Patrycja Kowalczyk-Rólczyńska

Department of Insurance

Wroclaw University of Economics

Poland

**Increasing life expectancy - impact on retirement incomes**

**Abstract:** Demographic changes observed at present on the European markets have an important influence on the stability of pension systems and the amount of retirement benefits. One of the most significant changes is increasing life expectancy, which significantly affect the amount of retirement benefits. These retirement benefits come from both mandatory part of the pension system, as well as voluntary part of the pension system and they are the main source of income for most of elderly households. Reducing these benefits due to increasing life expectancy is a major threat to the financial situation of households of retirees.

The purpose of the paper is identify the impact of increasing life expectancy on retirement benefits, from both mandatory and voluntary parts of the pension system. To achieve the aim of article life annuity calculations were used. The author focuses on the Polish market.

**Instroduction**

Aging of society is a global and irreversible process. The degree of advancement of aging depends on the phase of development of a given society. In Poland we observe some demographic trends, which are a result of systemic and structural changes that began in the 1990s. These trends directly affect the age structure of the population and thus the aging process. Particular attention is paid to trends in some issue, mainly: life expectancy, fertility and foreign migration, which determine changes in the age structure of the population and the intensity of population aging.

In Poland, as in other European countries, it is observed a positive tendency for a systematic increase in average life expectancy. Available projections of life expectancy at birth in Poland indicate that: male life expectancy at birth will increase from 72.8 years in 2013 to 82.6 years in 2060 and female life expectancy at birth will increase from 80.9 years in 2013 to 88.1 years in 2060 (European Commision, The 2015 Ageing Report). This situation will significantly affect the implementation of demographic risk in the pension system, because the period of payment of pension benefits will extend. If the increasing of period of pension benefits is not balanced by a respective increase of the saved pension capital (both from the mandatory and the voluntary parts of pension scheme), the value of paid benefit instalments will decrease in time. Because of that we will observe the growth of the risk of poverty in the elderly population (Zaidi A., 2010). Women are particularly vulnerable to poverty risk, with their markedly higher longevity projections and notably lower average retirement pensions compared to men. Female earners over the course of their working lives receive lower earnings and their pension system contributions are set at a correspondingly lower level, resulting in lower pension capital used as basis for the calculation of pension benefits (European Commission, 2011).

The purpose of the paper is identify the impact of increasing life expectancy on retirement benefits, from both mandatory and voluntary parts of the pension system. To achieve the aim of article life annuity calculations were used.

**Methodology and results:**

To indicate the impact of increasing of life expectancy on the amount of retirement benefits paid to elderly people living in Poland - from the mandatory and the voluntary part of the pension system - the author considers different types of pension benefits. The first one is based on the lifetime pension benefit model used by the Polish Social Insurance Institution, second one based on the life annuity model and third one based on the n-year temporary life annuity model.

Elderly people who live in Poland receive pension benefit from the Social Insurance Fund, which is managed by the Polish Social Insurance Institution. This benefit is paid under the mandatory part of the pension system. The amount of pension benefit received from the Social Insurance Fund under the new rules (the new rules of pension schemes in Poland was carried out in 1999) is the equivalent of the total amount of pension contributions after indexation collected after 31 December 1998 and the amount of the initial capital after indexation divided by the average life expectancy, expressed in months, for persons in the age equal to the retirement age of the given pension claimant (Social Insurance Institution, 2014). Due to legal regulations, the first pension benefits, according to the new rules, were paid in 2009. The value of retirement benefits can be written as:



where:

*b* – pension benefit

*K* - the sum of collected and indexed pension contributions and the indexed initial capital

- average life expectancy for persons in the age equal to the retirement age, expressed in months.

In 2009 the value of average pension benefit paid by the Social Insurance Fund was 1602.34 zloty. In the same year, the average life expectancy for person aged 60 was 247.3 months[[1]](#footnote-1) (in 2009 the retirement age for woman was 60 years). Based on the above data, the amount of capital K was calculated. The amount of capital K equal 396 258,68 zloty. This amount of capital K will be the basis for further calculations. Further calculations were made only for the first pillar of the pension system, the capital collected in the second pillar was not taken into account here. As it was mentioned above in 2009 the Polish Social Insurance Institution started to pay pension benefits from both the first and the second pillars of pension scheme, but the amount of retirement benefits from the second pillar was very low (it was approximately 3% of value of pension benefit[[2]](#footnote-2)). The value of retirement benefits in 2009-2015 are presented in Table 1. It was assumed that the amount of capital K was the same for each year. The average monthly gross wages in polish market and the relation of the retirement benefits to the monthly average gross wages and salaries in the national economy are presented in the same table.

Table 1. Calculation results for the first method (using the value of average pension benefit)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| year | the average life expectancy for person aged 60 (in months) | The amount of pension benefit from the first pillar of pension scheme, in PLN  | the monthly average gross wages and salaries in the national economy, in PLN | the relation of the retirement benefit to the monthly average gross wages and salaries in the national economy |
| 2009 | 247.3 | 1602.34 | 3 315.38 | 0.4833 |
| 2010 | 247.5 | 1601.05 | 3 435.00 | 0.4661 |
| 2011 | 251.5 | 1575.58 | 3 625.21 | 0.4346 |
| 2012 | 254.8 | 1555.18 | 3 744.38 | 0.4153 |
| 2013 | 255.2 | 1552.74 | 3 877.43 | 0.4005 |
| 2014 | 256.4 | 1545.47 | 4 003.99 | 0.3860 |
| 2015 | 261.4 | 1515.91 | 4 150.88 | 0.3652 |
| 2016 | 259.6 | 1526.42 | 4 118.63 | 0.3706 |

Source: own calculations based on data from Central Statistical Office

The results implicate that the amount of retirement benefits for person aged 60 decreased from 2009 to 2015. In the same time the relation of the retirement benefit to the average monthly gross wage also declined from year to year. Taking into account that the decreases of relation of the retirement benefit to the monthly average gross wages and salaries in the national economy were significant, people should be save money to retirement during their working life.

The European Commission points out that the rate of poverty among elderly people will increase in many Central and Eastern European countries. Therefore, the amount of minimum of pension benefit from the first pillar of pension scheme was calculated and the relation of the amount of minimum of pension benefit to the monthly average gross wages and salaries in the national economy (Table 2). It was assumed that the person who went on retirement in 2009, received a minimum of pension benefit equal 675.1 zloty (Central Statistical Office, 2010). This information determined the amount of capital needed to establish such the pension benefit, i.e. 166 952.23 zloty.

Table 2. Calculation results for the first method (using the value of minimum of pension benefit)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| year | the average life expectancy for person aged 60 (in months) | The amount of minimum of pension benefit from the first pillar of pension scheme, in PLN  | the monthly average gross wages and salaries in the national economy, in PLN | the relation of the amount of minimum of pension benefit to the monthly average gross wages and salaries in the national economy |
| 2009 | 247.3 | 675.10 | 3 315.38 | 0.2036 |
| 2010 | 247.5 | 674.55 | 3 435.00 | 0.1964 |
| 2011 | 251.5 | 663.83 | 3 625.21 | 0.1831 |
| 2012 | 254.8 | 655.23 | 3 744.38 | 0.1750 |
| 2013 | 255.2 | 654.20 | 3 877.43 | 0.1687 |
| 2014 | 256.4 | 651.14 | 4 003.99 | 0.1626 |
| 2015 | 261.4 | 638.68 | 4 150.88 | 0.1539 |
| 2016 | 259.6 | 643.11 | 4 118.63 | 0.1561 |

Source: own calculations based on data from Central Statistical Office.

The above calculations indicate that the significant difference between the average gross wages and the minimum pension amount. The results clearly show that living standard of persons who receive the minimum pension are very low.

The source of additional retirement income may be an equity release (see more: Reifner et al. 2009; Salter 2014; Tse 1994). This paper focuses on sale model (home revision). On the Polish market the sales model is offered by mortgage funds, which mainly pay lifetime benefits. Therefore, the life annuity model was used (Skałba 1999; Gerber 1990; Milevsky 2013). The value of the benefit paid by mortgage funds can be written as:

where:

 – the annual value of whole life annuity benefit (payment),

 - the sum of the home revision granted, as percentage of the market value of the property at the date of the signing of the agreement

 - the discount rate,

- the probability for a person aged *x* to live for the next *k* years.

In order to show the impact of life expectancy on the lifetime benefit under the sales model of equity release, the following assumptions were made:

- life table for male and life table for female were used for each year 2009-2015 (which were published by Central Statistical Office in Poland)

- the average transaction price per one square meter of a housing property was calculated as the average of transaction price per one square meter of a housing property from the biggest cities in Poland in 2010 (since 2010, the prices of housing property has been stability in Poland)

- the average of housing property surface equal 60 square meters

- the discount rate assumed as the average mortgage interest rate 4,5% (the average value from all analysed years)

- α = 0,5

The value of monthly life annuity benefits for a female aged 60 and the value of monthly life annuity benefits for a male aged 65 are presented in Table 3.

Table 3. Values of monthly life annuity payments from equity release (sale model)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| year |

|  |
| --- |
| The value of monthly life annuity benefits for a male aged 65, in PLN  |

 |

|  |
| --- |
| The value of monthly life annuity benefits for a female aged 60, in PLN  |

 |
| 2009 | 1111.59 | 821.53 |
| 2010 | 1096.64 | 815.41 |
| 2011 | 1083.88 | 810.42 |
| 2012 | 1081.03 | 810.67 |
| 2013 | 1075.86 | 809.34 |
| 2014 | 1058.65 | 801.33 |
| 2015 | 1066.69 | 804.04 |

 Source: own calculations based on data from Central Statistical Office

The results show values of monthly life annuity payments for persons who wrote the agreement with mortgage funds in a given year. In each year (from 2009 to 2014) the value of monthly life annuity benefits for a male aged 65 old was lower. In 2015 the amount of benefit was slightly higher. This is a consequence of the change in the number of survivors in the following years. In the case of benefits for women the value of benefits decreased in 2009-2011 and 2012-2014. However, these differences are small.

One of the mortgage fund operating on the Polish market uses the present value of the n-year temporary life annuity for calculating the life annuity benefits, taking into account information about life expectancy for a person at age x who lives in the city.



where:

 *v*=1/(1+*r*) - the discount rate

*n* – life expectancy of a person in age x expressed in months (or years, depending on type of benefit)

Values of monthly life annuity payments in advance in second method of calculating is presented in Table 4.

Table 4. Values of monthly life annuity payments from equity release (variant II)

|  |  |  |
| --- | --- | --- |
| year | The value of monthly life annuity benefits for a male aged 65, in PLN | The value of monthly life annuity benefits for a female aged 60, in PLN |
| 2009 | 1071.92 | 813.20 |
| 2010 | 1054.81 | 805.74 |
| 2011 | 1039.86 | 799.84 |
| 2012 | 1038.50 | 800.40 |
| 2013 | 1033.07 | 798.72 |
| 2014 | 1003.90 | 791.75 |
| 2015 | 1025.10 | 793.74 |

Source: own calculations based on data from Central Statistical Office

The results in Table 4 are slightly lower than in Table 3. The person signing the equity release agreement does not influence on the algorithm which is chosen by the mortgage fund.

It should be noted that the older the beneficiary, the higher the value of the life annuity benefit received from the equity release. To illustrate this phenomenon, the value of monthly benefits for women aged 60 to 85 living in cities were calculated using life table of 2015.

Table 5. Values of monthly benefits for women from aged 60 to aged 85 living in cities

|  |  |  |
| --- | --- | --- |
| The age of the woman living in the city | life expectancy (in month) | The value of monthly life annuity benefits in PLN |
| 60 | 289.8 | 793.74 |
| 61 | 279.84 | 809.44 |
| 62 | 270 | 826.19 |
| 63 | 260.28 | 844.09 |
| 64 | 250.68 | 863.24 |
| 65 | 241.08 | 884.03 |
| 66 | 231.72 | 906.08 |
| 67 | 222.36 | 930.10 |
| 68 | 213.12 | 956.01 |
| 69 | 204 | 984.00 |
| 70 | 195 | 1014.33 |
| 71 | 186.12 | 1047.26 |
| 72 | 177.24 | 1083.63 |
| 73 | 168.6 | 1122.83 |
| 74 | 159.96 | 1166.41 |
| 75 | 151.56 | 1213.70 |
| 76 | 143.28 | 1265.89 |
| 77 | 135.24 | 1322.84 |
| 78 | 127.44 | 1385.11 |
| 79 | 119.88 | 1453.35 |
| 80 | 112.56 | 1528.32 |
| 81 | 105.6 | 1609.39 |
| 82 | 99 | 1696.94 |
| 83 | 92.64 | 1793.26 |
| 84 | 86.64 | 1897.23 |
| 85 | 80.88 | 2011.68 |

Source: own calculations based on data from Central Statistical Office

The result indicate that the moment of making decision by elderly person about equity release is important.

Elderly people can receive the additional income from their savings under voluntary pension scheme (for example from unit-linked insurance). In this situation insurance companies can pay lifetime benefit or n-year temporary life annuity. In the second case the value of benefit can be written as:



where: *K* - the sum of collected under voluntary pension scheme

To illustrate this method the value of 20-years temporary life annuity are presented in table 6, separately for man aged 65 and for woman aged 60. The following assumptions were made:

* the value of collected capital was 200 000 zloty
* the interest rate 2,5 % (as an inflation rate)
* commissions and fees were omitted
* life table for male and life table for female were used for each year 2009-2015 (which were published by Central Statistical Office in Poland)

Table 6. Values of monthly benefits from collected capital under voluntary pension scheme

|  |  |  |
| --- | --- | --- |
| year | The value of 20-years temporary life annuity payable monthly for the man aged 65, in PLN | The value of 20-years temporary life annuity payable monthly for the woman aged 60, in PLN  |
| 2009 | 1442,59 | 1131.24 |
| 2010 | 1427.12 | 1127.43 |
| 2011 | 1412.37 | 1124.98 |
| 2012 | 1408.95 | 1126.22 |
| 2013 | 1403.55 | 1125.92 |
| 2014 | 1384.27 | 1120.03 |
| 2015 | 1393.71 | 1122.37 |

Source: own calculations based on data from Central Statistical Office

As in the previous methods the value of 20-years temporary life annuity payable monthly decrease from year to year, but the differences of the values are small. Because of that the level of living for elderly people who receive an additional income from voluntary part of pension scheme did not difference during analysed years.

**Conclusion**

The calculations in this paper indicate that the value of pension benefits both from obligatory and mandatory part of pension scheme declined from year to year. The decrease of benefits were not significant. Taking into account that people live longer, elderly people should decide to use their house or saving as additional income in late in life. Disturbing is the fact that the relation of the retirement benefit from the first pillar of pension scheme to the monthly average gross wages and salaries in the national economy declined significantly in the analysed years. Therefore it is necessary to accumulate savings for retirement time.

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2. Monthly payment between 40 zloty and 70 zloty <http://www.bankier.pl/wiadomosc/Emerytura-z-II-filaru-wynosi-kilkadziesiat-zlotych-1622005.html> ( Gazeta Podatkowa No 373, Accessed 21 May 2017) [↑](#footnote-ref-2)