FINANCIAL SERVICES COMMISSION

REPORT ON THE METHODLOGIES AND ASSUMPTIONS USED IN THE ACTUARIAL VALUATION REPORTS FOR DEFINED BENEFIT PLANS WITH VALUATION DATES BETWEEN JANUARY 1, 2018 AND DECEMBER 31, 2020

Prepared by: The Actuarial Division

Financial Services Commission

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Acknowledgment

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Executive Summary

There are two main classifications for pension plans: Defined Benefit ("DB") and Defined Contributions ("DC"). For DB plans, benefits payable at retirement are determined using a pre-defined formula contained in the schemes' trust deed and rules[1] which factors years of service, accrual factor and salary. A plan's actuary is responsible for setting the demographic and economic assumptions which will be used to determine the DB plan's liabilities.

This report provides the results of a survey of funding methodologies, and demographic and economic assumptions used in DB plan valuations that were conducted between January 1, 2018, to December 31, 2020, inclusive. The aim is to increase awareness among members of plans, trustees, administrators, investment managers and other professionals in the pension industry of the range of actuarial practice in Jamaica.

Fifty-three (53) actuarial valuation reports were examined. 21 plans were valued in 2018, 24 in 2019 and the remaining 8 in 2020. The reports were prepared by six (6) actuaries, all of whom are either Fellows of the Society of Actuaries or Fellows of the Institute and Faculty of Actuaries. Highlighted in the table below are the main findings of the survey.

Assumption	**Findings**
Funding Methodology	Four funding methodologies were used: Attained Age (AA) Method, Aggregate Attained Age Method (AAA),the Current Unit Actuarial Cost (CUC) and Projected Unit Cost (PUC) Methods. The AA approach was the most popular in valuations for both small and large plans. The CUC was used in the valuation of one small plan.
Discount Rates	Nominal discount rates ranged from 6.0% to 9.0% and, were for the most part higher than yields on 30-year Government of Jamaica (GOJ) bonds. Assuming inflation rate of 5%; the midpoint of BOJ's inflation target range, real rates would range from 1.0% to 4.0%. Long term real rates between 2013 and 2019 averaged 4.79%.
Salary Increase	All valuation reports had a salary increase assumption. Rates of escalation rates varied from a low of 4.5% to a high of 8.5%. 8.0% was the most frequently used nominal discount rate assumption across all years.
Mortality	Pre-retirement (active member) mortality assumptions varied considerably. Of the 53 valuations, • 18 assumed no pre-retirement mortality • 11 used Retirement Plan 2014 Employee Rates, • 10 used the 1994 Group Annuity Mortality Table (GAM94), • 9 used tables supplied by the actuary, • 3 based on the 1994 Group Annuity Mortality Table Static (GAM94S),

[1] The Choice of Actuarial Funding Methods for Funded Defined Benefit Pension Schemes by Onwonga Ogari

Assumption	Findings
	• 1 used the A1967-70 Table for Assured Lives, • 1 used the 1994 Uninsured Pensioner Mortality Table (UP-94). Standard tables were used as the bases for post-retirement (pensioner) mortality. For post-retirement mortality improvements, explicit assumptions were made in 30 valuations and 18 used the GAM94S table.
In Service Termination Rates other than Mortality	Withdrawal Rates – 32 out of 53 used a withdrawal decrement table. 63% of valuations for small plans assumed no withdrawals. Ill health Retirement – 31% made provisions for ill-health retirement. Early retirement – 13 made explicit provision for early retirement by loading the normal retirement provision, assuming a lower age or using rates supplied by the actuary. Late retirement - None of the valuations surveyed made provisions for late retirement
Pension Increase	Only 14 plans (26%) guaranteed a pension increase; rates ranged from 2.5% to 5.5%. The remaining 39 plans do not guarantee increases, so no uplifts were assumed.
Expense	Forty-seven (47) out of fifty-three (53) valuations had an explicit expense assumption. Expenses were expressed as a percentage of either members' pensionable salaries, employee and employer contributions, of members' contributions or plan service cost. For 6 plans, the discount rate assumed was adjusted for expenses. If the assumptions were converted to a percentage of member's pensionable salaries, expense rates would range between 0.1% and 6.5%.
Margins for Adverse Deviation	No explicit margins were disclosed in the reports examined.

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Section 1: Introduction

Objective

The objective of this report is to provide the results of a survey of valuation methodologies and demographic and economic assumptions used in the valuations of Defined Benefit (DB) plans during the period January 1, 2018, to December 31, 2020, inclusive. It is the second in the series of surveys conducted by the Financial Services Commission (FSC). The first was conducted in 2020 and covered Actuarial Valuation Reports (AVRs) of DB plans with valuation dates between December 31, 2016, and December 31, 2017.

The aim of the report is to increase awareness among members of plans, trustees, administrators, investment managers and other professionals in the pension industry of the range of actuarial practice in Jamaica.

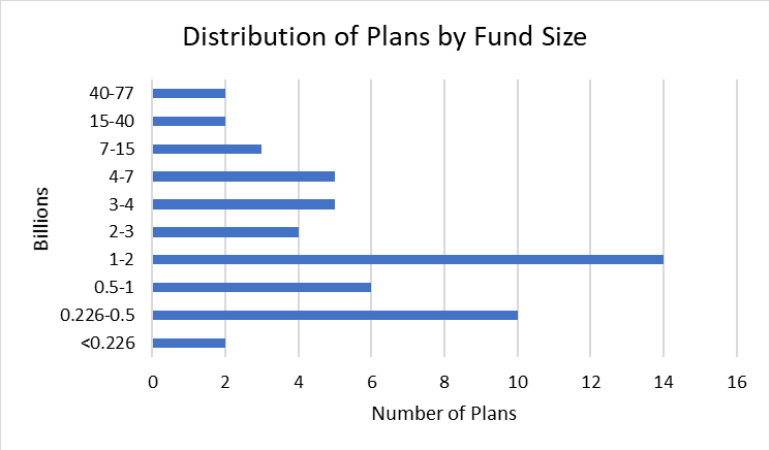
Background

Defined benefit pension plans are pension arrangements in which pension benefits payable at retirement are determined using a pre-defined formula contained in the schemes' trust deed and rules.[2] The formulas used include factors such as an accrual percentage, years of pensionable service, and pensionable salary. The Plan's actuary, using a funding methodology and demographic and economic assumptions, is responsible for determining the rate at which the employer/sponsor of the plan should contribute to fund plan liabilities. If at retirement, the fund assets are insufficient to provide benefits, the employer is responsible for funding the deficit. It is, therefore, critical that appropriate methods and assumptions are used.

Section 2: Section Data

Fifty-three actuarial valuation reports (AVRs) of DB Plans were examined. 21 plans had valuation dates in 2018, 24 in 2019 and the remaining 8 in 2020.

Plans of varying sizes were included in the data set. In terms of membership, 27 of the 53 plans are small, that is, having less than 100 active members. Fund assets ranged from $69 million to $76 billion, with the median being $1.7 billion. **Graph 1** illustrates the distribution of plans by fund size.



Graph 1: Distribution of Plans by Fund Size

[2] The Choice of Actuarial Funding Methods for Funded Defined Benefit Pension Schemes by Onwonga Ogari

The AVRs were prepared by six (6) actuaries, all of whom are either Fellows of the Society of Actuaries or Fellows of the Institute and Faculty of Actuaries. Five of the actuaries are Ordinary Members of the Caribbean Actuarial Association (CAA)[3].

The key findings of the survey are presented in the following sections.

- Section 3: Funding Methodology
- Section 4: Discount Rate
- Section 5: Mortality Assumption
- Section 6: In-service Termination Rates other than Mortality
- Section 7: Salary Increases
- Section 8: Pension Increases
- Section 9: Expense Assumption
- Section 10: Margins for Adverse Deviations

A breakdown of the data is included in the **Appendices 1 and 2.**

Section 3: Funding Methodology

The Funding Method of a pension plan may be viewed as the payment or budgetary scheme under which benefit payments are financed. A funding method does not affect the overall true cost of a plan; it is rather a technique allocating the actuarial present value of projected benefits (and expenses, if applicable) to time periods usually in the form of a normal cost and an actuarial accrued liability[4]. Normal cost will vary over time and depends on, among other things, the funding methodology used and the composition of the membership (for example: age, gender, pensionable salary).

Across the valuations in the survey, four funding methodologies were used, namely – Attained Age (AA)[5] Method, Aggregate Attained Age (AAA) Method, Current Unit Actuarial Cost (CUC) and Projected Unit Cost (PUC) Methods[6].

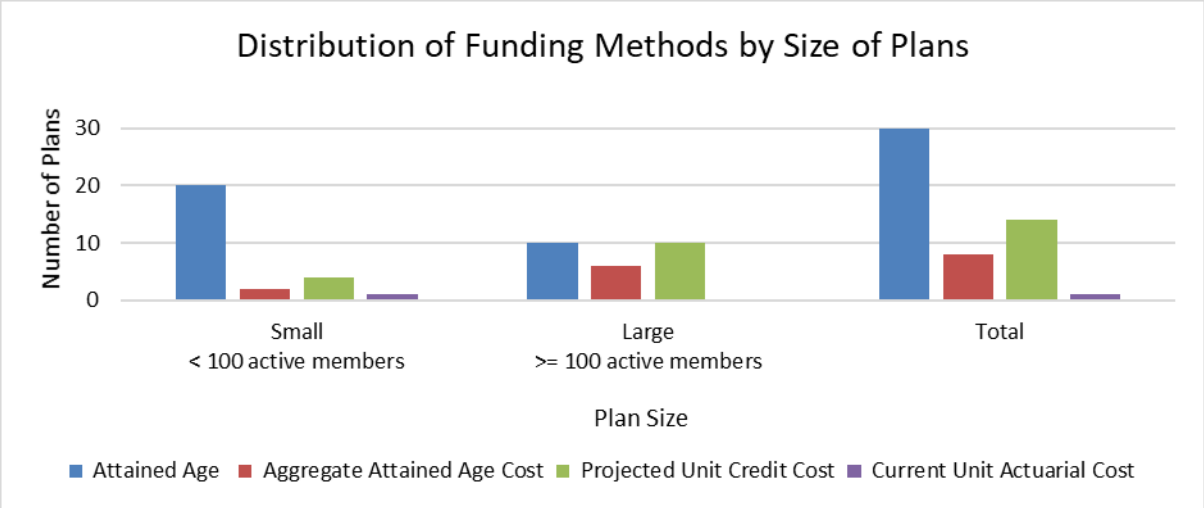
Graph 2 shows the distribution of funding methods for the plans surveyed by size of membership. For small plans, more than four (4) times as many valuations used the AA Method than any other actuarial funding technique. For large plans, the AA method and PUC method are equally popular, followed by the AAA method.

[3] An Ordinary Member is an Actuary who is practicing or is resident in a Caribbean Country https://www.caa.com.bb/Members/How-to-Become-a-CAA-Member.aspx

[4] http://www.actuarialstandardsboard.org/asops/asop-no-4-measuring-pension-obligations-and-determining-pension-plan-costs-or-contributions/#section-2-definitions

[5] "A method under which the excess of the actuarial present value of projected benefits over the actuarial accrued liability in respect of each individual included in an actuarial valuation is allocated on a level basis over the earnings or service of the individual between the valuation date and assumed exit. The portion of this actuarial present value, which is allocated to a valuation year, is called the *normal cost*. The actuarial accrued liability is determined using the unit credit actuarial cost method." http://www.actuarialstandardsboard.org/glossary/attained-age-actuarial-cost-method/

[6] Methods where the accrued liability on any valuation date is the sum of the accrued benefits (using service as at the valuation date and current (CUC) or projected (PUC) salaries at retirement or termination, if sooner) of all participants and normal cost is the present value of the increase in accrued benefits between year *t* and *t+1*



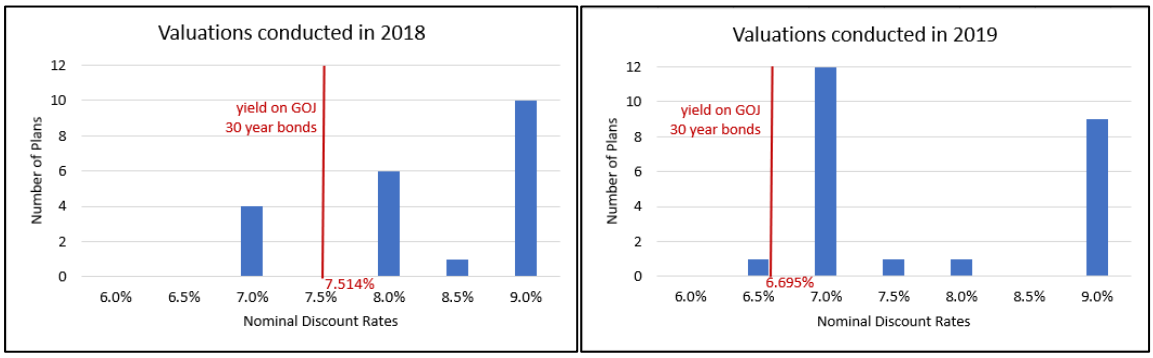
Graph 2: Distribution of Funding Methods by Size of Membership

Section 4: Discount Rate

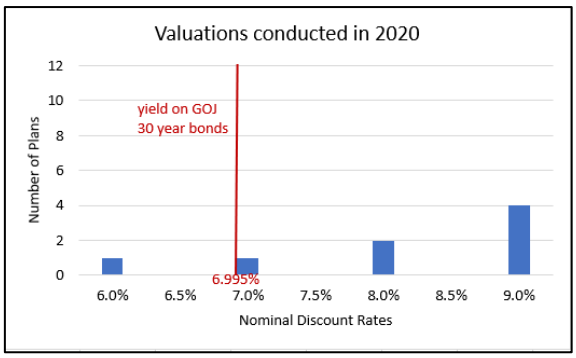
In an actuarial valuation, the discount rate is used to calculate plan liabilities or the present value of the future benefits. A rate that is too high will lower the estimate of plan liabilities and decrease required contributions, however it will also increase the probability that the plan will not be able to meet its future obligations. A rate that is too low may bolster benefit security but will place undue strain on the employer/sponsor.

When setting the discount rate assumption, the actuary considers, among other things, the plan's current and target asset mix as outlined in its Statement of Investment Policies and Procedures (SIPP), the expected long-term yield of plan assets, expected investment expenses, and economic indicators such as long-term nominal and real interest rates and inflation.

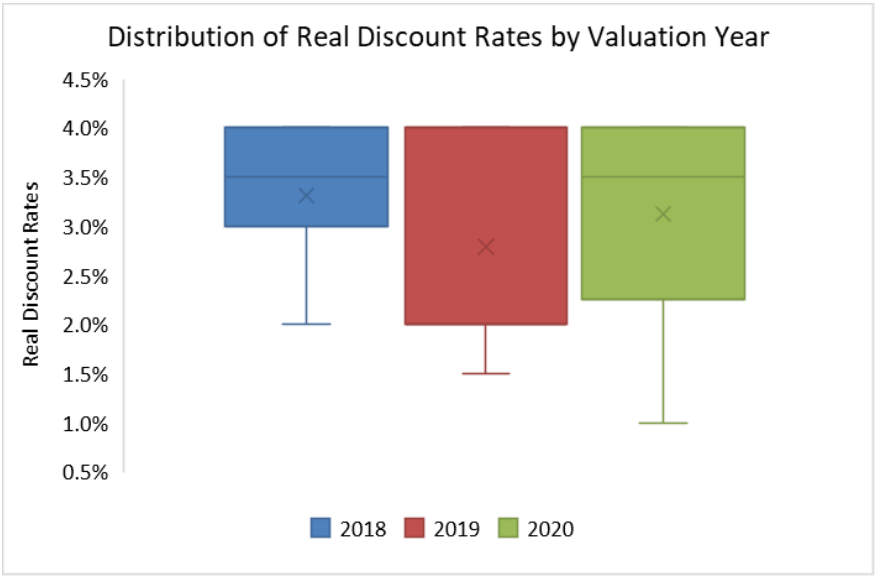
Graphs 3-5 compare the nominal net discount rates assumed in years 2018, 2019 and 2020 against the yields on 30-year Government of Jamaica (GOJ) bonds as at the end of the respective years. Since the pension funds are well diversified with large portfolios of equities and corporate debentures, net discount rates above long-term government yields are not surprising. **Graph 6** is a box and whisker plot illustrating the distribution of the real discount rates[7]. Between 2013 and 2019 real long-term rates[8] have averaged 4.79%.



[7] Nominal discount rates less 5%, the midpoint of BOJ's inflation target range (4%-6%)
[8] Yield on GOJ 30-year bonds as at yearend minus annual change in the Consumer Price Index



Graphs 3-5: Nominal Discount Rates by Valuation Year



Graph 6: Distribution of Real Discount Rates by Valuation Year

Section 5: Salary Increase

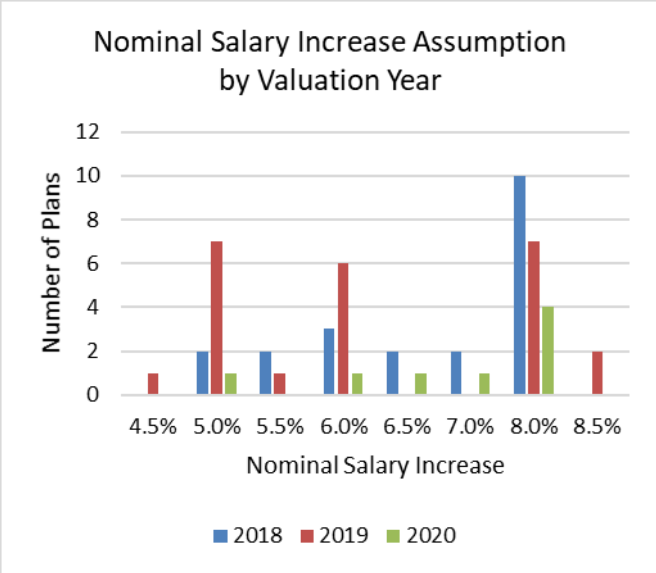
Rate of salary increase is the pay increase assumption used to project the future pay levels of each current active plan participant.[9] The rate reflects expected salary experience based on information supplied by a sponsor. The assumption is the second most important assumption made in connection with a pension valuation.

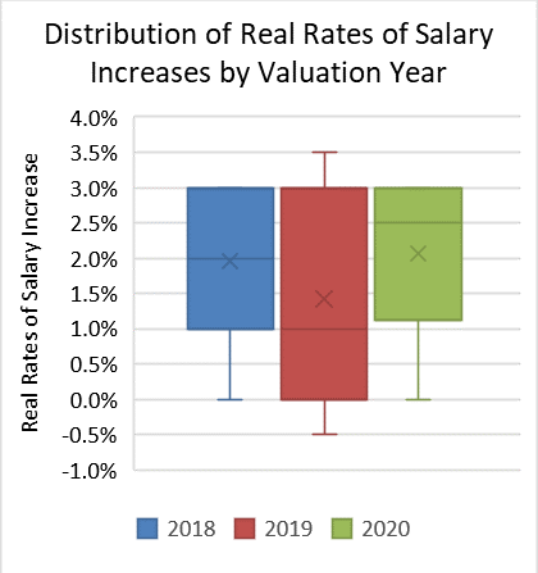
In setting the nominal salary increase assumption, the most popular approach applied was to follow the assumptions used in the IAS I9 valuations which were either in line with or a margin above inflation.

In the AVRs, nominal salary escalation rates varied considerably from a low of 4.5% to a high of 8.5%, with the medians being 7.0%, 6.0% and 8.0% for 2018, 2019 and 2020, respectively. 8.0% was the most frequently used assumption across all years. See **Graph 7**.

Graph 8 is a box and whisker graph showing the range of the real rates of salary increase[10] used. The real rates range from -0.5% to 3.5% with medians of 2.0%, 1.0% and 2.5% for 2018, 2019 and 2020, respectively.

[9] https://www.soa.org/globalassets/assets/files/edu/edu-2009-fall-ea-assess-sn.pdf
[10] Nominal rate of salary increase less 5%, the midpoint of BOJ's inflation target range (4%-6%)





Graphs 7 and 8 Distribution of Nominal and Real Rates of Salary Increase

Section 6: Mortality Assumptions

A mortality rate is defined as a measure of the frequency of the occurrence of death in a specific population during a designated interval.[11] Mortality rates vary by factors such as age, gender and type of retirement (healthy or disabled).[12]

Most plans base the mortality rates on a standard table published by a reputable agency, such as Society of Actuaries and Institute and Faculty of Actuaries, whose characteristics are similar to the plan being valued.[13] If a plan is large and its data credible, the actuary may use plan experience to develop a table of mortality rates. To account for how mortality rates improve over time, projection scales may be used. Other simpler methods for recognizing mortality improvement are (a) applying a setback, that is, using a younger age to look up the rates in a mortality table (b) fixed years projection and, (c) a fixed margin to the table of mortality rates.

Table 1 outlines the pre- and post-retirement mortality assumptions used in the valuations in the study. Standard mortality tables were used as the basis for pensioner mortality in all valuations while for active members, standard tables were used alongside rates supplied by the actuary.

In 18 valuations, the actuary took the conservative approach of assuming no pre-retirement mortality. Twelve of these plans were small. All AVRs which used the Retirement Plan 2014 tables, shifted from 1994 Group Annuity Mortality, the base table assumed in the prior valuations.

Mortality Table	Pre-Retirement (Active Members)	Post-Retirement (Pensioner)
None assumed	18	-
Retirement Plan 2014 Employee Rates (RP-2014 Emp)	11	-
Retirement Plan 2014 Pensioner Rates (RP-2014 Pens)	-	10
1994 Group Annuity Mortality Table (GAM94)	10	24

[11] https://www.cdc.gov/csels/dsepd/ss1978/lesson3/section3.html
[12] SOA Assessment and Selection of Actuarial Assumptions for Measuring Pension Obligations by Marilyn Oliver, FSA, 2009 https://www.soa.org/globalassets/assets/files/edu/edu-2009-fall-ea-assess-sn.pdf
[13] IBID

Mortality Table	Pre-Retirement (Active Members)	Post-Retirement (Pensioner)
1994 Group Annuity Mortality Table Static (GAM94S)	3	18
1994 Uninsured Pensioner Mortality Table	1	1
Tables supplied by actuary	9	-
A1967-70 Table for Assured Lives	1	-
Total	**53**	**53**

Table 1: Pre- and Post- Retirement Base Mortality Assumption

A comparison of the mortality tables used in the valuations is given in **Table 2**. The rates supplied by the plan actuary are heavier than those in the standard tables and the older GAM94 table has higher rates than the RP-2014 Pensioner table.

	Mortality Rates per 1000 lives							
	Males				Females			
Age (yrs.)	Rates supplied	RP-2014 Emp.	RP-2014 Pen.	GAM94	Rates Supplied	RP-2014 Emp.	RP-2014 Pens.	GAM94
25	0.8	0.5		0.7	0.6	0.2		0.3
30	0.9	0.5		0.9	0.7	0.2		0.4
35	1.1	0.5		0.9	0.9	0.3		0.5
40	1.5	0.6		1.2	1.4	0.4		0.8
45	2.7	1.0		1.7	1.9	0.7		1.0
50	5.4	1.7	4.1	2.8	3.2	1.1	2.8	1.5
55	8.7	2.8	5.7	4.8	5.3	1.7	3.6	2.5
60	14.0	4.7	7.8	8.6	8.6	2.4	5.2	4.8
65		8.3	11.0	15.6		3.7	8.0	9.3
70		13.9	16.8	25.5		6.3	12.9	14.8
75		23.2	26.8	40.0		10.8	20.9	24.4
80		38.8	44.7	66.7		18.4	34.8	42.4
85			77.5	104.6			60.5	72.8
90			135.9	164.4			107.1	125.0

Table 2: Comparison of Mortality Rates at selected ages

Table 3 sets out the assumptions for mortality improvement used in valuations in the study. An explicit allowance was made for pre-retirement mortality in 19 valuations. Three (3) valuations used the GAM94S table which contains a loading for mortality improvement. For post-retirement mortality, explicit assumptions were made in 30 valuations while 18 used the GAM94S table.

Mortality Improvement	Pre-Retirement (Active Members)	Post-Retirement (Pensioner)
SOA MP-2014 Scale	11	11
SOA Scale AA	8	8
Age Rated Down by 5 years	-	10
Included in GAM94S	3	18
20% Reduction to pre-retirement rates	-	1

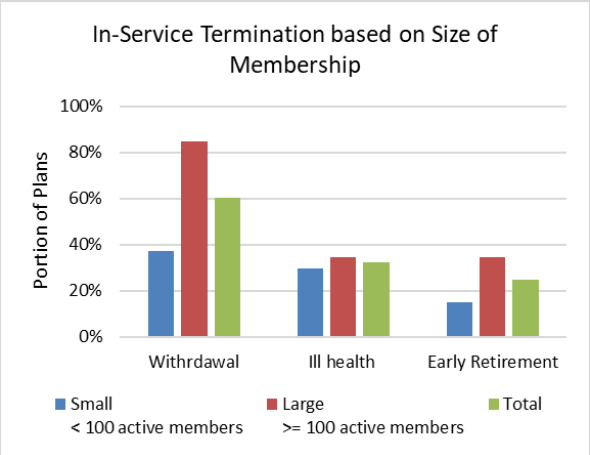
Table 3: Pre- and Post- Retirement Mortality Improvement Assumption

Section 7: In-Service Termination Rates other than Mortality

In-service termination rates are the rates at which members leave the plan as a result of termination, ill-health or retirement (early, normal or late). If a plan is sufficiently large and the data is credible, experience studies may be undertaken to develop terminations rates for the plan. From our review, we observed that:

- Among the AARs examined, 60 per cent made provisions for withdrawals. Withdrawal assumptions were less prevalent in small plans with 17 out of 27 valuations of small plans assuming no in-service termination. Only 4 of the 26 large plans assumed no withdrawals.
- An average of 31% of valuations made provisions for ill-health retirement.
- Twice as many valuations for large plans had an early retirement assumption when compared to AVRS for small plans. The assumptions ranged from applying a loading factor to the normal retirement age liability, to assuming a lower age or using rates supplied by the actuary. These assumptions were present in valuations of plans which allowed unreduced benefits at early retirement.
- None of the valuations surveyed made provisions for late retirement as the benefit at late retirement were assumed to be actuarially equivalent to the benefit at normal retirement.

Graph 9 and **Table 4** outline the in-service termination rates other than mortality.



In-Service Termination	Plan Size		
	Small (<100 active mem.)	**Large** (>=100 active mem.)	**Total**
Withdrawal	10	22	32
Ill health	8	9	17
Early Ret.	4	9	13

Graph 9 and Table 4: In-Service Termination Rates

Section 8: Pension Increase

The Pensions (Superannuation Funds and Retirement Schemes) Act and concomitant regulations do not require pension plans to guarantee a level of pension increases to preserve purchasing power. Trustees are usually given the discretion to augment benefits with or without the permission of the sponsor in the plan's constitutive documents.

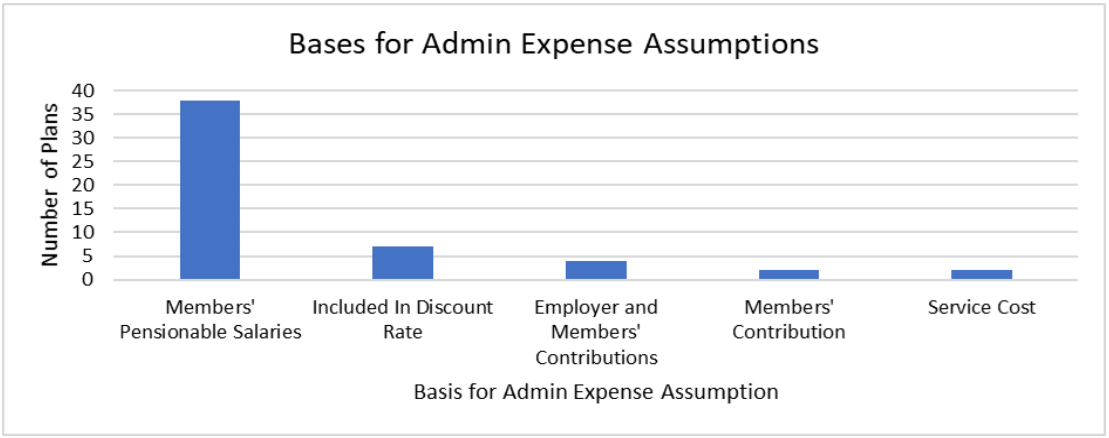
Fourteen plans (26%) guarantee a pension increase in their Trust Deeds and Rules; rates ranged from 2.5% to 5.5%. The remaining 39 plans do not guarantee increases, so no uplifts were assumed.

Section 9: Admin Expense Assumption

Administrative expenses include insurance advisory, accounting, auditing, actuarial, plan administration, legal, and trustee services but exclude investment related expenses and benefit payments or lump sums paid to plan participants and their beneficiaries.

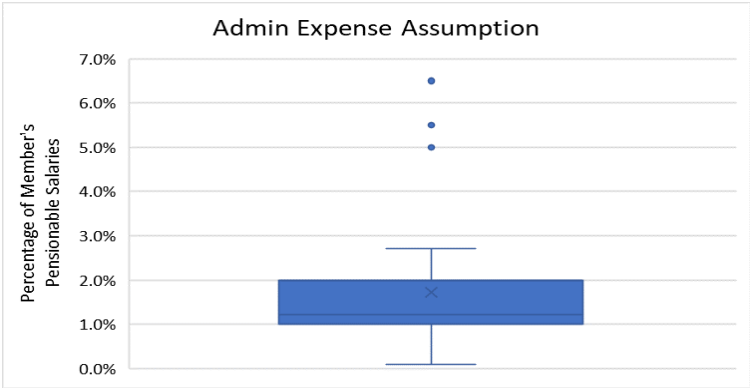
In setting the admin expense assumptions, the actuaries stated that they considered the plan's historical experience. Some further stated that the payment of expenses depended on the solvency of the fund. They assumed that if a plan had a surplus, expenses would be deducted from the fund. If a plan was in deficit, it was assumed that expenses would be paid by the sponsor.

Of the 53 AVRs surveyed, 47 had an explicit expense assumption expressed as a percentage of either: (i) members' pensionable salaries, (ii) employee and employer contributions (joint contributions), (iii) members' contributions or (iv) plan's service cost. For the remaining 6 plans, the discount rate assumed includes an adjustment for expenses. **Graph 10** shows the distribution of the expense bases used.



Graph 10: Bases for Expense Assumptions

To compare expense assumptions, the bases were converted to the percent of members' salaries. The range of percentages are shown in the box and whisker plot in **Graph 11.** The plot shows that the percentages range from 0.1% to 6.5%, with the median and mean equal to 1.2% and 1.7%, respectively. The small circles above the boxplots represent outliers (unusually high or low values of data). Plans 41, 5, 13, 6 and 3 represent outliers with admin expenses of 5.0%, 5.0%, 5.5%, 5.5% and 6.5%, respectively of member's pensionable salaries. We note that these plans are small; each having less than 90 active members.



Graph 11: Admin Expense Assumptions expressed as a Percentage of Members' Pensionable Salaries

Section 10: Margins for Adverse Deviation

The CAA actuarial standards require actuaries to consider the extent it is appropriate to adjust assumptions with margins for adverse deviation. Margins are incorporated in the work of an actuary to make allowance for uncertainty in the data, assumptions, or methodology. Margins may be implicit (included in the assumption) or explicit (disclosed separately from the best estimate assumption). No explicit margins were disclosed in the reports examined.

Appendices

Appendix 1 – Data Set (Demographic Data)

Actuarial Valuation Reports Conducted in 2018

Plan	Active Members	Assets (millions)	Total Contributions (millions)
1	10	69	7
2	50	1,117	61
3	81	6,253	144
4	53	2,810	60
5	27	613	10
6	17	290	53
7	103	1,982	130
8	157	6,558	133
9	132	2,072	52
10	283	3,475	291
11	61	1,997	21
12	64	524	76
13	23	118	7
14	51	381	100
15	95	1,928	99
16	279	13,682	2198
17	127	1,099	120
18	69	2,785	77
19	31	484	43
20	603	3,875	226
21	53	386	32

Actuarial Valuation Reports Conducted in 2019

Plan	Active Members	Assets (millions)	Total Contributions (millions)
22	199	1,447	208
23	59	253	34
24	170	3,287	127
25	61	250	28
26	411	40,296	673
27	91	2,662	22
28	122	1,691	63
29	36	613	34
30	690	6,716	831
31	582	30,606	1373
32	68	354	43
33	49	1,272	41
34	1,063	10,890	1289
35	1,129	4,321	626
36	207	3,945	94
37	123	4,295	91
38	67	1,411	132
39	157	1,556	103
40	411	1,748	831
41	37	1,699	36
42	209	805	104
43	74	288	45
44	11	453	19
45	65	1,394	193

Actuarial Valuation Reports Conducted in 2020

Plan	Active Members	Assets (millions)	Total Contributions (millions)
46	1,549	76,105	1,154
47	823	3,077	379
48	50	326	43
49	922	13,079	807
50	105	754	70
51	170	1,377	146
52	312	33,408	-
53	54	746	43

Appendix 2 – Data Set (Methodologies & Assumptions)

Actuarial Valuation Reports Conducted in 2018

Plan	Methodology	Inflation Rate	Nominal Discount Rate	Mortality - pre-retirement	Mortality - post-retirement	Withdrawal from Service	Ill-health	Early Retirement	Nominal Salary Increases	Nominal Pension Increase	Admin Expense
1	Attained Age Method	7.0%	9.0%	GAM94	GAM94	none assumed	none assumed	none	8.0%	0.0%	1% of pensionable salary
2	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	1% of pensionable salary
3	Attained Age Method	5.0%	7.0%	specimen rates	GAM94 (rated down by 5 years)	specimen rates	specimen rates	10% loading	6.0%	5.0%	6.5% members' pensionable earnings
4	Aggregate Attained Age	not stated	8.0%	GAM94 (projected using SOA scale AA)	GAM94 (projected using SOA Scale AA)	specimen rates	none assumed	specimen rates	6.5%	0.0%	included in discount rate
5	Attained Age Method	6.0%	8.0%	specimen rates	GAM94 (rated down by 5 years)	specimen rates	specimen rates	10% loading	7.0%	5.0%	5% members' pensionable earnings
6	Attained Age Method	5.5%	8.0%	specimen rates	GAM94 (rated down by 5 years)	none assumed	specimen rates	none	6.0%	5.5%	5.5% members' pensionable earnings
7	Projected Unit Credit Cost	5.0%	7.0%	specimen rates	GAM94 (rated down by 5 years)	specimen rates	specimen rates	none	5.5%	0.0%	2.5% members' pensionable earnings
8	Projected Unit Credit Cost	not stated	7.0%	GAM94 (projected using SOA scale AA)	GAM94 (projected using SOA Scale AA)	specimen rates	specimen rates	specimen rates	6.0%	0.0%	included in discount rate
9	Aggregate Attained Age	not stated	8.0%	GAM94 (projected using SOA scale AA)	GAM94 (projected using SOA Scale AA)	none assumed	none assumed	none	5.0%	3.0%	1.5% pensionable Salaries
10	Attained Age Method	7.0%	9.0%	GAM94	GAM94	specimen rates	none assumed	NRA reduced	8.0%	0.0%	0.5% of pensionable salary
11	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	1.5% of pensionable salary
12	Attained Age Method	6.0%	8.0%	specimen rates	GAM94 (rated down by 5 years)	specimen rates	specimen rates	none	7.0%	0.0%	1.6% of members' pensionable earnings

Plan	Methodology	Inflation Rate	Nominal Discount Rate	Mortality - pre-retirement	Mortality - post-retirement	Withdrawal from Service	Ill-health	Early Retirement	Nominal Salary Increases	Nominal Pension Increase	Admin Expense
13	Attained Age Method	7.0%	9.0%	none	GAM94	none assumed	none assumed	none	8.0%	0.0%	5.5% of pensionable salary
14	Projected Unit Credit Cost	not stated	8.0%	GAM94 (projected using SOA scale AA)	GAM94 (projected using SOA Scale AA)	none assumed	none assumed	none	6.5%	0.0%	4% of Joint Contributions
15	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	1% of pensionable salary
16	Attained Age Method	7.0%	9.0%	none	GAM94S	specimen rates	none assumed	none	8.0%	0.0%	0.5% of pensionable salary
17	Attained Age Method	7.0%	9.0%	none	GAM94S	specimen rates	none assumed	none	8.0%	0.0%	1% of pensionable salary
18	Aggregate Attained Age	not stated	8.5%	GAM94 (projected using SOA scale AA)	GAM94 (projected using SOA Scale AA)	none assumed	none assumed	none	5.5%	2.5%	included in discount rate
19	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	1% of salary
20	Aggregate Attained Age	not stated	7.0%	GAM94 (projected using SOA scale AA)	GAM94 (projected using SOA Scale AA)	specimen rates	loading of NRA liability	6% loading	5.0%	3.0%	2% Future Earnings
21	Attained Age Method	7.0%	9.0%	none	GAM94	none assumed	none assumed	none	8.0%	0.0%	2% pensionable of salary

Actuarial Valuation Reports Conducted in 2019

Plan	Methodology	Inflation Rate	Nominal Discount Rate	Mortality - pre-retirement	Mortality - post-retirement	Withdrawal from Service	Ill-health	Early Retirement	Nominal Salary Increases	Nominal Pension Increase	Admin Expense
22	Projected Unit Credit Cost	not stated	7.0%	RP-2014 Employee rates (projected using SOA MP-2014)	RP-2014 Annuitant rates (projected using SOA Scale MP-2014)	specimen rates	none assumed	none	6.0%	0.0%	5% of Service Cost
23	Attained Age Method	5.0%	7.0%	specimen rates	GAM94 (rated down by 5 years)	specimen rates	specimen rates	none	5.0%	0.0%	2.7% members' pensionable earnings
24	Projected Unit Credit Cost	5.0%	7.0%	specimen rates	GAM94 (rated down by 5 years)	specimen rates	specimen rates	10% loading	6.0%	0.0%	2.5% members' pensionable earnings
25	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	1% of pensionable salary
26	Projected Unit Credit Cost	not stated	6.5%	RP-2014 Employee rates (projected using SOA MP-2014)	RP-2014 Annuitant rates (projected using SOA Scale MP-2014)	specimen rates	none assumed	7.5% loading	6.0%	3.0%	included in discount rate
27	Current Unit Actuarial Cost	4.0%	8.0%	UP94 (projected using SOA scale AA)	UP94 (projected sing SOA Scale AA)	specimen rates	loading of mortality rates	10% of active members retire early p.a.	6.0%	0.0%	0.27% of pensionable salary
28	Projected Unit Credit Cost	5.0%	7.0%	specimen rates	GAM94 (rated down by 5 years)	specimen rates	specimen rates	none	6.0%	0.0%	1.6% of members' pensionable earnings
29	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	1% of pensionable salary
30	Aggregate Attained Age	not stated	7.0%	RP-2014 Employee rates (projected using SOA MP-2014)	RP-2014 Annuitant rates (projected using SOA Scale MP-2014)	specimen rates	none assumed	none	5.0%	0.0%	7.5% of Joint Future Contributions

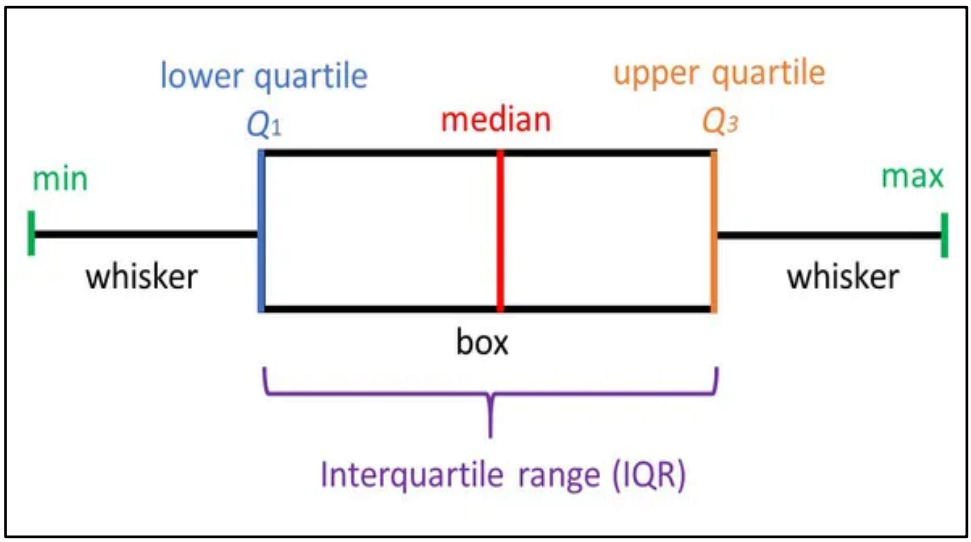
Plan	Methodology	Inflation Rate	Nominal Discount Rate	Mortality - pre-retirement	Mortality - post-retirement	Withdrawal from Service	Ill-health	Early Retirement	Nominal Salary Increases	Nominal Pension Increase	Admin Expense
31	Attained Age Method	5.0%	7.0%	Males: A67/70 Females: A67/70 (rated down 4 years)	GAM94 (rated down by 5 years)	specimen rates	specimen rates	none	5.0%	3.0% (if retired before 30 Sep, 2015	0.5% of members' pensionable earnings
32	Attained Age Method	7.0%	9.0%	none	GAM94	none assumed	none assumed	none	8.0%	0.0%	2% of salary
33	Projected Unit Credit Cost	3.0%	7.0%	RP-2014 Employee rates (projected using SOA MP-2014)	RP-2014 Annuitant rates (projected using SOA Scale MP-2014)	specimen rates	specimen rates	none	5.0%	3.0%	1.50% Pensionable Salaries
34	Attained Age Method	7.0%	9.0%	none	GAM94S	specimen rates	none assumed	none	8.0%	0.0%	2% of pensionable salary
35	Attained Age Method	7.0%	9.0%	GAM94S	GAM94S	specimen rates	none assumed	none	8.0%	0.0%	2% of pensionable salary
36	Attained Age Method	7.0%	9.0%	none	GAM94S	specimen rates	none assumed	none	8.5%	0.0%	1% of pensionable salary
37	Attained Age Method	7.0%	9.0%	none	GAM94S	specimen rates	none assumed	90% of membership retire early	8.5%	0.0%	1% of pensionable salary
38	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	1% of pensionable salary
39	Projected Unit Credit Cost	not stated	7.0%	RP-2014 Employee rates (projected using SOA MP-2014)	RP-2014 Annuitant rates (projected using SOA Scale MP-2014)	specimen rates	none assumed	NRA reduced	5.0%	2.0%	5% of Service Cost
40	Aggregate Attained Age	not stated	7.5%	GAM94 (20% loading)	GAM94	specimen rates	loading of NRA liability	none	6.0%	0.0%	2% of members contributions
41	Attained Age Method	5.0%	7.0%	specimen rates	GAM94 (rated down by 5 years)	specimen rates	specimen rates	none	5.0%	0.0%	5% of members' pensionable earnings

Plan	Methodology	Inflation Rate	Nominal Discount Rate	Mortality - pre-retirement	Mortality - post-retirement	Withdrawal from Service	Ill-health	Early Retirement	Nominal Salary Increases	Nominal Pension Increase	Admin Expense
42	Projected Unit Credit Cost	not stated	7.0%	RP-2014 Employee rates (projected using SOA MP-2014)	RP-2014 Annuitant rates (projected using SOA Scale MP-2014)	none assumed	none assumed	none	5.5%	0.0%	20% members' contributions
43	Projected Unit Credit Cost	not stated	7.0%	GAM94 (projected using SOA scale AA)	GAM94 (projected using SOA Scale AA)	specimen rates	none assumed	none	4.5%	0.0%	7.5% of Joint Contributions
44	Projected Unit Credit Cost	not stated	7.0%	RP-2014 Employee rates (projected using SOA MP-2014)	RP-2014 Annuitant rates (projected using SOA Scale MP-2014)	none assumed	none assumed	none	5.0%	3.0%	5% of Joint Contributions
45	Attained Age Method	7.0%	9.0%	GAM94S	GAM94S	specimen rates	none assumed	none	8.0%	0.0%	2% of pensionable salary

Actuarial Valuation Reports Conducted in 2020

Plan	Methodology	Inflation Rate	Nominal Discount Rate	Mortality - pre-retirement	Mortality - post-retirement	Withdrawal from Service	Ill-health	Early Retirement	Nominal Salary Increases	Nominal Pension Increase	Admin Expense
46	Aggregate Attained Age	not stated	8.0%	RP-2014 Employee rates (projected using SOA MP-2014)	RP-2014 Annuitant rates (projected using SOA Scale MP-2014)	specimen rates	specimen rates	specimen rates	7.0%	3.8%	1.25% of pensionable salaries
47	Projected Unit Credit Cost	not stated	7.0%	RP-2014 Employee rates (projected using SOA MP-2014)	RP-2014 Annuitant rates (projected using SOA Scale MP-2014)	none assumed	none assumed	none	6.0%	0.0%	included in discount rate
48	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	1.5% of pensionable salary
49	Aggregate Attained Age	not stated	8.0%	RP-2014 Employee rates (projected using SOA MP-2014)	GAM94S (projected using SOA Scale MP-2014)	specimen rates	specimen rates	none	6.5%	3.0%	included in discount rate
50	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	1.5% of pensionable salary
51	Attained Age Method	7.0%	9.0%	GAM94S	GAM94S	specimen rates	none assumed	none	8.0%	0.0%	1% of pensionable salary
52	Projected Unit Credit Cost	4.0%	6.0%	RP-2014 Employee rates (projected using SOA MP-2014)	RP-2014 Annuitant rates (projected using SOA Scale MP-2014)	specimen rates	none assumed	25% p.a. within 10 years of NRA	5.0%	2.5%	included in discount rate
53	Attained Age Method	7.0%	9.0%	none	GAM94	none assumed	none assumed	none	8.0%	0.0%	1.5% of pensionable salary

Appendix 3– How to Read a Box and Whisker Plot



[14]

Minimum Score - The lowest score, excluding outliers (shown at the end of the left whisker).

Lower Quartile - Twenty-five percent of scores fall below the lower quartile value (also known as the first quartile).

Median - The median marks the mid-point of the data and is shown by the line that divides the box into two parts (sometimes known as the second quartile). Half the scores are greater than or equal to this value and half are less.

Upper Quartile - Seventy-five percent of the scores fall below the upper quartile value (also known as the third quartile). Thus, 25% of data are above this value.

Maximum Score - The highest score, excluding outliers (shown at the end of the right whisker).

Whiskers - The upper and lower whiskers represent scores outside the middle 50% (i.e., the lower 25% of scores and the upper 25% of scores).

Interquartile Range (IQR) - This is the boxplot showing the middle 50% of scores (i.e., the range between the 25th and 75th percentile)

Outliers – These are extreme values; values exceeding 1.5 times the IQR

[14] https://www.simplypsychology.org/boxplots.html