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Actuarial Calculation of Pension Funds Using Attained Age Normal (AAN) at PT Taspen Cirebon Branch Office: For Normal Pension

Hana Safrina Amalia[1*], Betty Subartini[2], Sukono[3]

[1,2,3]*Department of Mathematics, Padjadjaran University, Bandung, Indonesia*
**Corresponding author email: hanasafrin28@gmail.com*

Abstract

The pension program for Civil Servants (PNS) in Indonesia is managed by PT Taspen (Persero), which is responsible for ensuring the welfare of employees after retirement. One of the important components in the management of this pension fund is the actuarial calculation, which serves to determine the amount of normal contributions that must be paid by participants and the actuarial obligations that are the company's dependents. This calculation uses the right actuarial method to maintain the financial stability of the company and ensure that pension benefits can be optimally provided to participants. This study focuses on the use of the Attained Age Normal (AAN) method in calculating pension funds for pension program participants at PT Taspen Cirebon Branch Office. In addition, this study also compares the results of the AAN method calculation with another method, namely Projected Unit Credit (PUC), to see the advantages and disadvantages of each method. The AAN method calculates liabilities based on the current age of the participant, thus providing more conservative results and tending to be stable in the long term. The results showed that the AAN method produced a higher total normal contribution compared to the PUC method. Normal contributions calculated by the AAN method for participants of the PT Taspen pension program at the Cirebon Branch Office showed an increase of 2,095,355.33 rupiah at the age of 32 years. On the other hand, the PUC method produces a lower normal contribution, which is 827,843.62 rupiah for the same age. In terms of actuarial obligations, the AAN method also shows a more significant increase than PUC. These results show that the AAN method is more stable in the calculation of actuarial liabilities, although it requires larger contributions. Thus, although the Attained Age Normal (AAN) method results in higher normal contributions, it provides better assurance in maintaining the company's financial balance in the long term. This study provides a recommendation that PT Taspen can consider the AAN method as a more conservative alternative in pension fund management.

Keywords: Pension fund, civil servant, normal attained age, normal contributions, actuarial obligations

1. Introduction

The pension fund is one of the welfare programs designed to ensure the sustainability of income for employees after entering retirement (Ebbinghaus, 2011). This program is very important in providing a decent retirement guarantee, especially for employees who have devoted themselves for a long period of time. One of the companies that manages pension funds for Civil Servants (PNS) in Indonesia is PT Taspen (Persero), an institution that has a responsibility to ensure the welfare of civil servants after they are no longer actively working.

PT Taspen (Persero) uses various actuarial methods to calculate the funds needed to meet the obligation to pay pension benefits in the future. The calculation of this pension fund aims to determine the amount of normal contributions that must be paid by pension program participants and actuarial obligations that are the responsibility of the company. Normal contributions are contributions paid periodically by program participants to guarantee their retirement rights, while actuarial obligations are an estimate of the amount that the company must provide to meet future pension benefits.

One of the methods used in calculating pension funds at PT Taspen is the Attained Age Normal (AAN) method. This method calculates the value of retirement benefits based on the age of the participant at the time of calculation and projects it up to retirement age. AAN is known as a more conservative method compared to other methods such as Projected Unit Credit (PUC), because it takes into account the current age of the participant as an important factor in determining the amount of contributions and liabilities.

This study focuses on the application of the AAN method in calculating normal contributions and actuarial obligations for pension program participants at PT Taspen Cirebon Branch Office. Using this method, the study focused on the importance of a fair allocation of retirement benefits based on the age of the participants at the time of the calculation, as well as taking into account variables such as mortality, interest rates, and other economic factors.

This research is expected to provide a more in-depth picture of the effectiveness of the AAN method in pension fund management, as well as provide recommendations for optimizing pension fund management in the future.

2. Literature Review

The actuarial calculation of the pension fund is a very important aspect in determining the amount of normal contributions and actuarial obligations, both for the company and the participants. Some actuarial methods that are commonly used in pension fund management are Projected Unit Credit (PUC) and Attained Age Normal (AAN) (Andani, 2023). Each of these methods has different characteristics and approaches in calculating actuarial contributions and liabilities.

The Projected Unit Credit (PUC) method is a method that calculates retirement benefits by dividing the total benefits that will be received by participants at retirement age based on their working period. This method assumes that each year of work the participant contributes equally to the pension benefits that will be received in the future. Therefore, this method generally produces a smaller normal contribution at the beginning of the working period, but tends to increase as the working period and age of the participant increases (Winklevoss, 1993). The PUC method is often considered more flexible and easy to implement, especially in retirement plans that have participants with varying tenures.

On the other hand, Attained Age Normal (AAN) is a method that calculates retirement benefits based on the age of the participant on the date of calculation (Ebbinghaus, 2011). In this method, the benefits that the participant will receive are calculated by allocating the present value of the retirement benefit until the participant reaches retirement age. According to Anderson (1985), the AAN method tends to be more conservative because it takes into account age during calculation and periodically updates the value of benefits based on the latest assumptions about mortality rates, interest rates, and other economic factors. With this approach, the AAN generates higher contributions than PUCs, but provides better stability in terms of the company's actuarial obligations in the future.

Previous research by Islam et al. (2016) compared the calculation of pension funds between the AAN and PUC methods on PT Taspen data. Their results showed that although the PUC method resulted in smaller normal contributions, the AAN method was more stable in the long term and offered greater protection against economic and demographic fluctuations. This is because the AAN method takes into account changes in the age and condition of participants more comprehensively, resulting in more accurate and realistic actuarial obligations. They also found that the AAN method, while more conservative, requires a larger allocation of funds to meet future retirement obligations.

Another study by Utami et al. (2012) also shows that the AAN method provides advantages in terms of stability of contribution payments. significant increase in contributions occurred as participants approached retirement age. On the other hand, the AAN method produces more consistent contributions from year to year, thereby reducing the burden on companies to make massive adjustments at certain times (Duggan, 2007). Their study found that although the normal contributions generated by the PUC method were lower initially, a

The conclusions of these studies suggest that the AAN method can be a more stable and conservative option for pension fund calculations, especially for companies that want to minimize the risk of insufficient funds in the future. However, for companies with limited budgets or those looking to provide more flexibility to participants, the PUC method can be a more efficient option in the short term.

3. Materials and Methods

This research was conducted using secondary data from Civil Servants participating in the PT Taspen Cirebon Branch Office pension program in 2022. The data includes gender, age of participants when appointed, retirement age, length of service, and last basic salary. The calculation was carried out using the Attained Age Normal (AAN) method assuming an interest rate of 9.7% and a salary proportion of 25%. The analysis was carried out using the Microsoft Excel application.

The calculation steps include:

(a) Collection and processing of employee data.
(b) Calculation of pension benefits based on the last salary.
(c) Calculation of the present value of future benefit (PVFB).
(d) The calculation of normal contributions and actuarial obligations uses the AAN method.

The supporting theories used are:

1) Actuarial Assumptions

Actuarial assumptions in the Standard Actuarial Practice of Pension Funds (SPA-DP) No. 5.01 of 1998 are defined as a set of estimates regarding future changes, which are used to calculate the present value of pension benefits. According to Winklevoss (1993), actuarial assumptions are a series of estimates used in calculating pension benefits related to future changes that affect the financing of defined benefit pension programs, including assumptions of depreciation rates, assumptions of salary increases, and assumptions of interest rates.

2) Flower Function

According to Winklevoss (1993) the interest function is used to discount a payment that will come to the present time. If the interest rate is assumed for the next year, and the amount does not change for each year, then the calculation of the present value of the unit payment after the year is:$i_n ni\ 1n$

$$v = \frac{1}{(1+i_1)(1+i_2)\dots(1+i_n)}. \quad (1)$$

3) *Actuarial Liability*

According to Winklevoss (1993) the general equation of actuarial obligations is notated by being a PVFB minus PVFNC or can be defined as follows: ${}^{r}(AL)_x$

$${}^{r}(AL)_x = {}^{r}(PVFB)_x - {}^{r}(PVFNC)_x. \quad (2)$$

4) **Metode *Attained Age Normal* (AAN)**

a. Normal Contributions

According to Anderson (1985) in Islam et al. (2016), the equation for calculating normal contributions using the AAN method for a person who is currently old and registered as a participant in the pension fund program when he is old is:xy

$${}^{AAN\ r}(NC)_x = \frac{{}^{r}(PVFB)_y}{\frac{N_x - N_r}{D_x}}, \quad (3)$$

with

${}^{AAN\ r}(NC)_x$: normal contributions for participants aged using $x$the AAN method,
${}^{r}(PVFB)_y$: the present value of retirement benefits for aged participants,y
N_x : accumulation of values from age to age,$D_x xw$
D_x : The present value of the sum assured payment is 1.

b. Actuarial Obligations

According to Anderson (1985), in Islam et al. (2016) the calculation of actuarial liabilities using the AAN method for a person of current age based on the general equation of actuarial liabilities, is notated with and defined as follows:$x^{AAN}\ {}^{r}(AL)_x$

$${}^{AAN\ r}(NC)_x = \frac{{}^{r}(PVFB)_y}{\frac{N_x - N_r}{D_x}}, \quad (2.27)$$

with

${}^{AAN\ r}(NC)_x$: normal contributions for participants aged using $x$the AAN method,
${}^{r}(PVFB)_y$: the present value of retirement benefits for aged participants,y
N_x : accumulation of values from age to age,$D_x xw$
D_x : The present value of the sum assured payment is 1.

4. Results and Discussion

4.1. Employee Data

The data used in this paper is secondary data of Civil Servants (PNS) participants in the normal retirement of PT Taspen (Persero) Cirebon Branch Office which contains the gender of the participant, the age of the participant when appointed as a civil servant, retirement age, working period, and the last basic salary of the participant as contained in the following.

Table 1: Data on PT Taspen pension program participants

It	Gender	Participant Entry Age	Participant Retirement Age	Length of Service	Last Basic Salary (IDR)
1	Woman	27	60	33	55,399,200
2	Woman	29	60	30	48,429,600
3	Woman	24	60	35	42,280,800
4	Woman	20	60	39	56,188,800
5	Man	27	58	31	46,464,000
6	Man	21	60	38	65,182,800

7	Man	22	60	38	62,538,000
8	Woman	21	60	38	60,000,000
9	Man	29	58	28	49,297,200
10	Man	25	60	35	56,391,600
11	Woman	28	58	30	30,621,600
12	Man	23	58	34	51,528,000
13	Woman	23	58	34	52,068,000
14	Man	22	60	37	65,182,800
15	Man	30	58	27	56,982,000
16	Man	22	58	36	43,658,400
17	Woman	28	60	31	48,300,000
18	Man	22	60	37	62,538,000
19	Woman	20	60	39	60,000,000
20	Man	23	60	36	60,627,600

The assumption of the interest rate used in this study is taken from the company's internal assumption used by PT Taspen, which is 9.7%, and the proportion of civil servant salaries according to government regulations, which is 2.5%. $(i = 9.7\%)$ $(k = 2.5\%)$

4.2. Calculation of Pension Benefits based on Last Salary

Samples are taken randomly to make calculations, assuming the sample used is participant number 9 with a male gender. When the calculation was made, the participant was 32 years old, he was appointed as a civil servant at the age of 29 with a retirement age of 58 years and the basic salary for the last year was IDR 49,297,200.00. Furthermore, $(x = 32)(y = 29)(r = 58)(s_{r-1} = 49{,}297{,}200.00$)the amount of pension benefits based on the assumption of the last salary to be presented as follows.$r = 58$

$$B_r = k(r - y)s_{r-1}$$

$$B_{58} = 2.5\%\ (58 - 29)\ s_{57} = 2.5\%\ (29)\ 49{,}297{,}200 = 35{,}740{,}470$$

So, the amount of pension benefits received by participants when they retire at the age of 58 is IDR 35,740,470. Furthermore, the amount of pension benefits is used to calculate the amount of the present value of pension benefits.

4.3. Present Value of Future Benefit (PVFB)

a. Present value of retirement benefits at entry age $(y = 29)$

$$^{r}(PVFB)_y = B_r\ v^{r-y}\ {}_{(r-y)}p_y\ \ddot{a}_r,$$
$$^{58}(PVFB)_{29} = 35{,}740{,}470\left(\frac{1}{1+0.097}\right)^{29}\left(\frac{l_{29+39}}{l_{29}}\right)\left(\frac{N_{58}}{D_{58}}\right),$$
$$^{58}(PVFB)_{29} = 21{,}272{,}839.61.$$

The current value of pension benefits that participants will get at the entry age (years) is IDR 21,272,839.61 $y = 29$.

b. Present value of retirement benefits at the age of calculation $(x = 32)$

$$^{r}(PVFB)_x = B_r\ v^{r-x}\ {}_{(r-x)}p_x\ \ddot{a}_r,$$
$$^{58}(PVFB)_{32} = 35{,}740{,}470\left(\frac{1}{1+0.097}\right)^{26}\left(\frac{l_{32+26}}{l_{32}}\right)\left(\frac{N_{58}}{D_{58}}\right),$$
$$^{58}(PVFB)_{32} = 28{,}146{,}683.21.$$

The present value of pension benefits that participants will get when the calculation age is 32 years old is IDR 28,146,683.21.

The results of the calculation of the current value of the next retirement benefit until the participant reaches retirement age with the help of an excel application are shown in the following table.$(r = 58)B_r = 35{,}740{,}470$

Table 2: Calculation of the present value of retirement benefits (PVFB) with $i = 9.7\%$

x	v^{r-x}	${}_{(r-x)}p_x$	$\ddot{a}_r$	${}^{r}(PVFB)_x$
29	0.068235095	0.906966844	12.94904938	**21,272,839.61**
30	0.074853899	0.907602165	12.91401314	23,352,651.91
31	0.082114727	0.908283378	12.87679179	25,637,086.96
32	0.090079856	0.909019684	12.83733337	**28,146,683.21**
33	0.098817602	0.90981122	12.79545208	30,903,797.79
34	0.108402909	0.910658132	12.75094663	33,933,023.88
35	0.118917992	0.911560577	12.70359892	37,261,416.00
36	0.130453037	0.912536991	12.653426	40,919,557.28
37	0.143106981	0.913596763	12.60031645	44,940,885.77
38	0.156988359	0.914758507	12.54427299	49,362,842.49
39	0.172216229	0.916031791	12.48516922	54,226,412.93
40	0.188921204	0.917453844	12.42323877	59,578,722.00
41	0.20724656	0.91904379	12.35847804	65,471,123.08
42	0.227349477	0.920820975	12.29087768	71,960,706.18
43	0.249402376	0.922814253	12.22054427	79,111,776.12
44	0.273594406	0.925043608	12.1474632	86,995,277.02
45	0.300133064	0.927547988	12.07185426	95,692,187.80
46	0.329245971	0.930357668	11.99382395	105,292,312.80
47	0.36118283	0.933512942	11.91359782	115,897,400.35
48	0.396217565	0.937045604	11.83128961	127,620,577.77
49	0.434650668	0.940978896	11.7468948	140,587,429.27
50	0.476811783	0.945336899	11.66040083	154,938,677.21
51	0.523062526	0.95016373	11.57201876	170,835,573.61
52	0.573799591	0.955476178	11.48161805	188,454,430.88
53	0.629458152	0.961330682	11.38950961	208,001,238.22
54	0.690515592	0.967785813	11.2960148	229,709,520.83
55	0.757495605	0.974873141	11.20112818	253,836,737.43
56	0.830972678	0.982626061	11.10483559	280,673,414.20
57	0.911577028	0.99102	11.00644704	310,528,915.29
58	1	1	10.90488871	343,736,978.14

4.4. Normal Contributions and Actuarial Obligations

4.4.1. Normal Contribution Calculation

An example of calculating the size of normal contributions using the AAN method on participants when the age of calculation is carried out (), with the following is known.$x = 32\ {}^{r}(PVFB)_y = 21{,}272{,}839.61$

$$^{AAN\ r}(NC)_x = \frac{{}^{r}(PVFB)_y}{\frac{N_x - N_r}{D_x}},$$

$$^{AAN\ 58}(NC)_{32} = \frac{{}^{58}(PVFB)_{29}}{\frac{N_{32} - N_{58}}{D_{32}}},$$

$$^{AAN\ 58}(NC)_{32} = \frac{21{,}272{,}839.61}{10.15237814} = 2{,}095{,}355.33.$$

The normal amount of contributions that must be paid by participants when they are 32 years old is IDR 2,095,355.33. The calculation of normal contributions uses the next AAN method until the participant reaches retirement age, as shown in the following table.$(r = 58)\ {}^{r}(PVFB)_y = 21{,}272{,}839.61$

Table 3: Calculation of normal contributions using the AAN method

x	$\frac{N_x - N_r}{D_x}$	${}^{AAN\ r}(NC)_x$
29	10.41372175	2,042,770.12
30	10.33408662	2,058,511.84
31	10.2471784	2,075,970.45
32	10.15237814	**2,095,355.33**
33	10.04890136	2,116,931.88
34	9.935885164	2,141,011.02
35	9.812380282	2,167,959.15
36	9.677536133	2,198,166.90
37	9.5303123	2,232,124.08
38	9.369652051	2,270,398.04
39	9.194288361	2,313,701.59
40	9.00308912	2,362,837.84
41	8.794603429	2,418,851.49
42	8.567214686	2,483,052.01
43	8.319203991	2,557,076.33
44	8.048563817	2,643,060.31
45	7.753208169	2,743,746.74
46	7.430710106	2,862,827.28
47	7.078414026	3,005,311.58
48	6.693253753	3,178,250.88
49	6.271715136	3,391,869.55
50	5.809854936	3,661,509.60
51	5.303351892	4,011,206.51
52	4.747171298	4,481,161.15
53	4.135834144	5,143,542.72
54	3.463108993	6,142,700.00
55	2.721818183	7,815,672.53
56	1.903855971	11,173,555.11
57	1	21,272,839.61
58	0	-

It can be seen that the normal calculation of contributions using the AAN method does not reach the retirement age (, because $r = 58$)the result of the calculation at the time of retirement age is .$\frac{N_x - N_r}{D_x}(r = 58)0$

4.4.2. Actuarial Liability Calculation

An example of calculating the magnitude of actuarial liabilities using the AAN method for participants when the age of calculation is carried out), which is known and presented as follows.($x = 32\ {}^{r}(PVFB)_x = 28{,}146{,}683.21 {}^{AAN\ r}(NC)_x = 2{,}095{,}355.33$

$${}^{AAN\ r}(AL)_x = {}^{r}(PVFB)_x - {}^{AAN\ r}(NC)_x \frac{N_x - N_r}{D_x},$$
$${}^{AAN\ 58}(AL)_{32} = {}^{58}(PVFB)_{32} - {}^{AAN\ 58}(NC)_{32} \frac{N_{32} - N_{58}}{D_{32}},$$
$${}^{AAN\ 58}(AL)_{32} = 6{,}873{,}843.60.$$

The amount of actuarial liability that must be paid by the company when the participant is 32 years old is IDR 6,873,843.60. The results of the calculation of actuarial liabilities using the next AAN method until the participant reaches retirement age are shown in the following($r = 58$).

Table 4: Calculation of actuarial liabilities using the AAN method

x	${}^{r}(PVFB)_x$	$\frac{N_x - N_r}{D_x}$	${}^{AAN\ r}(NC)_x$	${}^{AAN\ r}(AL)_x$
29	21,272,839.61	10.41372175	2,042,770.12	0
30	23,352,651.91	10.33408662	2,058,511.84	2,079,812.30
31	25,637,086.96	10.2471784	2,075,970.45	4,364,247.35
32	28,146,683.21	10.15237814	2,095,355.33	**6,873,843.60**
33	30,903,797.79	10.04890136	2,116,931.88	9,630,958.17
34	33,933,023.88	9.935885164	2,141,011.02	12,660,184.27
35	37,261,416.00	9.812380282	2,167,959.15	15,988,576.39
36	40,919,557.28	9.677536133	2,198,166.90	19,646,717.67
37	44,940,885.77	9.5303123	2,232,124.08	23,668,046.15
38	49,362,842.49	9.369652051	2,270,398.04	28,090,002.88
39	54,226,412.93	9.194288361	2,313,701.59	32,953,573.32
40	59,578,722.00	9.00308912	2,362,837.84	38,305,882.39
41	65,471,123.08	8.794603429	2,418,851.49	44,198,283.47
42	71,960,706.18	8.567214686	2,483,052.01	50,687,866.57
43	79,111,776.12	8.319203991	2,557,076.33	57,838,936.51
44	86,995,277.02	8.048563817	2,643,060.31	65,722,437.41
45	95,692,187.80	7.753208169	2,743,746.74	74,419,348.19
46	105,292,312.80	7.430710106	2,862,827.28	84,019,473.19
47	115,897,400.35	7.078414026	3,005,311.58	94,624,560.74
48	127,620,577.77	6.693253753	3,178,250.88	106,347,738.15
49	140,587,429.27	6.271715136	3,391,869.55	119,314,589.65
50	154,938,677.21	5.809854936	3,661,509.60	133,665,837.59
51	170,835,573.61	5.303351892	4,011,206.51	149,562,734.00
52	188,454,430.88	4.747171298	4,481,161.15	167,181,591.27
53	208,001,238.22	4.135834144	5,143,542.72	186,728,398.61
54	229,709,520.83	3.463108993	6,142,700.00	208,436,681.22
55	253,836,737.43	2.721818183	7,815,672.53	232,563,897.82
56	280,673,414.20	1.903855971	11,173,555.11	259,400,574.59
57	310,528,915.29	1	21,272,839.61	289,256,075.68
58	343,736,978.14	0	-	-

It can be seen that the calculation of actuarial liabilities using the AAN method does not reach the retirement age, because $(r = 58)$the result of the calculation at the time of retirement age is .$\frac{N_x - N_r}{D_x}(r = 58)0$

5. Conclusion

Using the Attained Age Normal (AAN) method, the total value of normal pension contributions obtained from the time the participant was appointed as a civil servant until the age of 58 (retirement age) was IDR 115,061,971.63. Meanwhile, the actuarial obligation of the pension fund that must be paid by PT Taspen when the participant is 57 years old using the same method is IDR 289,256,075.68.

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