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PERSPECTIVES FOR DEVELOPMENT OF THE PENSION SYSTEM IN RUSSIA ON THE BASIS OF ACTUARIAL CALCULATIONS

The article deals with the problems of pension provision in Russian Federation. The features of actuarial modelling of the pension systems development are considered. Construction order of the actuarial model of pension provision development in Russia is provided. Forecasts on Russian pensioner quantity, sizes of their labor and social pensions are presented on the basis of actuarial calculations for the perspective up to 2030. The forecast of the dynamics of Pension Fund deficit in Russian Federation, taking into account the pension reforms introduced in 2015 is given. The ways to improve the pension system in Russia are proposed basing on the analysis conclusions.
Keyword: *actuarial calculations; pension reform; pension system; forecast.*

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ПЕРСПЕКТИВИ РОЗВИТКУ ПЕНСІЙНОЇ СИСТЕМИ РОСІЇ НА ОСНОВІ АКТУАРНИХ РОЗРАХУНКІВ

У статті розглянуто проблеми розвитку пенсійного забезпечення Російської Федерації (РФ). Виявлено особливості актуарного моделювання розвитку пенсійних систем. Представлено порядок побудови актуарної моделі розвитку пенсійного забезпечення Росії. На основі актуарних розрахунків зроблено прогнози чисельності російських пенсіонерів, розмірів трудових і соціальних пенсій на перспективу до 2030 року. Надано прогноз по динаміці дефіциту пенсійного фонду РФ з урахуванням пенсійних змін 2015 року. На основі проведеного аналізу запропоновано шляхи вдосконалення пенсійної системи Росії.
Ключові слова: *актуарні розрахунки; пенсійна реформа; прогнозування; пенсійна система.*
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ПЕРСПЕКТИВЫ РАЗВИТИЯ ПЕНСИОННОЙ СИСТЕМЫ РОССИИ НА ОСНОВЕ АКТУАРНЫХ РАСЧЕТОВ

В статье рассмотрены проблемы развития пенсионного обеспечения Российской Федерации (РФ). Выявлены особенности актуарного моделирования развития пенсионных систем. Представлен порядок построения актуарной модели развития пенсионного обеспечения России. На основе актуарных расчетов сделаны прогнозы численности российских пенсионеров, размеров трудовых и социальных пенсий на перспективу до 2030 года. Дан прогноз по динамике дефицита пенсионного фонда РФ с учетом пенсионных преобразований 2015 года. На основе проведенного анализа предложены пути совершенствования пенсионной системы России.
Ключевые слова: *актуарные расчеты; пенсионная реформа; прогнозирование; пенсионная система.*

Problem setting. In this article forecast on the pension system condition is based on actuarial accounting. Actuarial modelling appeared in Russia in the early 1990s and was based on the techniques developed in Western countries.

Actuarial assessment of pension systems involves the evaluation of the pension system ability to perform the undertaken financial obligations to pay pensions in the long term under different scenarios of demographic and socioeconomic country's development.

Actuarial modelling in pension insurance is understood as calculations in form of mathematical dependences on the mechanism of formation and expenditure of

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accumulated insurance fund for long-term insurance operations, connected to population life expectancy.

Several factors make the main contribution to the pension system: demographic, socioeconomic, macroeconomic and pensionary ones are taken into account while considering the actuarial pension models.

Resent research and publications analysis. The main directions of actuarial modelling are widely covered by Booth et al. (2004), Bowers et al. (1997), Fedotov (2012), Promislow (2010), Rotar (2006), Solovyev (2006) and others. At the same time it should be noted that construction of adequate actuarial models is rather complicated and time-consuming thus requiring further development and study.

The research objective is the construction of an actuarial model of the pension system in Russia, taking into consideration the reforms of 2015, in order to evaluate the financial performance of the pension system.

Key research findings. By the end of 2013 the deficit of Russian Federation Pension Fund amounted to about 80 bln USD, which accounted for 3.8% of gross domestic product (GDP) (Table 1).

Table 1. **The deficit of Russia's Pension Fund,** *bln USD*

Years	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Contributions to pension provision	16.48	21.54	27.19	34.89	42.97	44.83	65.52	97.08	104.36	119.28
Contributions to insurance pensions part	14.00	19.03	23.94	30.37	34.29	35.07	53.06	82.66	87.91	101.52
Contributions to cumulative pensions part	2.48	2.51	3.25	4.52	8.68	9.76	12.46	14.42	16.44	17.76
Means for payment of pensions	31.93	38.66	44.41	51.76	69.76	88.10	127.59	140.73	156.00	181.03
Pension Fund deficit	17.93	19.62	20.47	21.39	35.47	53.03	74.52	58.07	68.09	79.52

Source: author's development (Bataev, 2014) on the basis of official statistics (Indicators of the pension and social provision of the Russian Federation; Interstate statistical Committee of the CIS, 2012).

Further increase in the deficit of the pension system became an unbearable burden for Russia's budget, from which it takes repayment. In this regard, steps were taken to reduce the disparity between pensions and collected taxes.

A new pension reform with has been initiated in 2015 the main task to cut down the deficit of the Pension Fund of Russian Federation.

Here we will simulate the development of pension system in Russia on the basis of actuarial calculations and taking the reformation into account.

There exist universal foreign models (the PROST model of the World Bank and the International Labor Organization model). These models allow performing actuarial modelling as purely distributive, cumulative, and mixed systems, regardless pension legislation and specific state features (Bowers et al., 1997; Dickson et al., 2013; Rotar, 2006; Solovyev, 2006).

To make a forecast on Russian pension system a new actuarial accounting model which takes into account the details and specifics of Russian pension law was developed. The data from the Department of Economic and Social Affairs of the United Nations (UN) (the forecast on Russia's population), the Federal Service of State Statistics data and the information of Ministry of Economic Development of Russian Federation (the socioeconomic development of Russia for 2013–2015; scenario conditions of long-term socioeconomic development till 2030) were used for actuarial modelling.

The actuarial model building starts with the assessment of the revenue part of Russian Federation pension system. For the beginning we estimate the main financial indicators of mandatory pension insurance system, characterizing the development of Russian pension system (Indicators of the pension and social provision of Russian Federation).

For this purpose we carry out the retrospective data analysis for 2004–2013 and estimate the level of tax collection to the Pension Fund of Russian Federation on insurance pension part by the following formula (Bowers et al., 1997; Fedotov, 2012; Rotar, 2006; Solovyev, 2006):

$$K_S = \frac{I_S}{I_{SR}}, \tag{1}$$

where K_S – the factor of tax collection on the insurance pension part; I_S – income of Russian Federation Pension Fund on the insurance pension part; I_{SR} – possible income of Russia's Pension Fund on the insurance pension part.

The quantity I_{SR} is calculated by the following formula:

$$I_{SR} = W\left(\frac{N_1 T_{S1}}{N\ 100} + \frac{N_2 T_{S2}}{N\ 100}\right), \tag{2}$$

where W – wages fund; N_1 – number of employees born in 1966 and older; N_2 – number of employees born in 1967 and younger; N – the total number of employees in the economy; T_{S1} – tariff for insurance contributions of employees born in 1966 and older; T_{S2} – tariff for insurance contributions of employees born in 1967 and younger.

The wage fund is determined by the formula:

$$W = W_{AM} \times N, \tag{3}$$

where W_{AM} – the average monthly wage in Russia.

The level of tax collection to the Pension Fund of Russia on the cumulative pension part is calculated as follows (Bowers et al., 1997; Dickson et al., 2013; Fedotov, 2012; Rotar, 2006l Solovyev, 2006):

$$K_N = \frac{I_N}{I_{NR}}, \tag{4}$$

where K_N – the factor of tax collection on the cumulative pension part; I_N – income of Russian Federation Pension Fund on the cumulative pension part; I_{NR} – possible income of Russia's Pension Fund on the cumulative pension part.

I_{NR} is estimated by the following formula:

$$I_{NR} = W \frac{N_2 T_N}{N\ 100}, \tag{5}$$

where T_N – tariff for cumulative contributions of employees born 1967 or younger.

The obtained analysis results are shown in Table 2.

Table 2. **Coefficients of tax collection to the Pension Fund of Russian Federation,** *author's development*

Years	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
I_s, bln USD	14.00	19.03	23.93	30.38	34.28	35.07	53.07	82.66	87.93	101.52
I_n, bln USD	2.48	2.51	3.25	4.52	8.68	9.76	12.46	14.42	16.44	17.76
I_{sr}, bln USD	22.99	27.18	33.78	43.55	54.71	57.02	99.97	153.11	142.35	157.73
I_{nr}, bln USD	3.29	6.68	8.83	16.24	16.41	17.98	21.29	25.04	31.17	36.14
K_s, %	60.87	70.02	70.87	69.73	62.68	61.51	53.08	53.99	61.76	64.36
K_n, %	75.29	37.55	36.79	27.86	52.9	54.27	58.5	57.58	52.76	49.14

The average value of the insurance contributions collection factor amounted to $K_S = 62.89\%$, and the coefficient of collection to the cumulative part of the pension system $K_N = 50.26\%$.

Building a profitable part of the actuarial model on collected contributions was carried out as follows:

$$I = I_S + I_N. \tag{6}$$

The amount of income on the insurance pension part is can be described by the following formula:

$$I_S = W\left(\frac{N_1 T_{S1} K_S}{N\ 100\ 100} + \frac{N_2 T_{S2} K_N}{N\ 100\ 100}\right). \tag{7}$$

The quantity I_N was calculated by the following formula:

$$I_N = W \frac{N_2 T_N K_N}{N\ 100\ 100}. \tag{8}$$

The following results (Table 3) were received by using the retrospective analysis on the number of employed in the economy, the distribution of workers born in or before 1966 and persons born in 1967 and younger, and also the dynamics of average monthly wages in Russia, in total with the forecast of development of Russian Federation till 2030 (Labor market, employment and wages; The forecast of socioeconomic development of Russian Federation...). The following insurance contributions indicators were introduced in modeling: $T_{S1} = 22\%$, $T_{S2} = 16\%$ and $T_N = 6\%$. Collection tariffs of pension contributions were taken into account by the maximum value as the regressive rate influence was considered when calculating the coefficients of collection to the Pension Fund. In addition, preferential categories of insured persons were taken into consideration in these factors.

The costs of the Russia's Pension Fund for pension payments calculate by the following formula:

$$E = E_R + E_{STPR}, \tag{9}$$

where E – total payments of Russian Federation Pension Fund on pensions; E_R – payment of retirement pensions; E_{STPR} – state-provided pension payments.

Table 3. **Income from insurance contributions to Russian Pension Fund till 2030,** *author's development*

Years	2014	2016	2018	2020	2022	2024	2026	2028	2030
W_{am}, USD	1140.31	1367.24	1579.98	1758.52	1902.01	2057.22	2225.08	2406.65	2603.03
N, mln persons	71.08	70.25	69.41	68.58	67.74	66.90	66.07	65.23	64.40
W, bln USD	972.68	1152.53	1316.02	1447.09	1546.09	1651.61	1764.06	1883.86	2011.47
N_1, mln persons	21.11	18.05	15.06	12.13	9.28	6.48	3.76	3.17	2.58
N_2, mln persons	49.98	52.20	54.35	56.44	58.46	60.42	62.31	62.06	61.82
I_s, bln USD	108.77	127.14	143.19	155.26	163.55	172.22	181.29	193.01	205.43
I_n, bln USD	20.62	25.83	31.08	35.92	40.24	44.98	50.17	54.05	58.24
I, bln USD	129.39	152.97	174.27	191.18	203.80	217.21	231.46	247.06	263.66

The value of payments on retirement pensions calculates using the following formula:

$$E_R = E_{OA} + E_{DIS} + E_{SUR}, \quad (10)$$

where E_{OA} – old-age pension payments; E_{DIS} – disability pension payments; E_{SUR} – survivor's pension payments.

The pension quantity for each category can be calculated from the values of monthly pensions and the number of pensioners in each category. Then the total costs will be calculated by the following formula:

$$E = P_{OA}N_{OA} + P_{DIS}N_{DIS} + P_{SUR}N_{SUR} + P_{STPR}N_{STPR}, \quad (11)$$

where P_{OA} – average monthly old-age pensions; P_{DIS} – average monthly disability pensions; P_{SUR} – average monthly survivor's pensions; P_{STPR} – average monthly state-provided pensions; N_{OA} – number of old-age pensioners; N_{DIS} – number of disability pensioners; N_{SUR} – number of survivor's pensioners; N_{STPR} – number of state-provided pensioners.

The number of Russian pensioners till 2030 was forecasted on the basis of the retrospective data for 2002–2013, which is quite clearly correlated with the forecast on the number of pensioners according to Department of Economic and Social Affairs of the United Nations (Figure 1).

There was carried out the analysis on the distribution of pensioners by types of pension provision for 2002–2013 year, based on the data of state statistics (Table 4).

The old-age pensions quantity was predicted in a binding to the average monthly wage in Russia; which makes today about 37% and in the forecast should not be below the current level and in the long term should reach the value in 40% of average salary. Other pensions types are considered in relation to retirement pensions and in

perspective their value should not be less than 70% of retirement pensions (The forecast of socioeconomic development of Russian Federation and the individual sectors of the economy).

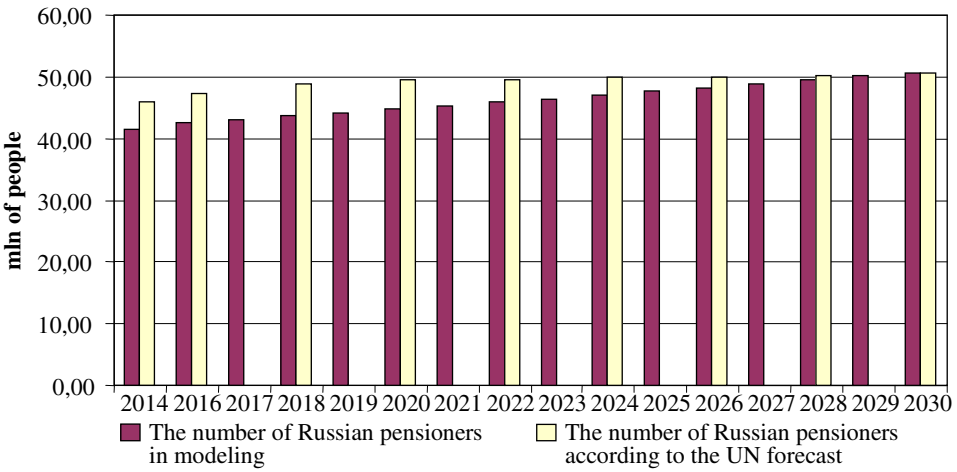

Figure 1. **Forecast on the quantity of Russian pensioners till 2030,** *author's development on the basis of statistics* (www.esa.un.org)

Table 4. **Distribution of pensioners by types of pension**

Years	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	The average value
old-age pensions	0.75	0.75	0.76	0.76	0.76	0.78	0.78	0.79	0.82	0.82	0.82	0.83	0.79
disability pensions	0.12	0.12	0.11	0.11	0.11	0.11	0.10	0.10	0.07	0.06	0.06	0.06	0.09
survivor's pensions	0.09	0.08	0.08	0.07	0.06	0.05	0.04	0.04	0.04	0.03	0.03	0.03	0.05
state-provided pensions	0.04	0.04	0.05	0.05	0.06	0.07	0.07	0.08	0.08	0.08	0.08	0.08	0.07

Source: author's development on the basis of statistics (Indicators of the pension and social provision of Russian Federation; The forecast of socioeconomic development of Russian Federation and the individual sectors of the economy).

The following quantities for the expenditure side of the Pension Fund of Russia, in connection with pensions were obtained basing on the modelling results (Table 5).

Beginning from 2015 changes directed on redistribution of pension savings system will be made in the pension legislation of Russia. The essence of reforms is to transfer cumulative part of pensions to the insurance one. For this purpose future retirees are offered either to transfer cumulative pension part to the insurance one, or to leave their savings in non-state pension funds (NSPF) till 2015. And those who will put their savings into the insurance system, larger accumulation of points in the formation of future pension are guaranteed (Indicators of the pension and social provision of the Russian Federation).

Table 5. **Pension costs of the Pension Fund of Russia,** *author's development*

Years	2014	2016	2018	2020	2022	2024	2026	2028	2030
N_{oa}, mln of people	34.52	35.68	36.87	38.11	39.37	40.68	42.03	43.41	44.84
N_{dis}, mln of people	2.35	2.41	2.47	2.54	2.60	2.66	2.73	2.80	2.87
N_{sur}, mln of people	1.32	1.29	1.26	1.23	1.19	1.15	1.11	1.06	1.01
N_{stpr}, mln of people	3.35	3.21	3.06	2.90	2.73	2.56	2.38	2.18	1.98
P_{oa}, USD	380.49	470.49	560.21	641.89	714.15	783.17	847.08	916.20	990.96
P_{dis}, USD	259.98	327.42	396.93	462.91	524.04	579.63	626.93	678.09	733.42
P_{sur}, USD	258.69	325.83	395.04	460.75	521.63	576.99	624.07	675.00	730.08
P_{stpr}, USD	268.51	335.98	404.77	469.19	528.02	582.35	629.87	681.27	736.86
E, bln USD	179.84	228.89	280.49	330.70	378.53	426.70	474.00	526.54	584.90

We analyzed 3 variants of possible events. The first variant, when beginning from 2015 all Russians will take away their savings from the cumulative system and move into the insurance one, thus having liquidated the cumulative part of pensions; it is the best variant from the point of view of the state for today. The second variant, when all future retirees leave the cumulative part of pensions in non-state pension funds and management companies. For the government's position this variant is the worst; because in this case all cumulative parts of all pensions are kept for future retirees. And it will be impossible to spend their means for payment of current pensions; therefore, it is necessary to find other sources for pension's payment. These two variants define the limits of the range, in which the Pension Fund deficit of Russian Federation will vary. The third variant is more realistic and determines the existing situation in the pension system. 22.3 mln Russians kept accumulative investment in not-state pension funds with the total investment of about 37.93 bln USD; in management companies – 0.5 mln people with the total of 1.21 bln USD by the end of 2013. There were also 56 mln people with the total savings of approximately 62.1 bln USD in the system of public service accumulative investment (Indicators of the pension and social provision of Russian Federation). 29% of Russians are keeping savings in the NSPF and in system of state service. In NSPF system 18.1 mln applications for transfer of savings from the state service system to the non-state sector were submitted during 2013; 9.9 mln applications were satisfied, the rest were rejected because of technical errors (Indicators of the pension and social provision of the Russian Federation). As a consequence, it is possible to assume that at least 8.2 mln people moved to NSPF in 2014. Thus, the total number of non-state pension sector would be approximately 44% of the total number of future retirees in 2015. In the future, this value change can be associated with the choice of cumulative or insurance systems for the persons who reached 18 years and joined the insurance relations. It is supposed that the achieved value is fairly constant in the coming years.

In this research we need to keep in mind two factors: firstly, the transfer accumulated funds of future retirees into the insurance system in 2014 and 2015; secondly, the fact that the defined contribution system means of future retirees who move into the insurance system would be directed to pay current pensions evenly in the next 5 years, therefore, the following results were received (Table 6).

For illustration purpose, the results are also given in graphical representation (Figure 2).

Table 6. **The deficit of Russian Pension Fund till 2030,** *bln USD, author's development*

Years	2014	2016	2018	2020	2022	2024	2026	2028	2030
The first variant	50.44	55.69	85.98	119.27	174.74	209.49	242.54	279.48	321.23
The second variant	50.44	101.75	137.30	175.44	214.98	254.47	292.71	333.54	379.47
The third variant	50.44	80.32	112.92	148.34	192.42	229.26	264.59	303.23	346.82

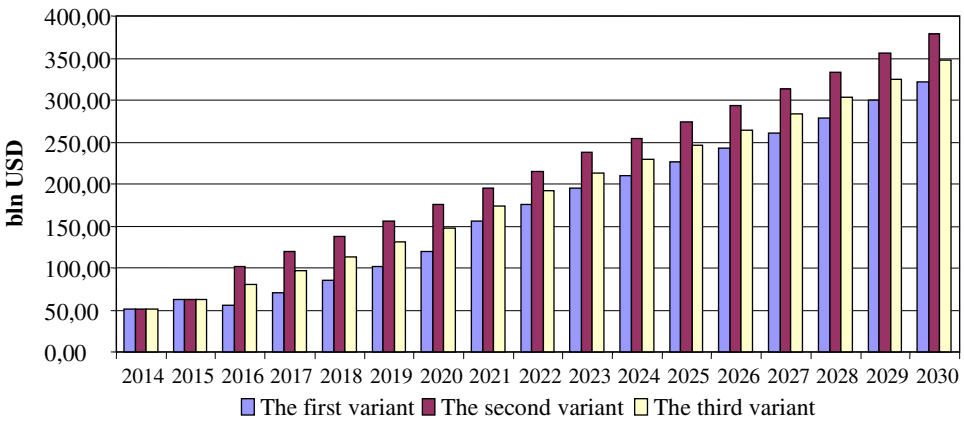

Figure 2. **The deficit of Russia's Pension Fund till 2030,** *author's development*

As a result of the research we can draw the following **conclusions**:

- based on the adjustment of pension legislation for 2014 and 2015 the Pension Fund deficit would be reduced by 36.5% and 22.5% as compared to 2013, respectively;
- starting from 2016 to 2020, the Pension Fund deficit would be declining due to the means, raised for previous years cumulative pension part of future retirees, also the annual insurance contributions increases, redistributed from the cumulative part into the insurance one. The average reduction would be about 18% per year;
- from 2021 to 2030, the effect of the funds raised from previous years existence the defined contribution system would disappear and the reduction would be achieved only owing to the reallocation of funds from the defined contribution system into the insurance one. The average rate would be, 9.7%;
- a short-term effect will be received as a result of the pension legislation adjustments, which give a positive outcome for the next 5–7 years. After that the Pension Fund deficit will increase, thus requiring new changes;
- the decrease of the Pension Fund deficit might be primarily aimed at improving the collection of insurance contributions, which are at a rather low level: 62.89% of the insurance system, and 50.26% for the defined contribution one. It is caused by not official payments of wages ("envelope" salary to workers without deductions to social funds). Increase in the wage fund is possible due to developing new highly competitive industries and modernization of the existing enterprises. This would ensure the dynamic development of the pension system in Russia.

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