



Analysing the impact of the parametric model correction of premium rate on financing social security's long-term commitments using actuarial knowledge

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Abstract

This survey involves examination of the rate change that is the right to have insurance is one three parametric models (premium rate, experience and age of retirement in financing social security organization by using actuary knowledge and computational software such as ILO-PENS. The statistical population of this survey is the social security organization of the Islamic Republic of Iran. The population and community, are variables because they are huge, there is not statistical sample. And to achieve hypothesis goal which is based on the total number of insured persons, pensioners and the source of income of the organization from 2013 – 2019 as well as estimating the amount of resource available in order to fulfil long term commitment it is actuarial calculation in long term period for commitment payment in long term. In this study the effect of change in rate, insurance right is 1%-5% and the effect is considered over 70 years' time, on the sustainability resource of the organization and it is measured and examined. In addition, considering the limitation and risk taken from these implements of the parameter are described below and according to the results obtained in case of application, the point of balance was postponed until 1413, and during this time, the necessary resources for paying the commitment is provided. The short gap is an opportunity for the social security organization, to have enough time for long term planning which is a structured reform.

Keywords: Parametric reform, Financing, Long term commitment, Actuary, Social security organization

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1. Introduction

Today social security organization is one of the most experienced events in humanity for supporting a person society facing danger and social event such as unemployment retirement, death and loss of job and etc. and the main goal of social security is the social safety and social economic for people facing events and danger which can cause better welfare. But the same human experience can cause opposite effect and can cause national crisis. The experience gained during the recent years in countries like Greece, the fact shows that the pension fund can be like the heel of a country and the security of a country can face a real challenge and problem [18]. The lack of budget in social security organization during the recent years show the first constant financial crisis and it is predicted that in the coming year's social security organization is not able to support enough resources to pay for the long-term commitment and can have a bad insecure social background. In the establishment of the social security organization there are many services the most important one is the main subject is how to pay the salaries and pension and its effect on balancing these payments during the long-term commitment. This is the reason why the payment is important, is that it shows the judgment social security [5]. Subject social service is the main topic for a century and due to the role of social service in developing the economics of a country first is in spreading the wealth, increasing the health and provides the needs in society these are the most attentive subject [11].

The resource income scheme of social security consists of different things one of them is the most important and that is the participation of the government, the collection of insurance money from the employer, the amount of money obtained from the investors [7]. The decision about how to consume resources and distribute the cost and is not purely technical but the decision must be made on the base of economic, social and political consideration [17]. Another important point is that not all of these criteria, both financial and nonfinancial, are of equal importance; rather, some criteria are more important than others. Financial performance forecasting models are the tools used to make the decision to invest in a firm [14] Financing social schemes is usually done in two ways:

- A: Financing from taxing:** Tax financing (public revenue) is usually done in public support scheme. It depends on the citizenship or residency which includes social assistance and social services. Support system: this system is dependent on government funds and all the scope include the vulnerable section of society (due to inability to earn money, disabled and physically and mentally disability, orphans, prisoner's family0). (This subject is not one of the government duties in Iran).
- B: Financing from the premium:** when the financial resources is paid by the employer or new workers and the protection of the workers are based on the payment made. This plan is called insurance premium, and this payment is called insurance right (insurance system is common only in Iran.)

One of the most important factors that affect the stability of pension payment is the approach of the system, financing, the method of calculating retirement benefits and the distribution of age of the population that are covered by the system. One of the most common financing systems in public pension funds is the income cost, financing system. In the pension system and retirement system which are financed by income cost the retirement benefit are paid by deducing the premium from employed people which covers the plan. This type of system needs a balance between paid retirement and the income [structure of income cost system this system is affected by demographic changes and age of the population, like the change of economic condition and population rates. In addition to migration, two factors are the causes of change of population and they are fertility rate and mortality rate].

According to united nations in 2017, the fertility rate decreased from 6.91 to 1.75 and the mortality rate decreased from 26.8 to 4.7 from 1950 to 2015 [10]. Evidence suggests that this trend is declining over time. Also, the probability of death over the years and life expectancy in Iran are increasing from 49.59 in 1950 to 76.22 in 2015. As the fertility rate decreases, so does the number of insured employees and as the mortality rate decreases, the number of retirees and pensioners increases? These changes have resulted in insufficient income from deductions to cover paid retirement benefits. As a result, demographic change has hindered the long-term sustainability of the incomeexpenditure pension system [4]. Social security benefits provided by government require financing systems, such as actuarial assessments and management to ensure that their future obligations are met and to ensure that they have a fair approach to deal with those requirements. It is actually risky. Risk accumulation results in an overall increase in the wellbeing of members, as large losses associated with uncertainty are distributed among groups of individuals [12]. Pension system should be designed in such a way that the balance between its resources and expenditures is maintained in the long run and it requires complex calculations and how to set effective parameters in receipts (premium rate, salary and benefits and premium payment period, etc.) and payments (retirement age, life expectancy, pension formula, etc.) according to economic and social factors [5].

Actuarial science is a rational response to the process of future incomes, commitments and expenses, and how to reach equilibrium for financial planning in relation to long-term commitment and social security. Actuary will be directly responsible for assessing the quality and the risks to be covered by the insurer [2]. The pension fund should pay to long-term members; naturally it is said in the law of the fund. Therefore, the discussion of periodic actual is one of the most important tasks that the members of the organization must do the duty by an independent actuary and should show the result. The social security organization is no exception. Act 28 of the organization clarifies that the situation of the fund should be analyzed every three years. In addition to all the things mentioned above from 1384 onward the auditing standard, accountancy committee of the auditing organization, they have designed a new standard for how to prepare the financial statements of pension fund. Obeying this standard which is called accounting standard number 27 from retirement facilities plan for supervising the accounts of retirement, which was effective from 1th Farvardin 1384 or after the resumption. Therefore, performing the actuary, this calculation should cover two legal requirements mentioned above and pension fund in change are obliged to evaluate the ability of the fund and the result should be recorded at the balance sheet [8]. In some sense, profitability is a measure of health of a firm and liquidity is a vital sign that indicating the firm is economically alive. In other words, a firm may be deemed as sick should it fails to be profitable, while if not have liquidity, its survival is at stake. An effective management of working capital, positioning and controlling of present assets and debts in a way that executes the danger of letdown to meet due here and now assurances from one perspective and keep away from over the top interest in these benefits then again [23].

2. Literature review and previous studies

The financial system and placement of payment:

It is the most important technical problem which is related to the financial system is one of the plans chosen in the social security and it is being performed, financial system has some ways that according to them, the members of the plan in a given time is presented to the financial support and the money is given to them. Suitable financial system for special support usually depends on some differences in parametric like these variety are background support, need to keep reserves. Funds investment opportunities, need stable payment. Also, the plan or decision that is made, their age

should be taken into account. There are many financial systems that can help those who are under social security but only some of the financial systems are being used.

Systems governing the insurance financial systems funds:

In this system, the cost of insurance premium is according to support expenses and they are chosen according to annual income of that year. In the beginning of the plan due to less pensioners the cost of premium was low but at the same time the pension fund and increase in numbers of pensioners the cost of premium will increase slowly, therefore in this system storing and the result in investment is not obvious but in order to prevent the instability level and when the pensioners come across some special conditions like illness, flood, earthquake with less increase in the cost of insurance premium is usually a careful storage. In this system usually the number of pensioners, some percentage average wage is given during their bad time. The average wage is different in different countries according to the rule of that country. The average wage is estimated from the last wage or payment that the person gets when he was at work or average of the last two years or the last year of payment and the average income of the employee. It is to be noted that due to natural method of annual premium, the rate of premium at the beginning of the scheme was very less because the obligation was less, and this motivates and encourages the society for using social security insurance. But with the passage of time, increase in the number of pensioners' premium rate increases. Even in some cases when the premium rate was high, some people could not afford to pay the insurance. This system is present in most of the countries especially in Western Europe, Canada and Australia. But the point which is mentioned in this system is that premium rate is required to cover the cost of pension [19].

Financial balance of funds based on annual evaluation (PAYG pension fund balance):

Undoubtedly financial balance of fund between the resources and expenditure of the fund during the period of supervision is one of the greatest concerns to policy makers and decision makers. Assuming that the expenses of funds is only for pension, and the resource is only premium; the following relationship is provided to balance the resources and expenses.

$$B \times P = C \times E$$

B: average pension

P: number of pensioners

C: average premium

E: the numbers of people insured

Average pension (B) and average premium (C) according to the following formula, is described:

$$C = W \times CR$$

CR: rate of premium

RR: average replacement rate

W: average wage

$$DR = P/E$$

DR: dependency rate

Therefore, we are going to have

$$RR \times W \times P = W \times CR \times E$$

$$RR \times P = CR \times E \rightarrow CR = RR \times DR$$

So, the premium rate is affected by two factors, replacement rate and premium rate. It is clear that we assume that if replacement rate is steady whenever the dependency rate increases in order to be certain resources also increase. In other words, assuming that replacement rate is increased, the amount of insurance rate changes following the changes in the dependency rate [19].

Replacement rate:

Replacement rate means the ratio between the first pension and the last premium. This rate shows that how generous insurance fund is. This rate is higher than other countries in such a way the total sum of pension and the benefits of other facilities, 93% are given to pensioners from the last pension.

Dependency rate:

Dependency rate is one of the most important schemes in social security which shows the financial situation in the scheme. Dependency rate comes from the number of pensioners and insurers. The numbers of pensioners have two factors, Demographic and Policy factors. Demographic factors include structural age, death rate after retirement life expectancy after retirement and policy factors such as how to cover, retirement age, conditions of using pension for disability and survivors. The numbers of insurers, many factors affect the number of insurer that the most important are as follows: Economical pollution factors and policy makers. Demographic factors such as fertile rate the past, death and immigration. Economic factors such as age of quitting school, increase of workforce and also political factors such as retirement age, cover level, premium rate. [19].

Fully funded defined contribution system:

In this system premium received from insurer include insurer share and share of employer. This is recorded in every insurer's file, and they are used for protecting this valuable saving and for increasing the saving money. The sum of money is invested and the profit received from this investment are deposited in their account and when they are able to withdraw their money- the premium and interest are given to them. In this system unlike to annual evaluation system, no hidden debt arises without collateral. This system is seen in South America and East Europe, the amount of pension in this system depends on the premium rate of individual or individual wage premium capital return rate and the ratio of the years receiving pension and the years of employment. The implementation of graded premium system or any other financial system does not mean that the cost of payment has decreased but the goal is that a flexible and regular system should be used, to compare the storage system with a low premium rate and it can provide the necessary savings to pension cost [20].

The task and role of actuary knowledge:

The actuary knowledge presents its role with at least 4 practical ways:

Periodic review of a business scheme:

For one scheme of social service, periodic review likes a health checkup and acts as a tool to monitor the financial aspect of the scheme. If the actual experience is different from what was predicted periodic review is an opportunity for rapid reform. In fact, the figures reported in actuary are not actually important, what matters is how to change from one evaluation to the next. Someone who reads the evaluation report should know that in every review the long-term prediction will change and the direction of these predictions are important. The laws of social security organization usually require an actuary review over 3 or 4 years (the scheme of accidents on job location is often reviewed every year). In fact, the main purpose of actuary reviews every 3 to 5 years is to set premium rates, that most probably it would be required in the coming years to offset the benefits of national insurance scheme.

The premium rate:

There are many factors to be taken into account while estimating the premium rate by actuary. The most important of these are the benefit scheme, the cost of management scheme and financial scheme on the condition that the main emphasis of policy maker is to set a maximum premium rate from wages, then actuary needs to propose alternative suggestions to allow the suitable total cost, to commensurate the financial scheme. But on the condition that the main goal determines a certain level of support benefits, then actuary needs to suggest alternative premium rate scheme. Three economic important factors namely the unemployment rate, the inflation rate and the interest of investment must always be taken into account in determining the premium rate.

Unemployment rate:

This rate shows the percentage of unemployment people in the social and simultaneously it has effect on the resources (non-employment and consequently nonpayment of insurance premium) and project cost (receiving unemployment insurance support) and eventually effects on premium rate.

Inflation rate:

In addition, the impact on the macro economy of society which also reflects on social security scheme as one of the sub-systems, this rate is affected on the value of project reserves. Especially the reserves that are noted in the books also effects on the wages. The result is affected on the number of benefits (in order to maintain the power of purchase).

Return on the investment rate:

This rate shows the amount of profit related to project reserves, which in turn is one of the financial resources. If the rate is low (due to economic problems or mismanagement) financial balance is at risk. If the inflation rate is more than the investment rate, the real value of the project decreases, this situation requires immediate review of the funds status.

Table 1: Retirement age of men and women in different types of members of economic development and pension reform programs

Country	Men's retirement age	Women's retirement	Retirement increase program
Spain	65 years 5 month	65 years 5 month	(2027) years67
Australia	65 years	60 years	(2033) years65
Estonia	63 years 3 month	63 years 3 month	(2026) years65
Slovakia	62 years 2 month	59-62 years 2 month	(2017) More than 62 years
Slovenia	65 years	65 years	-
England	65 years	63 years 7 month	(2028) More than 67 years
Italy	66 years 7 month	65 years 7 month	More than 67 years(2028)
Ireland	66 years	66 years	(2028) years68
Iceland	67 years	67 years	(2029) years69
Germany	65 years 5 month	65 years 5 month	years67 (2031)
USA	66 years	66 years	(2027) 67years
Belgium	65 years	65 years	(2030) years67
Bulgaria	65 years	62 years	(2020) Women 63 years
Portugal	66 years 3 month	66 years 3 month	-
Czech	63 years 2 month	58 years 4 month	(2041) years67
Denmark	65 years	67 years	More than 67 years (2030)

Romania	65 years	60 years 6 month	(2030) Women more than 63 years
Japan	62 years	61 years	(2025) years65
Switzerland	65 years	64 years	(2020) years65
France	65 years 4 month	65 years 4 month	(2023) years67
Finland	63 years-68 years	63 years-68 years	(2027) years65
Cyprus	65 years	65 years	(2018) More than 65 years
Canada	65 years	65 years	-
Croatia	65 years	61 years 9 month	(2038) years67
Poland	65 years 7 month	60 years 7 month	-
Lithuania	63 years 6 month	62 years	(2026) years65
Malta	62 years	62 years	(2027) years62
Hungary	62 years 6 month	62 years 6 month	(2022) years65
Norway	62 years	62 years	-
Netherlands	65 years 9 month	65 years 9 month	(2022) More than 67 years
Greece	67 years	67 years	More than 67 years(2021)

Design and evaluation of a scheme new:

At the beginning of a fund activity, actuary assessment should answer one of the following two questions: 1) from a certain financial resource how much support can be expected. 2) For a certain level resource what financial resource are required. It is clear that the amount of social support in every country is determined by the level development and Gross Domestic Product. Nevertheless, the priorities of each society play an important role in determining the social level and cannot have one general rule for the amount of social support from economic point of view. In general, the main problem in social security system is social resources and is practically limited such as other economic resources. Therefore, the financing estimates the financial which is recommended by actuary, it should enable the efficiency and effective use of available resources. The introduction of a new social security scheme requires actuarial intervention and it cannot be done due to lack of related uncertainties. The beginning of this intervention with consolation process has specially established the legal basis to various stockholders (government, workers and employees). In total designing and evaluating actuary scheme for a social security scheme, four main issues should be taken into consideration.

Performing actuary correction:

Actuary interference in the reform process depends on nature and scope of the reform. Legal changes in a current scheme often happen for long-term consolidation. These changes are usually related to the coverage of a scheme, level of benefits or legal provision related to financing. Two of the important changes are mentioned: Systemic reforms and structural reforms. In many countries, social security institution should submit their proposal budget, including resources and expenditures to the government every year. For this reason, actuarer makes short term prediction in investment income premiums, and administrative benefits and expenses for future scheme [22].

Parametric reform is considered in most countries as an inevitable necessity for the stability of insurance funds. Most countries for parametric reforms, long-term programs have been considered. In parametric reform a number of factors are taken into account, the most usual are change in premium, age correction, correction of record rule to receive retirement benefits. As can be seen on the chart below, many countries around the world are at risk of ageing population as well as declining birth rates. Parametric corrections are being used for correction of retirement age and the

years of experience for retirement and the implementation of each reform depend on various factors and situations prevailing in the country such as political social and economic factors [18].

Research ackground:

Najarpour [15] did this research "presenting a hybrid model to identify the challenges affecting the implementation of a multilayered social security system". In this research, based on the third act of the result of parametric reforms and it is to overcome this crisis of lack of liquidity in meeting long-term commitment and these are emphasized. Hindi and others [6] in a research named (comparative study of disability insurance in Iran and 50 countries). He analyzed how to finance ongoing disabilities and compare how to provide resources for paying these liabilities between Iran and 50 selected countries. They found out that disability insurance along with retirement and survival insurance is generally a long-term insurance risk. Ali Naghikhani [1] in a research named "pension sustainability index in insurance institutions in 2014", he examined the need of reforms in the social security system and do the reforms in social security. It is inevitable to change the demographic and continuity of the old system. In this research these factors have been pointed those factors affecting the decrease of sustainability index such as very low retirement age, increase the informal section and reducing insurance coverage, scattered insurance, high replacement rages, a significant increase in elderly population consequently an increase in the dependency ratio, early retirement and delays in making needed reforms. Zanjirdar [24]. in a research named" Overview of Portfolio Optimization Modelsaveraging the variance models", he showed the researchers focused on other models such as discretetime models, continuous-time models, and random programming models". Each of these methods has its disadvantages and advantages that can be selected according to the investor decision making conditions. Continuous and discrete multi-period models are solved by dynamic scheduling and optimal control methods.

Sadeghpour [16], in his research, he studied the valuation of liquidity balance retirement schemes with Hall-White model and he came to this conclusion that the retirement schemes in Iran is one of the simplest retirement scheme that is receiving a pension from employees who are still at work and paying the deductive funds to retired, disabled and survivors. Therefore, the need of parametric reforms is seriously felt especially in pension scheme in the country. Mehdipour Ghobadlou [10] in his research, he studied the maintenance of the stability of public pension funds with parametric reforms. They examined the automatic balance mechanism and in order to maintain liquidity system and stability in the long-term by examining the liquidity in the next 75 years and it is obvious that if no reforms were made in the pension system, in 1468 the ratio in expenses in retirement benefit to the money received will be four times. The result obtained show that there is crisis and financial deficit and the importance of parametric reforms in the pension system.

Mir et al [13] has done a research which shows the challenges and strategies of pension funds in Iran: a case study of Jahad Keshavarzi pension funds. In the period from 1358-1391 they have been analyzed and done by actuary system. The result of the research shows that several systematic and parametric factors affect the performance of the funds. The dependency ratio of the elderly is increasing very much. The retirement system is threatened to collapse in future, the factors are, high inflation rate, imposing support cost on the insurance system, ignoring the principles and actuary calculation in the decisions and policies of funds and nonprofessional government interference. Continuation of DB-PAYG pension system is a failure to fulfill the government obligation to the fund. Short term medium term and long-term solutions for controlling and managing the threat and reforming the pension system have been suggested.

Grishchenko [3] has done a research study named retirement after pension reform. Comparative analysis of Belarus, Kazakhstan and Russia has been noted. In this study, due to similarities to the

three countries such as geographical environment, economic situation politics and social conditions and also considering the age of working population. Parametric reforms for the insurance funds are emphasized. Vidal – melia et al [21], in this research named in a study used income cost pension system with an automated balanced mechanism for parametric corrections and it was introduced as a set of scales predetermined according to low whenever the index of wealth or financial stability the system needs to be modified and it is used frequently.

3. Research hypotheses

The research hypotheses that are designed based on the literature review are as follows:

H1: changes on premium rates have a significant effect on funding source.

H2: changes on premium rates have a significant effect on long-term liabilities.

H3: changes on premium rates have a significant effect on relationship between funding source and long-term liabilities.

4. Research methodology

In terms of purpose, this is research is an applied type [9]. The results of this research are to develop knowledge regarding the comparison of parametric model in financing the long-term obligation of the social security organization by using actuary knowledge. Parametric models and proposition of modification of structure will help to assist the social security in future programming and also it is used to find a way out of current financial crisis. In terms of data type, the type of research data is a kind of help that can be used in the data of the financial statement of the social security organization and also information concerning the number of insurers, pensioners, and the source of income and expenses of the social security organization. This information is used for statistical analysis. In terms of the type of reason the logic performance is inductive-deductive. In terms of method and nature, it is a descriptive analysis (Experimental). In terms of time of research; according to the study of this research retrospective data related to the years 2013-2019 are collected and finally are analyzed, this research is considered perspective type in terms of time. Statistical population of the research since the topic of this research is to analyses and compares the parametric models of social security and their impact on the financing the long-term liabilities of the organization. Therefore, the statistical population of this research is to study the social security organization of Islamic Republic of Iran. Due to the lack of sample selection from the large community, there is no statistical sample. In order to achieve the hypothesis goals, based on the total number of insurers, pensioners and income sources, the organization is obliged to pay the long-term commitments.

Table 2: The main insurer separates of gender and the percentage changes from 2013-2019.

Year	main insured-Man	main insured-Woman	Total	Changes - growth rate
2013	10389169	2418878	12808047	4/24
2014	10910580	2433918	13344498	4/19
2015	11229537	2482189	13711726	2/75
2016	11183835	2595785	13779620	0/5
2017	11303024	2679930	13982954	1/47
2018	11268452	2760741	14029193	0/13

2019	11519830	2853430	14373260	45/2
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Table 3: The growth rate of pensioners especially the retired pensioners change from 2013-2019.

Year	Retirement pension	Disability pension	Retired pension	Total
2013	1177828	120550	1276314	2574692
2014	1272288	125035	1394479	2791802
2015	1374438	128817	1508094	3011349
2016	1472425	133607	1630951	3236983
2017	1567284	137866	1767182	3472332
2018	1660808	141830	1926463	3729101
2019	1758215	144021	2079368	3981604

As it can be seen in table 2, the number of main insurers (male, female) from 2013-2019 has increased unsteadily, according to the pre-criteria (replacement rate and dependency rate) in order to continue paying long-term liabilities according to the PAYG system (payment of pensioners from premium received) this system need an increase in the number of insurers. But due to the declining population growth rates this can create a serious risk to the fund. As it can be seen in table 3 the growth rate of pensioners especially the retired pensioners are more than the growth rate of main insurers. This shows a warming to the social security fund for programming and planning for future problems.

Table 4: The amount of income of the social security in terms of income commitment from 2013-2019- million Rials

Year	Premiums received	Investment income	Grants	Other income	Transfer premium from other plans	Surplus income over expenses	Total revenue
2013	407115435	33072184	6216295	5482341	457894	33412565	485756714
2014	553518244	54041039	6730599	7391754	562615	47715591	666959842
2015	767309480	33308328	9445272	10137423	697712	29393914	850292129
2016	854777303	14415232	78609	10662945	912398	(673501)	880172986
2017	967419061	23776624	96617	11885014	1677292	4886735	1009741343
2018	1491960227	23426778	41556	14089008	2316000	388525	1531222094
2019	1383196533	24624153	105042	17112850	2382524	(27914608)	1399506494

Table 4-According to the current system in the payment of pensions in social security organization (income-expenses) the amount of income in the social security organization from 2013-2019 is limited. It should be noted that base long-term payment, the organization is currently facing a shortage of resources and is forced to get a loan from the country, banking system in order to pay the pension monthly. This issue needs to lean on parametric correction and this is shown twice as much.

Table 5: Basic financial formulas

Financial balance:

The basic equation for financial balance of a retirement scheme can be obtained as follows
 Suppose that $V(t)$ storage at the end of the year

$R(t)$ the total annual income per year (profit income)

Ct annual income from pension premium (without profit income)

$tI(t)$ annual income got from profit per year

$tB(t)$ annual consumption per year

$tS(t)$ the whole annual income per year

$tCR(t)$ the rate of premium per year

$ti(t)$ interest rate per year

In this term equation below are shown $R(t) = c(t) + I(t)$ (5,1) formula

$$\text{Formula } \mathbf{I(t)} = \left[\sqrt{\mathbf{1 + i(t)}} - \mathbf{1} \times [\mathbf{C(t) - B(t)}] + \mathbf{i(t) \times V(t)} \right] \quad (5,2) \text{ formule}$$

$$\Delta \mathbf{V(t)} = \mathbf{V(t) - V(t - 1) = R(t) - B(t)} \quad (5.3) \text{ formula}$$

$$C(t) = CR(t) \times S(t) \quad (5.4) \text{ formula}$$

$$\mathbf{V(t)} = [\mathbf{1 + i(t)}] \times \mathbf{V(t - 1)} + \sqrt{\mathbf{1 + i(t)}} \times [\mathbf{CR(t) \times S(t) - B(t)}] \quad (5.5) \text{ formula}$$

$$\mathbf{v(t)} = [(\mathbf{1 + i(t)})]^{-1} \quad (5.6) \text{ formula}$$

$$\mathbf{U(t)V(t) = U(n - 1) \times V(n - 1) + CR(t) \times [\overline{S(t)} - \overline{S(n - 1)}] - [\overline{B(t)} - \overline{B(n - 1)}]} \quad (5.7) \text{ formule}$$

BY:

$$\overline{S(t)} = \sum_{k=1}^t S(k) \times W(k) , \overline{B(t)} = \sum_{k=1}^t B(k) \times W(k)$$

$$U(t) = \prod_{k=1}^t v(k) , W(t) = U(t - 1) \times v(t)^{\frac{1}{2}}$$

The main financial system

Balance the cost of income:

$$\text{PAYG}_t = \frac{B(t)}{S(t)} \quad (5.8) \text{ formula}$$

$$\text{PAYG}_t = d(t) \times r(t) \quad (5.9) \text{ formula}$$

Definite saving named, that the saving is counted, as annual expense. By setting k_0 as the desired value the cost of pension under which the ratio of reserves are estimated at the end $[n, m]$ reaches the desired and is shown below; formula $cR(K = ko; n, m) = ko * u(m - 1)8B(m) - u(n - 1) * B(m - 1) - (n - 1)$.

$$\text{CR}_{(n,m)}^{level} = \frac{\overline{B(m)} - \overline{B(n - 1)} - V(n - 1)}{\overline{S(m)} - \overline{S(n - 1)}} \quad (5.10) \text{ formula}$$

8.2.3 Determining the premium rate in terms of a certain reserve ratio:

$$\text{CR}(k = k_0; n, m) =$$

$$\frac{k_0 \times U(m - 1) \times B(m) - U(n - 1) \times V(n - 1) + [\overline{B(m - 1)} - \overline{S(n - 1)}]}{\overline{S(m - 1)} - \overline{S(n - 1)}} \quad (5.11) \text{ formula}$$

$$S(m - 1) - s(n - 1)$$

If in the above equation $ko=0$ the fixed premium formula is obtained during the period $[n, m - 1]$

8.2.4 Determining the premium rate in terms of a certain ratio:

$$\begin{aligned} \mathbf{CR}(\lambda = \lambda_0; \mathbf{n}, \mathbf{m}) = & \\ & \mathbf{1} + \lambda_0 \times [\mathbf{v}(\mathbf{m})^{-\frac{1}{2}} - \mathbf{1}] \times \\ & \frac{\mathbf{U}(\mathbf{m}) \times \mathbf{B}(\mathbf{m}) + \lambda_0 \times [\mathbf{1} - \mathbf{v}(\mathbf{m})] \times [\overline{\mathbf{B}(\mathbf{m} - \mathbf{1})} - \overline{\mathbf{B}(\mathbf{n} - \mathbf{1})} - \overline{\mathbf{U}(\mathbf{n} - \mathbf{1})} \times \overline{\mathbf{V}(\mathbf{n} - \mathbf{1})}]}{\mathbf{1} + \lambda_0 \times [\mathbf{v}(\mathbf{m})^{-\frac{1}{2}} - \mathbf{1}] \times \mathbf{U}(\mathbf{m}) \times \mathbf{S}(\mathbf{m}) + \lambda_0 \times [\mathbf{1} - \mathbf{v}(\mathbf{m})] \times [\overline{\mathbf{S}(\mathbf{m} - \mathbf{1})} - \overline{\mathbf{S}(\mathbf{n} - \mathbf{1})}]} \end{aligned}$$

(5.12) formule

Suppose that $8t = [B(t) - L(t)]$; $I(t)$ balance ratio which indicates the status of expenditure resources,. By putting 80 as the desired value of the balance ratio, the premium rate under which the balance ratio at the end of the peri-od (n,m)it seems to be estimated as follows formula

If we substitute 8=10 in the above equation, we get the stepped premium rate formula that makes the fund stable (that is zero fund level) at the end of the period

Description of the table above;

Cost-benefit balance rate; in this method in principle, no saving is set aside from the beginning, and the annual cost of benefits and the executive affairs of the project adoring to the spending pattern of the retirement plan, the cost rate in this method is called the cost-benefit balance rate (PAYG) is low at the beginning of the plan but it grows each year to reach the system saturation.

Overall average premium rate (Gap)

These indexes with the equation of the present value on the predicted future, the insurance premium of insurers (current insurers and new entrants) along with the existing reserves are calculated. The present value benefits and administrative expenses which are predicted in the future. The insurers and the current and future beneficiaries are also included. This does mean that the scheme will be balanced every year but when the scheme will reach zero at the end of the period mentioned. Technically this premium can be noted as the long-term average of PAYG premium.

4.1. Research variables

4.1.1. Independent variable

Premium rate; it is important and necessary to ensure the coverage of the insured in the reform of the pension system. However parametric retirement without maintaining comprehensive coverage can have an opposite effect by reducing the number of insurers and it can pose a serious threat. One of the non-modifying parameters is the increase of premium rate. By following the rules of Iranian social security organization, approved in 1975, the premium rate is currently 30 percent of wages which is one of the highest rates in the world. Experts indicate that in the current economic conditions of the country there is a possibility of increasing the premium rate. It is considered to be risky, either. It will attract the insurance or it will make them escape from insurance.it can be concluded that the increase in premium rates in the recent situation can lead to high risk.

4.1.2. Dependent variables

Our dependent variables are as follows, financial resources; the income received from premiums, the income received from investments, the income from images and fines (transfer premium from other scheme), the income from grants, aid without interest and other income, other incomes.

5. Results

One of the reasons for the deficit of resources is the resource expenses of social security organization is very high. During the years 2009-2019, the growth rate of pensioners is twice much than the main insurers (table below).

Table 6: the growth rate of insured / persons

Year	main insurers	Pensioners	growth main insurers	growth Pensioners
2009	9917542	1455166	8/36	8/56
2010	10573705	1552096	6/62	6/66
2011	11497089	1726457	8/73	11/23
2012	12286683	1883142	6/87	9/08
2013	12808047	2013984	4/24	6/95
2014	13344498	2179572	4/19	8/22
2015	13711726	2350088	2/75	7/82
2016	13779620	2526372	0/5	7/5
2017	13982954	2716610	1/47	7/5
2018	14029193	2929653	0/13	7/8
2019	14373260	3219148	2/45	6/81

According to the table(6) the growth rate of insured persons and pensioners .the geometric average growth of the main insurers during the years 2009-2019 was 3.08 %; while the geometric average growth of pensioners using the same period was 8.15% however in order to keep the finance stable it is needed to have the growth rate of the main insurer five times more than the pensioners that is on average from 2009-2019 every year the pensioners must grow more than 4% in order to maintain the stability. Pensioner is a person who accordance to law is the subject for retirement, death of main insurer and disability, the survivors are entitled to a monthly salary and benefits, among pensioner group, retirees make up to 65% of the population, the growth rate is 40% and is higher than the growth rate of the dead and 82% higher than the growth rate of disabled pensioners. The transformation of the insured status into a retiree depends on three main characteristics; the age pyramid of the insured, the amount of insurance payment history and the rules and regulations [20]. The basic premium received is 27% and 9% is for medical expenses and 18% is for short term and long-term assistance. We assume that the premium rate increases 1 to 5%. What effect this increase will have on the situation of social security fund. By increasing the premium by 1 to 5% the revenues and the resources will increase. In the coming years while increasing the revenues, the financing resources will increase and will the pension obligation in the long run.

Table 7: Premium increase sensitivity test.

The Scenario	Average premium 75 age (%)	rate of PAYG 2090 (%)	year by series of resources and expenditure
Basic scenario	74/1	110/6	1405
Hypothesis test(one % increase)	70/1	101/3	1405
Hypothesis test (two % increase)	61/2	75/2	1406
Hypothesis test (3% increase)	52/3	58/2	1407
Hypothesis test (4% increase)	48/5	50/5	1408
Hypothesis test (5% increase)	36/6	48/2	1413

According to the above table, assuming the present conditions, the premium rate is to be increased. If the rate is one to five percent of the organization finally it will reach the point of overflow of resources and expenditures in 2034. That is with this parametric correction the social security organization can postpone the critical conditions, resulting from the long-term commitments until 2034. During that time, it can provide sufficient time and opportunity for reforms, which requires all insurance funds in the world and it will take more than 50 years.

6. Discussion and Conclusions

Given the recent state of the country pension funds, there is no doubt that they will improve. Social security organization is the largest insurance organization in the country and there is a crisis in the current income system – the cost of increasing in the number of insurer and resort the inter-generational payment methods. According to actuary calculations, the social security fund is facing shortage of resources and the authorities need to act on the basis of principled and logical decisions and make the necessary corrections and adjustments. It is usual that insurance funds in all countries of the world, have a salary payment system. After reaching the age of 50 years old, the need for parametric corrections is needed. Before reaching the age of maturity these funds have various schemes for the transition from this period, including short term planning (parametric correction) which is a prelude to long-term planning (structural reform). The most important parametric corrections can be the correction of the premium rate and correction of the retirement age and the correction of payment of the premium to qualify for retirement. In fact, parametric reform or short term reform delays the retirement conditions and pension fund revenues. The expenditures during puberty and long-term reform can be reformed immediately, according to the present study, the amount of premium received is 27% of which 9% is medical expenses 18% for short term and long-term assistance. With the increase in the coming years, it will not only increase the revenues but also increase the organization funding sources. However, in the long run, the organization liabilities for pension will increase.

It is seen what effect this increase in premium rates will have on the organization as a whole- that is the ratio of the organization resources in long-term liabilities. With an increase in the premium rate 5%, the general average insurance premium (Gap) rate will decrease from 74,1% to 36.6% and the PAYG rate is from 110.6% to 18.2% and all reserves will cover in 1410. The effect of 5% change in the premium will be described in the table. When the fund is delayed by 5% the increase in premium will be delayed too. According to the Iranian social security law approved in 1975 the premium rate is 30% of wages and salaries when compared to others, it is the highest premium rate. Expert research indicates that in the current economic conditions of the country it is impossible to increase the premium rate and it can even provide the conditions to attract people to insure themselves or those who are evading from insurance. But from the experiences of some countries such as Greece, Argentina and Chile five OECD countries after 2009 in terms of changes in premium. It shows that by increasing the premium rates, although in the current situation of the country, it is a high risk, but it is suitable as a short-term reform program and a solution is proposed. Of course, all political, economic and social aspect must be taken into account.

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