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Accelerated Pension Fund Calculations Using the Individual Level Premium Method and the Projected Unit Credit Method Case Study: PT. Dirgantara Indonesia

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Abstract

This paper examines the calculation of accelerated pension funds using two actuarial methods: the Individual Level Premium (ILP) method and the Projected Unit Credit (PUC) method. The case study focuses on PT. Dirgantara Indonesia. We compare the methods' impact on normal contribution amounts, actuarial liabilities, and retirement benefits. The research highlights the advantages and disadvantages of each approach, considering factors like participant age and contribution period. The findings demonstrate that the PUC method generally leads to lower normal contributions but may result in lower final retirement benefits compared to the ILP method. This study provides valuable insights for companies and employees in PT. Dirgantara Indonesia to choose the most suitable method for their accelerated pension plan, considering their financial goals and risk tolerance.

Keywords: Pension fund calculation, accelerated pension, individual level premium, project unit credit, PT. Dirgantara Indonesia

1. Introduction

Pension fund planning and management is an important aspect of human resource and financial management in companies that aims to ensure the livelihood of employees during retirement. A well-managed pension fund program not only provides financial security for employees during retirement but also serves as a form of appreciation from the company for their contributions during their working years (Kotun, 2016).

The number of employees who retire in a company cannot be predicted, which causes the company to experience an unstable decline in the number of employees (Gallo, 2006). As a result, the company must pay pensions to retired employees to avoid financial instability and losses to the company. The amount of premium that must be paid in pension insurance is called a normal contribution. The amount of normal contributions to be paid by employees can be calculated using actuarial calculation methods, namely the projected unit credit method and the individual level premium method. The projected unit credit method is an actuarial calculation method that divides the total pension benefits and allocates them during the employee's working years, while the individual level premium method is a method that allocates the total pension benefits evenly from the actuarial calculation date. The calculation will be carried out using the assumption of the employee's last received salary (Sukono, 2018).

Based on this, the author is interested in calculating the amount of normal contributions paid annually by pension program participants and the value of benefits received by employees upon reaching retirement age, using the assumption of the last salary with the projected unit credit and individual level premium methods. Furthermore, a comparison of the calculation results between the two methods will be carried out.

2. Literature Review

2.1. Pension Fund

A pension fund is a program that serves as a form of appreciation from a company to its employees for their dedication and hard work during their employment with the company (Andonov, 2014). According to Law No. 11 of 1992 on Pension Funds, Article 1, "A pension fund is a legal entity that manages and operates a pension program that promises pension benefits." In a pension fund, there are several benefits that are provided as additional benefits caused by death, early retirement, retirement due to inability to work (disability), and retirement upon reaching retirement age. In addition, there are the following additional benefits (Futami, 1993):

- Widow/widower's pension benefit paid upon death.
- Early retirement pension benefit paid employees who terminate.
- Disability pension benefit paid for employees who are unable to work due to disability.
- Pension benefit paid for employees who have reached retirement age.

2.2. Multiple Decrement Table

A multiple decrement table presents the probabilities of employees leaving a company due to early retirement (leaving), death, and disability retirement (Yuniwati, 2016). The probabilities of employees retiring between ages x and $x+1$ in a company are consecutively denoted as follows:

$$q_x^{(w)} = \frac{w_x}{l_x^{(T)}};\ q_x^{(d)} = \frac{d_x}{l_x^{(T)}};\ q_x^{(m)} = \frac{m_x}{l_x^{(T)}} \tag{1}$$

This calculation is based on the Service Table and is an example of the application of a multiple decrement table as explained in the previous section. This table illustrates the situation of the decline in the number of employees in the company caused by death, early retirement, disability retirement, or retirement at the established retirement age. One of these models will be illustrated based on the equations that have been explained previously, therefore:

$$p_x^{(T)} = 1 - q_x^{(d)} - q_x^{(w)} - q_x^{(m)} \tag{2}$$

explanation:

$l_x^{(T)}$: The number of people who are still actively working who do not retire early (w), do not die (m) and are not permanently disabled (x) at age x
d_x : The number of people who are permanently disabled at age x
w_x : The number of people who retire early at age x
m_x : Number of people who die at age x
$q_x^{(T)}$: Combined probability of early retirement, permanent disability, and death at age x
$q_x^{(w)}$: Probability of early retirement at age x
$q_x^{(m)}$: Probability of death at age x
$p_x^{(T)}$: Probability of active amployment at age x

2.3. Benefit Functions

Benefit functions are utilized to determine the amount of benefits payable to employees upon early retirement (exit), death, disability retirement, or normal retirement (Rosenberger, 2017). The annual benefit amount received by a participant of age x is as follows:

$$B_r = k s_{r-1}(r-e) \tag{3}$$

Where e is the age which the employee first starts working, r is the employee retirement's age, k is the proportion of salary allocated for retirement benefits B_r is represents the total accumulated benefit during the employee's active employment period, from age e to age r, and s_{r-1} is the final salary at age $(r-1)$ which is formulated as follows:

$$s_{r-1} = (1+s)^{r-1-x} s_x \tag{4}$$

The interest rate is denoted as i, and the salary at age x is denoted as s_x.

2.4. Present Value of Future Benefit

Present Value of Future Benefit (PVFB) is the current worth of a stream of future pension payments that a retirement plan participant will receive upon reaching retirement age. Pension payments are typically made annually until the participant's death. The PVFB is calculated using the following formula (Oktiani, 2013)*:*

$$^{r}(PVFB)_x = B_r v^{r-x} \ddot{a}_{r\,r-x} p_x \tag{5}$$

2.5. Actuarial Valuation Methods

The actuarial valuation methods used in this study are the projected unit credit method and the individual level premium method.

2.5.1. Project Unit Method

The projected unit credit method is an actuarial calculation method that divides the total pension benefit at the normal retirement age by the total years of service into pension benefit units and allocates them over the employee's working life. Based on the definition of normal contributions using the projected unit credit method, it is obtained:

$$\begin{aligned} {}^{PUC}(NC_x) &= \frac{1}{r-e}\ddot{a}_r \;\; {}^{r}(PVFB)_x \\ &= \frac{1}{r-e} B_r \ddot{a}_r v^{r-x} r-x \;\; p_x{}^{(T)} \end{aligned} \tag{6}$$

Because $r-x \;\; p_x{}^{(T)} = \frac{l_r^{(T)}}{l_x^{(T)}}$

$$= \frac{1}{r-e} B_r \ddot{a}_r \frac{v^r}{v^x} \frac{l_r^{(T)}}{l_x^{(T)}} \tag{7}$$

Based on computing function,

$$= \frac{1}{r-e} B_r \ddot{a}_r \frac{D_r^{(T)}}{D_x^{(T)}} \tag{8}$$

2.5.2. Individual Level Premium Method

The individual level premium method is the current value at the actuarial calculation date up to the normal retirement age. This method allocates total pension benefits evenly from the actuarial calculation date. The normal contribution amount using the individual premium level method is formulated as follows:

$$NC\left(\frac{N_e^{(T)} - N_r^{(T)}}{D_e^{(T)}}\right) = B_r \ddot{a}_r \frac{D_r^{(T)}}{D_e^{(T)}} \tag{9}$$

The normal contribution paid by participants periodically (PVFNC) when the participant is aged e years to the age of r years is used to pay the benefits (PVFB) that the participant will receive at retirement. Therefore we obtain the equation:

$$r(PVFB)_e = \;\; r(PVNC)_e \tag{10}$$

The normal contribution payment scheme during the working period of participants who start participating in the pension program from the age of e years until they reach r-1 year is formulated as follows:

$$1 + vp_a + v^2 2 \;\; p_a \;\; + \cdots + v^{r-1-a} r-1-a \;\; p_a = \ddot{a}_{a:r-a} \tag{11}$$

so,

$$r(PVNC)_e = NC(\ddot{a}_{a:r-a}) \tag{12}$$

It is assumed that the participant's age when entering the pension program is the same as the participant's age when entering work ($a = e$). Therefore, we obtain the equation:

$$r(PVNC)_e = NC(\ddot{a}_{a:r-a}) = NC\left(\frac{N_e^{(T)} - N_r^{(T)}}{D_e^{(T)}}\right) \tag{13}$$

So, you get it,

$$NC\left(\frac{N_e^{(T)} - N_r^{(T)}}{D_e^{(T)}}\right) = B_r \ddot{a}_r \frac{D_r^{(T)}}{D_e^{(T)}} \tag{14}$$

$$N = B_r \ddot{a}_r \frac{D_r^{(T)}}{N_e^{(T)} - N_r^{(T)}}$$

Therefore, the calculation of normal contributions using the individual level premium method when participants are x years old can be formulated as

$$^{ILP}(NC_x) = B_r \ddot{a}_r \frac{D_r^{(T)}}{N_e^{(T)} - N_r^{(T)}} \quad (15)$$

3. Materials and Methods

3.1. Materials

This research uses basic salary data from 2 PT employees. Indonesian Aerospace. In this research, the data used is synthetic data with assumptions that are close to the cases that occurred. The employees in this study are employees who are participants in the pension program, then calculations are made based on their final salary and the proportion of salary that will be allocated to pension benefits. There are 2 employees in the data, employee A is a man who is currently 35 years old, became a participant at the age of 22 years, and retired at the age of 50 years, his basic salary received in a year is IDR 95,250,000. The second employee or employee B is a woman who is currently 32 years old, started as a participant at the age of 25 years, and started retiring at the age of 50 years, the basic salary received in a year is IDR 86,150,000.

3.2. Methods

The analysis steps taken to achieve the objectives of this research are described as follows:

1. Prepare a plural depreciation table with i=5%
2. Determine pension program benefits based on pension program contributions of k=2.5% of the proportion of salary received
3. Calculating the present value of pension benefits based on pension benefits at retirement age (PVFB)
4. Calculate the amount of normal contributions that participants must pay using the projected unit credit method and the individual level premium method
5. Calculate the final value of normal contribution financing

4. Results and Discussion

Tabel 1: Pension Fund Participant Data PT. Dirgantara Indonesia

Employee	Gender	Participant Registered Age (e)	Retirement Age (r)	Basic Salary (Rupiah)/Year (S_e)
A	Male	22	50	IDR 95,250,000
B	Female	25	50	IDR 86,150,000

4.1. Retirement Benefits

4.1.1. Final Salary Calculation

Calculation of the final salary one year before retirement age for employee A, namely:

$$S_{49} = (1 + 5\%)^{50-22-1} S_{22}$$
$$= 355{,}611{,}714$$

Meanwhile, the pension benefits that participants will receive at retirement with a salary proportion (k) of 2.5% are $B_{50} = 2.5\%(355{,}611{,}714)(50 - 22)$

$$= 248.928.200$$

So the total pension benefit that employee A will receive is IDR 248,928,200,00.

4.1.2. Present Value of Retirement Benefits

$$^{50}(PVFB)_{35} = B_{50} v^{50-22} \ddot{a}_{50\ 50-22} p_{35}$$
$$= B_{50} v^{28} \frac{N_{50}}{D_{50}}\ {}_{28}p_{35}$$
$$= 248{,}928{,}200(0.255093637) \frac{4{,}955{,}034.22}{733{,}627.57} (0.841413)$$
$$= 360{,}872{,}790$$

So the present value of the total pension benefit at age 35 is IDR 360,872,790,00.

4.2. Calculation of Normal Contributions

4.2.1. Projected Unit Credit Method

The calculation of normal contributions using the projected unit credit method is:

$$^{PUC}(NC_{35}) = \frac{1}{50-22}\ddot{a}_{50}\ \ ^{50}(PVFB)_{35}$$
$$= \frac{1}{28}\left(\frac{4{,}955{,}034.22}{733{,}627{,}57}\right)(360{,}873{,}000)$$
$$= 87{,}049{,}668$$

So a 22 year old participant who retires at the age of 50 years, the normal contribution that must be paid later when he is 35 years old is IDR 87,049,668,-.

4.2.2. Metode *Individual Level Premium*

Calculation of normal contributions using the individual premium level method is:

$$^{ILP}(NC_{35}) = B_{50}\ddot{a}_{50}\frac{D_{50}^{(T)}}{N_{22}^{(T)} - N_{50}^{(T)}}$$
$$= 248{,}928{,}445\left(\frac{4{,}955{,}034.22}{733{,}627.57}\right)\frac{733{,}627.57}{22{,}799{,}149.81}$$
$$= 54{,}100{,}603$$

So a 22 year old participant who retires at the age of 50 years, the normal contribution that must be paid later when he is 35 years old is IDR 54,100,603,00.

Tabel 2: Calculation of Normal PT Employee Contributions. Indonesian Aerospace

Employee	Gender	NC UPC	NC ILP
A	Male	IDR 87,049,668	IDR 54,100,603
B	Female	IDR 92,481,352	IDR43,429,311

4.3. Final Value of Normal Contribution Financing

4.3.1. Project Unit Credit Method

$$^{PUC}(NA) = \sum_{x=22}^{49} {}^{PUC}(NC_x)(1+i)^{50-x}$$
$$= 5{,}204{,}336{,}053$$

So, the total final value of normal contribution financing for a 22 year old male employee who will retire at the age of 50 using the projected unit credit method is IDR 5,204,336,053,00.

4.3.2. Premium Level Individual Method

$$^{ILP}(NA) = \sum_{x=22}^{49} {}^{ILP}(NC_x)(1+i)^{50-x}$$
$$= 3{,}205{,}124{,}419$$

So, the total final value of normal contribution financing for a 22 year old male employee who will retire at the age of 50 using the individual level premium method is IDR 3,205,124,419,00.

Tabel 3: Calculation of the final value of funding for normal employee contributions PT. Dirgantara Indonesia

Employee	Gender	NA UPC	NA ILP
A	Male	IDR 5,204,336,053	IDR 3,205,124,419
B	Female	IDR 3,883,114,103	IDR 2,176,392,769

5. Conclusion

A pension fund is a program designed to provide replacement income for participants after they stop working. This program is managed by the Pension Fund Provider (PDP), which is a non-bank financial institution supervised by the Financial Services Authority (OJK).

The results of the analysis and calculation of employee pension funds in the portfolio show that the pension fund benefits received by employee A amounted to IDR 248,928,200. According to calculations, there are differences in the results obtained from the 2 methods used and of course there are also differences in results between male employees and female employees.

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