THE DIFFERENCE IN PRESENT VALUE OF RETIREMENT PENSIONS FOR EDUCATION GROUPS

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Abstract

The retirement pension in the Czech Republic is to some extend dependent on the pre-retirement average income. Due to the fact that the average income is higher for segments of population with higher education, the retirement pension will also tend to be higher for individuals with higher education. There is however also an additional aspect amplifying this difference which is rarely mentioned in this context. Namely the fact that the population segments with higher education have also higher expected lifetime and hence not only that they earn higher annuity amounts but also they on average earn the pension longer. Both these aspects contribute to the difference in the present value of a retirement pension. The purpose of this article is to quantify this difference of the retirement pension by four education groups using the income statistics and unique life tables constructed for different educational groups. The results show that differences are relatively large.

Key words: Education level, Mortality, Pension, Annuity, Life table

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Introduction

Positive influence of higher education on many aspects of human existence was described in many studies and is known for a long time. Some studies describe relation between education level and some socio-economic indicator as wage (see Marek, 2010), some describe education as way of investing (see Finardi, Fischer, Mazouch, 2012). What is clear is that higher education level brings benefits to the individual as well as to the society.

On the other hand there are many studies about future educational structure of the population (see Fiala, Langhamrova, Miskolczi, 2012) and population aging (Fiala, Langhamrova, 2013) which shows that education structure is maybe more important and could reduce effect of aging than changes in age structure.

Because of discussion about necessities of changes in pension system (in accordance to aging of the population) questions about differences of profitability of the system for different subpopulations appear.

Aim of the paper is to quantify differences of the retirement pensions by four education groups using the income statistics and unique life tables constructed for different educational groups.

1 Model assumptions

1.1 Cash flow model

We assume a simple deterministic yearly cash flow model with a valorized amount of yearly pension. The expected present value of the retirement pension, denoted as $\ddot{a}_x^{(ed)}$ is calculated for each educational level (*ed*) based on the following formula:

$$\ddot{a}_x^{(ed)} = \sum_{t=0}^{\omega-x-0.5} c^{(ed)}{}_{t+0.5}\, p_x^{(ed)} i_{t+0.5} d_{t+0.5}\,, \quad (1)$$

where $c^{(ed)}$ is the yearly pension, assumed to be paid out at once in the middle of the corresponding year, ${}_{t+0,5}p_x^{(ed)}$ is the survival probability for a person in the age x surviving another t+0,5 years, $i_{t+0,5}$ is the valorization index and $d_{t+0,5}$ is the discount factor (Cipra, 1996). Index indicating the sex of the person is omitted in order to keep the notation reasonably complex.

1.2 The inputs

Education levels used in this article were based on the International Standard Classification of Education (ISCED) categories. The classification table is in the Table 1.

Tab. 1: Levels of education used in the analysis - their abbreviations and ISCED codes

Level of education	Educational attainment (ISCED 97)	Educational attainment (ISCED 2011)
Basic	ISCED 2	ISCED 2 and lower
Vocational	ISCED 3C	ISCED 35
Secondary	ISCED 3A	ISCED 34
University	ISCED 5A and higher	ISCED 64 and higher

The following parameters were assumed:

The retirement age x was calculated based on Act of Law on Pension Scheme 155/1995 (Czech Republic, 2014). For all education levels the same level of the retirement age is assumed.

Tab. 2: Retirement ages for Males and Females in 2009, Czech Republic

Sex	Retirement age x
Males	62
Females	59

Source: Czech Republic, 2014

There is no information about pensions of specific groups (education, nationality etc.). The monthly amount of retirement pension was estimated from combination of two sources. The first source was the empirical distribution of wages in the Czech Republic in 2009 (ISPV, 2010) denoted as F_w The second source was the empirical distribution of pensions (data available in CSSZ, 2010) denoted as F_p. Our estimate of the average pension for each educational level (denoted as $c^{(ed)}$) was based on average wage for each educational level (denoted as $w^{(ed)}$) and on an assumption of approximative equality of distribution functions

$$F_p\left(c^{(ed)}\right) = F_w\left(w^{(ed)}\right) \quad (2)$$

and hence

$$c^{(ed)} = F_p^{-1}\left(F_w\left(w^{(ed)}\right)\right). \quad (3)$$

The estimate was also performed separately for each sex (index of sex is omitted for simplicity). Estimated average pensions by sex and education level are in Tab. 2.

Tab. 2: Mean estimated pension by education level in 2009, Czech Republic

Educational level	All	Males	Females
Basic	10 650	11 450	9 870
Vocational	11 800	12 550	9 990
Secondary	12 900	13 200	11 400
University	14 300	14 700	12 900

Source: ISPV, 2010, CSSZ, 2010, authors' computations

The valorization index in the model was assumed identical to the interest rate used for discounting which was set to 2 % p.a.

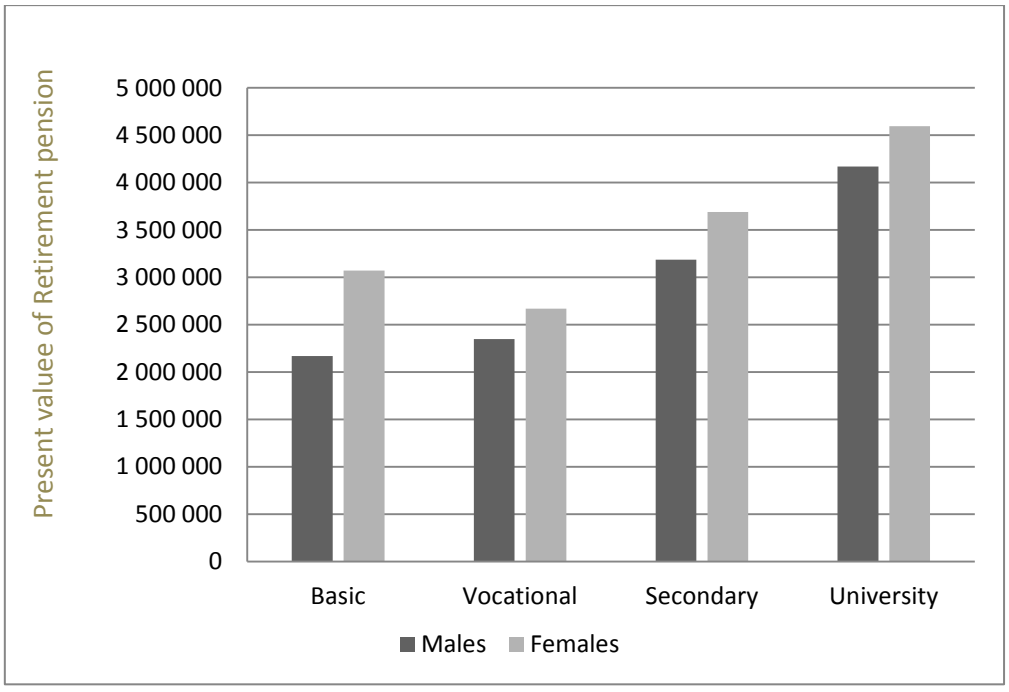
1.3 Survival probability p_x

Life tables by educational level are also based on multiple sources. Numbers of deaths divided by highest attained level of education in 2009 are from the database of individual data from Czech statistical office. Missing values were completed by methodology of Zimmermann, Mazouch, Hulíková Tesárková, 2013. The second source needed to construct life table is population structure (by age, sex and education level). Those data are not commonly published in the Czech Republic. We used data from project RELIK (Langhamrová et al., 2009) and for ages bellow 25 (because prognosis in this project was from 25 years) was the structure extrapolated to age 15. Life tables were constructed in common way (see e.g. Pavlik, Rychtarikova, Subrtova, 1986).

2 Results

The model described above allowed quantification of the differences in the present values of the retirement pensions for different educational levels and different genders. The results are contained in Fig. 1:

Fig. 1: Present values of the retirement pensions for different educational levels and different genders.



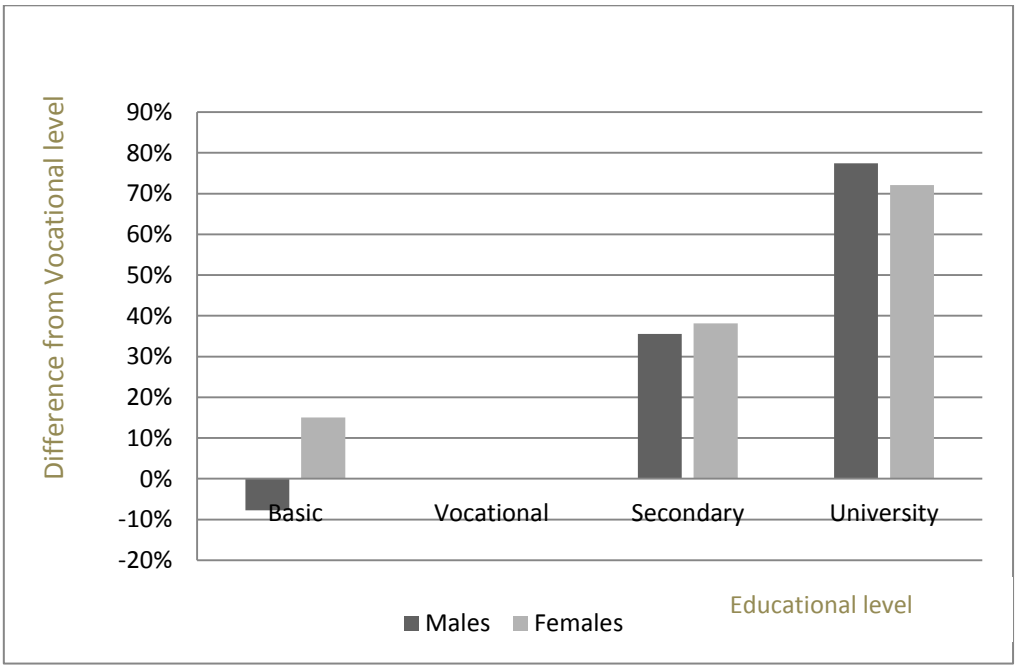
Source: authors' computations

For comparison between the particular cathegories the Vocational educational category was selected as the "reference" cathegory. The relative difference coparing the educational

cathegories relative to the Vocational cathegory (separately for males and females) is displayed in the Fig. 2.

We can see that the joint effect of the higher longevity (lower mortality) together with higher average yearly retirement pension causes a massive difference between the present value of the pensions for high and low educational levels. For example the University educated males have present value of the retirement pesion about 77 % higher than persons with vocational education which is the difference around CZK 1,8 million.

Fig. 2: Relative difference comparing the educational categories relative to the Vocational category



Source: authors' computations

Conclusion

In this article, the present value of the retirement pension for subpopulations with different educational level was calculated. These populations differ substantially not only in the amount of yearly pension but also differ in their longevity. Both these factors are very important drivers of the present value. Comparison of the present value of the retirement pensions to the reference educational category revealed differences in of tens of percent for both males and females. Further research will therefore be focused on the income side of the pension system in order to reveal how much are this differences in the present value balanced with the differences of the contributions to the pension system.

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