PART III / FELLOWSHIP PROGRAM ASSIGNMENT COVER SHEET

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Candidate to complete the following section (and update details in header and footer):

Candidate Number: XXXXX	**Course: Life Insurance and Retirement Valuation**
Date Due: Monday 2 March 2020 at 9.00am (AEST)	

- **Please ensure that your candidate number and course name is located on the header and footers of each page of the assignment.**
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Assignment Marker to complete and update the following section:

Comments on Questions

Overall Comments

Q1a Assumption Setting

Context:

In setting assumptions for the DB scheme, it has been assumed the medium-sized firm operates in a country similar to Australia. As such, given the lack of internal data, external data to support the assumption setting process has primarily been sourced from Australian economic and demographic data, with some references to the Example Pension Scheme Table provided in the *Formulae and Tables for Examinations of the Institute and Faculty of Actuaries*. The Trustees of the scheme are assumed to have an average risk tolerance and the investment managers selected by the trustee invest in a moderate risk portfolio with adequate liquidity.

Purpose of the model:

The purpose of the model developed for the Defined Benefit Scheme is to assist the Board of Trustees in comparing:

1. the pace of funding between the PUC and EAN method
2. the initial contribution rate for each Grade using the Projected Unit Credit (PUC) method and Entry Age Normal (EAN) method
3. the funding position after a projection of 15 years between the PUC and EAN method
4. the impact of various scenarios on the funding position and pace of funding between the PUC and EAN method

As such, the following assumptions have been set with this purpose in mind and simplifying assumptions may have been made where the assumptions would not impact the purpose of the model.

Economic Assumptions:

1. Investment return: 7% p.a.

Purpose:

The investment return is used as the discount rate for liabilities related to future benefits payable and in projecting the growth of assets in the future.

Rationale:

Given this is a new scheme, we have no experience of how the investment managers have historically performed. An important factor to note is that a lump sum is paid on retirement, and hence there is no need to match assets to the annuities and therefore less need to invest in lower yielding bonds. Given the similar risk tolerance and profile of liabilities, the investment manager is expected to invest in a similar profile of assets to that of a superannuation scheme i.e. predominantly investment in shares and property to deliver higher returns with some investment in more stable assets. The industry average investment return was 7.4% per annum over the past 5 years[1]. The investment objective for both the EquipSuper and EnergySuper DB schemes is to obtain a long-term net return of CPI + 3%[2]. We also note, the QSuper long term investment assumption for their DB fund was 7% as per the Actuarial Report[3]. Therefore, in order to be in line with the investment objective of DB Schemes, superannuation scheme returns and DB scheme returns, the long-term investment return assumption has been set at 7%.

[1] https://www.superannuation.asn.au/resources/superannuation-statistics

[2] https://www.energysuper.com.au/performance-and-fees/defined-benefit-investment-pool
https://www.equipsuper.com.au/investments/your-investment-options/defined-benefit

[3] https://qsuper.qld.gov.au/-/media/pdfs/qsuper-public/publications/annual-report/actuarialreport2018.pdf?la=en

2. Wage Inflation: 2% p.a.

Purpose:
Salary inflation is the overall increase in the wages of employees over time used in the projection of the Final Salary for the Retirement and Withdrawal benefits.

It should be noted that we have split the salary inflation assumption into 2 parts:

a) Wage inflation: general increase in salary over time without allowing for promotions and improvements in work i.e. not related to quantity or quality of work
b) Salary growth: Growth in salary due to promotions and length of service with the company (will be discussed in the Demographic assumptions section)

Rationale:
Wage inflation in Australia over the past 5 years to December 2018 was 2.2% per annum[4] and 2.2% over the 12 months to December 2019[5]. It is noted that wage inflation is expected to continue to be sluggish over the next few years, given the current economic environment. Therefore, we have set wage inflation to 2%. It is noted a 2% assumption is also consistent with the Example Pension Scheme Table provided in the *Formulae and Tables for Examinations of the Institute and Faculty of Actuaries*.

Demographic Assumptions:

3. Salary Growth: Grade A: 3.5% p.a., Grade B: 1.5% p.a.

Purpose:
As mentioned above, this is related to the salary inflation assumption which has been split into 2 assumptions due to the difference salary growth between Grade A and Grade B. It is used in the projection of the Final Salary for the Retirement and Withdrawal benefits.

Rationale:
As mentioned earlier, salary growth refers to the increase in salary due to promotions and length of service with the company. From the membership data provided, the implicit salary growth is shown below:

Age at start of year	Number of employees	Average Salary $	Grade	Annual salary growth
30	20	100,000	A	
40	15	150,000	A	4.14%
45	30	175,000	A	3.13%
50	25	185,000	A	1.12%
55	10	250,000	A	6.21%
30	210	78,000	B	
40	220	87,000	B	1.10%
45	240	95,000	B	1.77%
50	180	103,000	B	1.63%
55	50	103,000	B	0.00%

[4] https://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/rp/rp1819/WageSlowdown
[5] https://www.abs.gov.au/ausstats/abs@.nsf/mf/6345.0

As a simplifying assumption, a salary scale across the ages has not been utilised due to the lack of granularity in the data at each age group as well as the small amount of data impacting the credibility of such granular assumptions. Additionally, the simplifying assumption would not have a significant impact on the purpose of the model noted above.

The overall salary growth rate for Grade A and Grade B members was 3.73% and 1.11% respectively. However, for Grade B, there was no growth in salaries between ages 50 to 55, which appeared unreasonable. Taking the average between 30 and 50, the average annual salary growth was 1.4%, which is more consistent with the average salary growth in the salary scale in the Example Pension Scheme Table provided in the *Formulae and Tables for Examinations of the Institute and Faculty of Actuaries* which is considered a credible external data source. Therefore, the assumption for salary growth was set to 3.5% for Grade A and 1.5% for Grade B.

4. Retirement rates: Grade A: 40% at age 50 with a drop to 20% at age 51 increasing to 100% at age 60, Grade B: 100% at age 60

Purpose:
Retirement rates are used to calculate the probabilities of members leaving the fund at or after the NRA, which feed into the Membership base, the Actuarial Liability calculation and the Payments for members exiting the fund.

Rationale:
Using the Australian demographic to set the retirement rate for each age was considered unreasonable given there is no access to superannuation until between ages 55 – 60 which would heavily skew the data.

Benefits do not accrue for Grade B members after the normal retirement age (NRA) at age 60. Therefore, contributions required for Grade B members after NRA would be negative as the investment return is greater than the wage inflation and salary growth combined. As such, a more conservative approach has been taken to assume a 100% retirement rate assumption for members aged 60.

Experience with DB schemes similar to Grade A and Example Pension Scheme Table provided in the *Formulae and Tables for Examinations of the Institute and Faculty of Actuaries* suggests there is a tendency for a high proportion of individuals to retire at NRA. There is often a fall in retirements in the following years before retirement rates steadily increase as members get older. We have designed the member retirement rates in line with this experience as shown in the table below:

Retirement age	Grade A	Grade B
50	40%	0%
51	20%	0%
52	20%	0%
53	30%	0%
54	40%	0%
55	50%	0%
56	60%	0%
57	70%	0%
58	80%	0%
59	90%	0%
60	100%	100%

5. Voluntary withdrawal rates (pre-retirement):

Purpose:
Withdrawal rates are used to calculate the probabilities of members leaving the fund before the NRA, which feed into the Actuarial Liability calculation and the Payments for members exiting the fund. There is some relationship between this assumption and the retirement rate assumption as both feed into the same calculations and the decrement table.

Rationale:
According to research from the Australian Industry Group, 8.5% of the Australian workforce changed their employer in the year to February 2019[6]. However, we note that the Australian HR Institute has found that turnover among older workers was significantly lower possibly due to organisations attempting to retain valuable corporate memory[7]. Therefore, we have used an assumption that voluntary withdrawals averaged 10% for all workers except those 10 years from retirement, where withdrawal rates would drop to 8% as shown in the table below.

Voluntary withdrawal rates	Grade A	Grade B
30-40	10%	10%
41-49	8%	10%
50-59	0%	8%
60+	0%	0%

6. New entrant rates:

Purpose:
New entrant rates are used to determine the age at which new entrants enter the membership base to replace members who leave the fund. The membership base is used to calculate the Actuarial Liability and Salary which feed into the initial contribution rate for PUC. This assumption is implicitly linked to the retirement rates and withdrawal rates as the new entrant rates are a replacement ratio i.e. replaces members who leave the fund. It should be noted, the growth in the membership base is also related to this assumption as they both combine to provide the new entrants to the membership base.

Rationale:
Given there is no data on the ages of new entrants into the firm, an implicit model assumption is made such that a person exiting at an age group will be replaced by someone of either age 30, 35, 40, 45, 50, 55. A replacement ratio is common practice in determining the SCR and valuing DB schemes.

It has been assumed that new entrants who join the fund would, on average, be younger than those they are replacing. For Grade A, older employees are less likely to be replaced by younger employees as they are professionals where certain roles e.g. Executives and Managers require experience and knowledge. On the other hand, most manual labour jobs can be performed by younger individuals. As such, the age of new entrant replacement assumptions for those exiting aged 50-60 are higher for Grade A than Grade B.

[6] https://www.aigrouptalent.com.au/wp-content/uploads/Ai-Group-factsheet-Labour-Turnover-in-2019.pdf
[7] https://www.thebusinessconversation.com.au/news/2018/08/10/report-finds-businesses-face-rising-staff-turnover-rates/1533853822

Grade A		Age of new entrant					
		30	35	40	45	50	55
Age of exit	30-34	100%	0%	0%	0%	0%	0%
	35-39	60%	40%	0%	0%	0%	0%
	40-44	30%	30%	40%	0%	0%	0%
	45-49	10%	20%	30%	40%	0%	0%
	50-54	0%	10%	20%	30%	40%	0%
	55+	0%	10%	20%	30%	40%	0%

Grade B		Age of new entrant					
		30	35	40	45	50	55
Age of exit	30-34	100%	0%	0%	0%	0%	0%
	35-39	60%	40%	0%	0%	0%	0%
	40-44	30%	30%	40%	0%	0%	0%
	45-49	10%	20%	30%	40%	0%	0%
	50-54	10%	10%	30%	30%	20%	0%
	55+	10%	10%	30%	30%	20%	0%

7. Growth in membership base: 2% p.a.

Purpose:
The company is expected to continue to expand its workforce along with its business. The growth in membership base will determine how many new employees join the workforce each year. It is used to project of the membership base, to calculate the Actuarial Liability and Salary which feed into the initial contribution rate for PUC.

Rationale:
Over the past year, trend employment in Australia has increased by 2% over the past year, in line with the average annual growth over the past 20 years of 2%[8]. Furthermore, the growth rate of its workforce is expected to be slightly under the Australian economic growth rate to allow for productivity improvements offsetting the company growth being higher than economic growth. Australia is expected to realise average annual real GDP growth of 2.7 per cent between 2019 and 2023 and has had an average growth rate of 2.6 per cent between 2014 and 2018.[9]

Therefore, the workforce growth rate and hence the growth in membership base has been set to be 2%.

Simplifying Assumptions in the model:

Purpose:
The following assumptions were made as simplifying assumptions to reduce the complexity of calculations as they did not affect the comparison between the two methods.

8. Starting age: Employees of the firm are 30 at the youngest

This was a simplifying assumption made, given there was no data provided indicating there were any employees aged younger than 30 or their salaries. Additionally, this was identified to not have an impact on the comparison between the two funding methods.

[8] https://www.abs.gov.au/ausstats/abs@.nsf/lookup/6202.0Media%20Release1Jan%202020
[9] https://www.austrade.gov.au/International/Invest/Why-Australia/robust-economy

9. New entrant joining age: New entrants can only start at ages 30, 35, 40, 45, 50

A simplifying assumption was made such that new starters could only start working at ages 30, 35, 40, 45, 50. Greater granularity could not be identified from the membership data provided and assumptions made at a more granular level would not be based on statistically credible data. Furthermore, this would not materially alter the comparison between the two methods.

10. Timing of events: Birthdays, new entrants entering the scheme, withdrawal payments and retirement payments occur at the end of the year. Contributions occur before the withdrawals and retirement leave the fund and before new entrants join the fund at the end of the year. Salary increases occur at the end of the year.

This was a simplifying assumption made as it was identified to have an immaterial impact on the comparison of initial contribution rate, funding position and pace of funding between the two methods.

11. Expenses: Nil

Expenses have been ignored in the determination of contribution rates for both methods, given the funding method will not be affected by the scheme's operating expenses.

12. Actuarial Reserve is based on the retirement benefit at NRA

The Actuarial Reserve was defined in the addendum the assignment as: "present value of the expected future normal retirement benefit payment, applying past service (to date of withdrawal) only." Therefore, it has been assumed the Actuarial Reserve is the present value of the expected benefit payment at NRA. It should be noted this should have no impact on Grade B contribution rates and projections as the population is assumed to retire at age 60 and an immaterial impact on the comparison between PUC and EAN for Grade A members.

Assumptions specific to EAN method:

13. Average Entry Age: Grade A: 40, Grade B: 38

Purpose:
The average entry age is the average age a new employee will join the firm and is a fundamental assumption for the EAN method. This will be used as the starting age at which the EPV of benefits and EPV of contributions will be calculated under the EAN method. It is related to the new entrant assumptions, and therefore the withdrawal and retirement rates.

Rationale:
The Average Entry Age was determined by projecting the new entrants over the next 15 years using the withdrawal rates, retirement rates and new entrant rates specified above and calculating the average age of new entrants across the 15 years. The average age of new entrants excluding the initial population appeared to be consistent over the years being 39.5 for Grade A and 36.6 for Grade B. Allowing for the average age of the initial population (43 for Grade A and 41 for Grade B), the average age of new entrants was 40.6 and 38.4 respectively. Therefore, taking the average of the two average ages for new entrants, the assumed average entry age for modelling is 40 for Grade A and 38 for Grade B.

Given the average age of Professionals in Australia was 41.9 years old[10], the Grade A Entry Age assumption does not seem unreasonable accounting for the fact new entrants are younger than the average age. The average age of all employees in Australia was 39.8 years[10]. Following the same logic, especially given the new entrants are expected to be younger for a manual labour job, the Entry Age assumption for Grade B appears realistic.

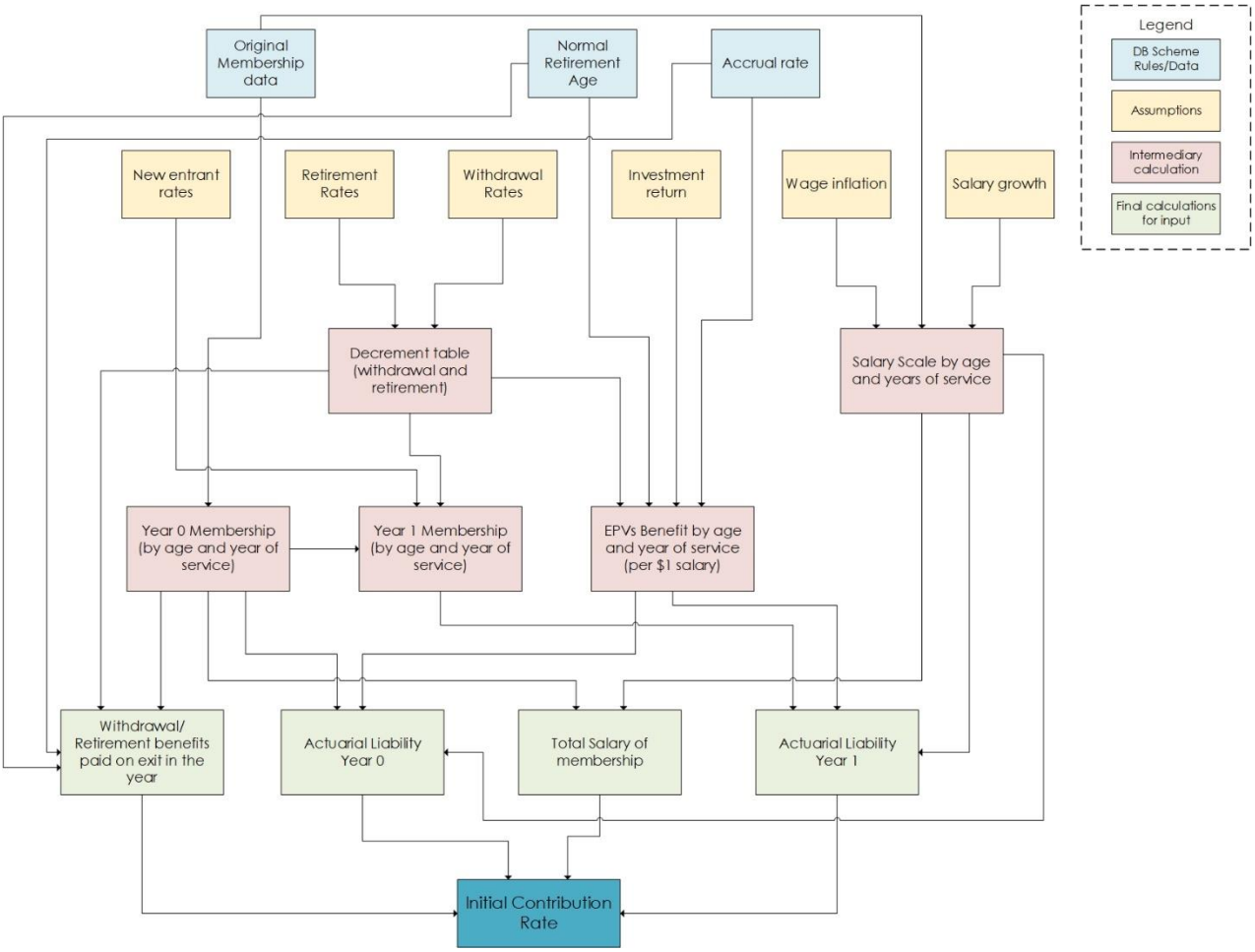
[10] https://www.abs.gov.au/ausstats/abs@.nsf/mf/6306.0/

Assumptions specific to PUC method:

None

Q1b Flowchart of PUC calculation logic

Refer below for the flowchart that shows the calculation logic for the determination of the initial contribution rate using the PUC method.



Refer above for details on how assumptions were determined. The intermediary and final calculations were calculated in the following way:

1. **Decrement table (withdrawal and retirement):** Calculates the probability of survival for each age based on withdrawal and retirement rate assumptions. Refer to tabs <Decrement table>, <Probabilities A> and < Probabilities B> for these calculations.
2. **Salary Scale by entry age and years of service:** Salary growth was added to the base salary for each additional year of service with the company for a given entry age. Refer to the <Salary Scale> tab for the calculations. It should be noted wage inflation is added to the entire population for the year as part of the Actuarial Liability calculation (#8 below).
3. **Year 0 Membership (by entry age and year of service):** Based on the original membership data with all members having 0 years of service.
4. **Year 1 Membership (by entry age and year of service):** Based on the Year 0 membership base provided *less* members who withdrew or retired (decrement table) *plus* new entrants (new entrant rates). Each member who was in the Year 0 membership base and did not withdraw or retire now has 1 year of service. New

entrants begin with 0 years of service. Refer to tabs <Population A> and <Population B> for these calculations.

5. **EPV Benefit by entry age and year of service (per $1 salary):** For a member currently aged x, this is calculated as:

$$Accrual\ rate \times years\ of\ sevice \times \sum_{t=0}^{Maximum\ retirement\ age\ (60)-x} ({}_tp_x \times w_{x+t} \times Withdrawal\ benefit + {}_tp_x \times r_{x+t} \times Retiremnt\ benefit) \times \left(\frac{(1+salary\ growth)\times(1+wage\ inflation)}{1+investment\ return}\right)^t$$

Where the Retirement benefit = 1 and the Withdrawal Benefit = 75% x ${}_{NRA-(x+t)}p_{x+t}$ x $\left(\frac{(1+salary\ growth)\times(1+wage\ inflation)}{1+investment\ return}\right)^{NRA-(x+t)}$

Refer to tabs <Accrual A> and <Accrual B> for these calculations.

6. **Withdrawal/Retirement benefits paid on exit in the year:** For a member who is retiring, the retirement benefit per $1 of salary is calculated as:

$$Accual\ Rate \times Years\ of\ Service.$$

For a member who is withdrawing at age x, the withdrawal benefit per $1 of salary is calculated as:

$$75\% \times Accual\ Rate \times Years\ of\ Service \times {}_{NRA-x}p_x \times \left(\frac{(1+salary\ growth)\times(1+wage\ inflation)}{1+investment\ return}\right)^{NRA-x}.$$

Refer to tabs <Accrual A> and <Accrual B> for these calculations. This is multiplied by the final salary for all members retiring or withdrawing over the year, which is determined based on the Year 0 membership and decrement tables, and summed together. Refer to tab <Initial Contribution rate> for these calculations.

7. **Actuarial Liability Year 0 (AL_0):** To calculate the Actuarial Liability for each entry age and year of service, the EPV of Benefits were multiplied by the Salary Scale and the number of members in the Year 0 membership table. The Actuarial Liability for each entry age and year of service was added together to get the Actuarial Liability for Year 0. Refer to tab <Initial Contribution rate> for these calculations.
8. **Actuarial Liability Year 1 (AL_1):** To calculate the Actuarial Liability for each entry age and year of service, the EPV of Benefits were multiplied by the Salary Scale (allowing for wage inflation) and the number of members in the Year 1 membership table. The Actuarial Liability for each entry age and year of service was added together to get the Actuarial Liability for Year 1. Refer to tab <Initial Contribution rate> for these calculations.
9. **Total Salary of membership:** For each entry age and years of service, multiplied the Salary scale and Year 0 membership (contributions are based on membership before withdrawals and retirements and before new entrants) and summed these together to get the total salary of the membership. Refer to tab <Initial Contribution rate> for these calculations.
10. **Initial Contribution rate:**

$$\frac{AL_1 + \text{Withdrawal/Retirement benefits paid on exit in the year} - AL_0 \times (1 + investment\ return)}{\text{Total Salary of membership}}$$

Refer to tab <Initial Contribution rate> for these calculations.

Question 1c Results

The initial contribution rates determined under PUC and EAN methods for Grade A and Grade B were:

Initial Contribution Rate	PUC	EAN	Average age	Entry age assumption
Grade A	8.342%	7.961%	43	40
Grade B	1.609%	1.679%	41	38

This was determined under the following Actuarial Liabilities and Salary for the PUC method.

PUC Method	Time	Grade A	Grade B
Total Actuarial Liability (t-1)	0	$ -	$ -
Total Actuarial Liability (t)	1	$ 1,029,019	$ 1,265,250
Total Payments for withdrawals/retirement	1	$ 357,868	$ 54,272
Total Salary	1	$ 16,625,000	$82,010,000
SCR		**8.342%**	**1.609%**

The Entry Age assumption for the EAN method was 40 for Grade A and 38 for Grade B. Refer to the calculations to determine the SCR below:

EAN Method	Grade A	Grade B
EPV benefits - retirement (per $1 salary)	$ 0.4420	$ 0.0653
EPV benefits - withdrawals (per $1 salary)	$ 0.1025	$ 0.0441
EPV Benefits - Total (per $1 salary)	$ 0.5445	$ 0.1094
EPV of Contributions (per $1 salary)	$ 6.8401	$ 6.5186
SCR	**7.961%**	**1.679%**

Sense Check:

For a member entering at the assume entry age, the EAN method will, in theory, initially fund liabilities more quickly than the PUC method as the EAN SCR will fund a proportion of future service during the earlier years of membership. Closer to retirement, the EAN method will require a lower contribution rate than the PUC method where the SCR will increase as the member ages in order to fund the higher accrued benefit for the service this year.

However, there are two factors skewing the results from this theory:

1. The assumed entry age is 40 and 38 for Grade A and Grade B respectively whereas the average age of the initial population is 43 and 41 respectively.
2. Membership base is not uniformly distributed around the entry age, it is skewed towards the older ages.

Given these factors, the results seem reasonable in that the initial contribution rate determined by the PUC method and EAN method are similar. A sense check was performed to ensure that if the Entry Age assumption was set as the average age of the starting population, the EAN method would result in a higher initial contribution rate. The contribution rates under the EAN method with an Entry Age assumption of 43 and 41 for Grade A and Grade B respectively were 8.69% for Grade A and 2.093% for Grade B. Therefore, the numbers appear reasonable.

It is noted the contribution rate under PUC is greater than under EAN for Grade A as the average age is closer to the average exit age than the entry age assumption and hence by using the EAN method, there is an expectation some contributions were made for member's service this year when the members were younger. For Grade B the average age is much closer to the entry age assumption than the average exit age or NRA and hence the contribution rate under PUC is lower than under EAN, as expected.

Question 2 Projection of Funding Position

Additional assumptions

There were no additional assumptions made in Q2 a and b. It should be noted that the new entrant rates and growth in membership base were already assumed as part of the Q1 assumption set, although they did not impact the calculations as new entrants had accumulated 0 years of service.

To project a scenario where the scheme was closed to new entrants 3 years after it was launched, it was assumed there were no new entrants in the scheme after year 3.

To project the large-scale redundancy scenario, the following assumptions were made:

1. Redundancy percentage: 25%
   Experience with redundancies in other schemes shows that a large-scale redundancy can range up to 25%. In this scenario, an assumption was set that an additional 25% of employees at all ages were made redundant and would leave the scheme during year 10. A simplifying assumption was made that the 25% of redundancies would be proportionate across all employees given the lack of information on the redundancy. Ideally, the assumption would be based on the business plan and after communication with the employer over employment plans.
2. No new hires by the company in Year 10
   During the year of the redundancy, it would be unlikely that a company would retrench its knowledgeable employees and hire new employees. Such an action would reduce staff morale and be inefficient for the company. Therefore, it was assumed that there were no new hires and hence no members joining the scheme in Year 10.

a) Base scenario under PUC method, updated every 3 years

Grade A

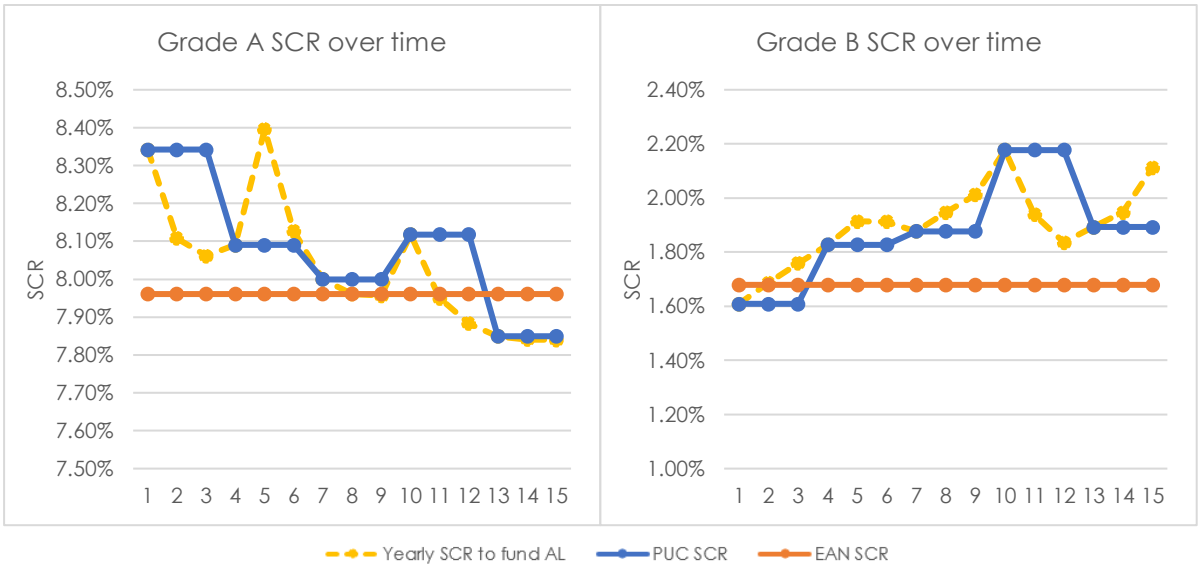
t	Accrual of Past Service Benefits	Total Salary	SCR	Contribution for the year	Payments for withdrawals/ retirements during the year	Value of Existing Assets	Funding Position	Funding Position Ratio
1	$1,029,019	$16,625,000	8.34%	$1,386,887	$357,868	$1,029,019	$0	100%
2	$2,067,898	$17,001,386	8.34%	$1,418,286	$411,559	$2,107,778	$39,880	102%
3	$3,166,289	$17,589,599	8.34%	$1,467,356	$464,287	$3,258,390	$92,101	103%
4	$4,278,615	$18,321,680	8.09%	$1,482,194	$591,508	$4,377,163	$98,548	102%
5	$5,401,399	$19,110,139	8.09%	$1,545,979	$781,102	$5,448,442	$47,044	101%
6	$5,590,013	$19,987,386	8.09%	$1,616,947	$1,813,865	$5,632,915	$42,902	101%
7	$6,310,622	$20,565,902	8.00%	$1,645,125	$1,315,817	$6,356,527	$45,905	101%
8	$7,180,162	$21,350,755	8.00%	$1,707,908	$1,271,947	$7,237,445	$57,283	101%
9	$7,990,203	$22,212,429	8.00%	$1,776,836	$1,459,867	$8,061,035	$70,833	101%
10	$8,751,274	$23,074,254	8.12%	$1,873,220	$1,671,463	$8,827,065	$75,791	101%
11	$8,889,335	$23,965,724	8.12%	$1,945,592	$2,379,845	$9,010,707	$121,372	101%
12	$9,351,383	$24,770,465	8.12%	$2,010,923	$2,112,831	$9,539,548	$188,166	102%
13	$10,029,647	$25,671,370	7.85%	$2,015,055	$1,991,387	$10,230,984	$201,337	102%
14	$10,780,644	$26,667,657	7.85%	$2,093,257	$2,042,100	$10,998,310	$217,666	102%
15	$11,553,326	$27,724,691	7.85%	$2,176,228	$2,155,596	$11,788,824	$235,499	102%

Grade B

t	Accrual of Past Service Benefits	Total Salary	SCR	Contribution for the year	Payments for withdrawals/ retirements during the year	Value of Existing Assets	Funding Position	Funding Position Ratio
1	$1,265,250	$82,010,000	1.61%	$1,319,521	$54,272	$1,265,250	$0	100%
2	$2,682,907	$85,907,931	1.61%	$1,382,238	$119,272	$2,616,783	-$66,124	98%
3	$4,255,163	$89,885,310	1.61%	$1,446,233	$196,238	$4,049,953	-$205,210	95%
4	$5,982,865	$93,950,064	1.83%	$1,716,369	$286,528	$5,763,290	-$219,575	96%
5	$7,865,249	$98,110,191	1.83%	$1,792,370	$413,576	$7,545,515	-$319,734	96%
6	$8,722,604	$102,569,504	1.83%	$1,873,837	$1,654,259	$8,293,278	-$429,326	95%
7	$10,819,805	$106,528,163	1.88%	$1,999,947	$513,328	$10,360,427	-$459,378	96%
8	$13,099,831	$111,306,372	1.88%	$2,089,653	$643,790	$12,531,520	-$568,312	96%
9	$15,561,869	$116,228,899	1.88%	$2,182,068	$793,725	$14,797,068	-$764,801	95%
10	$18,202,693	$121,303,931	2.18%	$2,640,647	$1,089,154	$17,384,356	-$818,337	96%
11	$14,747,546	$126,613,410	2.18%	$2,756,228	$7,183,380	$14,174,109	-$573,436	96%
12	$17,129,446	$129,591,497	2.18%	$2,821,058	$1,029,558	$16,957,796	-$171,650	99%
13	$19,715,018	$135,285,830	1.89%	$2,559,698	$1,173,187	$19,531,353	-$183,665	99%
14	$22,505,433	$141,181,826	1.89%	$2,671,254	$1,338,703	$22,231,098	-$274,335	99%
15	$25,499,566	$147,289,327	1.89%	$2,786,812	$1,692,553	$24,881,534	-$618,032	98%

Sense check:

It would be expected that the PUC funding method will match the rate at which the past service benefits accrue quite closely as it adjusts each year the SCR is set to the demographics of the membership base and the rate at which their past service benefits accrue. As such, the PUC method's pace of funding will more appropriately match the accrual of past service benefits. The SCR using the PUC method is set every 3 years, only accounting for the change in Actuarial Liability over one year and hence there are slight deviations in the funding position. As seen in the graph below, PUC SCR is always quite consistent with the SCR required to fund the accrual of past services and hence the funding position is always close to 100%.



b) Base scenario under EAN method

Grade A

t	Accrual of Past Service Benefits	Total Salary	SCR	Contribution for the year	Payments for withdrawals/ retirements during the year	Value of Existing Assets	Funding Position	Funding Position Ratio
1	$1,029,019	$16,625,000	7.96%	$1,323,478	$357,868	$965,611	-$63,409	94%
2	$2,067,898	$17,001,386	7.96%	$1,353,441	$411,559	$1,975,086	-$92,812	96%
3	$3,166,289	$17,589,599	7.96%	$1,400,268	$464,287	$3,049,322	-$116,967	96%
4	$4,278,615	$18,321,680	7.96%	$1,458,547	$591,508	$4,129,813	-$148,802	97%
5	$5,401,399	$19,110,139	7.96%	$1,521,314	$781,102	$5,159,113	-$242,286	96%
6	$5,590,013	$19,987,386	7.96%	$1,591,150	$1,813,865	$5,297,535	-$292,477	95%
7	$6,310,622	$20,565,902	7.96%	$1,637,204	$1,315,817	$5,989,751	-$320,872	95%
8	$7,180,162	$21,350,755	7.96%	$1,699,685	$1,271,947	$6,836,771	-$343,391	95%
9	$7,990,203	$22,212,429	7.96%	$1,768,281	$1,459,867	$7,623,759	-$366,444	95%
10	$8,751,274	$23,074,254	7.96%	$1,836,889	$1,671,463	$8,322,847	-$428,427	95%
11	$8,889,335	$23,965,724	7.96%	$1,907,856	$2,379,845	$8,433,458	-$455,876	95%
12	$9,351,383	$24,770,465	7.96%	$1,971,920	$2,112,831	$8,882,890	-$468,493	95%
13	$10,029,647	$25,671,370	7.96%	$2,043,639	$1,991,387	$9,556,944	-$472,703	95%
14	$10,780,644	$26,667,657	7.96%	$2,122,951	$2,042,100	$10,306,781	-$473,863	96%
15	$11,553,326	$27,724,691	7.96%	$2,207,099	$2,155,596	$11,079,759	-$473,567	96%

Grade B

t	Accrual of Past Service Benefits	Total Salary	SCR	Contribution for the year	Payments for withdrawals/ retirements during the year	Value of Existing Assets	Funding Position	Funding Position Ratio
1	$1,265,250	$82,010,000	1.68%	$1,376,957	$54,272	$1,322,685	$57,435	105%
2	$2,682,907	$85,907,931	1.68%	$1,442,403	$119,272	$2,738,404	$55,497	102%
3	$4,255,163	$89,885,310	1.68%	$1,509,184	$196,238	$4,243,038	-$12,125	100%
4	$5,982,865	$93,950,064	1.68%	$1,577,432	$286,528	$5,830,954	-$151,911	97%
5	$7,865,249	$98,110,191	1.68%	$1,647,281	$413,576	$7,472,826	-$392,423	95%
6	$8,722,604	$102,569,504	1.68%	$1,722,153	$1,654,259	$8,063,818	-$658,786	92%
7	$10,819,805	$106,528,163	1.68%	$1,788,619	$513,328	$9,903,577	-$916,229	92%
8	$13,099,831	$111,306,372	1.68%	$1,868,846	$643,790	$11,821,883	-$1,277,948	90%
9	$15,561,869	$116,228,899	1.68%	$1,951,496	$793,725	$13,807,186	-$1,754,683	89%
10	$18,202,693	$121,303,931	1.68%	$2,036,706	$1,089,154	$15,721,241	-$2,481,452	86%
11	$14,747,546	$126,613,410	1.68%	$2,125,853	$7,183,380	$11,764,201	-$2,983,345	80%
12	$17,129,446	$129,591,497	1.68%	$2,175,855	$1,029,558	$13,733,992	-$3,395,454	80%
13	$19,715,018	$135,285,830	1.68%	$2,271,464	$1,173,187	$15,793,648	-$3,921,370	80%
14	$22,505,433	$141,181,826	1.68%	$2,370,458	$1,338,703	$17,930,958	-$4,574,474	80%
15	$25,499,566	$147,289,327	1.68%	$2,473,004	$1,692,553	$19,966,576	-$5,532,990	78%

Sense check:

For Grade A, under the EAN method, the contributions are insufficient to fund the accrual of past service and the retirement of older members, as contributions have not been made for these members since the entry age. However, as the older population retires and are replaced by younger new entrants, there are enough members joining the fund below or equal to the entry age assumption who have an accrual of past service which is lower than the contribution rate to balance with the older members who have insufficient contributions for their age under

the EAN method. As seen in the graphs above, as the older population is replaced by younger new entrants, the SCR required to fund the AL reduces to a rate closer to the EAN SCR.

For Grade B, the Normal Retirement Age (NRA) is 60. As a result, the distribution of members around the average entry age of 38 is skewed towards older ages. Therefore, as the population ages, the EAN method does not maintain with the value of accrued past service benefits of the member base, as explained above for Grade A and seen in the graph above. Unlike Grade A, these members are not replaced by younger new entrants until they reach the NRA and hence it is logical that the funding position of Grade B worsens more than Grade A.

c) Scheme closure to new entrants after 3 years under EAN method

Grade A

t	Accrual of Past Service Benefits	Total Salary	SCR	Contribution for the year	Payments for withdrawals/ retirements during the year	Value of Existing Assets	Funding Position	Funding Position Ratio
1	$1,029,019	$16,625,000	7.96%	$1,323,478	$357,868	$965,611	-$63,409	94%
2	$2,067,898	$17,001,386	7.96%	$1,353,441	$411,559	$1,975,086	-$92,812	96%
3	$3,166,289	$17,589,599	7.96%	$1,400,268	$464,287	$3,049,322	-$116,967	96%
4	$4,278,615	$18,321,680	7.96%	$1,458,547	$591,508	$4,129,813	-$148,802	97%
5	$5,271,764	$16,813,190	7.96%	$1,338,460	$758,350	$4,999,010	-$272,753	95%
6	$5,195,961	$15,502,114	7.96%	$1,234,088	$1,764,149	$4,818,879	-$377,082	93%
7	$5,439,716	$12,788,835	7.96%	$1,018,090	$1,206,870	$4,967,421	-$472,295	91%
8	$5,677,533	$11,176,476	7.96%	$889,734	$1,104,903	$5,099,971	-$577,562	90%
9	$5,726,019	$9,882,259	7.96%	$786,704	$1,207,389	$5,036,284	-$689,735	88%
10	$5,716,708	$8,614,650	7.96%	$685,793	$1,209,288	$4,865,329	-$851,379	85%
11	$5,012,275	$7,556,309	7.96%	$601,540	$1,780,319	$4,027,123	-$985,153	80%
12	$4,588,385	$6,097,916	7.96%	$485,441	$1,319,183	$3,475,280	-$1,113,105	76%
13	$4,277,692	$5,099,497	7.96%	$405,959	$1,089,478	$3,035,031	-$1,242,662	71%
14	$3,956,281	$4,335,569	7.96%	$345,145	$1,004,330	$2,588,298	-$1,367,984	65%
15	$3,742,951	$3,672,379	7.96%	$292,350	$819,987	$2,241,841	-$1,501,109	60%

Grade B

t	Accrual of Past Service Benefits	Total Salary	SCR	Contribution for the year	Payments for withdrawals/ retirements during the year	Value of Existing Assets	Funding Position	Funding Position Ratio
1	$1,265,250	$82,010,000	1.68%	$1,376,957	$54,272	$1,322,685	$57,435	105%
2	$2,682,907	$85,907,931	1.68%	$1,442,403	$119,272	$2,738,404	$55,497	102%
3	$4,255,163	$89,885,310	1.68%	$1,509,184	$196,238	$4,243,038	-$12,125	100%
4	$5,982,865	$93,950,064	1.68%	$1,577,432	$286,528	$5,830,954	-$151,911	97%
5	$7,782,483	$87,996,752	1.68%	$1,477,475	$410,439	$7,306,157	-$476,325	94%
6	$8,451,090	$82,427,921	1.68%	$1,383,974	$1,643,637	$7,557,925	-$893,166	89%
7	$10,198,200	$73,704,627	1.68%	$1,237,509	$488,256	$8,836,232	-$1,361,968	87%
8	$12,007,220	$69,332,715	1.68%	$1,164,104	$598,456	$10,020,416	-$1,986,804	83%
9	$13,868,869	$65,253,413	1.68%	$1,095,612	$721,485	$11,095,972	-$2,772,897	80%
10	$15,769,802	$61,446,602	1.68%	$1,031,695	$984,611	$11,919,774	-$3,850,027	76%
11	$11,418,389	$57,868,857	1.68%	$971,624	$7,038,695	$6,687,088	-$4,731,301	59%
12	$12,605,607	$43,849,636	1.68%	$736,240	$831,171	$7,060,254	-$5,545,353	56%
13	$13,813,241	$41,059,116	1.68%	$689,387	$908,868	$7,334,990	-$6,478,250	53%
14	$15,033,247	$38,460,523	1.68%	$645,756	$992,308	$7,501,888	-$7,531,359	50%
15	$16,429,068	$36,041,149	1.68%	$605,135	$1,084,348	$7,547,806	-$8,881,261	46%

Sense check:
There is no impact on the funding position until Year 3, as expected.As noted in the Sense Check for Q2b, the EAN method is only able to maintain a funding position of above 80% for Grade B and above 95% for Grade A due to the younger new entrants who have an accrual of past service which is lower than the contribution rate offsetting the higher accrual of past service of older members. As such, when the scheme is closed to new entrants after Year 3, the contribution rate determined by EAN is insufficient to fund the accrual of past service of the aging membership base.

d) Redundancy at the start of year 10 under EAN method

Grade A

t	Accrual of Past Service Benefits	Total Salary	SCR	Contribution for the year	Payments for withdrawals/ retirements during the year	Value of Existing Assets	Funding Position	Funding Position Ratio
1	$1,029,019	$16,625,000	7.96%	$1,323,478	$357,868	$965,611	-$63,409	94%
2	$2,067,898	$17,001,386	7.96%	$1,353,441	$411,559	$1,975,086	-$92,812	96%
3	$3,166,289	$17,589,599	7.96%	$1,400,268	$464,287	$3,049,322	-$116,967	96%
4	$4,278,615	$18,321,680	7.96%	$1,458,547	$591,508	$4,129,813	-$148,802	97%
5	$5,401,399	$19,110,139	7.96%	$1,521,314	$781,102	$5,159,113	-$242,286	96%
6	$5,590,013	$19,987,386	7.96%	$1,591,150	$1,813,865	$5,297,535	-$292,477	95%
7	$6,310,622	$20,565,902	7.96%	$1,637,204	$1,315,817	$5,989,751	-$320,872	95%
8	$7,180,162	$21,350,755	7.96%	$1,699,685	$1,271,947	$6,836,771	-$343,391	95%
9	$7,990,203	$22,212,429	7.96%	$1,768,281	$1,459,867	$7,623,759	-$366,444	95%
10	$6,563,456	$23,074,254	7.96%	$1,836,889	$3,388,508	$6,605,802	$42,346	101%
11	$6,532,155	$15,593,481	7.96%	$1,241,361	$1,757,569	$6,552,000	$19,845	100%
12	$6,727,372	$16,072,434	7.96%	$1,279,490	$1,555,618	$6,734,512	$7,140	100%
13	$7,073,536	$16,610,843	7.96%	$1,322,351	$1,452,660	$7,075,619	$2,083	100%
14	$7,472,703	$17,218,184	7.96%	$1,370,700	$1,467,605	$7,474,007	$1,304	100%
15	$7,885,304	$17,874,201	7.96%	$1,422,924	$1,525,876	$7,894,236	$8,932	100%

Grade B

t	Accrual of Past Service Benefits	Total Salary	SCR	Contribution for the year	Payments for withdrawals/ retirements during the year	Value of Existing Assets	Funding Position	Funding Position Ratio
1	$1,265,250	$82,010,000	1.68%	$1,376,957	$54,272	$1,322,685	$57,435	105%
2	$2,682,907	$85,907,931	1.68%	$1,442,403	$119,272	$2,738,404	$55,497	102%
3	$4,255,163	$89,885,310	1.68%	$1,509,184	$196,238	$4,243,038	-$12,125	100%
4	$5,982,865	$93,950,064	1.68%	$1,577,432	$286,528	$5,830,954	-$151,911	97%
5	$7,865,249	$98,110,191	1.68%	$1,647,281	$413,576	$7,472,826	-$392,423	95%
6	$8,722,604	$102,569,504	1.68%	$1,722,153	$1,654,259	$8,063,818	-$658,786	92%
7	$10,819,805	$106,528,163	1.68%	$1,788,619	$513,328	$9,903,577	-$916,229	92%
8	$13,099,831	$111,306,372	1.68%	$1,868,846	$643,790	$11,821,883	-$1,277,948	90%
9	$15,561,869	$116,228,899	1.68%	$1,951,496	$793,725	$13,807,186	-$1,754,683	89%
10	$13,652,020	$121,303,931	1.68%	$2,036,706	$4,053,463	$12,756,932	-$895,088	93%
11	$10,974,255	$85,334,808	1.68%	$1,432,781	$5,384,212	$9,698,486	-$1,275,769	88%
12	$12,661,826	$87,088,257	1.68%	$1,462,221	$764,817	$11,074,785	-$1,587,041	87%
13	$14,489,205	$90,868,566	1.68%	$1,525,693	$867,721	$12,507,991	-$1,981,214	86%
14	$16,456,830	$94,788,763	1.68%	$1,591,514	$986,160	$13,988,904	-$2,467,925	85%
15	$18,563,481	$98,855,190	1.68%	$1,659,789	$1,244,865	$15,383,052	-$3,180,429	83%

Sense check:
There is no impact on the funding position until Year 10, as expected. When the redundancy occurs in Year 10, it has been assumed that only the withdrawal benefit will be paid out. The withdrawal benefit is 75% of the "present value of the expected future normal retirement benefit payment, applying past service (to date of withdrawal) only". As such, when the redundancy occurs in Year 10, withdrawal benefits paid will be approx. 25% lower than the accrued retirement benefits for the employees made redundant and hence the assets will drop (due to high payments for withdrawals during the year) by a lower proportion than the accrual of past service benefits (due to less members in the scheme). Therefore, in Year 10 of the redundancy scenario, we would expect an increase in the Funding Ratio. It would be expected that the funding ratio improve by approximately 5-6% (as an additional 25% of employees were made redundant and the value of assets should drop by approximately 25% less than the accrued past service benefits drop).

It should be noted a simplifying assumption is made that contributions will be made before retirements and withdrawals occur at the end of the year and new entrants enter the scheme, assuming that new entrants and people withdrawing/retiring will balance out. Therefore, contributions remain at a similar level in the redundancy year which is another driver causing the increase in the funding ratio.

Question 3 Scenarios affecting scheme position

The following scenarios might affect the progression of the scheme and contributions required. For the majority of the list below the outcome which would adversely impact the scheme's funding position/increase the contributions required has been shown, and a scenario in the opposite direction would positively impact the scheme's funding position/decrease the contributions required.

1. A **Financial Crisis** causing the equity market to fall would adversely impact the investment returns on assets. As the assets will not grow in line with the expected return, the scheme position will worsen, and the employer will have to provide more contributions as they bear the investment risk.
2. **Changes to investment mandates** could result in a change in the mix of assets investment to a more conservative portfolio and hence a lower investment return than originally expected. This would worsen the scheme position and result in the employer having to provide more contributions.
3. **Changes to risk appetite** of the Trustees to a highly risk averse tolerance may result in the Trustees requiring the fund to have a higher target surplus funding position than expected. This would require extra contributions from the employer and speed up the funding of the scheme to attain this higher target surplus funding surplus. This would improve the funding position of the scheme.
4. **Company merger/acquisition** could result in there being a large increase in the member base at the time of acquisition if the acquired company's employees join the DB scheme plan. This may worsen the funding position under the EAN method in the likely scenario where the average age of employees was higher than the age of new entrant assumption.
5. **Changes to DB scheme rules regarding benefits payable** e.g. an increase in the accrual rate could result in a worsening of the scheme position as the retirement benefits and withdrawal benefits will be higher and therefore a higher liability. This would result in increased contributions from the employer.
6. **Legal or regulatory changes** to the scheme funding requirements or benefits e.g. a change to the law requiring a withdrawal benefit of 80% of the actuarial reserve (rather than 75% currently mandated by the law of this country). This would result in the scheme positioning worsening as the benefit payable on withdrawal is higher than originally accounted for and hence would require extra contributions from the employer.
7. **Withdrawal rates lower than expected** due to improved staff retention will cause the funding position to worsen as more individuals will receive the full value of their funds rather than the Withdrawal benefit which is significantly lower at 75% of the Actuarial Reserve.
8. **Higher wage growth than expected,** e.g. a continuously greater than expected wage growth to prevent competitors from poaching employees, will slightly deteriorate the firm's current funding position as the increase in liabilities due to higher expected retirement salary will be offset by increased contributions due to higher wages.
9. An **increase in the average retirement age** will not materially affect the funding position of Grade B as benefits do not accrue after the NRA (will in fact make the funding position slightly better as the investment return is greater than wage growth). However, for Grade A it will result in a worsening of the funding position as the benefits payable upon retirement will increase.
10. An **increase in the average entry age** e.g. due to an increase in minimum experience requirements to for quality controllers, will increase the contributions required to maintain the value of past service under both the EAN method and PUC method as the average age of the population would increase.

Question 4 – memo to the Board of Trustees

Internal memorandum – Speed of funding

To: Board of Trustees 23 February 2020

cc: Institute of Actuaries of Australia

From: Scheme Actuary

Comparison of speed of funding for DB Scheme between funding methods

Executive Summary

The purpose of this report is to provide advice regarding which funding method should be used for the launch of the DB scheme. In this memorandum, the benefits of different funding methods, Entry Age Normal (EAN) method and Projected Unit Credit (PUC) method, have been outlined and the impact these methods have on the pace of funding have been identified through a 15-year projection and scenario analysis, along with a consideration of the interest of stakeholders. The PUC method is recommended for the launch of the scheme given it will more closely match the accrual of past service, is more able to adapt to risks and changing scenarios and will align with the interests of most stakeholders.

Purpose

The purpose of the memorandum is to provide a comparison of the scheme's pace of funding under two different funding methods; Entry Age Normal method and Projected Unit Credit method. A separate comparison has been performed for the proposed scheme rules for Grade A and Grade B members. Specifically, the memorandum covers a comparison between:

1. the initial contribution rate for each Grade using PUC and EAN methods
2. the pace of funding required by the employer over a projection of 15 years between the PUC and EAN method
3. the impact of various scenarios on the funding position and pace of funding between the PUC and EAN method

The memorandum also provides considerations around the management of conflicts of interests between different stakeholders.

Refer to Appendix A for a summary of the calculation of the contribution rates for the EAN and PUC methods.

Summary of results

Initial contribution rate

The initial contribution rate for the first year of each grade was calculated using both the PUC method and the EAN method. A comparison of the rates can be found below:

Initial Contribution Rate	PUC	EAN	Average age	Entry age assumption
Grade A	8.342%	7.961%	43	40
Grade B	1.609%	1.679%	41	38

Intuitively, the EAN standard contribution rate (SCR) would initially be expected to be higher than the PUC standard contribution rate if members are distributed uniformly around the entry age assumption. However, the average age of the current membership base, who are all classified as new entrants as they have 0 years of accumulated service, is older than the entry age assumption adopted for both grades and therefore EAN and PUC methods fund the liabilities of these members at a similar rate initially.

However, it should be noted, the PUC method increases with the average age of the membership whereas the EAN method will remain constant. The EAN method of funding is intended to be used for a stable fund where the number of new members and their entry age is expected to be relatively stable and have a low variance. Therefore, although there are benefits for a stable fund, the EAN method may not fund the scheme appropriately if used for the launch of the scheme.

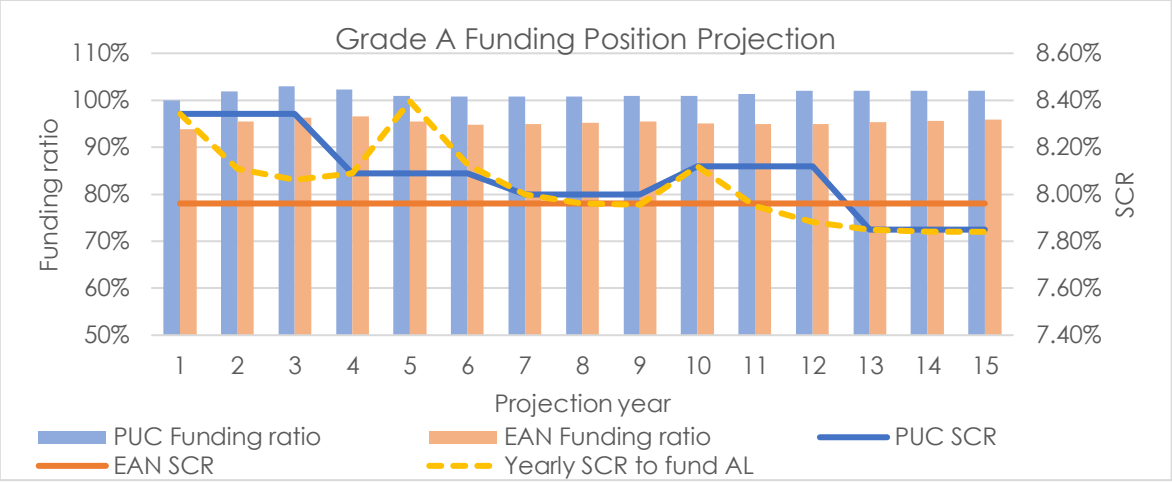
Comparison of pace of funding and funding position over 15 years

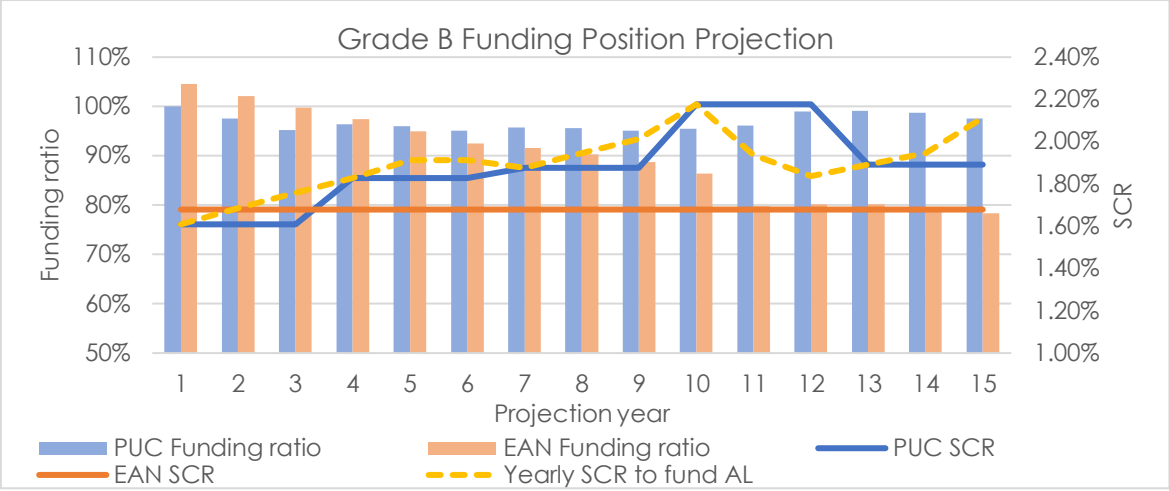
To understand the pace of funding for both methods, the funding position i.e. value of assets accumulated through contributions relative to the Actuarial Liability for accrued past service benefits (AL) has been projected over 15 years under the EAN and PUC methods with the PUC contribution rate being calculated every 3 years. A funding position over 100% indicates the method funds more quickly than the AL accrues whereas a funding position under 100% suggests the method funds slower than AL accrues. The EAN method often funds quicker than the AL accrues when the member is younger and more slowly when the member is older.

For Grade A, the EAN method appears to fund the AL slower than the PUC method for the projection period as shown in the graph below. Initially under the EAN method, the contributions are insufficient to fund the accrual of past service and the retirement of older members. However, as the older population retires and are replaced by younger new entrants, the EAN method matches the level of funding required by the AL, as demonstrated by the fact the EAN funding ratio does not continue to decrease later in the projection. This can be further illustrated through and the comparison of the EAN SCR and the Yearly SCR to fund the AL. As noted above, this is not the intent of using the EAN method.

For Grade B, the EAN method initially funds quickly, however this quickly declines and the EAN method consistently funds slower than the PUC method. As the member base ages, the EAN method does not maintain with the value of accrued past service benefits of the member base, similar to Grade A. Contrasting to Grade A, these members are not replaced by younger new entrants until later in the projection due to the higher Normal Retirement Age. Therefore, after 15 years, the funding position under the EAN method is 78% which is considered low.

The funding position under the PUC method for both Grade A and Grade B tends to not significantly deviate from 100% of the value of accrued past service benefits as the SCR will adjust to the demographics of the membership base and the rate at which their past service benefits accrue. The maximum variance of the funding position from 100% under the PUC method for Grade B was 5%. As such, the PUC method's pace of funding will more appropriately match the rate at which the past service benefits accrue.



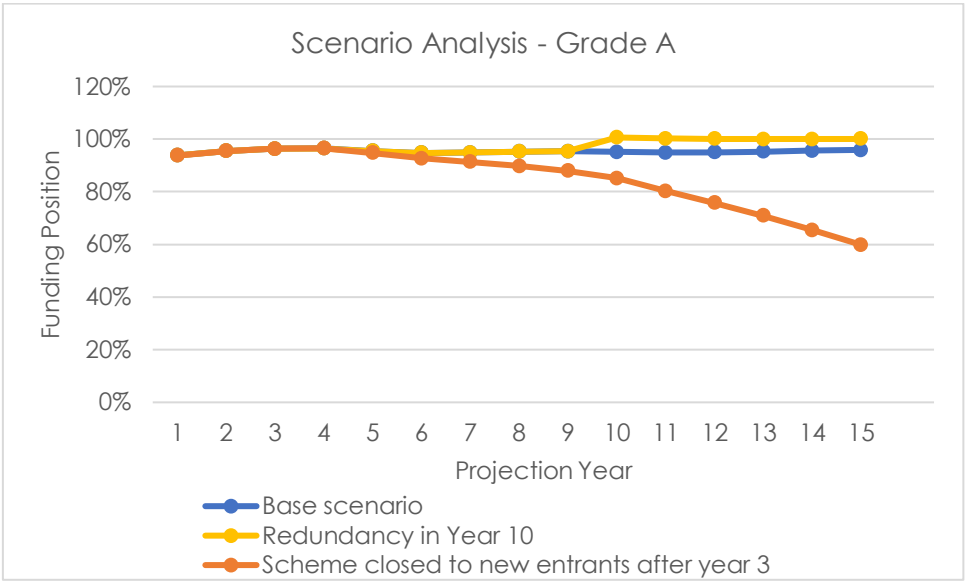


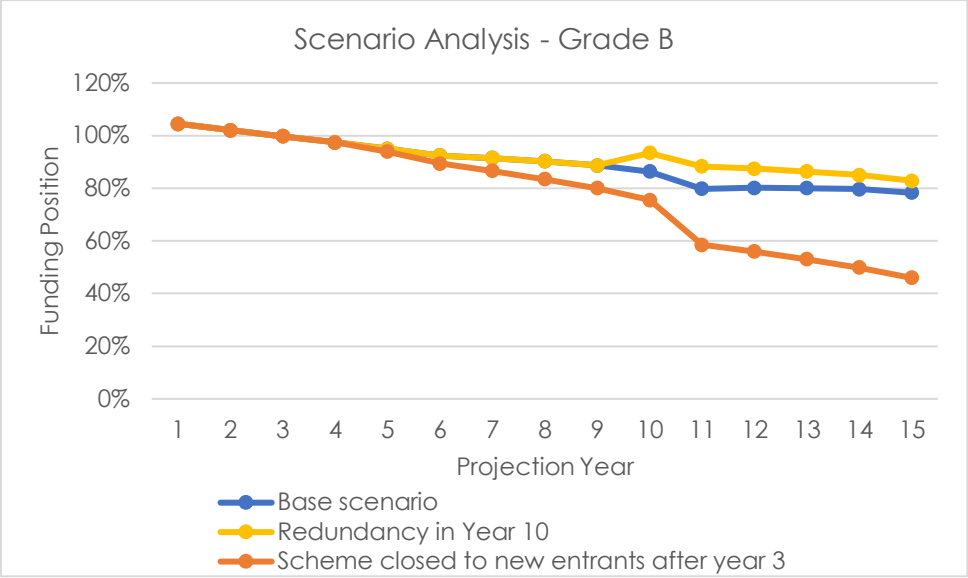
It should be noted, the above funding ratios would occur if experience is in line with assumptions. If experience varies from assumptions, which is likely during the earlier stages of the scheme due to the lack of data to set credible assumptions, the EAN funding position may vary significantly from 100% as the contribution rate will remain constant. As the SCR is recalculated every 3 years under the PUC method, assumptions can be updated to align with experience.

Scenario analysis

There are risks associated with the pace of funding for both Grade A and Grade B. There are various scenarios which may impact the pace of funding. For example, poor investment returns can result in a worsening funding position due to assets not growing in line with expectation and hence having insufficient assets for the accrual of past service benefits under both EAN and PUC methods. Other examples of scenarios which can impact your pace of funding include an increase in the average retirement age, a reduction in the average entry age, company mergers/acquisitions and regulatory change.

The impact of 2 scenarios has been quantified to identify the risks associated with the pace of funding and funding position of the scheme under the EAN method; a redundancy in Year 10 of the projection and the closure of the scheme to new entrants in Year 3.





The closure of the scheme to new entrants has a significant adverse impact on the pace of funding of the scheme for both grades. In the scenario projected in the graphs above, the pace of funding relative to the accrual of past service decreases significantly after closure of the scheme to new business. In the base scenario, young new entrants constantly enter the scheme offset the higher accrual of past service of older members. When new entrants are removed, the EAN contribution rate is far below what is required to fund the higher accrual of past services for older members causing the funding position to significantly deteriorate. By Year 15, the funding position would be 60% for Grade A and 46% for Grade B under this scenario, which is significantly worse than the base scenario.

On the other hand, redundancy has a positive impact on the pace of funding. As can be seen in the graphs above, after the redundancy in Year 10, the funding position goes up by approximately 5% for both grades. This is because the withdrawal benefit paid is significantly lower than the accrual for past service benefits. It should be noted for the redundancy scenario, only the withdrawal benefit of 75% of the Actuarial Reserve is paid upon redundancy as per the DB Scheme rules, however typically a greater benefit is paid upon redundancy which would adversely impact the funding position.

It is clear the EAN method is unable to adapt to various scenarios which may impact the pace of funding. On the other hand, the PUC method adjusts the contribution rate every three years and hence is more readily able to allow for changes in the membership base or assumptions. For example, in the scenario where the scheme closed to new entrants after 3 years, the SCR under the PUC method would gradually increase with the aging membership base.

Stakeholder considerations

The main stakeholders when determining the funding method are members, employers, regulators and the tax office . The interests of these stakeholders are provided below:

1. Members would prefer the scheme to be well funded to instil confidence they will receive their benefits upon withdrawal/retirement. As such, members are likely to prefer a faster pace of funding. It is the trustee's role to represent the member's interests.
2. Employers sponsoring the scheme, on the other hand, ideally want a pace of funding where they pay for benefits as they are accrued. Large funding surpluses can be seen as a waste of shareholders' funds. Furthermore, employers would prefer to maximise profits by reinvesting any extra funding into their own profitable business. During the sale of the company or fund wind-up surpluses can be a major issue. However, some sense of stability in the contribution rate would also be beneficial to the employer for

budgeting purposes as unexpected large year on year variances in the contribution rate may cause issues with liquidity.

3. Regulators are also interested in ensuring the ability of the scheme to pay withdrawal and retirement benefits as they fall due.
4. The Tax office are interested in excessive contributions being made to the scheme, which generally have lower taxation rates, particularly during more profitable years as this may be seen as trying to minimise tax. Therefore, they would prefer the pace of funding to match the accrual of past service benefits.

The main stakeholder conflict to manage is between the members, who prefer a faster pace of funding, and employers sponsoring the fund, who prefer a slower pace of funding. One method to manage this conflict is to choose a method of funding which matches the accrual of past benefit services, as this will satisfy both stakeholders. As mentioned above, the EAN method will result in a slower pace of funding and will end with a Funding Ratio of 78% by Year 15 for Grade B members. This level of funding is not sufficient to provide members with confidence that their benefit will be paid out upon retirement. The employer is also likely to be opposed to having such a low funding position as it can have adverse effects for the employer including a large liability on the balance sheet, regulators requiring cash injections to reduce the funding position deficit or a reduced company valuation when trying to sell the company or list on an exchange. On the other hand, the funding ratio under the PUC method does not deviate significantly from 100%. Therefore, using the PUC method to calculate the contribution rate can be one method to better manage these conflicts.

Other practices may also be employed in order to manage these conflicts including:

1. Enforcing employee representation within the trustees will ensure the interest of trustees better align with those of the fund's beneficiaries. They can also act as a channel for delivering information to and receiving feedback from members, strengthening the accountability of the board.
2. Open communication between the employer sponsoring the scheme, its trustees and the scheme actuary. This will enable the scheme actuary to ensure there is sufficient funding for any changes in circumstances to provide confidence to members while also ensuring the employer does not have to excessively contribute to the scheme. The trustee and scheme actuary should be informed as soon as possible of any future changes to the membership or wages (e.g. pay raises or other programs to improve staff retention) to enable these changes to be reflected in the contribution rates. For example, in the scenario in which the scheme was closed to new entrants, the contribution rate could be adjusted upwards or a change in funding method (e.g. Attained Age Normal method) would be implemented to sufficiently fund the accrual of past service. The scheme actuary and trustees should also inform the employer of expected future contribution rates to allow the employer to budget for these contributions appropriately.
3. Trustees and scheme actuaries continuously assessing the solvency and liquidity of the employer to ensure they can pay contributions as required. If the assessment finds the employer to have a low solvency, there may be a need to increase contributions. However, the employer may be unwilling to increase contributions at this stage given their solvency ratio is already low. This can be managed through an agreed upon management action plan whereby additional funding of the scheme is required to at least match the value of accrued benefits if the employer's solvency ratio drops below a certain percentage.
4. Appointing an independent trustee can also assist in managing conflicts of interest within the trustees, many of whom are hired by the employer sponsor. As such, an independent trustee can play a valuable role, similar to non-executive directors, as they are not prejudiced to this conflict of interest.

Reliances and limitations

The below calculations have been performed for the purpose of comparing PUC and EAN funding methods. The model has reduced complexity and some simplifying assumptions where it did not impact the purpose of this memorandum. The scenarios quantified did not account for potential management action. A more detailed assumption setting process and a more complex model should be used to determine the actual contribution rates to be used for the scheme.

Recommendation

Although there are benefits to the EAN method, the PUC method is recommended for the launch of the scheme as will closer match the accrual of past service benefits, especially earlier in the scheme. The PUC method is also more able to adapt to risks, changing scenarios and changing assumptions. Furthermore, it more likely to better manage conflicts between stakeholders. If experience varies from assumptions, which is likely during the earlier stages of the scheme due to the lack of data to set credible assumptions, the funding position under the PUC method will vary less than under the EAN method.

Actions required

The choice of funding method by the Board of Trustees will be required to be made by 31 March 2020, in order to provide sufficient time to set the contribution rate and provide early communication to the employer regarding the contributions required in 2021 for business planning purposes.

Appendix A - Summary of methods

PUC method

PUC is an accrued benefit funding method which targets the asset value to equal the accrued benefit liability (based on past service already completed). This is achieved by setting the Standard Contribution Rate (SCR) so that the Actuarial Liability at the start of the year plus contributions during the year are sufficient to meet the Actuarial Liability at the end of the year and any required payments during the year. This will result in a varying SCR over time and for a single member, contributions should increase over time as they get closer to retirement. For a membership base is relatively stable over time, the SCR will also remain stable.

EAN method

EAN is a projected benefit funding method which calculates the value of liabilities based on past service completed and service expected to be completed in the future. EAN is an approximation method used to find the SCR which would sufficiently fund the expected benefit of an average new entrant over their expected time at the company. This SCR is applied to the entire membership base each year. The EAN SCR will remain constant over time.

For a member entering at entry age, the EAN method will, in theory, initially fund liabilities more quickly than the PUC method as the EAN contribution rate will fund a proportion of future service during the earlier years of membership. In the later years i.e. closer to retirement, the EAN method would require a lower contribution rate than the PUC method where the contribution rate will increase as the member ages in order to fund the higher accrued benefit for their service.

Question 5 Magazine article

Refer to the pages below for the magazine article.

Helping you fund your retirement: Launch of a Defined Benefit Scheme and what it means for you

Company ABC is launching a Defined Benefit (DB) Scheme which will pay you a fixed lump-sum amount at retirement to help you during retirement.

What is Defined Benefit?

Defined Benefit is a type of superannuation fund designed to help you maintain your standard of living during retirement. In a Defined Benefit Scheme, you will receive a fixed lump-sum payment upon retirement based upon your Final Salary and number of years of service using a pre-determined formula. If you resign before retirement age, you will receive a proportion of the retirement benefit.

Who pays for the scheme?

Your employer will make yearly contributions towards the defined benefit pool. The contributions will be invested into the share market and other assets by our expert investment managers which will earn an investment return. All the fund's defined benefits payments are paid from this pool.

Advantages of Defined Benefit

The advantages of a Defined Benefit Scheme for you include:

- ✓ **You don't have to worry about the contributions** – we will make sure there's enough funds for you to receive your benefit.
- ✓ **Reward for loyalty to the company** – the longer you stay with Company ABC, the greater your benefit will be.
- ✓ **No investment risk** – risk of low investment returns will be taken on by your employer and will not affect your Retirement Benefit or Withdrawal Benefit.
- ✓ **No fees** – fees will be paid by your employer and will not affect your Retirement Benefit or Withdrawal Benefit.

Who is eligible for the scheme?

The scheme automatically applies to all employees of Company ABC classified as full-time manual labourers.

How is your benefit calculated?

You will receive either the:

1. Retirement Benefit - if you stay with the employer until age 60
   OR
2. Withdrawal Benefit – if you leave the employer before 60

Retirement Benefit

Your Retirement Benefit is calculated as a multiple of your final salary and the number of years of service. Final Salary refers to your salary at retirement excluding overtime and any bonuses.

If you continue working past 60, any additional years of service after 60 will not be counted towards your Retirement Benefit.

Example: David's Retirement Benefit

David, aged 60, decides to retire. David has 15 years of service since the Defined Benefit scheme launched and has a salary of 105,000. David's Retirement Benefit would be:

Retirement Benefit = 5% x 15 x $105,000
= $78,750

Example: Rachel's Retirement Benefit

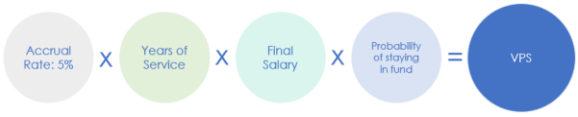
Rachel, aged 64, has 13 years of service since the Defined Benefit scheme launched and decides to retire. Her salary in the final year was 110,000. Rachel's Retirement Benefit would be:

Retirement Benefit = 5% x 9* x $110,000
= $49,500

* Only 9 years of service applies as the 4 additional years of service after 60 do not count towards the retirement benefit.

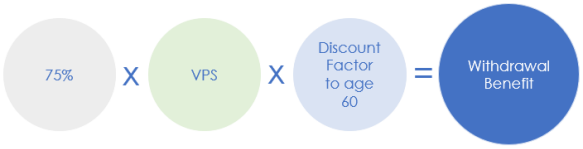
Withdrawal Benefit

The Withdrawal Benefit provided if you leave the fund before age 60 is based on the Value of Past Service (VPS). VPS is defined as the value of benefits relating to your service with the employer to date that will be paid out upon retirement.



The probability of staying in the fund until retirement is calculated based on the age of the member and the average withdrawal rates for the fund. For the probability of staying in the fund until retirement, please refer to the PDS. These rates are also available upon request.

The Withdrawal Benefit is calculated as:



Why is the amount discounted?

Contributions made by the employer are calculated to allow for investment return and salary increases until age 60. This means if you were to leave the employer before age 60, some of the expected investment return on contributions has not fully been realised yet. Therefore, if you were to leave the fund before 60, the VPS needs to be reduced to reflect the investment earnings not yet received. This is offset by the expected salary increases which have not yet occurred. The Discount Factor formula is as follows:

$$\text{Discount Factor to age 60} = (1.0353/1.07)^{60-\text{current age}}$$

We assume an investment return of 7% for the scheme which is offset by the 3.53% assumed average increase in salary each year. For the Discount factors to age 60, please refer to the PDS. These factors are also available upon request.

Example: Mary's Withdrawal Benefit

Mary has 14 years of service since the Defined Benefit scheme launched a salary of 92,000. She decides to resign from Company ABC at age 53. Mary's Withdrawal Benefit would be:

VPS = 5% x 14 x $92,000 x 21%*
= $13,524

Withdrawal Benefit = 75% x $13,524 x $(1.0353/1.07)^{60-53}$
= $8052.74

* For the probability of staying in the fund until retirement, please refer to the rates in PDS. These rates are also available upon request.

Important information about the launch

The Defined Benefit scheme will launch at the beginning of 2021 for all current employees. The years of service will only begin accumulating from the date the scheme launches for employees who joined the employer before on the launch date.

The scheme will also apply for all employees who join the employer after the launch date. The years of service will begin to accumulate from the date you join the employer.

Disclaimer

We disclaim that this is not financial advice. Please talk to a financial adviser about what is in your best interests. We also recommend seeking out financial advice on how to manage the lump sum received as a Retirement Benefit.