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IMPROVEMENT OF CITIZENS' PENSION SYSTEM UNDER THE INFLUENCE OF DEMOGRAPHIC AND ECONOMIC FACTORS BASED ON ECONOMETRIC MODELS

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Abstract:
The article studies the system of social protection, in particular, the issues of pension provision. The average monthly wages and pensions, and changes in the replacement rate in the pension system are analyzed. The methodology for determining the size of pensions and factors affecting the size of pensions are investigated. Based on the research results, proposals and recommendations for achieving a decent retirement have been developed.

Keywords: pension, pension provision, old-age pension, salary, seniority, pension fund, pensioner, pension, coverage ratio, demography, income, financial stability.

INTRODUCTION

Scientific research results aimed at adapting the pension system to the international standards of social security and ensuring the principles of social and economic justice have been carried out. In these studies, issues such as determining the optimal retirement age, achieving adequate pension amounts, improving the procedure for accounting for seniority in pension awarding, effective organization of pension provision, and strengthening the investment activities of pension funds have been solved. Also, the issues of improving the social insurance system and introducing a multi-level pension system are important for ensuring the development of the pension system is defined as the direction. However, problems in ensuring the financial stability of the pension system, harmonizing pension amounts with minimum consumption costs, determining the basis of the basic amount of pension, paying a survivor's pension to students and taking into account the period of child care when assigning a pension to women, issues related to the establishment of private pension funds and raising the retirement age have not yet been positively resolved.

According to the 2020-2022 report of the International Labor Organization on global social protection, "Pensions, among all social payments, play an important role in reducing poverty, especially among the elderly, and are the only source of income for most pensioners" [1].

The reform of the pension system in Uzbekistan directed to ensuring a consistent increase in pension amounts of pensioners by the country's economic indicators, to introduce a multi-level and state-guaranteed pension system based on international experience, excess documents from citizens demanding a transition to the system of assigning pensions based on

interdepartmental electronic information exchange without requiring. At the same time, the increase in the number of pensioners due to the increase in life expectancy, serious changes in the financial stability of the off-budget Pension Fund as a result of the improvement of the tax policy, the achievement of adequate pension amounts, the improvement of the procedure for assigning survivor's pensions, such as strengthening the principles of social and economic justice in the pension system require a revision of the main approaches to the field of pension provision. In this regard, "revision of the procedure for the appointment and payment of pensions and allowances" [2], and "improvement of the pension system" [3] were identified as one of important directions. In turn, these aspects require deep research and development of the citizen pension system.

2. LITERATURE REVIEW

Issues related to the creation and improvement of theoretical and methodological bases for the development of the pension system of citizens by foreign economic scientists: G.Tetlow [4], G.Vobruba [5], J.Peng [6], L.Christensen, A.Moore [7], C.Campbell [8], S.Butler [9].

In the scientific works of foreign scientists such as E.Azarova [10], G.Andryushchenko [11], S.Brovchak [12], D.Gusakov [13], M.Kulikova [14], N.Kosarenko [15], S.Orlov, A.Shemetov [16], V.Roik [17], A.Fedotov [18], A.Ijaeva [19], etc. issues related to the concepts of provision, including pension provision, development of the social insurance system, social protection of the population, development of the pension system.

A.Vakhabov [20], B.Umurzakov [21], R.Dalimov [22], T.Malikov, O.Olimzhanov [23], Sh.Shokha'zami [24], R.Karlibaeva [25], G.Kasimova [26], N.Majidov, B.Khusanov [27] in their studies of local economists' legal and institutional foundations of organization, theoretical and methodological aspects, development trends, problems in the field, priority directions, reforms were researched.

Despite the research and theoretical research carried out within the framework of this topic, precisely the issues of the development of the pension system of citizens have not been fully studied comprehensively and systematically, and the reform of the pension system of the current regulatory documents changes according to the conditions of production indicate the need to conduct deep scientific research in this field.

3. RESEARCH METHODOLOGY

The methodology of the research is the principles and patterns of the pension system of citizens. The study of the pension system of citizens is based on the collection, processing and analysis of information about the pension system, determining the factors that affect it. In the study, there are used methods such as generalization, logical analysis, synthesis, induction and deduction, a systematic approach, correlation and regression analysis.

4. ANALYSIS AND RESULTS

Sustainable development of the pension system of citizens in the Republic of Uzbekistan implies providing enough pensions for citizens to live comfortably in the future and at the same time ensuring the financial stability of the pension system. At the same time, the

insufficient amount of pensions to meet the needs of pensioners and the lack of income from the fund(s) formed to finance pension payments are among the main problems in the pension system today.

According to the current legislation, it is necessary for the Pension Fund, which finances pension payments in our country, to be in a balanced state of income and expenses. "The extra-budgetary income of the Pension Fund is mainly formed at the expense of social tax and transfers from the state budget calculated at fixed rates about the wage fund" [28]. Ensuring the pension system's financial stability requires that its revenues are sufficient to cover its costs in the long term. This process can be described mathematically as follows:

$$O'PM_t * PS_t \leq \sum_{i=1}^{k}(MHF_t * ISS_t) + \sum_{m=1}^{n}(QIST_t * QISS_t) + \sum_{z=1}^{l}(IBT_t * IBS_t) + T_t + e \quad (1)\ [29]$$

Description of modifiers of this equation: O'PMt – the average amount of pension in the t-period; PSt – the number of pensioners in the t-period; MHFt - wage fund in t-period; ISSt – social tax rate in period t, in percentages compared to MHF; QISTt – number of fixed social taxpayers in period t; QISSt – fixed social tax rate in period t; IBTt – the number of voluntary contributors in the t-period; IBSt – voluntary contribution rate in t-period, in fixed amounts; Tt – State budget transfers in the t-period; e - other unaccounted factors. i, k, m, n, z, l are indicators representing the differentiation of one type of variable.

In equation (1), mandatory deductions from the realization of goods (work, services) and compulsory insurance contributions of citizens who participated in providing funds for pension provision of citizens until 2019 are not included. In addition, the left side of the equation does not include social benefits paid from the Pension Fund in certain periods. If necessary, they can be added to the above formula for analysis. Finding the average pension amount is calculated using the following formula:

$$O'PM_t = \frac{PX_t}{PS_t} \quad (2)\ [29]$$

Description of the variables of this equation: PXt – total pension costs; PSt - total number of pensioners.

The formula for finding total pension costs

$$PX_t = \sum_{i=1}^{PS} PM_t \quad (3)\ [29]$$

Description of the variables of this equation: PMt is the amount of pension in the t-period; PS is the number of pensioners in period t.

The differential equation for calculating total pension costs in the section on tension types is as follows:

$$PX_t = \sum_{i=1}^{PS_{YDP}} YDPM_t + \sum_{i=1}^{PS_{NP}} NPM_t + \sum_{i=1}^{PS_{BYP}} BYPM_t \quad (4)\ [29]$$

Here: YDPMt is the amount of age-related pension in period t; NPMt is the – amount of disability pension in period t; BYPMt is – the amount of survivor's pension in period t; PSYDP – is the number of pensioners by age in the t-period; PSNP – number of disability pension recipients in period t; PSBYP - the number of survivors' pension recipients in period t;

The differential equation for calculating the average pension amount in the section of pension types:

On an old-age pension:

$$O'PM_{YDP} = \frac{\sum YDPM_t}{\sum PS_{YDPt}} \quad (5)\ [29]$$

On disability pension:

$$O'PM_{NP} = \frac{\sum NPM_t}{\sum PS_{NPt}} \quad (6)\ [29]$$

On survivor's pension:

$$O'PM_{BYP} = \frac{\sum BYPM_t}{\sum PS_{BYPt}} \quad (7)\ [29]$$

The differentiated formula for finding the average pension amount:

$$O'PM_t = \frac{\sum YDPM_t + \sum NPM_t + \sum BYPM_t}{\sum PS_{YDPt} + \sum PS_{NPt} + \sum PS_{BYPt}} \quad (8)\ [29]$$

Based on the current state of pension provision, the above-differentiated formulas can be used in the analysis. The above formulas are formed based on the indicators of the current pension system.

The reform of the state pension system involves long periods, primarily because it depends on demographic changes. Changes and updates made in this regard take a very long time to take effect or have negative effects. The proof of this can be seen in the results of pension system reforms implemented in many countries of the world. It is known from international experience that changes made during a short period will either cause dissatisfaction in society or be a heavy burden on the economy.

Reform of the pension system, as we noted above, should be carried out in parallel with demographic factors. An important factor affecting the pension system, in particular, the number of pensioners, is undoubtedly the life expectancy of the population. In our study, we will try to analyze the change in the number of pensioners and pensioners and the change in life expectancy in the example of Uzbekistan. To do this, we first sort out the factor and outcome variables. As indicators representing changes in life expectancy, the indicators of the share of women and men of retirement age in the total number of women and men in 2010-2021, as a result, indicator, namely,

Table 1 The number of pensions granted in Uzbekistan during 2010-2021 and the share of the population of retirement age in the total population [30]

Indicators	The number of assigned pensions (TP), ta	Share of women aged 55 and over in the total number of women (A55), in percent	Share of men aged 60 and over in the total number of men (E60), in percent
2010 year	193188	9.5569	5.1964
2011 year	116363	9.8792	5.3639
2012 year	129112	10.2072	5.4949
2013 year	139219	10.571	5.6738
2014 year	157491	10.9941	5.8219
2015 year	195928	11.4081	5.9937
2016 year	225317	11.8595	6.2052

2017 year	251894	12.3291	6.4598
2018 year	277397	12.7774	6.7351
2019 year	277261	13.2056	7.0674
2020 year	275109	13.6006	7.3919
2021 year	330450	13,929	7.662

Based on the econometric analysis of table data, we will be able to forecast the effect of changes in the share of pensioners on the number of pensions. At the first stage of the analysis, we can check whether there is a correlation between the selected factor signs and the resulting sign through the correlation coefficient (see Table 2).

Table 2 Correlation coefficients between the number of pensions granted in Uzbekistan during 2010-2021 and the share of the population of retirement age in the total population [31]

TP	A55	E60	Indicators
1.0000	0.9158	0.9131	TP
	1.0000	0.9907	A55
		1.0000	E60

The correlation coefficient indicates whether the change of one indicator has an effect on the change of another factor and varies in the range (-1;1) if the correlation coefficient between the two factors is greater than 0.7 if it is higher or lower than -0.7, it is considered that there is a strong relationship between the factors and it is concluded that the factors can be used in econometric modelling. In our example, the correlation coefficient between the number of assigned pensions and the share of women over 55 (A55) and the share of men over 60 (E60) is 0.9158 and 0.9131, respectively. So there is a very strong correlation between the factors. The correlation between A55 and E60 is 0.9907, but there is no interaction between them.
At the next stage of our analysis, we form the descriptive statistics of the obtained factors and the resulting signs (Table 3).

Table 3 Descriptive statistics of the number of pensions granted in Uzbekistan in 2010-2021 and the share of the population of retirement age in the total population [32]

Indicator	Average	Median	Minimum	Maximum
TP	214061	210623	116363	330450
A55	11,693	11,634	9.5569	13,929
E60	6.2555	6.0994	5.1964	7.6620
Indicator	**Standard deviation**	**Variation**	**Asymmetry**	**Excess**
TP	69521.	0.32477	0.058059	-1.2313
A55	1.4901	0.12743	0.067083	-1.3229
E60	0.81426	0.13017	0.39938	-1.0937

The average annual number of pensions granted during 2010-2021 is 214,061, the least amount of pensions granted in one year is 116,363, and the largest number of pensions is 330,450. The average share of women over the age of 55 in the total number of women is 11.693 percent, the minimum is 9.5563 percent, and the maximum is 13.929 percent, while in

men these indicators are 6.2555, respectively; 5.1964 and 7.6620 percent. By conducting analyzes with the participation of selected factors according to the hypothesis, we create a regression equation that satisfies all the necessary conditions (Table 4).

Table 4 The regression equation of the effect of the number of pensions granted in Uzbekistan during 2010-2021 and the share of the population of retirement age in the total population [33]

Factors	Coefficient	Standard error	t-statistics	P-value	Confidence level
const	2.24609	1.30165	1.726	0.0985	*
Ln A55	6.87069	1.38887	4.947	0.0008	***
Ln E60	-3.79362	1.20408	-3.151	0.0117	**
The sum of Squares of Residuals		12.80837	Standard error		1.192959
R-squared		0.945712	Adjusted R-squared		0.933649
F-statistic(2, 12)		78.39196	R-value (F)		2.02e-06
Logarithmic closeness to truth		-17.41841	Akaike criterion		40.83683
Schwartz criterion		42.29155	Hanna-Quinn criterion		40.29824
Rho parameter		0.072050	Darbin-Watson statistics		0.888299

*Note: *** Statistically significant at 1 percent significance level; ** Statistically significant at the 5 percent significance level; *Statistically significant at the 10 percent significance level.*

When constructing the model, we used logarithmic values of the indicators, since the variation indicators are smaller than the natural logarithmic values of the indicators. By performing the analysis by the least squares method, we selected the optimal regression equation for ourselves (see Table 5). Here, the natural logarithm value of the assigned annual pensions (LnTP) was taken as the dependent variable, and the natural logarithm value of the share of women of retirement age in the total number of women (LnA55) and the natural logarithm value of the share of men of retirement age in the total number of men was taken as independent variables (LnE60) obtained.

Inductive analysis of the model: the Fisher-Snedekor F-test value is less than 0.05, indicating that the constructed regression equation is indeed valid, and our constructed model is valid for application. The coefficients of the selected factor variables LnA55 and LnE60 were confirmed to be less than 0.05 and valid when tested by Student's t-test, which indicates their applicability. Darbin-Watson statistic (0.8883), which verifies the absence of autocorrelation problem in the constructed model, is also in the required range (0.569;1.274), which confirms that there is no autocorrelation problem in our model. Therefore, this model is suitable for inductive analysis. Interpretive analysis of the model:

$$LnTP = 6.87069*LnA55 - 3.79362LnE60 + 2.24609 + e \quad (9)$$

Here: LnTP –the natural logarithmic value of pensions assigned during the year; LnA55– natural logarithm value of the share of women of retirement age in the total number of women; LnE60 –the natural logarithm value of the share of men of retirement age in the total number of men; const – initial value; e - unaccounted factors.

The coefficient of determination of the created equation is equal to 0.9336, and 93.36% of the change in the number of pensions assigned during the year can be explained through the created model. The coefficient in front of LnA55 (6.87069) - a 1% increase (decrease) in the share of women of retirement age in the total number of women leads to an increase (decrease) in the number of pensions by 6.87%, the coefficient in front of LnE60 (-3.79362) a 1% increase (decrease) in the share of men of retirement age in the total number of men represents a 3.79% decrease (increase) in the number of pensions to be awarded.

The most important stage of research is forecasting the future period based on the conducted analysis. We also make predictions based on the model obtained from the research. For this purpose, based on the current demographic situation, we will form forecasts of the total shares of women and men of retirement age under 3 (three) different scenarios and make forecasts of the number of pensions to be assigned based on this data (see Table 5).

Table 5 Projections of the share of women and men of retirement age in the total number of women and men in 2022-2027 [34]

Years	Scenario 1		Scenario 2 (pessimistic scenario)		Scenario 3 (optimistic scenario)	
	A55	E60	A55	E60	A55	E60
2022	14.3338	7.9442	14.2313	7.8643	14.4364	8.0242
2023	14.7385	8.2205	14.5863	8.0561	14.8907	8.3850
2024	15.1431	8.4968	14.9477	8.2256	15.3386	8.7679
2025	15.5478	8.7730	15.3115	8.3779	15.7841	9.1681
2026	15.9525	9.0493	15.6763	8.5153	16.2286	9.5833
2027	16.3571	9.3255	16.0413	8.6393	16.6729	10.0118

In the forecasts according to 3 different scenarios, the share of women and men of retirement age in the total population will increase during 2022-2027. The share of women of retirement age in the total number of women (A55) will increase from 14.3338 percent 2022 in 2022 to 16.3571 percent in 2027 under scenario 1, correspondingly an increase of 2.4281 percentage points over the figure in 2021, in 2022 under the pessimistic scenario. will be 14.2313 percent in 2027, and will reach 16.0413 percent in 2027 and increase by 2.1123 percentage points compared to 2021, and according to the optimistic scenario, these indicators will increase from 14.4364 percent in 2022 to 16.4364 percent in 2027, respectively. It can reach 6729 percent and increase by 2.7439 percentage points from the indicator in 2021.

The share of men of retirement age in the total number of men (E60) will increase from 7.9442 percent in 2022 to 9.3255 percent in 2027 under the 1st scenario, correspondingly 1.6635 percentage points higher than the figure in 2021. Under the pessimistic scenario, 2022 will be 7.8643 percent in 2027 and will reach 8.6393 percent in 2027 and increase by 0.9773 percentage points compared to 2021. According to the optimistic scenario, these indicators will increase from 8.0242 percent in 2022 to 10.0242 percent in 2027, respectively. It can reach 0118 percent and increase by 2.3498 percentage points from the indicator in 2021.

Based on the data of table 6 below, we will make a forecast of the number of pensions to be assigned during the years 2022-2027 through the model.

Table 6 Forecasts of the number of pensions to be assigned during 2022-2027 [35]

Years	Scenario 1	Scenario 2 (pessimistic scenario)	Scenario 3 (optimistic scenario)
2022	320639	317144	324183
2023	341011	342829	339454
2024	362337	374803	351272
2025	384686	412411	361027
2026	408032	455814	369348
2027	432411	505415	376670

It can be seen from the data of Table 6 that according to all three scenarios, the number of pensions granted in 2022-2027 is expected to increase, but in the forecast, the number of pensions granted in 2022 will be the same as in 2021 in all three cases (330450) is predicted to be less. From 2023, pensions to be assigned will be more than in 2021 under all three scenarios. We illustrate this using Figure 4.4 below. According to the forecasts, 432,411 pensions will be assigned in 2027 under Scenario 1, 505,415 under Scenario 2, and 376,670 under Scenario 3. This is 31, 53, and 14 percent more than the indicators in 2021, respectively.

5. CONCLUSION

In the conditions of current economic development, the main criterion for the effectiveness of the pension system is the level of the coverage ratio and the share of the State expenses for pension provision in the volume of GDP, taking into account demographic factors. The higher its level, the more effectively the pension system can effectively solve the tasks of maintaining the standard of living of pensioners in the conditions of the increase in life expectancy and the increase in the level of pension costs. However, the fact that this indicator level is 1.46 in Uzbekistan indicates a relatively low level of coverage coefficient in the conditions of high state expenses for pension payments and is a negative situation from the point of view of ensuring the effectiveness of the pension system.

Starting in 2019, reforms in the tax system, including the cancellation of insurance contributions deducted from the income of citizens to the off-budget pension fund, had a serious negative impact on the income of the Pension Fund. This situation led to the subsidization of funds missing in the financing of citizens' pension payments from the State budget. At the same time, it is necessary to increase the employment of the population and legalize informal jobs. It is also necessary to reform the national pension model and establish a three-tier pension system to increase the interest of the population in paying pension contributions based on international experiences. This increases citizens' interest in paying pension contributions.

The following are important factors in ensuring the financial stability of the pension system and further improving the welfare of pensioners in the member countries of the Organization

for Economic Cooperation and Development: the development of a multi-level pension system that combines distributed and accumulated schemes that provide minimum guarantees; gradually increasing the retirement age based on the life expectancy after the retirement age; encouraging late retirement; promotion of labor activity after reaching the retirement age; strengthening of monitoring and control over the financial activity of pension funds; increasing the amount of funds for mandatory pension insurance and additional pension provision; strengthening the insurance mechanism of financing pension programs by legalizing informal employment, covering the employed population with various pension programs; gradually increasing the minimum length of service required for the appointment of a pension; distribution of the burden of pension payments within pension systems by funding sources (private/public), levels (public/corporate/private) and forms (distributive/accumulated).

It is necessary to organize the state pension system in the coming years by these changes, to increase the financial stability of the non-budgetary Pension Fund, to reform the model of the pension system, and to implement the necessary measures for the sustainable development of pension insurance. is enough.

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