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Sharia Early Retirement Modelling Using Accrued Benefit Cost

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Abstract. One approach for estimating normal cost and actuarial liability is Accrued Benefit Cost. In this study, researchers apply Accrued Benefit Cost to the Project Unit Credit to determine cumulative normal cost, actuarial liability, and to estimate cumulative fund development from sharia investment. This approach is applied to an insurance company that has 3 types of investment products, package A, package B, and package C. According to the simulation results, typical contributions are calculated based on the period of service and the initial income. The development fund depends on the investment package chosen, where participants who choose package A will get higher investment benefits than packages B and C. This is because the investment benefits of package A are more stable than that of B and C.

Keywords: *accrued benefit cost; early retirement; sharia investment; project unit credit.*

1 Introduction

Currently, pension funds have become an important part of people's financial planning. One of the institutions that manages pension funding is Financial Institution Pension Fund (DPLK). DPLK that offers pension fund management with Sharia principles is Sharia Muamalat Financial Institution Pension Fund (DPLK Muamalat). Based on statistics from the Financial Services Authority (OJK) in 2020 there are more than 3 million people who have become participants of the Financial Institution Pension Fund (DPLK). This number increased significantly compared to the position in 2014 where there were only 2.4 million DPLK participants. In addition, the 2015 – 2019 OJK Sharia Non-Bank Financial Industry (IKNB) roadmap shows that 74.8% of workers and 85.7% of entrepreneurs in Indonesia have an interest in Sharia pension funds, while the level of public knowledge about Pension Funds is still low, that is 27 .8% for workers and 28% for employers.

In the pension funding program, there are actuarial calculation methods that need to be considered. The actuarial approach is used to determine the normal contributions, actuarial obligations and pension benefits of participants after they are not actively participating. One of the actuarial approaches used is the Accrued Benefit Cost method. The Accrued Benefit Cost method emphasizes the retirement benefits that mature on a certain date. From the Accrued Benefit Cost method, it will be used to find the amount of contributions or the normal cost of participants and the company's actuarial liability. Normal Contribution paid by employees through monthly salary deductions will proceeds in accumulated funds for payment of Pension Benefits when Normal Retirement age. However, Pension Fund participants often stop being participants before the Normal Retirement age. This can happen because participants stop working for various reasons.

Burnay (2008) states that there are three reasons why someone makes the decision to retire early. Some of these reasons are individual and family reasons, organizational reasons, and social reasons. In individual reasons, a person can retire early due to health conditions and even because the person dies or is disabled. In addition, family factors can also be a cause for example financial difficulties and family conditions. For organizational reasons, it can be caused by changes in the organizational structure and the company's financial condition which is currently difficult. The company's difficult financial condition can lead to Early Retirement due to reducing company expenses from the salary side. Meanwhile, for social reasons, the occurrence of Early Retirement is due to the stereotype in the minds of some individuals that older workers will usually have difficulties in physical, thinking, learning new things, working with younger people and a refusal to change (Rosen & Jerdee in Burnay, 2008).

The number of factors that can cause early retirement employees is difficult to predict with certainty. This is a challenge for the company to really prepare well for the possibilities that occur in the event of an early retirement, both on a large and small scale. Therefore, from the explanation of the principles, researchers are interested in researching the process of funding for the retirement period when retiring early using Sharia and the Accrued Benefit Cost calculation method. This method is used to the employment data of Asuransi Jasindo Syariah, a sharia-compliant general insurance firm in Indonesia. The purpose of this study is to model the amount of normal contributions at the time of early retirement, to simulate the development model for each investment package and to estimate the total pension benefits obtained when early retirement occurs.

2 Theoretical Framework and Hypothesis Development

2.1 Pension Fund

Based on the Law of the Republic of Indonesia No. 11 of 1992, the Pension Fund is a legal entity that manages and runs programs that promise Pension Benefits (Article 1 paragraph 1). The pension program the Law of the Republic of Indonesia No. 11 of 1992, namely the Defined Benefit Pension Program and the Defined Contribution Pension Program. Tunggal (1995) suggests that there are four types of pension benefits provided by the Pension Fund, namely:

1. Normal Retirement Benefits
   Retirement benefits for participants who begin to be paid when the participant retires after reaching normal retirement age or thereafter.
2. Expedited Retirement Benefits
   Pension benefits for participants that are paid if the participant retires at a certain age before the normal retirement age
3. Disability Pension Benefits
   Disability Pension Benefit is a Pension Benefit given to a participant who stops working due to being declared disabled by the employer based on a doctor's statement appointed by the employer.
4. Postponed Retirement Benefits
   Pension benefits for participants who stop working before reaching normal retirement age, whose payments are postponed until the participant retires in accordance with Pension Fund regulations.

2.2 Early Retirement

According to Widjajanto (2009) that early retirement is one of the terms of retirement, which is seen from the causes, namely normal retirement, accelerated retirement, retirement due to disability, and retirement due to death. According to Burnay (2008), there are three factors that cause employees to make decisions for early retirement, the first is individual and family reasons, organizational reasons, and social reasons. In the Regulation of the Ministry of Manpower of the Republic of Indonesia Number 2 of 1993 that the normal retirement age for employers of the Pension Fund regulations is 55 (fifty-five years) and the maximum retirement age is 60 (sixty years) (Article 2). Normally, a person can apply for early retirement which is 10 years earlier than the normal retirement age.

2.3 Sharia Principles Early Retirement Program

Based on the Fatwa of DSN MUI Number 88/DSN-MUI/XI/2013 that the Sharia Principles Pension Program is a Pension Program that is managed and implemented based on Sharia Principles. In Sharia Principles, DPLK is defined as a Pension Fund established by a bank or life insurance company to administer a Defined Contribution Pension Program for individuals, both employees and independent workers, which is separate from the Employer Pension Fund for employees of the bank or life insurance company concerned.

The following are some of the provisions of the DPLK which organizes the Defined Contribution Pension Program (PPIP) with Sharia Principles according to the Fatwa of DSN MUI Number 88/DSN-MUI/XI/2013, as follows:

1. The contract between the employer and the participant is Hibab bi Syarth, employer as provider (Wahib), and Participants as Receiver (Mauhub lah);
2. The Employer has the right to determine the parties who are entitled to receive pension benefits under the Muqayyadah Grant contract;
3. The contract between the Employer and the Sharia Pension Fund is a wakalah contract;
4. In PPIP-Contributory, the contract between the Participant and the Sharia Pension Fund is the Wakalah bil Ujrah contract;
5. Contracts between Mandiri Participants and Sharia Pension Funds are Wakalah bil Ujrah contracts;
6. The contract between the Sharia Pension Fund and the Investee/Investment Manager is a Wakalah bil Ujrah contract or a Mudharabah contract.

Based on the statistics of the Financial Services Authority (OJK) in 2020, the DPLK that implements the Pension Program with Sharia principles is the DPLK of PT BANK MUAMALAT INDONESIA. Muamalat DPLK offers 3 types of investment packages for participants to develop their paid contributions. The following is the investment package and average return for April 2020 - January 2021 DPLK Bank Muamalat:

Table 1 The average rate of return of Muamalat DPLK.

Package	Explanation	Roi YoY (%)
Package A	100% Sharia Deposits in Islamic Banks	4,20%
Package B	100% Sharia Deposits in Sharia Banks, and/or sukuk/state Sharia securities (maximum 80%)	4,07%
Package C	Sharia Deposits in Sharia Banks (max. 100% and or Sharia Mutual Funds (max. 80%) and or Sharia Shares (max. 50%)	-19,36%

Source: https://dplksyariahmuamalat.co.id/

2.4 Mortality Table

The mortality table can be interpreted as a table containing survival data in a population (Bowers et al., 1997). The probability that someone will die is l_x used to represent the number of people who are exactly age x, and d_x represents the number of died people between the ages x and $x+1$ or can be formulated as follows :

$$d_x = l_x + l_{x+1}$$

According to Jordan (1991), the probability that a person of age x will survive at the age of $x+1$ years is expressed in ${}_n p_x$ or:

$${}_n q_x = \frac{l_{x-1}}{l_x}$$

The probability that a person will die before the age $x+n$ is denoted by ${}_n q_x$ or:

$${}_n q_x = \frac{d_x}{l_x}$$

2.5 Life Annuity

Annuity can be defined as a series of payments made continuously or at equal intervals, either in the form of monthly, quarterly, or yearly (Bowers et al., 1997). The following is a commutation symbol in a life annuity:

$$N_x = \sum_{t=0}^{1-x-1} D_{x+t} = D_x + D_{X+1} + D_{x+2} + \ \ldots + D_{w-1}$$

$$D_x = v^x . l_x = \left(\frac{1}{1+i}\right)^x . l_x$$

From this commutation, the initial lifetime annuity symbolized by $\ddot{a}_x$ or can be formulated as follows:

$$\ddot{a}_x = 1 + a_x = 1.v.\ p_x + v^2\ {}_2P_x + \cdots + v^{w-x-1}{}_{w-x-1}p_x$$

$$= \frac{1}{D_x}(D_x + D_{X+1} + D_{x+2} + \ \ldots + D_{w-1}) = \frac{N_x}{D_x}$$

2.6 Actuarial Assumption

Actuarial assumptions are used to reflect the best estimate of the anticipation of things that will happen in the future (Caraka, 2016). According to Winklevoss (1993), there are several actuarial assumptions used in calculating pension costs, namely the assumption of the depreciation rate, the assumption of an increase in salary rates, and the assumption of interest rates.

1. Salary Increase Rate Assumption
   One of the factors that determine the amount of pension benefits is the level of increase in participant salaries.
2. Interest Rate Assumption
   The most basic actuarial assumption and is always used is the interest rate assumption. This is because the funds collected from the participant's Normal Contribution will be invested in the long term and are expected to meet the company's Actuarial Liability later.

2.7 Basic Actuarial Function

To support the actuarial calculation process, basic actuarial functions are needed (Caraka, 2016). In this study, there are basic actuarial functions used in the

formulation of the determination of early retirement funding, namely the survival function, interest function, salary function, and benefit function.

1. Survival Function
   According to Winklevoss (1993), the composite survival function is the chance that a participant in pension funding will continue to work during the active working period until the time allowed to retire. The following is the formula survival function:
   $$ {}_np_x^{(T)} = \frac{l_{x+n}^{(T)}}{l_x^{(T)}} $$
   So, to calculate the total depreciation of active participants is the same as the sum of each cause of participant work continuity, as follows:
   $$ d_x^{(T)} = d_x^{(m)} + d_x^{(d)} + d_x^{(t)} + d_x^{(r)} $$
2. Interest Rate Function
   The interest rate function used to discount a future payment to the present time (Winklevoss, 1993). If the interest rate is constant at i, then the discount factor in years is:
   $$ v_n = v^n = \frac{1}{(1+i)^n} $$
3. Salary Function
   The salary function is used to estimate the participant's future salary to calculate the benefits of the participant's pension plan (Winklevoss, 1993). If the participant gets a salary increase of p per year, then the participant's salary before early retirement at age $r' - 1$ based on salary at age x is:
   $$ s_{r'-1} = s_x(1+p)^{r-1-x} $$
4. Benefit Function
   The benefit function is used to find the amount of benefits that will be obtained by a participant at retirement age. If b_x is he amount of benefits at age x where k is the percentage of the proportion of salary taken for retirement benefits then:
   $$ b_x = ks_x $$
   While the cumulative of the benefits are:
   $$ B_x = (x-y)b_x $$
5. Present Value of Future Benefit (PVFB)
   Present Value of Future Benefit (PVFB) is the present value of periodic pension benefits that will be received by pension fund program participants when participants enter early retirement age, which are as follows:
   $$ {}^{r'}(PVFB)_x = B_{r'}v^{r'-x}{}_{r'-x}p_x^{(T)}\ \ddot{a}_{r'} $$

2.8 Actuarial Cost Method

According to the Pension Fund Actuarial Practice Standard (SPA-DP) No. 3.02, Actuarial Cost Method is a calculation method used by Actuaries to determine the amount of Normal Contribution (Normal Cost) that must be paid to the Pension Fund for a certain period and the amount of Actuarial Accrued Liability. Based on the type, the actuarial calculation method is divided into two, namely the Accrued Benefit Cost with the Projected Benefit Cost method (Grizzle, 2005).

2.9 Pension Cost (Normal Cost)

The normal cost of participants using the Accrued Benefit Cost method increases every year from the beginning to the end of participation (Grizzle, 2015). In this study, the normal cost uses the Accrued Benefit Cost method with Project Unit Credit, which is as follows:

$$^{r'}(NC)_x = b_x v^{r'-x}\ {}_{r'-x}p_x^{(T)} \ddot{a}_{r'}\ (y \le x \le r')$$

2.10 Actuarial Liability

According to the Pension Fund Actuarial Practice Standard (SPA-DP) No. 5.02, actuarial liability (AL) is the obligation of the Pension Fund which is calculated based on the assumption that the Pension Fund continues until all obligations to participants and entitled parties are fulfilled. The following is an actuarial liability model using part of the Accrued Benefit Cost method, namely Project Unit Credit as follows:

$$^{r'}(AL)_x = \frac{(x-y)}{(r'-y)} B_{r'} v^{r'-x}\ {}_{r'-x}p_x^{(T)}\ \ddot{a}_{r'}$$

$$^{r'}(AL)_x = \frac{(x-y)}{(r'-y)}\ ^{r'}(PVFB)_x$$

3 Materials and Methods

3.1 Data

The data used as the calculation of early retirement funding with Sharia principles in this study is secondary data originating from the Pension Fund of the Jasindo Syariah Insurance Company. There is data on of 54 employees who are participate in the pension program. In addition, there is some data or information from Muamalat DPLK Syariah regarding the cost of managing funds

of 1.25% or 1% for total funds above 100 million and a minimum initial deposit of 200 thousand.

3.2 Assumptions

In this study using several assumptions according to the data obtained, namely as follows:

1. The age of participants for early retirement is 45 (forty-five) years
2. Salary is affected by 5% salary increase rate and 6.80% discount rate.
3. Resignation rates based on age are:

- 1-17 years at 0%

- 18-29 years at 10%

- 30-39 years by 5%

- 40-44 years at 3%

- 45-49 years at 2%

- 50-54 years by 1%

- 55-99 years at 0%

3.3 Data Variable

The data variables in this study were taken from the variables available in the participant salary data information and adjusted to the calculation needs of the early retirement funding program. These variables are:

1. Age of participant when accepted for work
2. Age of the participant at the time of calculation
3. Retirement age limit for participants
4. Participant's working period
5. Remaining working period of participants
6. Participant starting salary

3.4 Research Methodology

There are several stages of analysis carried out by the author to achieve the research objectives described as follows:

1. Compile a table of commutation symbols for values and based on the Indonesian Mortality Table IV Year 2019 with the company's data interest rate.
2. Determine the amount of participant contributions and the total contribution at the age of early retirement using the Accrued Benefit Cost method.
3. Calculating the amount of investment package development funds from participant fees.
4. Calculating the company's Actuarial Liability using the Accrued Benefit Cost method.
5. Calculate the total pension benefits of participants when retiring early.

4 Results and Discussion

The data used in this study is secondary data from PT. Asuransi Jasindo Syariah with a sample of 54 employees. As an example of calculation, the participant's normal contribution will be determined until early retirement age for the entry age of 35 years with the first basic salary entering Rp. 5,484,375 and the salary increase rate of 5%. In addition, there are allowances whose value is fixed every year, namely a basic allowance of Rp. 618,125.00 and a house allowance of Rp. 537,500, so the salary function is as follows:

$$s_{x+t} = s_x(1+p)^t + House\ allowance + Basic\ allowance$$

then the amount of the participant's salary at the age of 40 years is:

$$s_{40} = s_{35}(1+6{,}80\%)^5 + House\ allowance + Basic\ allowance$$

$$s_{40} = s_{35}(1+6{,}80\%)^5 + House\ allowance + Basic\ allowance$$

$$s_{40} = 5.484.372(1+6{,}80\%)^5 + 537.500 + 618.125$$

$$s_{40} = 8.776.124$$

With the proportion of salary prepared for the pension fund is 5% with the function of the pension benefit using the average salary during work. Then the pension benefit is calculated based on the equation as follows :

$$b_x = ks_x$$

then the amount of the participant's salary at the age of 40 years is:

$$b_x = 0{,}05 \times 8.776.124$$

$$b_x = 438.806$$

Based on the cumulative pension benefits of participants at the early retirement age of 45 years is Rp 4,721,427. The present value of the pension benefits of participants aged 40 years is:

$$^{45}(PVFB)_x = B_{r'} v^{r'-x}{}_{r'-x}p_x^{(T)}\, \ddot{a}_{r'}$$

$$^{45}(PVFB)_{40} = 4.721.427 \times 0{,}936329588 \times 0{,}8674 \times 5{,}409406$$

$$^{45}(PVFB)_{40} = Rp20.940.584$$

So, the present value of the participant's pension benefit at the age of 40 is Rp. 20,940,584. The calculation of the present value of pension benefits is carried out from the age of entry into work y to the early retirement age of r'. The calculation results are presented in the following table :

Table 2 Calculation result of present value of future benefit, normal cost and actuarial liability.

NO	x	s_x	b_x	$^{45}(PVFB)_x$	$^{45}NC_x$	$^{45}(AL)_x$
1	35	Rp 8.776.124	Rp438.806	Rp 11.429.667	Rp 1.142.967	Rp -
2	36	Rp 9.157.149	Rp457.857	Rp 12.191.872	Rp 1.354.652	Rp 1.219.187
3	37	Rp 9.557.225	Rp477.861	Rp 13.005.810	Rp 1.625.726	Rp 2.601.162
4	38	Rp 9.977.305	Rp498.865	Rp 13.874.994	Rp 1.982.142	Rp 4.162.498
5	39	Rp 10.418.389	Rp520.919	Rp 14.801.451	Rp 2.466.909	Rp 5.920.581
6	40	Rp 10.881.527	Rp544.076	Rp 16.160.130	Rp 3.232.026	Rp 8.080.065
7	41	Rp 11.367.822	Rp568.391	Rp 17.241.493	Rp 4.310.373	Rp 10.344.896
8	42	Rp 11.878.432	Rp593.922	Rp 18.394.024	Rp 6.131.341	Rp 12.875.817
9	43	Rp 12.414.573	Rp620.729	Rp 19.626.740	Rp 9.813.370	Rp 15.701.392
10	44	Rp 12.977.520	Rp648.876	Rp 20.940.584	Rp20.940.584	Rp 18.846.525

From the calculation above, it is continued by finding the estimated development fund using historical data on the average return of each investment package, which is as follows:

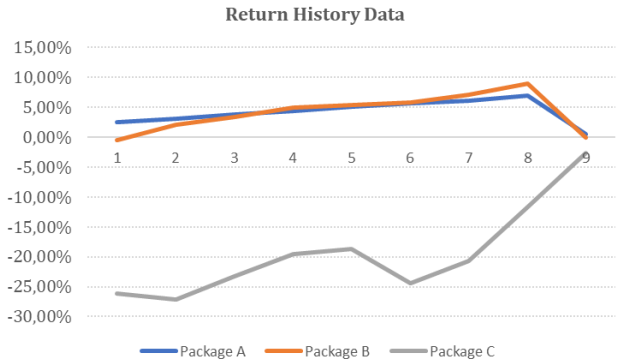

Figure 1 Investment package return history data.

From this data, the total pension benefits can be obtained after deducting management fees of 1.25% per year and administrative costs of Rp. 2,000 per month as follows:

Table 3 Calculation result of development fund of normal cost and nett benefit of the participant's pension benefit at the age of 40.

NO	x	Development Fund of Normal Cost			Nett Benefit		
		Package A	Package B	Package C	Package A	Package B	Package C
1	35	Rp 48.005	Rp 46.519	-Rp 221.278	Rp 1.152.084	Rp 1.150.617	Rp 886.167
2	36	Rp 105.283	Rp 101.964	-Rp 433.823	Rp 2.555.369	Rp 2.550.643	Rp 1.760.410
3	37	Rp 175.606	Rp 169.978	-Rp 655.556	Rp 4.278.243	Rp 4.268.019	Rp 2.672.448
4	38	Rp 262.936	Rp 254.382	-Rp 901.129	Rp 6.417.779	Rp 6.399.235	Rp 3.682.543
5	39	Rp 373.157	Rp 360.852	-Rp 1.190.534	Rp 9.118.122	Rp 9.087.658	Rp 4.872.931
6	40	Rp 518.706	Rp 501.411	-Rp 1.569.120	Rp12.683.993	Rp12.636.832	Rp 6.430.139
7	41	Rp 713.763	Rp 689.751	-Rp 2.079.363	Rp17.462.778	Rp17.392.494	Rp 8.528.885
8	42	Rp 990.953	Rp 957.420	-Rp 2.838.220	Rp24.253.759	Rp24.151.240	Rp11.650.232
9	43	Rp1.430.819	Rp1.382.360	-Rp 4.155.353	Rp35.030.224	Rp34.881.133	Rp17.067.895
10	44	Rp2.350.774	Rp2.271.944	-Rp 7.358.442	Rp57.568.562	Rp57.343.490	Rp30.242.912

From these results, it can be seen that the total net benefits that participants can get when retiring early are Rp. 57,568,562 for package A, and Rp. 57,343,490 for package B, and Rp. 30,242,912. The following is a comparison of pension benefits based on the package selected:

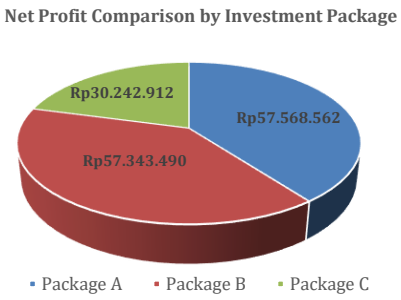

Figure 2 Net profit comparison by investment package.

Figure 3 Net benefit development for each package.

Conclusion

The amount of pension benefits for each employee varies, depending on the period of service, the amount of the first salary received and the type of investment package chosen. From the calculation results, the total net benefit in the investment package A is greater than the investment package B and C. This is because the historical data of the Muamalat Syariah DPLK shows that the return on package A is more stable than other packages and is more volatile.

Nomenclature

w = maximum age in mortality table.

v = the payment value of 1 unit is made 1 year later.

i = interest rate.

y = Age of participant when accepted for work.

${}^{r'}(PVFB)_x$: present value (at age x) pension benefit (at age r');

$B_{r'}$: cumulative pension benefit of a participant at retirement age r';

$v^{r'-x}$: discount factor from age x to retirement age r';

${}_{r'-x}p_x^{(T)}$: probability of survival from age x to retirement age r';

$\ddot{a}_{r'}$: initial lifetime annuity at retirement age r';

${}^{r'}(NC)_x$: pension contributions at age x with ealy retirement age r';

b_x : pension contributions at age x;

${}^{r'}(AL)_x$: actuarial liability of participants at age x with ealy retirement age r';

B_x : cumulative pension benefit of a participant at age x.

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