, No. 1914. Washington, D.C.: World Bank Group.

Keese, Mark. 2012. "A Method of Calculating the Average Effective Age of Retirement." OECD Working Papers, OECD, Paris.

Lager, Anton Carl Jonas, and Jenny Torssander. 2012. "Causal Effect of Education on Mortality in a Quasi-Experiment on 1.2 Million Swedes." *Proceedings of the National Academy of Sciences* 109(22): 8461–8466.

Lassila, Jukka, Niku Määttänen, and Tarmo Valkonen. 2014. "Linking Retirement Age to Life Expectancy – What Happens to Working Lives and Income Distribution?" Finnish Centre for Pensions Reports 2014/2, Helsinki.

Latulippe, Denis. 1996. "Effective Retirement Age and the Duration of Retirement in the Industrial Countries between 1950 and 1990." ILO Issues in Social Protection Discussion Papers 2, International Labour Organization, Geneva.

Lleras-Muney, Adriana. 2005. “The Relationship between Education and Adult Mortality in the United States.” *The Review of Economic Studies* 72: 189–221.

Loichinger, Elke, and Daniela Weber. 2016. “Trends in Working Life Expectancy in Europe.” *Journal of Aging and Health* 28(7): 1194–1213.

Lutz, Wolfgang, and Endale Kebede. 2018. “Education and Health: Redrawing the Preston Curve.” *Population and Development Review* 44(2): 343–361.

Lutz, Wolfgang, and Vegard Skirbekk. 2014. “How Education Drives Demography and Knowledge Informs Projections.” In *World Population and Human Capital in the 21st Century,* ed. Wolfgang Lutz, William P. Butz, and Samir KC, pp. 14–38. Oxford: Oxford University Press.

Lutz, Wolfgang, William P. Butz, and Samir KC. 2014. “*World Population and Human Capital in the Twenty-First Century*.” Oxford: Oxford University Press.

Mackenbach, Johan P., and Caspar W.N. Looman. 2013. “Life Expectancy and National Income in Europe, 1900–2008: An Update of Preston’s Analysis.” *International Journal of Epidemiology* 42: 1100–1110. https://doi.org/10.1093/ije/dyt122.

Monteiro, Maria Silvia, Juhani Ilmarinen, and Heleno Rodrigues Corrêa Filho. 2006. “Work Ability of Workers in Different Age Groups in a Public Health Institution in Brazil.” *International Journal of Occupational Safety and Ergonomics* 12(4): 417–427.

Organisation for Economic Co-operation and Development (OECD). 2017. “Average Effective Age of Retirement.” http://www.oecd.org/els/emp/average-effective-age-of-retirement.htm. Last retrieved on January 2, 2018.

Parker, Marti G., and Mats Thorslund. 2007. “Health Trends in the Elderly Population: Getting Better and Getting Worse.” *Gerontologist* 47(2): 150–158.

Preston, Samuel H. 1975. "The Changing Relation Between Mortality and Level of Economic Development." *Population Studies* 29: 231–248. https://doi.org/10.2307/2173509.

Rehkopf, David H., Nancy E. Adler, and John W. Rowe. 2016. "The Impact of Health and Education on Future Labour Force Participation Among Individuals Aged 55–74 in the United States of America." *Aging and Society* 37(7): 1313–1337.

Robine, Jean-Marie, and Colin Mathers. 1993. "Measuring the Compression or Expansion of Morbidity through Changes in Health Expectancy. In *Calculation of Health Expectancies, Harmonization, Consensus Achieved and Future Perspectives,* ed. Jean-Marie Robine, Colin Mathers, Margaret R. Bone, and Isabelle Romieu, pp. 169–286. Paris: Libbey.

Salomon, Joshua A., Haidong Wang, Michael K. Freeman, Theo Vos, Abraham D. Flaxman, Alan D. Lopez, and Christopher J. Murray. 2012. "Healthy Life Expectancy for 187 Countries, 1990–2010: A Systematic Analysis for the Global Burden Disease Study 2010." *The Lancet* 380(9859): 2144–2162.

Sanderson, Warren C., and Sergei Scherbov. 2010. "Remeasuring Aging." *Science* 329 (5997/2010): 1287–1288.

_____. 2013. "The Characteristics Approach to the Measurement of Population Aging." *Population and Development Review* 39(4): 673–685.

_____. 2017. "A Unifying Framework for the Study of Population Aging." *Vienna Yearbook of Population Research* 2016(14): 7–39.

Scherer, Peter. 2002. "Age of Withdrawal from the Labour Force in OECD Countries." OECD Labour Market and Social Policy Occasional Papers 49, OECD Publishing, Paris.

Schirle, Tammy. 2008. "Why Have the Labor Force Participation Rates of Older Men Increased Since the Mid-1990s?" *Journal of Labor Economics* 26(4): 549–594.

Silles, Mary A. 2009. "The Causal Effect of Education on Health: Evidence from the United Kingdom." *Economics of Education Review* 28: 122–8.

Sobotka, Tomas, and Wolfgang Lutz. 2010. "Misleading Policy Messages Derived from the Period TFR: Should We Stop Using It?" *Comparative Population Studies – Zeitschrift für Bevölkerungswissenschaft* 35(3): 637–664.

Vogler-Ludwig, Kurt, and Nicola Düll. 2008. "Analysis of the Average Exit Age from the Labour Force." Research Report. Access http://ec.europa.eu/social/main.jsp?advSearchKey=lifelongapproachwork&mode=advancedSubmit&catId=22&policyArea=0&policyAreaSub=0&country=0&year=0.

Appendix

Figure A1: Dynamic and static estimates of the time series of the effective retirement age in Central and Eastern Europe

Source: Dynamic estimates are calculated by the authors from the gender-specific dynamic OECD estimates (http://www.oecd.org/els/emp/average-effective-age-of-retirement.htm) by applying gender- and age-specific population weights. The calculation of static estimates is described in the body text.
Notes: Country codes as in **Error! Reference source not found.**. Time series start in 1996 in CZ, SK, PL, HU, and EE but in 2000 in SI, LT, and LV due to lack of data. The age span of the vertical axis is six years in the upper two rows but eight years in the bottom row.

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ABSTRACT

This paper shows that as the educational composition in the 55–64-year-old age bracket improved between the mid-1990s and the mid-2010s, the effective retirement age rose rapidly in the Central and Eastern European region. This increase was fast enough to keep life expectancies at the effective retirement age practically unchanged. In effect, the labor market absorbed all improvements in life expectancies in older working ages. The paper also shows that maintaining the current life expectancies at retirement over the next 30 years requires less effort in terms of further raising the effective retirement age than what the region achieved in this respect in the last 15 years.

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