Evolution of Contributions Paid by Pension Participants

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Abstract

The current value of the pension is a measure of the value of future pension benefit flows, being defined as the amount needed at the time of retirement to purchase an annuity that generates the same payment flows as those promised by pension schemes. The current value is expressed by a multiple of the gross annual individual earnings, the average of the current gross pension values for the OECD as a whole being around 9.6.

In this paper we intend to make a series of predictions on the level of pensions that will have the current contributors to the pillar of the Romanian pension system. These forecasts will be based on a series of actuarial calculations, made on the basis of assumptions about the main elements that determine the level of pensions.

Key words*: private pension funds, annuity, annual rate, pension system*
J.E.L. classification: J21, J26

1. Introduction

The main directions in which the pension reform in Romania focused after 1990 were the devaluation of the real pension by inflation, despite successive indexations, the alarming increase in the number of pensioners through early retirement, the decrease in the number of taxpayers, the change of contributions, insufficient coverage by the pension system. pensions of certain categories and narrow collection rate, amendments to the laws on pensioners in agriculture, creation of the social insurance fund, its administration separately from the state budget and the disappearance of some special funds, changing the methodology of calculating the pension, high administrative costs that could be reduced.

The pension can be considered as an annuity that must be received by a person (called beneficiary or pensioner) from a company (or sometimes from another person), based on a contract concluded between the two partners. Usually the payer of the pension is the state, an insurance company or a pension fund.

Due to their timing, pensions received in the form of annuities are intended to provide the beneficiary with a secure flow of income for the future, usually intended to ensure his livelihood from retirement.

Pension payments made in the form of annuities are based on one or more previous payments (also called contributions) made by the person to receive the pension in favor of the pension provider. These payments are called premiums. Single-contribution annuities are called single-premium annuities, while flexible annuities are based on a flow of payments over a period of time.

For pensions paid as fixed (or constant) annuities, the insurer assumes the obligation to provide the principal and a minimum interest, while the variable annuities are related to the return on investment made by the administrator.

2. Literature review

Given that the birth rate is falling dramatically and people's average life expectancy is increasing, an aging population is a major risk factor for the whole of Europe (Turner, 2011, p.95). Pensions in the private system will generally have a positive influence on participants' incomes after cessation of

activity. Through them, people who adhere to private pension schemes will be able to obtain better levels of future pensions and especially to improve their salary replacement rates within the pension (Stewart, 2010, p.139).

Future pension payments will be determined by the amounts accumulated in the accounts of each participant in the pension system. These amounts in turn can come both from the contributions made during the participation in the system and from the investments made, in the case of private pensions (Colomeischi, 2011, p.65).

The contributions paid by the participants to the Romanian pension system, whether state or private, are calculated as a percentage of the gross salary of the employee (Popa, 2011, p.97).

3. Research methodology

The proposed model for calculating the estimated future value of pensions that will benefit current taxpayers in the Romanian pension system, in terms of the state pension pillar (Pillar I), contains five variables, divided into two categories: two external variables, where it includes the life expectancy of the population and the income of the participants, and three internal variables, which include the contributions paid by the participants, the return on investment and the administration fees. In the case of each variable, we will make various hypotheses that capture as well as possible the current framework from which the predictions are made, as well as certain coordinates on which they will evolve in the future.

The calculation of the pension takes into account first of all the life expectancy at retirement age, defined as the average life expectancy of an individual or the average number of years of life remaining at a certain age. Life expectancy is directly determined by the mortality rate, which is worldwide in a process of continuous growth over the last 50 years.

The second external variable we took into account in calculating the projected value of pensions of the active population is represented by the gross earnings of the participants in the pension system.

An extremely significant negative aspect of the public pension system in Romania was the inequity in the calculation of the pension of different generations of pensioners. This shortcoming has been largely removed by the processes of recorrelation and recalculation of the pensions initiated. The recalculation of pensions aimed at eliminating the inequities that still existed between the different categories of pensioners in the public system, depending on the retirement date. The average annual score, according to the calculation formula, for all pensions from the former state social insurance system was determined by the pension recalculation process.

Currently, the legal regulations in the field of pensions provide for the payment by employees of an individual social insurance contribution of 10.5% of the gross salary to the social insurance system.

The share related to privately managed pension funds is 3.5% of the gross salary, being included in the individual social insurance contribution due by the employee. This quota was valid only for 2012, increasing annually by 0.5%, to the level of 6% of the non-taxable gross income.

According to Law 204/2006 on voluntary pensions, the total contribution to an optional pension fund cannot exceed a maximum of 15% of an employee's gross monthly taxable income.

The gross salaries of the participants in the pension system have had a positive evolution in recent years, increasing annually in real terms, an increase that has led to higher accumulations in the accounts of participants in the pension system. These increases were determined by the increase of GDP and by the increase of labor productivity (Colomeischi, 2018, p.3).

In the following I will present the way of working and the results obtained following the calculation of the contributions paid by the participants.

4. Calculation of contributions and their evolution

According to the principles of actuarial calculation in connection with staggered payments, the final value accumulated after a certain period of time, as a result of a deferred constant annuity is calculated according to the formula (Burlacu, 2000, p.125):

$$S_n^p(i) = \frac{(1+i)^n - 1}{i}, \quad \textbf{(1)}$$

where:
n = duration of the operation (expressed in years);
i = annual interest rate;
$S_n^p(i)$ = final value of an annuity equal to 1 p.m. for n years, with an annual interest rate i.

If the amounts deposited are not constant then the final amount accumulated after a period of n years will be calculated according to the formula (Burlacu, 2000, p.125):

$$S_n^p\left(\left(S_j\right)_{j=\overline{1,n}}, i\right) = \sum_{j=1}^{n}\left[S_j \cdot (1+i)^{n-j}\right], \quad \textbf{(2)}$$

where:

$S_n^p\left(\left(S_j\right)_{j=\overline{1,n}}, i\right)$= the final value of an immediate deferred annuity and limited to n years with variable annual rates;

Sj = annuity paid in year j, $j = \overline{1,n}$.

In table no. 1 we calculated the contributions accumulated on behalf of a beginner participant in the private pension system, having a monthly salary of 1,000 lei, under the conditions of a contribution rate of 6%. I chose the monthly salary of 1,000 lei close to that of a beginner aged 20, in order to be able to calculate the contributions accumulated in the account for longer periods of time (up to 40 years).

Table no.1 The value accumulated in the account of a beginner participant in private pension funds with a gross monthly salary of 1,000 lei, after certain periods of time (lei)

Period (years)	Annual return on investment r=0%				Annual return on investment r=3%				Annual return on investment r=4%				Annual return on investment r=5%			
	Annual increase in income (%)				Annual increase in income (%)				Annual increase in income (%)				Annual increase in income (%)			
	v=0%	v=3%	v=4%	v=5%	v=0%	v=3%	v=4%	v=5%	v=0%	v=3%	v=4%	v=5%	v=0%	v=3%	v=4%	v=5%
5	3.600	3.876	3.972	4.080	3.828	4.116	4.212	4.320	3.900	4.188	4.296	4.404	3.984	4.272	4.380	4.488
10	7.200	8.376	8.820	9.288	8.256	9.510	10.008	10.512	8.610	9.960	10.452	10.968	9.060	10.416	10.920	11.448
15	10.800	13.596	14.700	15.924	13.392	16.584	17.844	19.224	14.412	17.760	19.080	20.520	15.540	19.032	20.412	21.912
20	14.400	19.632	21.861	24.408	19.341	25.632	28.272	31.260	21.141	28.140	30.918	34.101	22.808	30.960	33.948	37.296
25	18.000	26.640	30.588	35.220	26.256	37.140	42.012	47.700	29.988	41.808	47.064	53.172	34.468	47.232	52.920	59.508
30	21.600	34.761	41.181	49.032	34.260	51.660	59.940	68.912	40.380	59.640	68.712	79.596	47.832	68.228	79.212	91.128
35	25.200	44.184	54.096	66.660	43.536	69.876	83.148	99.708	53.028	82.740	97.524	115.860	65.028	98.736	115.296	135.696
40	28.800	55.101	69.792	89.148	54.288	92.580	113.028	139.101	68.124	112.164	135.612	165.240	86.976	138.048	161.124	197.928

Source: Own elaboration

Several scenarios were imagined in relation to the increase in income, denoted by v (with annual percentages of 0%, 3%, 4% and 5%), respectively in relation to the return on investments, denoted by r (with the same annual percentages of 0 %, 3%, 4% and 5%). The values were calculated according to the following formulas (Colomeischi, 2014, p.397):

$$\begin{cases} C_n = \sum_{j=0}^{n-1}\left[C_{x+j} \cdot (1+r)^{n-1-j}\right] \\ C_{x+j} = 12 \cdot c \cdot k_{x+j} \cdot SMBE_x \cdot (1+v)^j, \forall j = \overline{1,n} \end{cases}, \quad \textbf{(3)}$$

where I noted:
n = the period (expressed in years) for which the accumulated amount is calculated;
x = age of the person at the reference time (considered here the year 2010);
C_n = amount accumulated after *n* years;
C_{x+j} = annual contribution paid at age *x+j*, $\forall j = \overline{1,n}$;

r = annual rate of return on investment;
c = the share (expressed as a percentage) of the gross salary according to which the contributions are paid;
k_{x+j} = the share of the person's salary compared to the average gross salary per economy at age *x+j*, $\forall j = \overline{1,n}$;
$SMBE_x$ = average gross monthly salary per economy in the reference year, when the person was age x;
v = annual real growth rate of income (of the average gross salary per economy).
From the previous formulas it is observed that in the calculation of the value accumulated over time, the weights that the person's salary has in the average gross salary on the economy with advancing age are taken into account, weights presented in Table 2.

Table no. 2 Average weights of the average gross salary for the different age groups of employees in relation to the average gross salary by economy (%)

Age of employee	**20**	**25**	**30**	**35**	**40**	**45**	**50**	**55**	**60**	**63**	**65**
Share of gross salary in SMBE at age *x* (k_x)	52,76	64,19	76,24	88,38	**100**	109,86	117,19	121,35	121,35	121,35	121,35

Source: Own elaboration

This explains why a certain real increase in the average gross salary in the economy entails a higher increase in the value of the account than in the case of a similar increase in the return on investment. The real increase of the salary by a certain percentage in a year will practically multiply with the increase of the share of the person's salary compared to the average gross salary per economy.

We will further analyze the influence of the annual salary increase on the amounts accumulated in the participants' accounts, by comparing the data from the first column of the table, in which the investments are not taken into account (r = 0%). Thus, it is observed that after 30 years in the participant's account will be found the amount of 21,600 lei if his income has not changed (v = 0%). However, if there is an annual increase in earnings of v = 3%, the amount increases by 60.94%, to the value of 34,764 lei. When the annual increase of income is v = 4%, the amount will increase to 41,184 lei, by 90.67% more than in the first variant and by 18.47% more than in the second. In the most optimistic version, when the salary increases by v = 5% annually, there will be an increase of 127% compared to the case of a constant salary and 19.06% compared to the situation v = 4%, reaching the amount of 49,032 lei. We thus observe that a 1% increase in the annual salary growth rate has an even greater influence as it applies to a higher reference percentage (the amount increases more when the rate increases from 4% to 5% than when it increases from 3% to 4%).

The increases will be all the more important as the accumulation period increases. After 40 years of contributions, the participant will have 28,800 lei if the income remains constant (v = 0%). However, if the annual salary increases by a real percentage v = 3%, the amount will increase by 91.33%, up to 55,104 lei. Assuming an increase v = 4%, the amount increases by 142.33% compared to the first variant and by 26.66% compared to the second, up to 69,792 lei. In the most favorable variant with v = 5%, the accumulated value will be of 89,148 lei, and the increase of 209.54% compared to the first case and of 27.73% compared to the variant with v = 4%.

In conclusion, the real increase in salary determines an increase in the value of the account, the longer the accumulation period and the more the increase applied to the percentage of growth v is applied at a higher rate v.

5. Conclusions

The sustainability of the Romanian public pension system requires the uniqueness of the model for calculating pension rights for all socio-professional categories of the population and, respectively, the renunciation of service pensions. At the same time, the increase in the number of taxpayers (employees and employers) in the public pension fund could guarantee the possibility of periodically increasing the amount of pensions with the inflation index.

If we consider the pensions in the public system, their future evolution will be directly and essentially influenced by the way of calculating the value of the pension point. Assuming the correlation of the value of the pension point with the inflation rate, the real increases of participants' salaries, which will determine higher contributions to the system, will not be fully found in future pension levels, which will be more visible as it is calculated. gross and net replacement rates in pension income for younger generations. These replacement rates will decline significantly, reaching extremely low levels for the younger generations. Also, the decrease in gross and net income replacement rates will be more pronounced the higher the annual growth rate of wages.

If the method of calculating the value of the pension point on the basis of the average wage in the economy had been maintained, the gross replacement rates of income would have remained constant over time, so that real wage increases, which lead to increased contributions, -would be found equally in future pension levels.

The purpose of introducing private pensions in Romania was, first of all, to reduce the responsibility of the state pension system for ensuring a decent living for people who have reached retirement age. On the other hand, it was considered to obtain superior performances by investing the money coming from the participants' contributions for the remaining period until retirement.

By moving from the correlation of the pension point in relation to the average gross wage per economy to the correlation with the inflation rate, partly by 2030 and totally after 2030, there will be a significant decrease in gross income replacement rates within the pension, and for current Pillar II taxpayers, who will combine the state pension with the mandatory private pension. If they do not take out additional insurance, they will be in danger of not being able to ensure a minimum standard of living. One solution available to them would be to take out additional insurance or join voluntary pension funds.

Given that the birth rate is falling dramatically and people's average life expectancy is increasing, an aging population is a major risk factor for the whole of Europe. Not only is Romania no exception, but it has one of the most pessimistic prospects in these respects, in part due to the large number of emigrants leaving the country. Consequently, as the public pension system is designed, an employee will have to support more and more retirees through his monthly contributions. If the ratio is currently 1 employee to 1.3 retirees, in 2050 an employee will have to financially support more than two retirees. One possible solution identified is to hold people accountable through savings and personal account, as well as financial planning for retirement, so as to ensure a decent old age. These objectives are only possible through strong support for the expansion and development of the private pension system.

6. References

- Burlacu, V., G. Cenuşă, 2000. *Bazele matematice ale asigurărilor [The mathematical basis of insurance]* Bucharest: Teora Publishing House
- Colomeischi T, Iancu E., 2018. The Demographic Trends on Pension Systems in Romania, *LUMEN Proceedings* 6 (1), pp. 1-6
- Colomeischi T., 2014. *Sistemul pensiilor din România din perspectivă matematică actuarială [The pension system in Romania from an actuarial mathematical perspective]*. Bucharest: Didactic and Pedagogical Publishing House
- Colomeischi, T., 2011. Optimal contracts of the main-agent model in conditions of symmetric information, *Economics and Finance Review* Vol. 1(6), pp. 60 – 68
- Popa, M., 2011. *Estimări ale nivelului pensiilor publice şi private în România [Estimates of the level of public and private pensions in Romania]*. Bucharest: Teşu Publishing House

- Stewart, F., 2010. Pension Funds' Risk-Management Framework, Regulation and Supervisory *Oversight, OECD Working Papers on Insurance and Private Pensions*, nr. 40, OECD publishing, France
- Turner, J. A., 2011. *Longevity Policy: Facing Up to Longevity Issues Affecting Social Security, Pensions and Older Workers*, W.E. Upjohn Institute