506 SAYILI KANUNUN GEÇİCİ 20. MADDESİ KAPSAMINDA KURULAN VAKIF SANDIKLARININ EMEKLİLİK PLANLARININ SABİT VE STOKASTİK FAİZ ORANLARIYLA AKTÜERYAL DEĞERLENDİRİLMESİ

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Özet

Emeklilik planlamalarına dair aktüeryal peşin değer, rezerv, sağ kalım süresi ve prim hesaplarında genellikle rastgele olmayan faiz oranları kullanılmıştır. Sigortalı kişinin hayatta kalma olasılığı emeklilik süresi boyunca rastsal olarak belirlenirken, faiz oranları sabit olarak tercih edilmiştir. Bu durumda emeklilik sistemini oluşturan birçok kuruluşa çeşitli risk unsurları yüklemiştir. Bu çalışmada söz konusu risklerin en belirsizi olan faiz unsuru hem sabit hem de stokastik düşünülerek hesaplamalarda daha net sonuçlar elde edilmeye çalışılmıştır. Ayrıca; Bankalar, Sigorta ve Reasürans Şirketleri, Ticaret Odaları, Sanayi Odaları, Borsalar ve bunların teşkil ettikleri birlikler personeli için kurulmuş bulunan sandıkların iştirakçilerinin Sosyal Güvenlik Kurumu'na devrine ilişkin esas ve usuller hakkındaki bakanlar kurulu karar taslağına yönelik hesaplamalar stokastik faiz oranlarıyla yapılmıştır. Excel tablolarında yapılan uygulamaların sonucu olarak, sabit ve stokastik faiz oranlarına bağlı sonuçlar elde edilerek devir işleminden sonra Emeklilik Sistemi'nin artı ve eksileriyle nasıl olacağıyla ilgili olarak bazı sayısal sonuçlar elde edilmiştir.

Anahtar Kelimeler: Stokastik faiz oranları, emeklilik sistemi, risk unsurları, aktüeryal değerler
Jel Kodu: E43

ACTUARIAL VALUATION BY DETERMINISTIC AND STOCHASTIC INTEREST RATES APPROACH OF PENSION PLANS OF FOUNDATION FUNDS WHICH ARE ESTABLISHED AS FOR THAT TEMPORARY ARTICLE 20 OF THE LAW NO 506

Abstract

Interest rates which have been deterministic are used in calculations of actuarial present values, reserve, mortality, premium concerning pension plans. Interest rates had been preferred a constant value while life contingencies were determined to be random during pension time of insured. These cases landed risk measures all establishments that constituted the pension system. In this study, interest rates which are the most uncertain risks at issue are considered both

deterministic and stochastic to decrease the effect of inflation in the actuarial valuations. Also, applications were made based on the procedures and principles in the draft resolution of ministerial cabinet relevant to Banks, Insurance Companies, Reinsurance Undertakings, Chambers of Commerce, Chambers of Industry, Bourses and the special retirement fund where consist all of these establishment personals. As a result of the applications made in Excel tables, Results connected with deterministic and stochastic interest rates were studied out and some outcomes obtained with reference to how will happen calculations of the pension system both pluses and minuses after cession term.

Keywords: Stochastic interest rates, pension system, risk measurement, actuarial valuations.
Jel Classification: E43

1. Introduction

An establishment which provides the insurance services must have taken the decisions in the light of actuarial equivalence principles to fulfill all of its liabilities; on the contrary, it can be faced with elements of risk. One of the most important problems in actuarial equivalence calculations is interest rates because of indeterminacy and variability; therefore, interest rates must be accepted the stochastic into long-term financial transactions. The applications of this study have been performed using the stochastic interest rates according to a draft resolution that is published about foundation funds by the ministerial cabinet. There isn't a new attempt to transfer from the foundation funds to Social Security System; on the other hand, ongoing efforts in this direction have been continuing for a long time. Consequently, Social Security Institution has been taken necessary step to gather under a single roof all of foundation funds with temporary twentieth article of the Social Security and General Health Insurance law. Interest rates which have been deterministic are used in calculations of actuarial present values, reserve, mortality, premium concerning pension plans. Interest rates had been preferred a constant value while life contingencies were determined to be random during pension time of insured. These cases landed risk measures; as a result of these reasons, stochastic interest rates were started to use for actuarial models. Lots of papers interested in stochastic interest rates have been published for different insurance models since long years. Some of them were presented chronologically in the following paragraph. H. Pollard and J. H. Pollard (1969) presented a study to compute the moments of actuarial random variables. Boyle (1976) carried out a study to present a theory by using varying rates of interest. Bellhouse and Panjer (1980, 1981) made a statement about characteristics of stochastic interest for continuous and discrete models. Giaccotto (1986) used the stochastic interest rates to compute insurance functions. A general method was developed for both the actuarial case and the equilibrium approach. Marcea and Gaillardetz (1999) studied on

life insurance reserves in a stochastic mortality and interest rates environment for the general portfolio. Zaks (2001, 2009) analyzed the accumulated value of some annuities-certain over a period of years where the interest rate is a stochastic under some limitation. He presented two methods to derive moments of the expected value and the variance of the accumulated value. Beekman and Fuelling (1990, 1992) studied extra randomness in certain annuity models, interest and mortality randomness in some annuities. In their recently study, they utilized the Wiener stochastic process for an alternative model which has extensive boundary crossing probabilities. Burnecki, Marciniuk, and Weron (2003) built accumulated values of annuities certain with payments varying in arithmetic and geometric procession by using the stochastic interest rates. Huang and Cairns (2006) aimed to obtain a proper contribution rate for described a benefit pension plans under the stochastic interest rates and random rates of return. Hoedemakers, Darkiewicz, and Goovaerts (2005) performed a study on the distribution of life annuities with stochastic interest rates.

1.1. Foundation Funds

Foundation is called the administrative control system of the funds. Foundation Funds have been undertaken the function of the Social Security Institution, are the Social Insurance Institutions where have the qualifications of the Social Security Institution which is established by the laws, have been containing state assistances which are presented by public social security as a minimum with regards to the social security rights. Seventeen piece foundation funds which are established as for that temporary twentieth article of the law no 506 have been consisting of Banks, Insurance Companies, Reinsurance Undertakings, Chambers of Commerce, Chambers of Industry, Bourses and their subsidiaries. Table 1 is given to show this foundation fund’s name.

Table 1 Classification of names of the foundation funds

	Names of Foundation Funds
1	Türkiye İş Bankası A.Ş. Mensupları Emekli Sandığı Vakfı
2	Yapı ve Kredi Bankası A.Ş. Emekli Sandığı Vakfı
3	Akbank T.A.Ş. Mensupları Tekaüt Sandığı Vakfı
4	Türkiye Vakıflar Bankası T.A.O. Memur ve Hizmetlileri Sandığı Vakfı
5	Türkiye Garanti Bankası A.Ş. Emekli ve Yardım Sandığı Vakfı
6	T.C. Ziraat Bankası ve Halk Bankası A.Ş. Mensupları Emekli Sandığı Vakfı
7	Türkiye Halk Bankası A.Ş. Mensupları Emekli Sandığı Vakfı (Pamukbank T.A.Ş.)
8	Türkiye Odalar Borsalar ve Birlik Personeli Sigorta ve Emekli Sandığı Vakfı
9	Şekerbank T.A.Ş. Emeklileri Sandığı
10	Fortis Bank A.Ş. Mensupları Emekli Sandığı ve Dış Bank Personeli Vakfı
11	Anadolu Anonim Türk Sigorta Şirketi Memurları Sandığı Vakfı (Anadolu Sigorta)
12	Türkiye Sinai Kalkınma Bankası Mensupları Munzam Yardımlaşma Vakfı
13	Esbank Eskişehir Bankası T.A.Ş. Mensupları Emekli Sandığı Vakfı
14	Mapfre Genel Sigorta
15	Milli Reasürans T.A.Ş. Mensupları Emekli ve Sağlık Sandığı Vakfı
16	Liberty Sigorta
17	İmar Bankası T.A.Ş. Memur ve Müstahdemleri Yardım ve Emekli Sandığı Vakfı

Relationships of the Ministry of Labor and Social Security with foundation funds are:

- The approval authority on the subject of the status change
- The financial audit authority
- The surveillance authority arising from establishment under the state guarantee of the social security according to sixtieth article of the constitution

The current cession is different from the previous cession owing to the following reasons:

- Only, the participations of the foundation funds, and individuals who are granted with pensions or incomes, and their survivors are included in the scope of this act will take place transferring them to the Social Security Institution
- The takeover with actives and passives of the foundation funds isn't in question

Regulations which are made in respect of the temporary twentieth article of the law no 5510 are envisaged as below:

- Protection of existing rights of the foundation fund participations
- Technical interest rate is taken as 9.8 percent
- Determined cash value is received, maximal fifteen years, in equal annual installments, for each year separately
- The cash value is accepted by a commission
- Processes of increase, decrease, discontinuation and reassignment due to state changes in pensions and income are restricted according to the law no 5510

1.2. Statistics of Foundation Funds

As from 2011, insured situation of the foundation funds which are established according to the temporary twentieth article of the law no 506 is given Table 2.

Table 2 Insured situation of the foundation funds as from 2011

	Insured					
No	**Active**	**Passive**	**Beneficiary**	**Total**	**General Total Ratio (%)**	**Active/Passive Ratio**
1	24.839	26.716	39.190	90.745	26,00	0,93
2	14.796	12.762	22.631	50.189	14,38	1,16
3	16.175	11.581	18.161	45.917	13,15	1,40
4	12.276	8.109	16.339	36.724	10,52	1,51
5	16.623	7.742	11.818	36.183	10,37	2,15
6	11.126	3.378	7.529	22.033	6,31	3,29
7	9.883	2.716	8.000	20.599	5,90	3,64
8	5.194	4.522	8.028	17.744	5,08	1,15
9	3.529	3.798	6.223	13.550	3,88	0,93
10	3.295	824	3.590	7.709	2,21	4,00
11	902	502	846	2.250	0,64	1,80
12	346	519	601	1.466	0,42	0,67
13	8	736	571	1.315	0,38	0,01
14	449	126	291	866	0,25	3,56
15	158	330	276	764	0,22	0,48
16	191	217	233	641	0,18	0,88
17	6	233	140	379	0,11	0,03
General Total	119.796	84.811	144.467	349.074	100,00	1,41

2. Applications

In this study, we aimed to explain difference between the stochastic interest rates and the deterministic interest rates. We made applications using the assumptions which located in the draft resolution of ministerial cabinet. Some controversial issues related to calculation of liabilities in opposition to the "Social Security Institution" of foundation funds which are established according to temporary twentieth article of the law no 506 have been existed. Some of them are as below.

2.1. Assumptions

The most controversial issue in terms of the non-state actors; inflation rate assumption which located in the draft resolution of ministerial cabinet and in parallel with the technical interest rate. When as, technical interest rate that will use for the calculation of the present value both the temporary twentieth article of the law no 5510 and the draft resolution of ministerial cabinet is determined as 9,80%. Funds and employers' representatives have been demanded to be removed from the text of the calculation of the liability which will be made according to this phrase and the phrase of the "inflation rate" in located the exposure draft. Because, they are claimed that the technical interest rate (9,80%) is adjusted for inflation (real interest rate) and it must not take into consideration. The main reason underlying of the objection is that incumbent liability (the amount of the liability which is necessary for the cession) of the each foundation fund will increase when the inflation rate is used in calculations. Undersecretariat of Treasury and Ministry of Development presented an opinion in the direction of taking into account of the inflation rate in the calculations. Because, in today's conditions, the real interest rate in the market is much lower than mentioned the inflation-adjusted real interest rate (9,80%). Therefore, "Inflation rate" was added to the text taking into consideration.

In this study, we will obtain some results about how will change incumbent liability of the each foundation fund for both technical interest rate (9,80%) and real interest rate (stochastic). By this means, we can comment about controversial issues of the draft resolution of ministerial cabinet. During the implementation of legal decision interested in the temporary twentieth article of the law no 5510; institution refers to "Social Security Institution (SSI)"; fund refers to the foundation funds which are subject to the temporary twentieth article of the law no 506; salary and income refer to the disablement, old age and survivor's pensions and the permanent incapacity income and survivor's income which are assigned in case of an occupational accident or professional disease, all of which are defined in law no 5510; dependents refer to the spouse, children and parents which a person is liable to look after as per law no 5510. In the Table 2,

general total numbers of beneficiaries are given as 144.467. Nine percent (9,00%) of the beneficiaries are accepted as dependents. These assumptions, other properties are in Table 3.

Table 3 Distribution in terms of type, number, age, salary of dependents

DEPENDENTS			
Type	**Mean Number**	**Mean Age**	**Mean Salary**
Spouse - Mother and Father - Children (>=25 age)	10.502	45	800 ₺
Children (<25 age)	2.500	15	300 ₺

Earning as basis to premium refers to the earning taken as basis to premium, defined in the foundation voucher of the relative fund. This value is assumed as 3.500₺ in the part of application; contributors refer to individuals who work, have worked and quitted, voluntarily pay premiums, receive salary and/or income and who received full settlement under funds which are subject to the temporary twentieth article of the law no 506. These persons are defined as actives and passives in the Table 2. Other assumptions about these persons are given in the Table 4.

Table 4 Distribution in terms of sex, number, age, salary of contributors

CONTRIBUTORS				
Properties	**Active**		**Passive**	
	Male	**Female**	**Male**	**Female**
Number	58.734	61.062	44.132	40.679
Mean Age	31	29	60	58
Mean Salary	1.800₺	1.800₺	1.800₺	1.800₺

Inflation rate refers to the rate of change in the general consumer price index in the medium term program for the two years following the endorsement of the fund to the institution (given in the Table 5), and the amount that corresponds to each year which will be gradually equalized to the average inflation rate in the 2003-2008 EU Euro Zone after 25 years (given in the Table 6).

Table 5 The general consumer price index in the medium term program (Republic of Turkey Ministry of Development, 2012)

THE GENERAL CONSUMER PRICE INDEX			
Appearance	**Years**		
	2013	**2014**	**Other Years**
Medium Term	5,30%	5,00%	5,00%

Table 6 The average inflation rate in the 2003-2008 EU Euro Zone (Eurostat, 2012)

EURO ZONE ANNUAL AVERAGE INFLATION RATE IN 2003-2008						
Years						**Average in 2003-2008**
2003	**2004**	**2005**	**2006**	**2007**	**2008**	
2,10%	2,20%	2,20%	2,20%	2,10%	3,30%	2,35%

As a result of Tables 5 and 6; inflation rate is obtained between 2013 – 2039 years as the following Table 7. For other years, inflation rate continues with constant value identified at 2039 year.

Table 7 Annual inflation rates according to the draft resolution of ministerial cabinet

AVERAGE ANNUAL RATE OF INFLATION						
Years	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**
Inflation Rate (%)	5,30	5,00	4,89	4,79	4,68	4,58
Years	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**
Inflation Rate (%)	4,47	4,36	4,26	4,15	4,05	3,94
Years	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**
Inflation Rate (%)	3,83	3,73	3,62	3,52	3,41	3,30
Years	**2031**	**2032**	**2033**	**2034**	**2035**	**2036**
Inflation Rate (%)	3,20	3,09	2,99	2,88	2,77	2,67
Years	**2037**	**2038**	**2039**	**2040**	**2041**	**2042**
Inflation Rate (%)	2,56	2,46	2,35	2,35	2,35	2,35

2.2. Present Value Calculations

The present value for liabilities of each fund, for each contributor, including the ones resigned from the fund by the date of endorsement, is calculated with regard to the provisions below, considering the income and expenditures of the fund as per law no 5510. The real interest rate (depending on the annual inflation rate) is designated according to 9,80% the technical interest rate. “CSO 1980 Female and Male Life Tables” are used for the morbidity probabilities with regard to age.

For both the premiums and liabilities are created in “EXCEL 2007”. Rows are enumerated until 99 age from 0 age, symbolized with “x” and represents the current age of the person. Columns are enumerated until 99 from 0, symbolized with “n” and represents that payments for no more than n years for temporary life annuities or represents that payments will not start until n years after issue for deferred life annuities.

In the present value calculation, $\ddot{a}_x$ is called as “pension coefficient”. For deterministic model, pension coefficient may be defined using the commutation functions; isn’t possible to stochastic

model. This value is found using EXCEL 2007 from 0 age to 99 age depending upon both stochastic model and deterministic model.

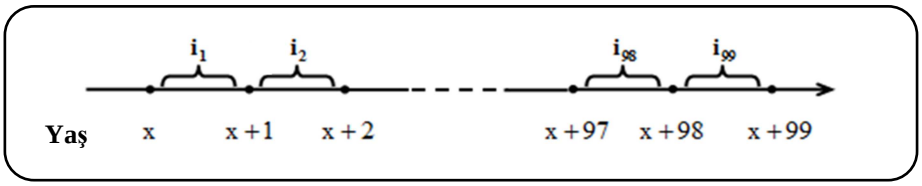

Figure 1 The series of payments associated with life annuity-due for stochastic rates

Assume that annually interest rates are changed randomly. The rate of increase to premium and salaries is accepted 0,00% at the start of each year. For these conditions; the present value of the amount collected from individuals who survived x years is denoted by l_x ; the present value of the amount collected from individuals who survived $x+1$ years is denoted by $l_{x+1}V_1$; the present value of the amount collected from individuals who survived $x+2$ years is denoted by $l_{x+2}V_1V_2$; these calculations are continued until 99 age…in conclusion, these values are added for each x age and divided by the number of people at age x. Then, the present value of this system or pension coefficient may be obtained as:

$$\ddot{a}_x = \frac{l_x + l_{x+1}\overbrace{\frac{1}{(1+i_1)}}^{V_1} + l_{x+2}\overbrace{\frac{1}{(1+i_1)}}^{V_1}\overbrace{\frac{1}{(1+i_2)}}^{V_2} + \ldots + l_{x+99}\overbrace{\frac{1}{(1+i_1)}}^{V_1}\ldots\overbrace{\frac{1}{(1+i_{98})}}^{V_{98}}\overbrace{\frac{1}{(1+i_{99})}}^{V_{99}}}{l_x}$$

In the present value calculation, $\ddot{a}_{x:\overline{n}|}$ is called as “premium coefficient”. For deterministic model, premium coefficient may be defined using the commutation functions; isn’t possible to stochastic model. This value is found using EXCEL 2007 tables depending upon the pension coefficient for both stochastic model and deterministic model.

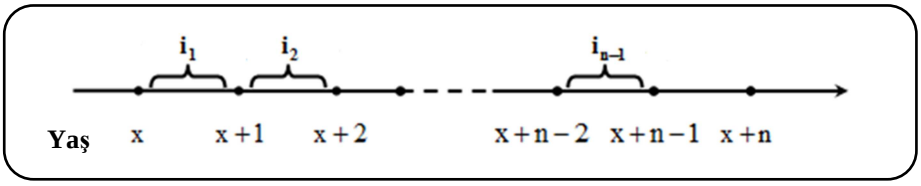

Figure 2 The series of payments associated with temporary life annuity-due for stochastic rate

Assume that annually interest rates are changed randomly. The rates of increase to premiums and salaries is accepted 0,00% at the start of each year. For these conditions; the present value of the amount collected from individuals who survived x years is denoted by l_x ; the present value of the amount collected from individuals who survived $x+1$ years is denoted by $l_{x+1}V_1$; the present value of the amount collected from individuals who survived $x+2$ years is denoted by $l_{x+2}V_1V_2$; these calculations are continued until $(n-1)$ age (payments for no more than n years)…in conclusion, the division of sums obtained consecutively until $(n-1)$ age for each x age. As a result, the present value of this system or premium coefficient may be obtained as:

$$\ddot{a}_{x:\overline{n}|} = \frac{l_x + l_{x+1}\overbrace{\frac{1}{(1+i_1)}}^{V_1} + l_{x+2}\overbrace{\frac{1}{(1+i_1)}}^{V_1}\overbrace{\frac{1}{(1+i_2)}}^{V_2} + \ldots + l_{x+n-1}\overbrace{\frac{1}{(1+i_1)}}^{V_1}\ldots\overbrace{\frac{1}{(1+i_{n-1})}}^{V_{n-1}}}{l_x}$$

In the present value calculation, ${}_{n|}\ddot{a}_x$ is called as "deferred coefficient". This value is found from the formula ${}_{n|}\ddot{a}_x = \ddot{a}_x - \ddot{a}_{x:\overline{n}|}$ for every age from 0 to 99.

2.3. Premiums and Liabilities

Premiums incoming from actives: The possible premiums that the individuals who work or voluntarily pay premiums under the fund would pay until they are assigned salaries and/or income as per law no 5510 are considered as income in the present value calculation. The part to 13,5% of total premium incomes is reserved for professional disease in accordance with active male and female numbers. The part to 20% of total premium incomes is reserved for the disablement, old age and survivor's pensions, the permanent incapacity income and survivor's income, occupational accident in accordance with active male and female numbers. As a result, The part to 33,5% of total premium incomes is accepted the general total of the incomes. The present value of premiums incoming from actives is formulated for both active male and female members according to mean age which gives in the Table 4, as following:

$$\underbrace{58.734}_{\text{active males}} \times \underbrace{12}_{\text{month}} \times \underbrace{3.500}_{\text{premium}} \times \underbrace{33,5\%}_{\text{disease and others}} \times \underbrace{\ddot{a}_{31:\overline{29}|}}_{\text{premium coefficient (male income)}} \quad ; \quad (Male)$$

$$\underbrace{61.062}_{\text{active females}} \times \underbrace{12}_{\text{month}} \times \underbrace{3.500}_{\text{premium}} \times \underbrace{33,5\%}_{\text{disease and others}} \times \underbrace{\ddot{a}_{29:\overline{29}|}}_{\text{premium coefficient (female income)}} \quad ; \quad (Female)$$

Active liabilities: The present value for the liability of the salary and/or income to be assigned to the individuals who are working or voluntarily paying premiums by the date of endorsement, which equals to the possible premium payment days between the first day of the premium payment to the day the salary and /or income is formulated for both active male and female members according to mean age and mean salary which gives in the Table 4, as following:

$$\underbrace{58.734}_{active\ males} \times \underbrace{12}_{month} \times \underbrace{1.800}_{salary} \times \underbrace{{}_{29|}\ddot{a}_{31}}_{deferred\ coefficient\ (male\ expense)} \quad ; \quad (Male)$$

$$\underbrace{61.062}_{active\ females} \times \underbrace{12}_{month} \times \underbrace{1.800}_{salary} \times \underbrace{{}_{29|}\ddot{a}_{29}}_{deferred\ coefficient\ (female\ expense)} \quad ; \quad (Female)$$

Passive liabilities: The present value for the liability of the salary and income to be paid to individuals receiving salaries and/or income by the date of endorsement is formulated for both passive male and female members according to mean age and salary which gives in the Table 4; as:

$$\underbrace{44.132}_{passive\ males} \times \underbrace{12}_{month} \times \underbrace{1.800}_{salary} \times \underbrace{\ddot{a}_{60}}_{pension\ coefficient\ (male\ expense)} \quad ; \quad (Male)$$

$$\underbrace{40.679}_{passive\ females} \times \underbrace{12}_{month} \times \underbrace{1.800}_{salary} \times \underbrace{\ddot{a}_{58}}_{pension\ coefficient\ (female\ expense)} \quad ; \quad (Female)$$

Dependents: The present value for the liability of dependents of active and passive members is represented under the headings of widow and orphan. Widows are composed of spouse, mother and father, children who is older than or equal to twenty five age (>=25 age); orphans are composed of children who is smaller than twenty five age (<25 age). The present value for the liability of dependents is formulated for both passive and active members according to mean age, mean salary and mean numbers which give in the Table 3 of dependents, as:

$$\underbrace{10.502}_{widow\ numbers} \times \underbrace{12}_{month} \times \underbrace{800}_{salary} \times \underbrace{\ddot{a}_{45}}_{\substack{pension\ coefficient \\ (male-female\ expense)}} \quad ; \quad (Widow)$$

$$\underbrace{2.500}_{orphan\ numbers} \times \underbrace{12}_{month} \times \underbrace{300}_{premium} \times \underbrace{\ddot{a}_{15:\overline{10}|}}_{\substack{premium\ coefficient \\ (male-female\ expense)}} \quad ; \quad (Orphan)$$

Health liabilities: For the calculation of the health expenses, all of active, passive and dependent members are incorporated into the present value. The annual mean expense of per member is assumed 2.000₺. The weighted mean age of all members is found 42. As a result, the present value of health expenses is formulated as following according to the information;

$$\underbrace{217.609}_{members} \times \underbrace{2.000}_{annual\ health\ expense} \times \underbrace{\ddot{a}_{42}}_{\substack{pension\ coefficient \\ (male-female\ expense)}} \quad ; \quad (All\ \ Members)$$

3. Conclusions

For actuarial valuations, six different scales are used, scales don't have the rate of increase to premium and salary, only, and interest rates are accepted deterministic and stochastic. For First Scale; the technical interest rate is accepted deterministic and taken as 9,8%. As a result, incumbent liabilities of the foundation funds are determined by subtracting from the sum of premiums to the sum of liabilities in the Table 8.

Table 8 Actuarial valuations for first scale (9,8% technical interest rate)

PREMIUMS		**LIABILITIES**	
Premiums Incoming from Actives		**Passives**	**16.122.611.353**
Disease	**6.964.794.686**	*Male*	7.946.617.247
Male	3.401.904.975	*Female*	8.175.994.107
Female	3.562.889.711	**Actives**	**1.328.776.773**
Others	**10.318.214.350**	*Male*	594.124.745
Male	5.039.859.222	*Female*	734.652.028
Female	5.278.355.127	**Dependents**	**1.081.931.802**
		Widow	1.020.981.415
		Orphan	60.950.387
		Health Liabilities	**4.215.852.861**
General Total	**17.283.009.036**	**General Total**	**22.749.172.788**
Liabilities of the Foundation Funds		**-5.466.163.753 ₺**	

Obtained results are divided into according to the insured ratio given for each foundation funds as Table 9.

Table 9 Incumbent liability of the each foundation fund for first scale

Names of Foundation Funds	Liability (₺)
Türkiye İş Bankası A.Ş.	1.421.202.576
Yapı ve Kredi Bankası A.Ş.	786.034.348
Akbank	718.800.534
Türkiye Vakıflar Bankası	575.040.427
Türkiye Garanti Bankası A.Ş.	566.841.181
T.C. Ziraat Bankası A.Ş. ve Türkiye Halk Bankası A.Ş.	344.914.933
Türkiye Halk Bankası A.Ş. (Pamukbank T.A.Ş.)	322.503.661
Türkiye Odalar Borsalar Birliği	277.681.119
Şekerbank	212.087.154
Fortis Bank A.Ş. ve Dış Bank	120.802.219
Anadolu Anonim Türk Sigorta Şirketi (Anadolu Sigorta)	34.983.448
Türkiye Sinai Kalkınma Bankası	22.957.888
Esbank Eskişehir Bankası	20.771.422
Mapfre Genel Sigorta	13.665.409
Milli Reasürans	12.025.560
Liberty Sigorta	9.839.095
İmar Bankası	6.012.780

For Second Scale; the technical interest rate is accepted deterministic and taken as 7,35%. As a result, incumbent liabilities of the foundation funds are determined by subtracting from the sum of premiums to the sum of liabilities in the Table 10. Obtained results are divided into according to the insured ratio given for each foundation funds as Table 11.

Table 10 Actuarial valuations for second scale (7,35% technical interest rate)

PREMIUMS		**LIABILITIES**	
Premiums Incoming from Actives		**Passives**	**18.976.523.279**
Disease	**8.447.160.148**	*Male*	9.237.757.264
Male	4.122.443.837	*Female*	9.738.766.015
Female	4.324.716.311	**Actives**	**3.012.489.308**
Others	**12.514.311.331**	*Male*	1.328.832.803
Male	6.107.324.203	*Female*	1.683.656.505
Female	6.406.987.128	**Dependents**	**1.319.586.501**
		Widow	1.253.151.158
		Orphan	66.435.343
		Health Liabilities	**5.210.737.853**
General Total	**20.961.471.479**	**General Total**	**28.519.336.941**
Liabilities of the Foundation Funds		**-7.557.865.462 ₺**	

Table 11 Incumbent liability of the each foundation fund for second scale

Names of Foundation Funds	Liability (₺)
Türkiye İş Bankası A.Ş.	1.965.044.760
Yapı ve Kredi Bankası A.Ş.	1.086.820.910
Akbank	993.859.177
Türkiye Vakıflar Bankası	795.087.341
Türkiye Garanti Bankası A.Ş.	783.750.545
T.C. Ziraat Bankası A.Ş. ve Türkiye Halk Bankası A.Ş.	476.901.248
Türkiye Halk Bankası A.Ş. (Pamukbank T.A.Ş.)	445.914.003
Türkiye Odalar Borsalar Birliği	383.939.515
Şekerbank	293.245.141
Fortis Bank A.Ş. ve Dış Bank	167.028.805
Anadolu Anonim Türk Sigorta Şirketi (Anadolu Sigorta)	48.370.333
Türkiye Sinai Kalkınma Bankası	31.743.031
Esbank Eskişehir Bankası	28.719.885
Mapfre Genel Sigorta	18.894.661
Milli Reasürans	16.627.302
Liberty Sigorta	13.604.156
İmar Bankası	8.313.651

For Third Scale; the technical interest rate is accepted deterministic and taken as 5,85%. As a result, incumbent liabilities of the foundation funds are determined by subtracting from the sum of premiums to the sum of liabilities in the Table 12. Obtained results are divided into according to the insured ratio given for each foundation funds as Table 13.

Table 12 Actuarial valuations for third scale (5,85% technical interest rate)

PREMIUMS		**LIABILITIES**	
Premiums Incoming from Actives		**Passives**	**21.254.144.310**
Disease	**9.663.107.903**	*Male*	10.248.538.891
Male	4.712.940.273	*Female*	11.005.605.419
Female	4.950.167.630	**Actives**	**5.078.586.360**
Others	**14.315.715.412**	*Male*	2.217.124.870
Male	6.982.133.738	*Female*	2.861.461.489
Female	7.333.581.674	**Dependents**	**1.522.623.532**
		Widow	1.452.375.787
		Orphan	70.247.746
		Health Liabilities	**6.076.411.939**
General Total	**23.978.823.316**	**General Total**	**33.931.766.140**
Liabilities of the Foundation Funds		**-9.952.942.824 ₺**	

Table 13 Incumbent liability of the each foundation fund for third scale

Names of Foundation Funds	Liability (₺)
Türkiye İş Bankası A.Ş.	2.587.765.134
Yapı ve Kredi Bankası A.Ş.	1.431.233.178
Akbank	1.308.811.981
Türkiye Vakıflar Bankası	1.047.049.585
Türkiye Garanti Bankası A.Ş.	1.032.120.171
T.C. Ziraat Bankası A.Ş. ve Türkiye Halk Bankası A.Ş.	628.030.692
Türkiye Halk Bankası A.Ş. (Pamukbank T.A.Ş.)	587.223.627
Türkiye Odalar Borsalar Birliği	505.609.495
Şekerbank	386.174.182
Fortis Bank A.Ş. ve Dış Bank	219.960.036
Anadolu Anonim Türk Sigorta Şirketi (Anadolu Sigorta)	63.698.834
Türkiye Sinai Kalkınma Bankası	41.802.360
Esbank Eskişehir Bankası	37.821.183
Mapfre Genel Sigorta	24.882.357
Milli Reasürans	21.896.474
Liberty Sigorta	17.915.297
İmar Bankası	10.948.237

For Fourth Scale; the technical interest rate is accepted deterministic and taken as 4,4%. As a result, incumbent liabilities of the foundation funds are determined by subtracting from the sum of premiums to the sum of liabilities in the Table 14. Obtained results are divided into according to the insured ratio given for each foundation funds as Table 15.

Table 14 Actuarial valuations for fourth scale (4,4% technical interest rate)

PREMIUMS		**LIABILITIES**	
Premiums Incoming from Actives		**Passives**	**23.987.879.080**
Disease	**11.152.308.832**	*Male*	11.441.494.303
Male	5.435.600.787	*Female*	12.546.384.777
Female	5.716.708.044	**Actives**	**8.559.052.994**
Others	**16.521.939.010**	*Male*	3.692.593.457
Male	8.052.741.907	*Female*	4.866.459.538
Female	8.469.197.103	**Dependents**	**1.782.237.792**
		Widow	1.707.925.072
		Orphan	74.312.720
		Health Liabilities	**7.201.865.603**
General Total	**27.674.247.842**	**General Total**	**41.531.035.469**
Liabilities of the Foundation Funds		**-13.856.787.627 ₺**	

Table 15 Incumbent liability of the each foundation fund for fourth scale

Names of Foundation Funds	Liability (₺)
Türkiye İş Bankası A.Ş.	3.602.764.783
Yapı ve Kredi Bankası A.Ş.	1.992.606.061
Akbank	1.822.167.573
Türkiye Vakıflar Bankası	1.457.734.058
Türkiye Garanti Bankası A.Ş.	1.436.948.877
T.C. Ziraat Bankası A.Ş. ve Türkiye Halk Bankası A.Ş.	874.363.299
Türkiye Halk Bankası A.Ş. (Pamukbank T.A.Ş.)	817.550.470
Türkiye Odalar Borsalar Birliği	703.924.811
Şekerbank	537.643.360
Fortis Bank A.Ş. ve Dış Bank	306.235.007
Anadolu Anonim Türk Sigorta Şirketi (Anadolu Sigorta)	88.683.441
Türkiye Sinai Kalkınma Bankası	58.198.508
Esbank Eskişehir Bankası	52.655.793
Mapfre Genel Sigorta	34.641.969
Milli Reasürans	30.484.933
Liberty Sigorta	24.942.218
İmar Bankası	15.242.466

For Fifth Scale ; the technical interest rate is accepted deterministic and taken as 3,00%. As a result, incumbent liabilities of the foundation funds are determined by subtracting from the sum of premiums to the sum of liabilities in the Table 16. Obtained results are divided into according to the insured ratio given for each foundation funds as Table 17.

Table 16 Actuarial valuations for fifth scale (3,00% technical interest rate)

PREMIUMS		**LIABILITIES**	
Premiums Incoming from Actives		**Passives**	**27.287.437.944**
Disease	**12.982.705.332**	*Male*	12.855.488.784
Male	6.323.177.770	*Female*	14.431.949.160
Female	6.659.527.563	**Actives**	**14.417.688.126**
Others	**19.233.637.529**	*Male*	6.137.228.396
Male	9.367.670.770	*Female*	8.280.459.730
Female	9.865.966.760	**Dependents**	**2.118.711.640**
		Widow	2.040.074.271
		Orphan	78.637.369
		Health Liabilities	**8.687.609.827**
General Total	**32.216.342.862**	**General Total**	**52.511.447.536**
Liabilities of the Foundation Funds		**-20.295.104.675 ₺**	

Table 17 Incumbent liability of the each foundation fund for fifth scale

Names of Foundation Funds	Liability (₺)
Türkiye İş Bankası A.Ş.	5.276.727.216
Yapı ve Kredi Bankası A.Ş.	2.918.436.052
Akbank	2.668.806.265
Türkiye Vakıflar Bankası	2.135.045.012
Türkiye Garanti Bankası A.Ş.	2.104.602.355
T.C. Ziraat Bankası A.Ş. ve Türkiye Halk Bankası A.Ş.	1.280.621.105
Türkiye Halk Bankası A.Ş. (Pamukbank T.A.Ş.)	1.197.411.176
Türkiye Odalar Borsalar Birliği	1.030.991.317
Şekerbank	787.450.061
Fortis Bank A.Ş. ve Dış Bank	448.521.813
Anadolu Anonim Türk Sigorta Şirketi (Anadolu Sigorta)	129.888.670
Türkiye Sinai Kalkınma Bankası	85.239.440
Esbank Eskişehir Bankası	77.121.398
Mapfre Genel Sigorta	50.737.762
Milli Reasürans	44.649.230
Liberty Sigorta	36.531.188
İmar Bankası	22.324.615

For Sixth Scale; the real interest rate (depending on the annual inflation rate) is taken as stochastic according to 9,8% technical interest rate. As a result, incumbent liabilities of the foundation funds are determined by subtracting from the sum of premiums to the sum of liabilities in the Table 18. Obtained results are divided into according to the insured ratio given for each foundation funds as Table 19.

Table 18 Actuarial valuations for sixth scale (real interest rate)

PREMIUMS		**LIABILITIES**	
Premiums Incoming from Actives		**Passives**	**21.844.508.917**
Disease	**9.906.525.638**	*Male*	10.554.400.462
Male	4.832.354.118	*Female*	11.290.108.455
Female	5.074.171.521	**Actives**	**4.022.423.548**
Others	**14.676.334.279**	*Male*	1.775.440.021
Male	7.159.043.137	*Female*	2.246.983.527
Female	7.517.291.142	**Dependents**	**1.544.867.159**
		Widow	1.472.479.117
		Orphan	72.388.042
		Health Liabilities	**6.139.244.136**
General Total	**24.582.859.917**	**General Total**	**33.551.043.760**
Liabilities of the Foundation Funds		**-8.968.183.843 ₺**	

Table 19 Incumbent liability of the each foundation fund for sixth scale

Names of Foundation Funds	Liability (₺)
Türkiye İş Bankası A.Ş.	2.331.727.799
Yapı ve Kredi Bankası A.Ş.	1.289.624.837
Akbank	1.179.316.175
Türkiye Vakıflar Bankası	943.452.940
Türkiye Garanti Bankası A.Ş.	930.000.665
T.C. Ziraat Bankası A.Ş. ve Türkiye Halk Bankası A.Ş.	565.892.400
Türkiye Halk Bankası A.Ş. (Pamukbank T.A.Ş.)	529.122.847
Türkiye Odalar Borsalar Birliği	455.583.739
Şekerbank	347.965.533
Fortis Bank A.Ş. ve Dış Bank	198.196.863
Anadolu Anonim Türk Sigorta Şirketi (Anadolu Sigorta)	57.396.377
Türkiye Sinai Kalkınma Bankası	37.666.372
Esbank Eskişehir Bankası	34.079.099
Mapfre Genel Sigorta	22.420.460
Milli Reasürans	19.730.004
Liberty Sigorta	16.142.731
İmar Bankası	9.865.002

As a result, different results were obtained for all stations in Table 20.

Table 20 Liabilities of foundation funds according to scales

Scale	Interest Rates	Liabilities
First	*i = %9,8*	-5.466.163.753
Second	*i = %7,35*	-7.557.865.462
Third	*i = %5,85*	-9.952.942.824
Fourth	*i = %4,4*	-13.856.787.627
Fifth	*i = %3*	-20.295.104.675
Sixth	*i = stochastic*	-8.968.183.843

The technical interest rate was decreased with rates respectively 2,45%, 1,50%, 1,45%, 1,40% beginning from 9,80%. We saw that when not have the rates of increase to premium and salary, the highest value of the liability will be for 3,00% technical interest rate. We understand that the liability of the foundation funds will increase when the technical interest rate decreases. Also, the liability of the foundation funds will increase for real (stochastic) interest rates according to the 9,80% technical interest rate.

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