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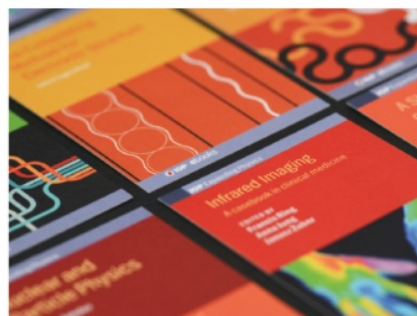
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2 Automatics adjustment on private pension fund for Asian Mathematics Conferences

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Abstract. This paper discussed about how the automatic adjustment mechanism in the pension fund with defined benefits in case conditions beyond assumptions - assumptions that have been determined. Automatic adjustment referred to in this experiment is intended to anticipate changes in economic and demographic conditions. The method discuss in this paper are indexing life expectancy. In this paper discussed about how the methods on private pension fund and how's the impact of the change of life expectancy on benefit.

1. Introduction

Defined benefit retirement systems are often designed with mechanisms to self-adjust for many factors. For example, plans have adjusted for inflation and real wage growth over the working lifetime with a myriad of design factors. Final average defined benefit plans adjust by basing the final benefit on final pay; cash balance defined benefit plans accrue over time with interest.

However, most systems do not have factors to take into account other risks. One key risk, improvement in average longevity, will be discussed at length as it has been the focus of many self-adjusting mechanisms put into place in recent years. But other factors will be discussed as well, including mechanisms to adjust for solvency in social insurance systems in ways other than raising or lowering taxes.

Within defined benefit retirement income systems both employer provided systems and social security systems much work has been done recently to put self adjusting mechanisms in place to deal with improvements in life expectancy. Improvements in life expectancy raise the lifetime generosity of these retirement income systems, raising the costs, and placing strains on their financing. As many of these systems have wrestled with significant improvements in life expectancy in the second half of the 20th century, we have seen several models emerge for how to deal with this systematic risk.

The failure to adjust social security systems for improvements in life expectancy is one of the causes of the financing problems they are facing [3]. Traditional social security systems generally are not self-sustaining in the face of increasing life expectancy at older ages because retirees receive benefits for more years. By contrast, in defined contribution systems, life-expectancy indexing of benefits occurs automatically when benefits are annuitized using current mortality tables because increases in life expectancy reduce benefit levels. Eventually, traditional social security systems require adjustments to deal with the increased benefit cost caused by rising life expectancy. With a pay-as-you-go system, solvency can be maintained three ways: cutting

7 benefits, raising taxes, or raising the early retirement age. Raising the early retirement age will help Social Security finances if benefits are not raised to adjust for the increase in age of eligibility [4].

Increased life expectancy raises the cost to employers of providing defined benefit pension plans. While in the short run, changes in interest rates normally dominate changes in life expectancy in their effect on pension liabilities, over a period of decades, the effect on pension costs of the increase in longevity can be considerable, while changes in interest rates generally have much less effect. The short run and long run importance of the effects on pension cost of changes in life expectancy are thus quite different. The life expectancy coefficient is a mechanism affecting the pension amount and used to hold in check the pension expenditure due to a prolonged life expectancy. The coefficient is based on the average length in life expectancy calculated on the basis of the mortality rates for the preceding five years. The coefficient is determined annually for those who have turned 65 years.

The purpose of index security for pensions is to ensure that a person retiring may receive a starting pension that is reasonable considering the income level while still working, and to ensure the future purchasing power of the pension in payment.

When determining the starting earnings-related pension, the pension provider adjusts the insureds wages and income from work during his or her career to the level of the first year of pension by the wage coefficient. Adjustment by the wage coefficient, i.e. indexing, ensures that a person who is retiring will receive a pension that is proportionate to his or her income level while still working.

Following retirement, the pension provider annually adjusts the earnings-related pension in payment at the beginning of January according to changes in the earnings-related pension index. Indexation with the earnings-related pension index secures and even improves the pensions purchasing power. The Social Insurance Institution annually adjusts national pensions in payment based on changes in the national pension index at the beginning of January. Indexation preserves the purchasing power of national pensions in relation to changes in consumer prices.

The life expectancy coefficient is defined so that the capital value of the pension adjusted with the coefficient is the same when calculated with the available mortality rates of TMI. When calculating the capital value, a two-per-cent interest rate is used.

1.1. Method

The life expectancy coefficient is calculated by dividing the longevity indicator (with 6 decimals) for the base year 2010 with the longevity indicator for year 2015 (with 6 decimals). The life expectancy coefficient is given with five (5) decimals. [1]

$$EAK = EAL_{2010} / EAL_{2015} \quad (1)$$

The longevity indicator (EAL) is calculated using the formula [1]

$$EAL = \sum (1.02^{-x+0.5-65})(L_x \div l_{65}) \quad (2)$$

in which,

$x =$ the age use in the calculation, $x = 65, 66, \dots, 100$

$l_x =$ the number of pension alive at age x , $l_{65} = 1$; the number of pension alive at age $x + 1$

is obtain using formula

$$l_x = (1 - q_x) \cdot l_x$$

$q_x =$ based on mortality table indonesia

$L_x =$ the average number of person alive at age cohorts $x, x + 1$

$L_x = (l_x + l_{x+1}) \div 2$ the calculation of the life expectancy coefficient for the years 2015

Therefore, the life expectancy coefficient for 2015 is 0.93969

Table 1. Life Expectancy Coefficient 2015

x	q_x	l_x	L_x	EAL
65	0.021	1	0.98950000	0.923241
66	0.02288	0.97900000	0.96780024	0.885289
67	0.02486	0.95660048	0.944709936	0.84723
68	0.02702	0.932819392	0.92021702	0.809076
69	0.02921	0.90761461	0.894358901	0.770922
\vdots	\vdots	\vdots	\vdots	\vdots
96	0.34662	0.01615405	0.013354393	0.006744
97	0.3677	0.010554734	0.008614246	0.004265
98	0.39016	0.006673758	0.005371842	0.002607
99	0.41413	0.004069925	0.003227186	0.001536
100	0.43974	0.002384447	0.001860179	0.000868

which result the EAL = 11.979234

The calculation of the life expectancy coefficient for the years 2010

Table 2. Life Expectancy Coefficient 2010

x	q_x	l_x	L_x	EAL
65	0.02415	1	0.987925	0.921772
66	0.02653	0.97585	0.96290535	0.880811
67	0.02915	0.9499607	0.936115022	0.839515
68	0.03203	0.922269345	0.907499202	0.797894
69	0.03518	0.892729058	0.877025954	0.755981
\vdots	\vdots	\vdots	\vdots	\vdots
96	0.37269	0.01148307	0.009322014	0.004708
97	0.40523	0.007160957	0.00571004	0.002827
98	0.43542	0.004259123	0.003331869	0.001617
99	0.46687	0.002404615	0.001843294	0.000877
100	0.49945	0.001281973	0.000640986	0.000299

which result the EAL = 11.256785

1.2. Pension Fund

In this section will be the notion of Pension Funds, various pension funds, Benefit Functions is a function that is used to determine the amount of benefit that an employee will receive on retirement, resignation, disability, and death during the active period. The formula for the benefit is;

$$B_x = \sum b_x \tag{3}$$

Normal Cost is an annual fee imposed on those who are still active which is determined using an actuarial cost method. The formula for the normal cost is;

$${}^\tau(NC)_x = b_x p_x^{(T)} v^{(r-x)} \tag{4}$$

some actuarial funding methods used in the pension program, has a different actuarial liability. In general Actuarial Liability can be expressed as follows :

$$\tau (AL)_x = B_x p_x^{(T)} v^{(r-x)} \ddot{a} \tag{5}$$

Next will be discuss about the total unfunded Liability plans in the year t is defined as the difference between the asset and the actuarial liabilities denoted as follows:

$$ul(t) = AL(t) - f(t) \tag{6}$$

Annuity function is a series of periodic payments, there are two types of functions, namely annuities Life Annuity function which is a series of periodic payments in which each payment is only made if the designated person is still alive at the time payment is due.

$$\ddot{a} = \sum p_x^m v^t \tag{7}$$

And the fixed annuity function which is a series of periodic payments that are carried out within a certain period. There are two types of fixed annuity, immediate and due.[2]

$$a_{\overline{n}|} = (1 - v^n) \div i \tag{8}$$

and

$$\ddot{a}_{\overline{n}|} = (1 - v^n) \div d \tag{9}$$

1.2.1. *Muhammadiyah Pension Fund* The Muhammadiyah pension fund uses the defined benefit scheme, the result of life coefficient indexation on benefit in muhammadiyah pension fund.

Table 3. Life Expectancy indexation on benefit

Birth	Retire	\ddot{a}_{65}	B	R*	E(R)
1950	2015	16.1	-1%	65	18 y, 6 m
1955	2020	16.4	-2%	65 and 3 m	18 y, 6 m
1960	2025	16.8	-4%	65 and 4 m	18 y, 8 m
1965	2030	16.9	-6%	65 and 8 m	19 y, 2 m
1970	2035	17.1	-9%	66 and 1 m	19 y, 3 m
1975	2040	17.6	-11%	66 and 4 m	19 y, 4 m
1980	2045	17.8	-12%	66 and 7 m	19 y, 5 m
1985	2050	17.9	-12%	66 and 11 m	19 y, 6 m
1990	2055	18.0	-13%	67	19 y, 8 m
1995	2060	18.1	-13%	67 and 2 m	19 y, 10 m
2000	2065	18.4	-14%	67 and 3 m	19 y, 11 m

note : y = years ; m = months

As we can see on Table 3, the annuity factor at age 65 differ according to the year of birth. The change in Benefit (B) because of the the change of life expectancy also can be seen here. The R* on Table 3 is the retirement age required to neutralize the effect of increased life expectancy and the E(R) is the implying the expected length of retirement.

2. Conclusion

Automatic adjustment on private pension sector due to the change of demographics and economics can be solved by adjusting the life expectancy coefficient. The research result produce the life expectancy coefficient for 2015 is 0.93969, which mean that the capital value of the pension adjusted with the coefficient. The consequences because of change in the life expectancy coefficient made the benefit also change according to the year of birth, the retirement age needs to be neutralize and also the expected retirement length the result can be seen on Table 3.

Acknowledgments

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