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LONGEVITY RISK-ADJUSTED ACTUARIAL MODELLING AS A PATH TOWARDS PENSION SYSTEM SUSTAINABILITY IN RM

МОДЕЛИРОВАНИЕ АКТУАРНЫХ РИСКОВ ДОЛГОЛЕТИЯ В КОНТЕКСТЕ УСТОЙЧИВОСТИ ПЕНСИОННОЙ СИСТЕМЫ В РМ

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Abstract: *В связи с нарастающим риском долголетия и снижением рождаемости, государственная система социального страхования рискует столкнуться актуарным дефицитом из-за недостатка выплат. Данная статья направлена на анализ текущей финансовой ситуации бюджета государственного социального страхования и изучение потенциальных рисков, связанных с растущим числом пенсионеров. Методология, применяемая в этой статье, включает анализ нормативных актов и документов, статистический анализ и количественные методы оценки качества текущих пенсионных выплат.*
Key words: ***пенсионные системы, актуарное моделирование, устойчивость, риск долголетия***
JEL CLASSIFICATION : C53, J26, G22, H55

INTRODUCTION

The transformation of current demographic structure in the Republic of Moldova, which is characterised by the rising proportion of the elderly population, highlights the importance of ensuring financial sustainability of pension system. This article is aimed to critically explore financial stability of this structure through the prism of longevity risk-adjusted actuarial modelling as traditional PAYG system faces persistent funding shortfall due to constant brain-drain and increased life expectancy.

The study mainly focuses on the 45-65 age group, that are key contributors to the National Social Insurance Budget. Currently, this segment provides the main inflow of funds via the 24% social insurance contribution rate and also constitutes deferred actuarial obligation, that the system must fulfill over the next two decades. Methodology, applied in this research, incorporates both theoretical and practical aspects and is based on relevant studies developed either in our country or abroad.

MAIN CONTENT

The financial sustainability of current pension system, which is based on PAYG model, is mathematically defined by the Equilibrium Condition, where the present value of total contributions must equal the present value of total future benefits (Plamondon P., 2002). However, longevity risk, that our country is exposed to, introduces a stochastic drift into this equation as it affects the duration of the payment period. From an actuarial perspective, even if the retirement age is unified at 63 years, the systematic pressure on the State Social Insurance Budget is asymmetric due to the survival probability variance. (Verejan O., et al 2018)

In order to conduct an actuarial assessment of the pension model's sustainability, it is necessary to analyse the current exposure of contributors and the resource distribution structure of the State Social Insurance Budget. A key indicator is the ratio between the accumulated contributions of the 45-65 age group and their prognosed pension liabilities.

According to National Bureau of Statistics data (Figure 1, below), the total population of age group 45-65 exceeds 700 000 individuals. Moreover, age group 61-65 are in the immediate phase of retirement, transitioning from the category of contributors to the category of recipients. This fact

becomes a source of a deferred financial deficit which is further aggravated by a longevity risk. With an increase in life expectancy for this sizable group, the accumulated contributions may prove insufficient to cover their pension annuities in the long run.

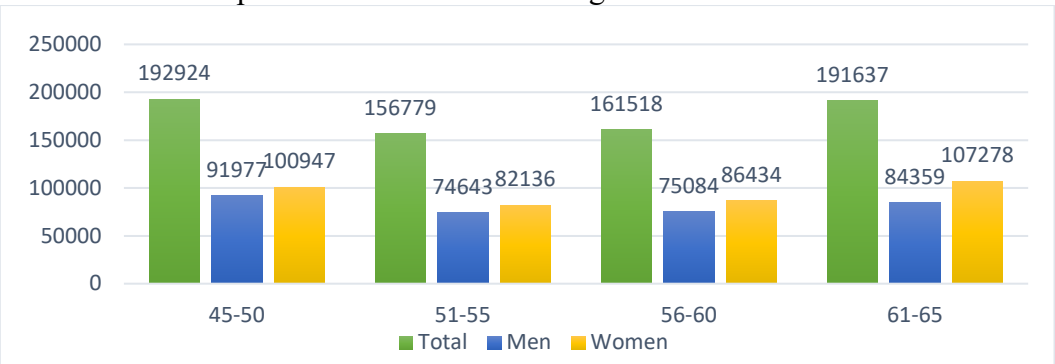


Figure 1. Resident population by age and sex
Source: National Bureau of Statistics

Table 1. Key performance indicators of the National Social Insurance Budget in 2024

Indicator	Value
Number of pensioners	528 666
Total annual expenditure (thousands of MDL)	19 872 130.7
Average retirement payment per person	3 683.2
Share of retirement benefits in total expenditures (%)	51%

Source: National Social Insurance House

According to the National Social Insurance House, the current expenditures for pension payments are 19 872 130.7 thousand MDL for 528 666 seniors. The average pension retirement payment is 3 683.62, meaning that average salary of 13 990 MDL is insufficient for covering this sum of money and as a result, requires transfers from the State Budget, assuming less than a 1:1 worker-to-pensioner ratio. Moreover, taking into consideration demographic issues, the burden on the working population is expected to increase, as the number of future pensioners from the studied age-group exceeds the current number of centenarians by 33%.

$$N_w = \frac{P \times N_p}{W \times c}$$

Formula 1. Required number of employees for covering pension payments
Source: evaluated by author based on Krpan M., (2018)

$$N_w = \frac{3683.2 \times 528666}{13990 \times 0.24} = 579\,932$$

Provided evaluation shows, that our pension system requires minimum 580 000 of officially-employed people with average salary of 13 990 MLD for covering retirement payments for seniors. Despite the fact, that current number of officially-employed workers is 632 400 (according to NBS data), the system's solvency margin is only 8%, which is considered extremely low.

In this regard, the main challenge for the Republic of Moldova is the upcoming retirement of the 45-65 age group, which currently consists of 702 000 of individuals. Even taking into account mortality rates for pensioners, the number of beneficiaries (N_p) is expected to double over the next 20 years, which inevitably leads to a structural deficit due to lack of the workforce.

Statistical data for 2024 reveals a critical gender pay gap, with the average gross earnings for women (12 787.8 MDL) being 16.6% lower than those for men (15 335.8 MDL), leading to disproportionate pressure generated by female group as this wage disparity directly turns into lower cumulative social insurance contributions (Figure 2). Although, the legal retirement age is about to equalise by 2028, the survival probability at the age 63 remains higher for women. Moreover, in

realms such as Education, Social Work and Healthcare, which are predominantly female-staffed, the lower contribution base is insufficient to fund the extended payout period. Consequently, longevity risk in the Republic of Moldova is primarily female-driven fiscal challenge, when the liability periods exceed the valorised capital inflows.

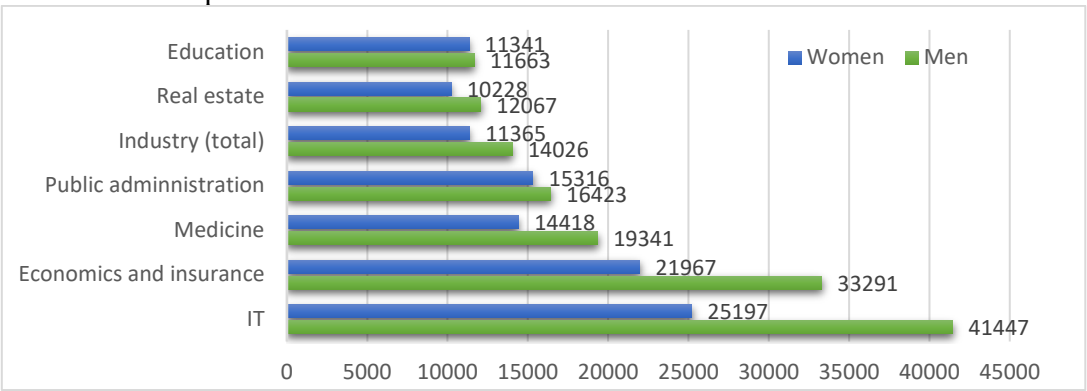


Figure 2. Average monthly gross earnings by gender and activity, 2024
Source: National Bureau of Statistics

The system's financial imbalance, described above, is rooted in the individual retirement payment calculation mechanism. In order to evaluate, how gender pay gap and increased live expectancy impact the social insurance budget, the mathematical structure of pension liabilities is about to be analysed. The transition from current budgetary expenditures to future pension liabilities requires an understanding of the individual benefit calculation system through the process of valorisation, that adjusts past earnings to current economic reality.

$$V_{av} = \frac{\sum \frac{con_i}{c_i} \times K_{vi}}{n}$$

V_{av} – valorised average insured income
con_i – the sum of individual contribution, paid in the i-year
C_i – amount of individual contribution, established in the i-year
n – number of paid months
K_{vi} – valorisation coefficient

Formula 2. Valorised average monthly insured income
Source: General Government Law on Pensions and Social Insurance

To illustrate the application of formula 2, the pension liabilities for a female professional in the Education sector are calculated. Assuming an average career path with average income of 11 341 MDL per month, the current valorisation coefficient K_{vi} = 1.0684 is applied to adjust the salary to current economic situation.

$$V_{av} = \frac{\sum \frac{11341 \times 0.24}{0.24} \times 1.0684}{34 \times 12} = 12\ 116.72\ MDL$$

Then, for calculation of full retirement pension payments on adjusted basis, there should be used another formula:

$$P = 1{,}35\% * T_t * V_{av}$$

P – full retirement pension
T_t – full insurance period
V_{av} - valorized average monthly insured income

Formula 3. Full retirement pension payment
Source: General Government Law on Pensions and Social Insurance

For a female professional in Education sector full retirement pension payment per month is:

$$P = 1{,}35\% * 34 * 12\ 116.72 = 5\ 561.6\ MDL$$

This is where longevity risk appears. To evaluate the sustainability of the system, the total lifetime contributions ought to be contrasted with the total expected payouts. For a female educator earning 11 341 MDL, her cumulative contribution to the Budget is:

$$\sum con_i = 11341 \times 0.24 \times 12 \times 34 = 1\ 110\ 510\ MDL$$

This amount of money is sufficient to cover the retirement period of 16.6 years, however, women are expected to live longer, that is why an actuarial deficit appears, when the state should cover the newly-appeared expenses.

CONCLUSION

Current pension system in the Republic of Moldova faces a huge pressure due to increased life expectancy, becoming more vulnerable than ever. Longevity risk is predominantly female-driven, which inevitably creates a deferred actuarial deficit as the Social Insurance Budget has to cover future liabilities that exceed the contributions made throughout their lives. Furthermore, it is evaluated that the gap between the officially-employed contributors and the number of pensioners is growing at a lightning speed, demonstrating a 1:1 pensioner-worker ratio. This means, that current social insurance revenues can not fully cover pension payments without significant transfers from the State Budget.

In order to tackle the occurred situation, there can be taken some steps forward. Firsly, by integrating private pension fuds and transitioning from PAYG to mixed pension payments, the pressure on the State Insurance System can be significantly reduced with the help of voluntary savings. What is more, attracting new workforce and encouraging official employment among younger generation can help increase budget revenues as well as reduce financial gap caused by appeared longevity risk. However, the implementation of these policy recommendations into real-world condition requires a revolution in the pension system itself and attraction of highly-qualified professionals in this realm.

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