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Application of Projected Unit Credit Method (PUC) and Entry Age Normal (EAN) in Pension Fund Calculation

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Abstract— This study explores the application of the Projected Unit Credit (PUC) and Entry Age Normal (EAN) methods in calculating normal cost and actuarial liability for pension funds. By comparing the two methods, the research aims to provide insights into their implications for pension fund management. The PUC method, which takes into account salary growth over time, typically results in increasing normal cost and smaller actuarial liability as the participant's service period lengthens. Conversely, the EAN method spreads the pension cost evenly over an employee's working years, leading to stable normal cost and higher actuarial liability, particularly in the mid-period of membership. The study utilizes data from PT. XYZ, applying both methods separately for male and female participants due to differences in life expectancy. The results offer a comparative analysis that highlights the financial implications of each method for both participants and pension fund companies, contributing to more effective pension fund management strategies.

Keywords— Actuarial Liability; Entry Age Normal; Normal Cost; Pension Fund; Projected Unit Credit.

I. INTRODUCTION

Pensions represent a crucial element of the social welfare system, designed to provide a stable and sustainable income for individuals upon reaching retirement age. A well-functioning pension system not only secures financial well-being for retirees but also promotes broader economic stability. For most employees, participation in a pension program begins with their entry into the labor force, typically through companies that incorporate pension schemes as part of their employee benefits. These pension arrangements are often formalized through employment contracts or collective bargaining agreements. Pension funding is considered a forward-looking strategy aimed at ensuring income continuity during retirement and serves as a form of corporate responsibility toward employees who have dedicated their careers to the organization [1]. The *Statistics Indonesia Pension Fund (SDPI)* serves as a publication platform that presents data on private pension funds in Indonesia. It is guided by the provisions of Law No. 11 of 1992 concerning Pension Funds, which was subsequently replaced by Law No. 4 of 2023 on the Development and Strengthening of the Financial Sector, effective at the time of the book's publication. It is important to note that the SDPI does not include pension funds for civil servants, military personnel (TNI), and police officers (POLRI), as these are managed by PT Taspen and PT Asabri [2]

This study investigates the calculation of normal cost and actuarial liability of pension funds using two actuarial funding methods: the Entry Age Normal (EAN) method and the Projected Unit Credit (PUC) method. The EAN method calculates funding based on the participant's age at entry and spreads the cost evenly from the entry age to the normal retirement age. In contrast, the PUC method focuses on the pension benefits accrued in a specific year t, and evaluates costs accordingly [3]. The EAN and PUC methods are widely utilized to estimate normal costs and actuarial liabilities in pension fund evaluations. Previous research [4] demonstrates that under the EAN method, normal costs for male and female employees remain constant annually. However, the PUC method produces increasing normal costs as the duration of employment grows. Actuarial liabilities also rise with longer service periods under both methods. Notably, the EAN method results in higher actuarial liabilities during the middle years of plan participation but converges with the PUC method at the start and end of the service period. Moreover, the total normal cost borne by participants is lower under the EAN method, making it more beneficial for employees. Conversely, the PUC method results in lower actuarial liabilities, offering a financial advantage to the pension fund provider. Another study [3] found that normal costs calculated using the PUC method increase in tandem with salary growth, while those under the EAN method remain steady. From the

midpoint of the participation period onwards, PUC-based normal costs surpass those derived from the EAN method. Additionally, actuarial liabilities computed using the PUC method are consistently lower than those calculated using the EAN method.

In this research, actuarial calculations using both the EAN and PUC methods were conducted on data related to civil servants. Results obtained from both methods were compared to assess differences in outcomes. Furthermore, the calculations of normal cost and actuarial liability were disaggregated by gender, in recognition of the differing life expectancies between men and women, as outlined in the 2023 Indonesian Population Mortality Table issued by BPJS Kesehatan. The calculation of pension benefits was based on final salary, discount factors, life expectancy, and annuity values. Annuity values were derived using the applicable mortality tables. The objective of this research is to apply and compare the EAN and PUC methods in the context of pension fund valuation. Through an examination of the theoretical framework, practical implementation, and comparative analysis of both methods, the study aims to contribute to more effective and efficient management of pension funds. The findings are expected to offer valuable insights into the adequacy and sustainability of different pension funding approaches.

II. LITERATURE REVIEW

A. Projected Unit Credit Method (PUC)

The Projected Unit Credit (PUC) method is used to estimate pension costs by accounting for both the projected salary scale and anticipated future benefits. This approach is based on the assumption of consistent salary growth over time. The provided formula calculates the normal cost (NC) under a final salary plan with a 2% accrual rate, incorporating variables such as current salary, projected salary growth, discount rates, survival probabilities, and annuity factors. Due to its inclusion of salary progression, the PUC method typically yields higher normal costs and actuarial liabilities compared to traditional unit credit methods. Consequently, the application of this method necessitates the use of consistent and carefully aligned assumptions regarding salary increases, inflation, and interest rates [5]

B. Entry Age Normal (EAN)

The Entry Age Normal (EAN) method allocates the cost of projected pension benefits as a uniform amount or a fixed percentage of salary over the duration of an employee's working life. When the level dollar method is applied, the cost is distributed evenly across all service years, leading to higher normal costs in the early stages of employment and lower costs in later years. In contrast, the level percentage method produces initially lower costs that increase over time, often aligning more closely with the trajectory of employee salary growth. In the absence of an assumed salary scale, cost estimates tend to be lower; however, this can result in actuarial experience losses. Furthermore, if mortality or withdrawal decrements are excluded from the assumptions, the normal cost calculations may be affected, potentially producing either actuarial gains or losses depending on the actual experience [5].

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D. Life Annuity

Annuities whose payments are linked to the life and death of a person are life annuities. Based on the payment period, life annuities are divided into life annuities, endowments, term annuities, and deferred annuities [3].

1. Lifetime Annuity
   An annuity whose payments are made as long as the insured is alive is called a life annuity, payments can be made at the beginning or at the end.
2. Pure Endowment
   A pure endowment is a payment made at the end of a certain period for a certain person if he or she lives to the end of that period.
3. Term Annuity
   A term annuity is a life annuity where payments are made at a certain period of time.
4. Deferred Annuity
   A deferred annuity is a series of periodic payments that are postponed for a certain period of time. a certain period of time.

E. Actuarial Basic Functions

Basic actuarial functions are all basic functions that support the actuarial calculation process. Process of actuarial calculation.

1. Survival Function
   The survival function predicts an employee's likelihood of remaining active until retirement. The survival function is described as follows [8]:

$$ {}_np_x^{(T)} = \frac{l_{x+n}^{(T)}}{l_x^{(T)}} \quad \textbf{(1)} $$

   ${}_np_x^{(T)}$: The probability that an employee of age x will remain employed for the following n years

   $l_x^{(T)}$: The number of employees who are still active at age x

   $l_{x+n}^{(T)}$: The number of employees who are still actively working at age $x + n$

2. Interest Function
   The interest function discounts future payments to the present period. If i is the assumed interest rate for n years and the amount does not change annually, then [8]:

$$ v^n = \frac{1}{(1+i)^n} \quad \textbf{(2)} $$

   v^n is the present value of a payment of 1 unit made n years in the future.

3. Salary Function
   S_x gives the current pay for a participant at age x, while S_x represents the accumulated salary from age entrance to age $x - 1$. where $x > e$, or can be expressed as [3]:

$$ S_x = \sum_{t=e}^{x-1} s_t \quad \textbf{(3)} $$

   If the participant receives a salary increase every year, then the amount of the participant's salary at age $x + t$, based on the wages at age x is:

$$ s_{x+t} = s_x(1+s)^t \quad \textbf{(4)} $$

4. Benefit Function
   The benefit function is used to determine the number of benefits paid at the time of retirement, personal termination, disability, and death. There are three types of benefit formulas that are often used in defined benefit pension plans to determine the amount of retirement benefits at age $r, (B_r)$ [6].

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1. Final Salary

$$B_r = k\, s_{r-1}\,(r-e) \tag{5}$$

2. Average Salary While Working

$$B_r = k\, s_{r-1} \tag{6}$$

3. Average Salary for n years

$$B_r = k(r-e)\frac{1}{n}\sum_{t=r-n-x}^{r-x-1} s_x(1+s)^t \tag{7}$$

F. Present Value of Future Benefit (PVFB)

The present value of future benefits (PVFB) is the current value of predicted pension payments received by pension plan participants in the future (after retirement). Participants in future pension programs (after retirement). PVFB is formed by:

$$^{r}(PVFB)_x = B_r\, \ddot{a}_r\, v^{r-x}\, {}_{r-x}p_x \tag{8}$$

G. Normal Cost

The normal cost for any given year is the amount needed to cover that year's share of the present value of pension benefits. This is determined by the greater of the participant contributions specified in the pension fund regulations and the allocated portion of the present value of pension benefits for that year. This allocation follows the pension fund regulations and uses the actuarial method of calculation [3].

The general equation for the normal pension contribution for a participant aged x is

$$^{r}(NC)_x = b_x\, \ddot{a}_r\, v^{r-x}\, {}_{r-x}p_x \tag{9}$$

1. Project Unit Credit Method

$$^{PUC}\,{}^{r}(NC)_x = \frac{^{r}(PVFB)_x}{(r-e)} \tag{10}$$

2. Entry Age Normal Method

$$^{EAN}\,{}^{r}(NC)_x = \frac{v^{x-e}\ {}_{x-e}p_e}{\ddot{a}_{e:\overline{r-e}}}\ {}^{r}(PVFB)_x \tag{11}$$

H. Actuarial Liability

Actuarial liability (AL) is the cash value of benefits accumulated from entry age y to age x (excluding x) [6].

$$(AL)_x = B_x\ {}_{r-x}p_x\ v^{r-x}\ \ddot{a}_r \text{ with } B_x = \textstyle\sum_{t=y}^{x-1} b_t \tag{12}$$

The ongoing application of the repayment concept in standard contribution calculations means that as the program advances or when the participant reaches age x, a difference between $^{r}(PVFB)_x$ and $^{r}(PVFNC)_x$ will emerge. This difference creates an actuarial liability. Thus, the equation for the actuarial obligation is

$$^{r}(AL)_x = {}^{r}(PVFB)_x - {}^{r}(PVFNC)_x \tag{13}$$

1. Projected Unit Credit Method

$$^{PUC}\,{}^{r}(AL)_x = \frac{(x-e)}{(r-e)}\ {}^{r}(PVFB)_x \tag{14}$$

2. Entry Age Normal Method

(15)

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$$^{EAN\ r}(AL)_x = \frac{\ddot{a}_{e:\overline{x-e}}}{\ddot{a}_{e:\overline{r-e}}}\ ^{r}(PVFB)_x$$

I. Mortality Table and Commutation Symbol

Life insurance companies base all calculations of annuities, premiums, insurance and so on mortality tables. Mortality tables contain the chances of a person dying by age from the group of insured people (insurance policyholders) [7]. The notation l_0 indicates the number of people born in a specific year. l_1 refers to those from l_0 who reach the age of 1. l_2 represents those from l_1 who reach the age of 2, and so forth, until the general definition of l_x, which is the number of people who live to age x. The number of individuals from l_x who die before reaching age $x + 1$ is denoted by the symbol d_x, namely [8]

$$d_x = l_x - l_{x+1} \tag{16}$$

The probability that a person aged x will survive at least 1 year, reaching the age of x + 1 is written as follows:

$$p_x = \frac{l_{x+1}}{l_x} \tag{17}$$

The probability that a person aged x will die in the next n years is expressed with the notation ${}_nq_x$, following the equation [9]

$${}_nq_x = 1 - {}_np_x \tag{18}$$

Simplification of calculations is often done in calculating mortality tables by creating commutation symbols. Here are some commutation symbols used, among others:

1. D_x Notation

$$D_x = v^x\, l_x \tag{19}$$

With $v = \frac{1}{(1+i)} = (1+i)^{-1}$

2. N_x Notation

$$N_x = D_x + D_{x+1} + D_{x+2} + \cdots + D_\omega = \sum_{i=0}^{\omega-x} D_{x+i} \tag{20}$$

III. METHODOLOGY

A. Data Collection Technique

The data in this study were obtained from PT. XYZ. In addition, secondary data used was taken from several sources and literature.

B. Data Analysis

To obtain the value of normal costs and actuarial liability using Entry Age Normal and Projected Unit Credit Methods. Data processing is done using Microsoft Excel as a calculation tool. The stages of data analysis in this research are as follows:

a. Created a calculation table using the 2023 Indonesian Population Mortality Table from BPJS Health, assuming an interest rate of 5.5%.
b. Determine each participant's pension benefits amount based on their final salary, assuming an 8% salary increase rate and a pension benefit allocation rate (k) of 2.5%.

c. Determine the present value of retirement benefits ${}^{r}(PVFB)_x$ by considering the retirement benefit amount, the initial lifetime annuity at retirement age, the discount factor, and the probability of surviving to a specified number of years.
d. Determine the amount of salary, based on the equation

$$s_{x+t} = s_x(1+s)^t \tag{21}$$

e. Determine the amount of retirement benefits, based on the equation

$$B_r = k\, S_{r-1}\,(r-e) \tag{22}$$

f. Calculating actuarial liability and normal costs using the Projected Unit Credit (PUC) and Entry Age Normal (EAN) methods.
g. Determine Normal Cost (NC) with PUC method, based on the equation

$${}^{PUC}{}^{r}(NC)_x = \frac{{}^{r}(PVFB)_x}{(r-e)} \tag{23}$$

h. Determine Normal Cost (NC) with EAN method, based on the equation

$${}^{EAN}{}^{r}(NC)_x = \frac{v^{x-e}\ {}_{x-e}p_e}{\ddot{a}_{e:\overline{r-e}}}\ {}^{r}(PVFB)_x \tag{24}$$

i. Determine Actuarial Liability (AL) with PUC method, based on the equation

$${}^{PUC}{}^{r}(AL)_x = \frac{(x-e)}{(r-e)}\ {}^{r}(PVFB)_x \tag{25}$$

j. Determine Actuarial Liability (AL) with EAN method, based on the equation

$${}^{EAN}{}^{r}(AL)_x = \frac{\ddot{a}_{e:\overline{x-e}}}{\ddot{a}_{e:\overline{r-e}}}\ {}^{r}(PVFB)_x \tag{26}$$

IV. RESULT AND DISCUSSION

A. *Data Preparation*

The analysis of data in this study were obtained from PT. XYZ, with total of 51 data shown in Table 1. This data is processed using Microsoft Excel.

TABLE 1
DATA SHEET OF THE CURRENT SALARY OF PT XYZ

No	Gender	Current Age	Period of Employment	Current Salary	Entry Age
1	L	55	28	18,336,000	27
2	L	50	28	18,651,000	22
3	L	54	31	19,436,000	23
4	L	54	31	18,906,000	23
5	P	56	33	18,298,900	23
6	L	51	29	18,223,500	22
7	L	50	28	18,165,400	22
8	L	56	33	16,481,000	23
9	L	54	31	15,661,000	23
10	L	44	23	15,661,000	21
11	L	52	27	15,481,000	25

12	L	53	28	12,549,000	25
13	L	56	33	14,117,500	23
14	P	56	33	14,117,500	23
15	L	55	32	14,117,500	23
16	L	55	32	14,715,400	23
17	P	53	29	14,117,500	24
18	P	51	25	14,117,500	26
19	L	49	25	14,059,400	24
20	L	49	27	13,944,800	22
21	P	41	17	13,824,500	24
22	L	47	32	11,674,000	15
23	L	51	25	11,424,000	26
24	L	54	30	11,425,500	24
25	L	52	27	11,648,400	25
26	P	51	26	11,333,200	25
27	L	51	27	11,477,500	24
28	L	53	29	10,761,000	24
29	L	51	26	9,949,000	25
30	P	40	10	9,824,000	30
31	L	56	33	10,699,000	23
32	L	53	29	9,949,000	24
33	L	47	17	9,932,000	30
34	P	56	34	9,667,800	22
35	L	54	23	9,563,500	31
36	L	54	32	7,716,000	22
37	L	49	21	7,716,000	28
38	P	45	18	7,738,000	27
39	L	56	32	6,691,000	24
40	L	55	32	6,691,000	23
41	L	49	21	6,329,000	28
42	L	51	23	6,521,000	28
43	L	52	31	6,691,000	21
44	L	48	24	6,329,000	24
45	L	46	23	6,350,000	23
46	L	48	21	6,521,000	27
47	L	49	23	6,521,000	26
48	L	53	30	6,350,000	23
49	L	45	22	5,689,000	23
50	L	48	21	6,691,000	27
51	L	54	32	6,329,000	22

B. Sample Calculation

A male civil servant who is male, started as a participant at the age of 15 ($e = 15$) and started to retire at the age of 58 ($r = 58$). The last base salary received in a year was Rp11,674,000. The calculation when the participant is 25 years old ($x = 25$) is

a. Calculation of Pension Benefits Based on Final Salary

$$B_r = k(r-e)S_{r-1}$$
$$= 2.5\%(58-15)25203290.42$$
$$= 27093537.2$$

Used k factor of 2.5%. So, the amount of pension benefits those participants will receive at the time of retirement in a year is as follows Rp27,093,537.2.

b. Calculation of the Present Value of Retirement Benefits

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

$${}^{58}(PVFB)_{25} = B_{58}\, \ddot{a}_{58}\, v^{58-25}\, {}_{58-25}p_{25}$$
$$= 27093537.2\, \frac{N_{58}}{D_{58}} (1+0{,}055)^{-33} \frac{l_{25+58-25}}{l_{25}}$$
$$= 27093537.2 \left(\frac{8083369.62}{447361.11}\right) 0.170871185 \left(\frac{9983915}{9997213}\right)$$
$${}^{58}(PVFB)_{25} = 83539275.41$$

c. Normal Cost Calculation

1) Projected Unit Credit Method

$$PUC\ {}^{r}(NC)_x = \frac{{}^{r}(PVFB)_x}{(r-e)}$$
$$PUC\ {}^{58}(NC)_{25} = \frac{83539275.41}{(58-15)}$$
$$PUC\ {}^{58}(NC)_{25} = 1942773.847$$

So, the amount of normal costs for a year at the age of 25 using the Projected Unit Credit method is Rp1,942,773.847.

2) Entry Age Normal Method

$$EAN\ {}^{r}(NC)_x = \frac{v^{x-e}\ {}_{x-e}p_e}{\ddot{a}_{e:\overline{r-e}}}\ {}^{r}(PVFB)_x$$

$$EAN\ {}^{58}(NC)_{25} = \frac{v^{25-15}\ {}_{25-15}p_{15}}{\ddot{a}_{15:\overline{58-15}}} 83539275.41$$

$$EAN\ {}^{58}(NC)_{25} = \left(\frac{(1+0.055)^{-10}\frac{l_{15+25-15}}{l_{15}}}{\frac{N_{15}-N_{58}}{D_{15}}}\right) 83539275.41$$

$$EAN\ {}^{58}(NC)_{25} = \left(\frac{0.585430579\left(\frac{9997213}{9998001}\right)}{\frac{85380685.24-49768313.74}{4478435.28}}\right) 83539275.41$$

$$EAN\ {}^{58}(NC)_{25} = 2{,}833{,}307.648$$

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So, the amount of normal cost for a year at the age of 25 using the Entry Age Normal method is Rp2,833,307.648.

d. Actuarial Liability Calculation

1) Projected Unit Credit Method

$$^{PUC\ r}(AL)_x = \frac{(x-e)}{(r-e)}\ ^{r}(PVFB)_x$$

$$^{PUC\ 58}(AL)_{25} = \frac{(25-15)}{(58-15)}\ 83539275.41$$

$$^{PUC\ 58}(AL)_{25} = 19427738.5$$

So, the amount of actuarial liability at the age of 25 years using the Projected Unit Credit method is Rp19,427,738.5

2) Entry Age Normal Method

$$^{EAN\ r}(AL)_x = \frac{\ddot{a}_{e:\overline{x-e}}}{\ddot{a}_{e:\overline{r-e}}}\ ^{r}(PVFB)_x$$

$$^{EAN\ 58}(AL)_{25} = \frac{\ddot{a}_{15:\overline{25-15}}}{\ddot{a}_{15:\overline{58-15}}}\ 83539275.41$$

$$= \left(\frac{\frac{N_{15}-N_{25}}{D_{15}}}{\frac{N_{15}-N_{58}}{D_{15}}}\right) 83539275.41$$

$$= \left(\frac{\frac{85380685.24-49768313.74}{4478435.28}}{\frac{85380685.24-8083369.62}{4478435.28}}\right) 83539275.41$$

$$^{EAN\ 58}(AL)_{25} = 38488163.36$$

So, the amount of actuarial liability at the age of 25 years using the Entry Age Normal method is Rp38,488,163.36.

Meanwhile, when viewed from financing each year we can see on Table 2.

TABLE 2
FINANCING EACH YEAR NORMAL COST AND ACTUARIAL LIABILITY WITH SAMPLE AGE 15

x	Br	$^{58}(PVFB)_x$	PUC		EAN	
			$^{58}(AL)_x$	$^{58}(NC)_x$	$^{58}(AL)_x$	$^{58}(NC)_x$
15	27093537.2	48902588.07	0	1137269.49	0	2833307.65
16	27093537.2	51592544.05	1199826.61	1199826.61	2989157.74	2833307.65
17	27093537.2	54430486.28	2531650.53	1265825.26	6142740.74	2833307.65
18	27093537.2	57424554.58	4006364.27	1335454.76	9469795.62	2833307.65
19	27093537.2	60583339.88	5635659.52	1408914.88	12979867.11	2833307.65
20	27093537.2	63915908.74	7432082.41	1486416.48	16683026.00	2833307.65
21	27093537.2	67431824.97	9409091.86	1568181.98	20589897.27	2833307.65
22	27093537.2	71141176.27	11581121.72	1654445.96	24711689.93	2833307.65

23	27093537.2	75054609.22	13963648.23	1745456.03	29060231.18	2833307.65
24	27093537.2	79183358.78	16573261.14	1841473.46	33648000.49	2833307.65
25	27093537.2	83539275.41	19427738.47	1942773.85	38488163.36	2833307.65
26	27093537.2	88134857.82	22546126.42	2049647.86	43594608.09	2833307.65
27	27093537.2	92983297.87	25948827.31	2162402.28	48981989.93	2833307.65
28	27093537.2	98098518.07	29657691.51	2281360.89	54665773.56	2833307.65
29	27093537.2	103495203.7	33696112.82	2406865.20	60662273.37	2833307.65
30	27093537.2	109188842	38089130.94	2539275.40	66988698.21	2833307.65
31	27093537.2	115195779.1	42863545.72	2678971.61	73663207.85	2833307.65
32	27093537.2	121533268.7	48048036.44	2826355.09	80704967.14	2833307.65
33	27093537.2	128219512.6	53673284.34	2981849.13	88134195.64	2833307.65
34	27093537.2	135273710.7	59772104.71	3145900.25	95972223.50	2833307.65
35	27093537.2	142716134.6	66379597.50	3318979.88	104241566.34	2833307.65
36	27093537.2	150568187.9	73533301.08	3501585.77	112965992.19	2833307.65
37	27093537.2	158852451.1	81273347.09	3694243.05	122170578.47	2833307.65
38	27093537.2	167592736.1	89642626.28	3897505.49	131881775.49	2833307.65
39	27093537.2	176814184	98686986.39	4111957.77	142127505.33	2833307.65
40	27093537.2	186543344.6	108455432.90	4338217.32	152937249.05	2833307.65
41	27093537.2	196808236	119000328.70	4576935.72	164342118.73	2833307.65
42	27093537.2	207638410	130377606.30	4828800.23	176374934.43	2833307.65
43	27093537.2	219065079.8	142647028.70	5094536.74	189070354.86	2833307.65
44	27093537.2	231121215.7	155872447.80	5374911.99	202464983.53	2833307.65
45	27093537.2	243841608.5	170122052.40	5670735.08	216597448.15	2833307.65
46	27093537.2	257262947.2	185468636.30	5982859.24	231508491.46	2833307.65
47	27093537.2	271423998.4	201989952.30	6312186.01	247241154.69	2833307.65
48	27093537.2	286365747.1	219769061.70	6659668.54	263840930.21	2833307.65
49	27093537.2	302131481.7	238894659.90	7026313.53	281355865.48	2833307.65
50	27093537.2	318766888.9	259461421.20	7413183.46	299836674.03	2833307.65
51	27093537.2	336320280.4	281570467.30	7821401.87	319336972.08	2833307.65
52	27093537.2	354842725.2	305329786.80	8252156.40	339913429.84	2833307.65
53	27093537.2	374388058	330854562.90	8706699.02	361625802.98	2833307.65
54	27093537.2	395012909	358267522.10	9186346.72	384536980.92	2833307.65
55	27093537.2	416777027.3	387699560.30	9692489.01	408713319.63	2833307.65
56	27093537.2	439743504.3	419290318.00	10226593.12	434224883.31	2833307.65
57	27093537.2	463978866.8	453188660.60	10790206.21	461145559.19	2833307.65
58	27093537.2	489553225.2	489553225.20	11384958.72	489553225.15	2833307.65

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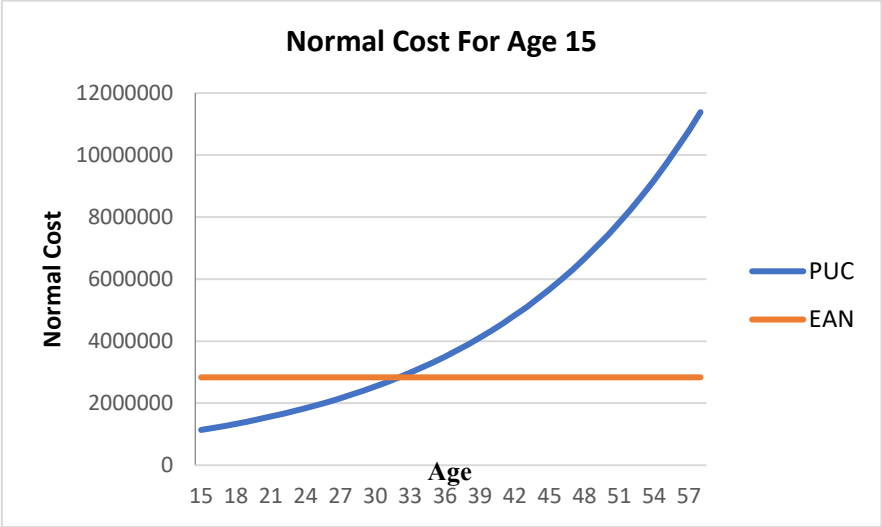

Figure 1. Comparison of Normal Cost for Age 15

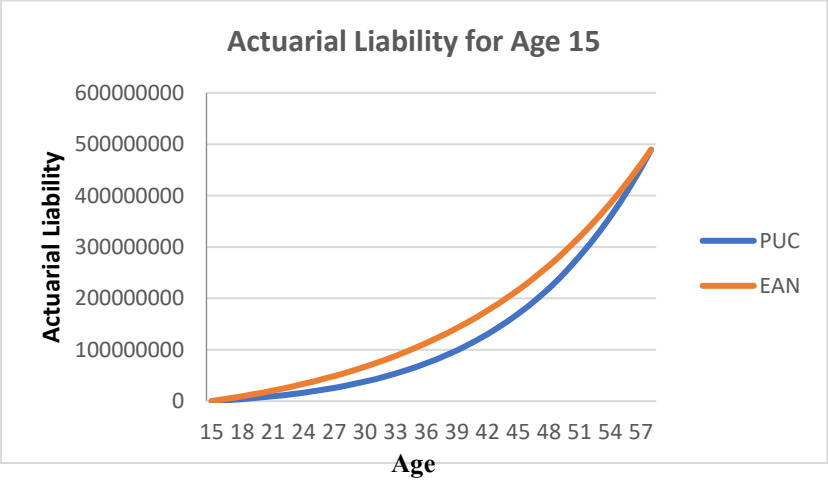

Figure 2. Comparison of Actuarial Liability for Age 15

Figure 1 shows that for EAN the Normal cost is similar throughout the period while PUC is increasing. EAN is not suitable enough for early employment as they should spend more money for retiring benefit while PUC is suitable because its match with the salary increasing throughout period. Meanwhile the Actuarial liability of EAN also higher than PUC, but it will the same at the maturity which is shown in Figure 2.

V. CONCLUSION

The Projected Unit Credit (PUC) method results in higher normal costs and actuarial liability as individuals age compared to the Entry Age Normal (EAN) method. The PUC method shows a steep increase in normal cost, indicating a back-loaded cost distribution where a larger portion of the costs is allocated to the later years of service. Conversely, the EAN method maintains a relatively stable and lower normal cost, reflecting a more even allocation over an individual's working life. Similarly, the actuarial liability under the PUC method rises significantly with age, while the EAN method exhibits a more gradual increase, indicating a slower accumulation of liabilities.

The comparison for all ages reinforces these observations. The normal cost under the PUC method fluctuates considerably but remains higher overall compared to the EAN method, which shows more stability. The actuarial liability also consistently remains higher under the PUC method, despite both methods showing a decreasing trend with age. In summary, The EAN method is generally considered better for organizations seeking stability and predictability in their funding requirements. It spreads costs more evenly over time, reducing the risk of

significant future liabilities and making financial planning more manageable. On the other hand, the PUC method might be more suitable for organizations that anticipate higher future revenues and prefer to defer larger costs to later years.

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