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ROMANIAN PENSION SYSTEM AND ITS SUSTAINABILITY IN A SCENARIO WITH ACCUMULATION VERSUS WITHOUT ACCUMULATION. CASE STUDY: WOMEN

Elena Lucia Croitoru

Assistant Professor PhD, Romanian-American University, Bucharest

Abstract – The demographic phenomena and its evolution led to high public expenditures in the sector of public pensions. The deficit of the social insurance budget has increased after '90, so, Romania, like other countries face problems in terms of public pensions. In these conditions, is normal to ask if the public pensions system it's sustainable or not. The aim of this paper is to determine if, in case of women, and assuming that benefits are equal contributions, a pension system with accumulation is more sustainable than one without accumulation.

Keywords: pension system, pension expenditure, social security pension, contributions, benefits.

1. Methodology and data description

The aim of this paper is to determine if, in case of women, a pension system with accumulation is more sustainable than one without accumulation, while assuming that benefits are equal contributions. Thus, we create two scenarios taking into consideration the variables: average gross salary, contribution to the scheme, compound rate based on interest rate, discount rate based on inflation and life expectancy at birth.

The average gross salary for 2013 is established at 2.223 lei[1] and the contribution rate for the pubic system, for the same year, is 31,3% for normal work conditions[2], 10,5% contribution paid by employee and 20,8% contribution paid by employer. So, the every month contribution it's calculated at 695 lei. The full contribution period it's based on 35 years for men and the standard retirement age of 63 years for women[3]. In this research, we kept the average gross salary constant (for econometrical, economical and social reasons), but it can be admitted that this fact can be a limitation of the model, so in future researches we can take into consideration a growth rate of average gross salary.

The research begins by calculating the value of the total contributions paied, the value of the benefits received, the consumption of the contributions during the payment of the pension and the pension obtained, assuming the benefits are equal to the contributions, in a system with accumulation.

[1] Capitolul III, artiolul 16 din Legea bugetului asigurărilor sociale de stat pe anul 2013, nr.6/2013, publicată în Monitorul Oficial nr. 107 din 22 Februarie2013

[2] Titlul V, capitolul II, secțiunea a II-a, articolul 296, alineatul 3 din Codul Fiscal

[3] Legea 263/2010 privind sistemul unitar de pensii publice, publicată în Monitorul Oficial nr.852 din 20 decembrie 2010, pentru persoanele prevăzute la articolul 6 alineatul (1), punctul (I), litera a) şi litera b)

2. Model

2.1. Scenario 1 – pension system with accumulation.

In this scenario, it's calculated the present value of contributions paid by a woman who entered the workforce at the age of 18 and retired at the statutory retirement age 63 and reaching a full 35-year contribution period (both essential conditions to get the old-age pension), based on formula:

$F_{value} = \sum_{i=0}^{n} [montly\ contribution \times (1+k)^n]$

where:

- F_{value} represents future value
- k represents compound rate
- n represents the contributions period time equal 540 month

The compound rate (k) it's calculated according with the inflation rate, which shows the purchasing power and interest rate on deposits, which shows how much the future value of the monthly contributions would be, if we deposit this amount at bank.

To determine the compounding rate based on inflation rate (*) and interest rate (**) we have the models:

Inflation = f (time) = a + b*time (*)

Interest = f (time) = c + d*time (**)

For both, inflation rate and interest rate in Romania, we took into consideration period from January 2009- April 2013, resulting 52 observations[4] for each, with a monthly periodicity.

Following the descriptive statistics, correlogram and the Phillip-Peron test for the stationarity of data series for both model: inflation model [Inflation = f (time) = a + b*time] and interest rate [Interest = f (time) = c + d*time], it has been observed that the series which offer the possibility for predictions and presents a deterministic trend it's interest rate. The inflation data series is random and not present a deterministic trend, the values of the series being random walk.

Thus, the compound rate (k) it's determined based on interest rate and so in research result 3 types of models which can predict:

- Model 1 – LAG – 1 autoregressive deterministic model
- Model 2 – Trend deterministic, logarithmic trend model
- Model 3 – Trend deterministic, power trend model

- ***Model 1 – LAG – 1 autoregressive deterministic model***

The following linear regression model was used:

*D(t) = a + b * D(t-1),*

where:

D represents monthly interest,

D(t) represents monthly interest t moment,

D(t-1) represents monthly interest with lag 1

Testing the model we have the following results:

Figure no. 1 - Estimating the parameters

SU
MMARY

[4] www.insse.ro and www.bnr.ro

OUTPUT

Regression Statistics	
Multiple R	0,995653651
R Square	0,991326194
Adjusted R Square	0,991149177
Standard Error	0,020625922
Observations	51

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	2,382482345	2,382482345	5600,19231	3,48804E-52
Residual	49	0,020846005	0,000425429		
Total	50	2,402332835			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*er 9*
Intercept	0,017834682	0,008549889	2,085954781	0,042211045	0,000653037	0,035016328	0,000653037	501
X Variable 1	0,948417845	0,012673549	74,83443265	3,48804E-52	0,922949395	0,973886294	0,922949395	388

Source: own calculation based on data from www.bnr.ro

From the results we can see that the model it's valid, so we can write it:

*D(t)=0.0178+0.9484*D(t-1)*

Based on this model we determined the *monthly compounding rate – 0.35%* and an *annual compounding rate – 4.17%.*

Model 2 – Trend deterministic, logarithmic trend model

We used the following model:

*D(t)= c + d *log(time),*

where:

D(t) represents monthly interest

Testing the model we have the following results:

Figure no. 2 - Estimating the parameters

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0,969164875
R Square	0,939280554
Adjusted R Square	0,938066166
Standard Error	0,057251274
Observations	52

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	2,535174463	2,535174463	773,4594297	4,43142E-32
Residual	50	0,16388542	0,003277708		
Total	51	2,699059882			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	1,382401117	0,02817383	49,06685139	5,83766E-44	1,325812316	1,438989918	1,325812316	1,438989918
X Variable 1	-0,250019073	0,008989859	-27,81113859	4,43142E-32	-0,268075798	-0,231962349	-0,268075798	-0,231962349

Source: own calculation based on data from www.bnr.ro

From the results we can see that the model it's valid, so we can write it:
D(t)= 1.3824 – 0.2500 log(time)*
Based on this model we determined the *monthly compounding rate – 0.02%* and an *annual compounding rate – 0.027%.*

Model 3 – Trend deterministic, power trend model

We used the following model:
$D(t)= e *log(Time)^{\wedge f}$,
where:
D(t) represents monthly interest

Testing the model we have the following results:
Figure no. 3 - Estimating the model

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0,970217803
R Square	0,941322585
Adjusted R Square	0,940149037
Standard Error	0,077013667
Observations	52

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	4,75743778	4,75743778	802,1166086	1,88222E-32
Residual	50	0,296555247	0,005931105		
Total	51	5,053993027			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95*
Intercept	-79895	0,037899068	-107,8833879	6,77887E-61	-4,164802412	-4,012557377	-4,164802412	-4,012557377
X Variable 1	-0,342496213	0,012093083	-28,32166324	1,88222E-32	-0,366785884	-0,318206543	-0,366785884	-0,318206543

Source: own calculation based on data from www.bnr.ro

From the results we can see that the model it's valid, so we can write it:

$D(t)= 0.0167 *log(Time)^{(-0.3424)}$

Based on this model we determined the *monthly compounding rate – 0.02%* and an *annual compounding rate – 0.027%.*

Synthetizing the results of the three models used (table no.1), we can admit that the LAG -1 autoregressive model is the model in order to determine compounding rate (k).

Determination method for k	**Adjusted R2**	**F stat**	**P-value**	
			Coefficient	**Intercept**
LAG – 1 autoregressive model	0,9911	5600,923	0,000000	0,042
Logarithmic trend model	0,9381	773,494	0,000000	0,000
Power trend model	0,9401	802,156	0,000000	0,000

Table no.1 Determination method for k

Source: own calculation

So we gone use de monthly compounding rate (0.35%) for determination the future value, based on LAG-1 autoregressive model. We can rewrite the formula:

$Fvalue=\sum_{i=1}^{540}[695 * (1 + 0.35\%)^{540}]$

Doing the calculations we have a future value for a woman who contribute 540 months, from 18 years to 63 years, set as *1.107.253,77 lei.*

Forward, will gone determine the pension for a woman who worked from age 18 years till the standard retirement age of 63 years and fulfill the full contribution period of 35 years. The average gross salary take into consideration is 2.223 lei[5] and the retirement point is 762,1 lei[6]. The amount of the pension is determined according with the law in force[7] and indexed whit inflation (used for the same period as interest in this study: January 2009-april 2013).

The pension calculation method according with the law in force is:

Pension = annual average score*value of the pension point

Annual average score = ($\sum_{n=1}^{t}$ annual score) / full contribution period,

[5] Establish for 2013

[6] Establish for 2013

[7]Capitolul IV, Sectiunea a 6-a, Art. 94-96 din Legea nr.263 din 16 decembrie 2010 privind sistemul unitar de pensii publice, publicata in Monitorul Oficial nr. 852 din 20 decembrie 2010

Where t represents contribution number of years
Annual score = ($\sum_{n=1}^{k}$ annual score) / 12,
Where k represents contribution numbers of months
Monthly score = average gross salary (individual) / monthly average gross salary
Based on this, the pension can be calculated:
Monthly score = 2.223 / 2.223 = 1
Annual score = 12 / 12 = 1
Annual average score = 45 / 35 = 1,28571
Pension = 1,28571*762,1 = *979,83 lei*
We index with monthly inflation rate, 0.43% (took into consideration) and results a pension of *984, 04 lei.*

Considering the pension received by a woman (984,04 lei) and the life expectancy at birth, it can be determine the present value of the future benefits, based on formula:

$Avalue=\sum_{n=1}^{x}[monthly\ pension/\ (1+k)^{n}]$

where,
- k represents the compounding rate
- n represents the period of time between retirement moment and the end of life

The amount of the pension is calculated on 984,04 lei, life expectancy at birth for 2013 is 77,89 years and the numbers of months from the retirement moment till the end of life according life expectancy is 179 months [for exemplification: 77,89-63)*12= 178,68=179 months]. So the present value of the future benefits can be write:

$Avalue=\sum_{n=1}^{179}[984{,}04/\ (1+0{,}35\%)^{179}]$

Doing the calculation the present value of future benefits leads to *188.954,47*lei.

Consumption index of contributions during the payment of pension = future value / present value. Based on this formula the index is 17,07%

2.2. Scenario 2 – pension system without accumulation

In this scenario, a woman who enter the work force at age 18 years and retire at age 63 years and fulfill a 35 years full stage of contribution will contribute for a period of 45 years (540 months) with a monthly contribution of 695 lei (each month). The total contribution for this period (calculated by multiply the monthly contribution with total number of months for which he contribute) is *375.300 lei.*

Further, based on the pension received (984,04 lei) and life expectancy at birth (77,89 years) minus retirement age (63 years) we can calculate the amount of future benefits in a scenario without accumulation. So, multiplying the pension received with the numbers of years from retirement moment till the end of life, we have a total amount of future benefits of *176.143,16 lei.*

Consumption index of contributions during the payment of pension is 46,93%

3. Results and conclusions

The results obtained in this research (table no. 2) shows that a system with accumulation is more sustainable, when benefits equal contributions. Also, we can observe that benefits are almost equal in both scenarios, so the difference in consumption index of contributions during the payment of pension comes from the total of contribution, because in the case of a system with accumulation the total contribution is higher. Hence, it results a lower value of the index in case of a system with accumulation.

In the system with accumulation the difference from 100% and the value of index – 17,07% represents "saving up" through accumulation in the capitalization version, which can be paid to followers or can be used to partially raise the monthly pension, in conditions when a finite period of time is specified.

In the system without accumulation the difference from 100% and 46,93% represents the redistribution inter and intragenerations and here one question can be rise: which should be the „decent level" of the social solidarity?!.

Table no. 2 Results obtained in the 2 scenarios

	System with accumulation	**System without accumulation**
	Women	**Women**
Total contribution	1.107.253,77	375.300
Total benefit	188.954,47	176.143,16
Consumption index of contributions during the payment of pension	17,07%	46,93%

Source: own calculation

The Romanian public system has been affect in the last decades from the demographic evolutions. Low birth and fertility rates, ageing, rising the life expectancy at birth and migration raise problems regarding the services for older persons.

The pension expenditures increase through an ageing population, with a life expectancy growing bigger, aspect that led to a reform of the public pension, in order to assure a long-term sustainability. So, even if Romania adopted a 3-pilon system, still needs to "find a way" for the sustainability of the public pension system.

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