



REPORT ON THE METHODOLOGIES AND ASSUMPTIONS USED IN
THE ACTUARIAL VALUATION REPORTS FOR
DEFINED BENEFIT PLANS WITH VALUATION DATES
BETWEEN JANUARY 1, 2020, AND DECEMBER 31, 2022

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Financial Services Commission

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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 plans' trust deed and rules¹ 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, demographic and economic assumptions used in defined benefit plan valuations that were conducted between January 1, 2020, and December 31, 2022, inclusive. The aim of this paper is to increase awareness among members of plans, trustees, administrators, investment managers and other pension industry professionals as well as the general public about the range of actuarial practice in Jamaica.

Sixty-four (64) actuarial valuation reports were examined. Twenty-three (23) plans were valued in 2020, 26 in 2021 and the remaining 15 in 2022. The reports were prepared by 5 qualified 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	Five funding methodologies were used; the Attained Age Method was the most prevalent method followed by the Projected Unit Cost Method.
Discount Rates	Nominal discount rates varied considerably, ranging between 6.0% and 10.0% and were higher than the ultimate risk-free rates determined by the FSC. There was an upward trend in the discount rate assumptions used by the actuaries over the 3-year period.
Salary Increase	Salary increase assumptions were primarily influenced by experience studies, IAS19 requirements/assumptions, and inflation. The most frequently used salary increase assumption was 8.0%.
Discount rates less salary increases	Majority of the surveyed plans had a net positive difference between discount rate and salary increase assumptions. The expectation of higher salary increases in 2022 resulted in lower net discount rates for that valuation year.
Mortality	Pre-retirement (active member) base mortality assumptions varied significantly. Standard tables developed by actuarial organizations were used as the bases for post-retirement (pensioner) mortality assumptions. Three valuations had no post-retirement mortality improvement assumptions.

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

Assumption	Findings
In-Service Termination Rates other than Mortality	<p>Withdrawal and Ill-health retirement assumptions were based on specimen rates developed by actuaries. These assumptions were employed more frequently in large plans.</p> <p>Less than 20% of plans had an early retirement assumption while none of the valuations made provisions for late retirement.</p>
Pension Increase	<p>Most pension plans did not guarantee pension increases, so actuaries had no increase assumptions.</p> <p>Among the plans with increases, rates ranged from 1.0% to 5.0%.</p>
Expense	<p>Over 90% of the surveyed plans had an explicit expense assumption.</p> <p>Administrative expenses as a percentage of members' pensionable salaries ranged between 0.5% to 6.8% over the three-year period. This metric increased sharply after 2020.</p>
Margins for Adverse Deviation	<p>No explicit margins were disclosed in the reports examined.</p>

The results of the last study can be found by clicking [here](#) to aid in comparative analysis.

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Section 1: Introduction

Objective

This report aims to present the findings of a survey conducted on the funding levels, valuation methodologies, demographic factors, and economic assumptions utilized in the assessment of Defined Benefit (DB) plans from January 1, 2020, to December 31, 2022, inclusively. It represents the third instalment in a series of surveys administered by the Financial Services Commission (FSC). The preceding two reports examined Actuarial Valuation Reports (AVRs) spanning the following valuation periods:

1. The initial report conducted in 2020, analyzed 20 AVRs dated between December 31, 2016, and December 31, 2017.
2. The subsequent report conducted in 2022, examined 53 AVRs dated from January 1, 2018, to December 31, 2020.

The primary goal of this report is to enhance understanding among stakeholders in pension plans, including members, trustees, administrators, investment managers, actuaries, and other industry professionals, regarding the diversity of actuarial practices observed within the Jamaican context.

Background

Defined benefit pension plans are structured such that retirement benefits are calculated according to a predetermined formula specified in the plan's trust deed and rules. This formula typically considers factors such as the accrual percentage, years of pensionable service, and pensionable salary. The plan's actuary plays a pivotal role in determining the rate at which the employer or sponsor should contribute to fund the plan liabilities. This rate is dependent on the funding methodology and demographic and economic assumptions selected by the actuary. Moreover, the actuary's decisions significantly influence the plan's funding level, as they directly impact the future value of the liabilities. In instances where the fund assets fall short of covering retirement benefits, the employer bears the responsibility of funding the deficit. Thus, it is essential to employ appropriate methodologies and assumptions to ensure the plan's financial health and sustainability.

Section 2: Data

Sixty-four (64) AVR of DB Plans were examined. Twenty-three (23) plans had valuation dates in 2020, 26 in 2021 and the remaining 15 in 2022.

Plans of varying sizes were included in the data set. In terms of membership, 59.4% (38 plans) of the 64 plans were “small”, that is, having less than 100 active members while the remaining 40.6% (26 plans) were large. Fund assets ranged from \$67 million to \$76 billion, with the median being \$1.2 billion. **Figure 1** illustrates the distribution of plans by fund size.

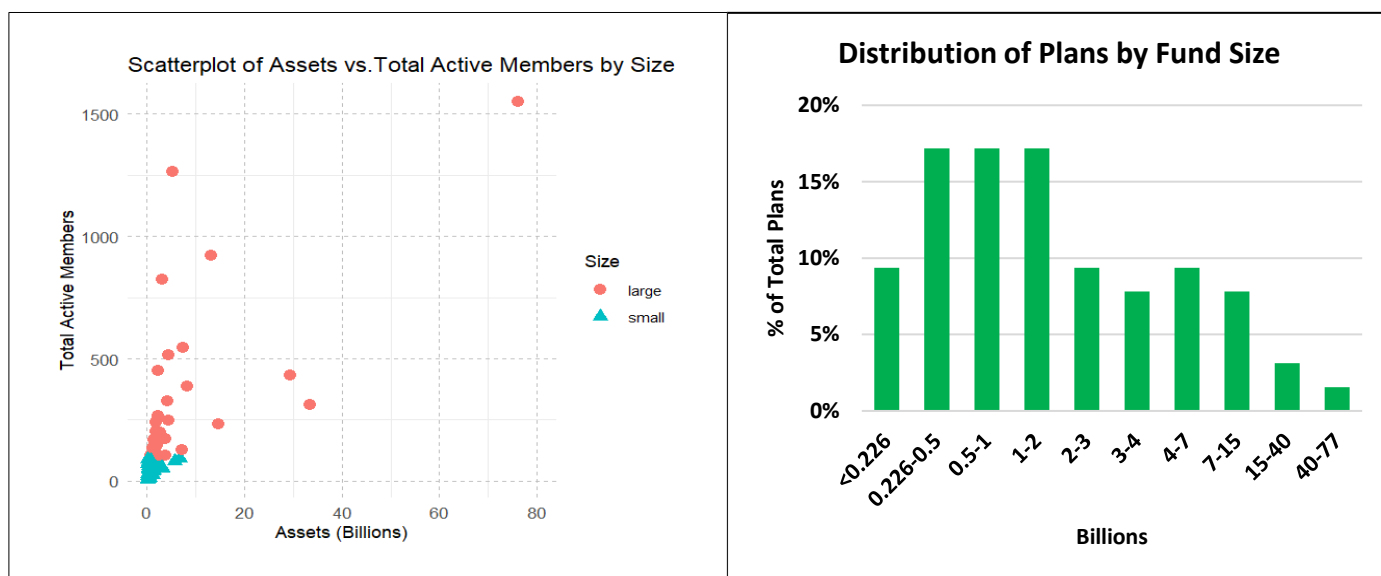
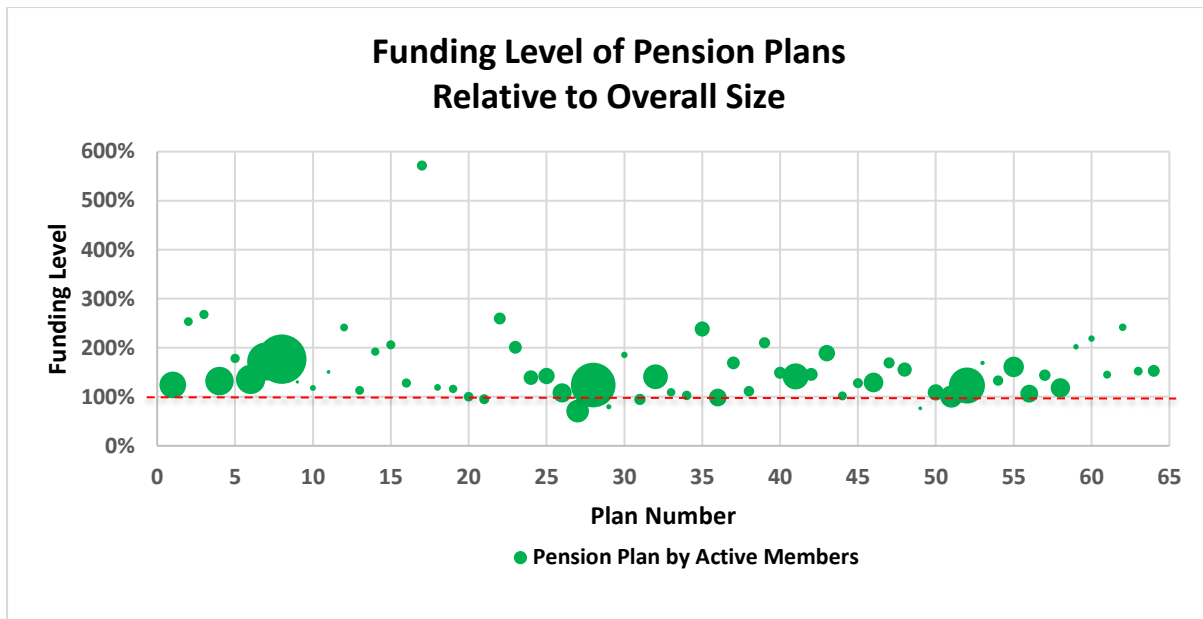


Figure 1: Distribution of Plans by Fund Size and Membership

From the scatterplot in **Figure 1**, it is evident that there is a strong positive correlation between the number of active members in a plan and the total plan assets, i.e. as the number of active members increases, the total assets also increase. Statistical analysis of the data indicates a correlation of 0.69². In addition, the column chart in **Figure 1** indicates that the distribution of plans by their fund size is right skewed, implying that majority of the plans have assets that are smaller than the median.

Actuarial assumptions such as mortality, salary escalation, and discount rates significantly influence the funding level of pension schemes. **Graph 1** overleaf provides a visual representation of the funding levels of the plans surveyed in this report.

² The correlation stated is based on the Pearson Correlation Coefficient (PCC). The PCC ranges between -1 and 1 and measures the strength and direction between two variables.



Graph 1: Funding Levels of 64 Defined Benefit Pension Plans Displayed by Active Membership Size

From the survey, 90.6% (58 of 64) of the plans were in a surplus; six (6) plans had funding levels below 100%, ranging from 71.0% to 99.0%. Four (4) of the 6 underfunded plans were small. A breakdown of the data is included in **Appendices 1 and 2**.

The AVRs were prepared by five (5) actuaries, all of whom are either Fellows of the Society of Actuaries or Fellows of the Institute and Faculty of Actuaries. All the actuaries are Ordinary Members of the Caribbean Actuarial Association (CAA)³.

Section 3: Structure of the Report

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

- Section 4: Funding Methodology
- Section 5: Discount Rate
- Section 6: Salary Increase
- Section 7: Relationship between Discount Rate and Salary Increase Assumptions
- Section 8: Mortality Assumptions
- Section 9: In-Service Termination Rates other than Mortality
- Section 10: Pension Increase
- Section 11: Administrative Expense Assumption
- Section 12: Margins for Adverse Deviations

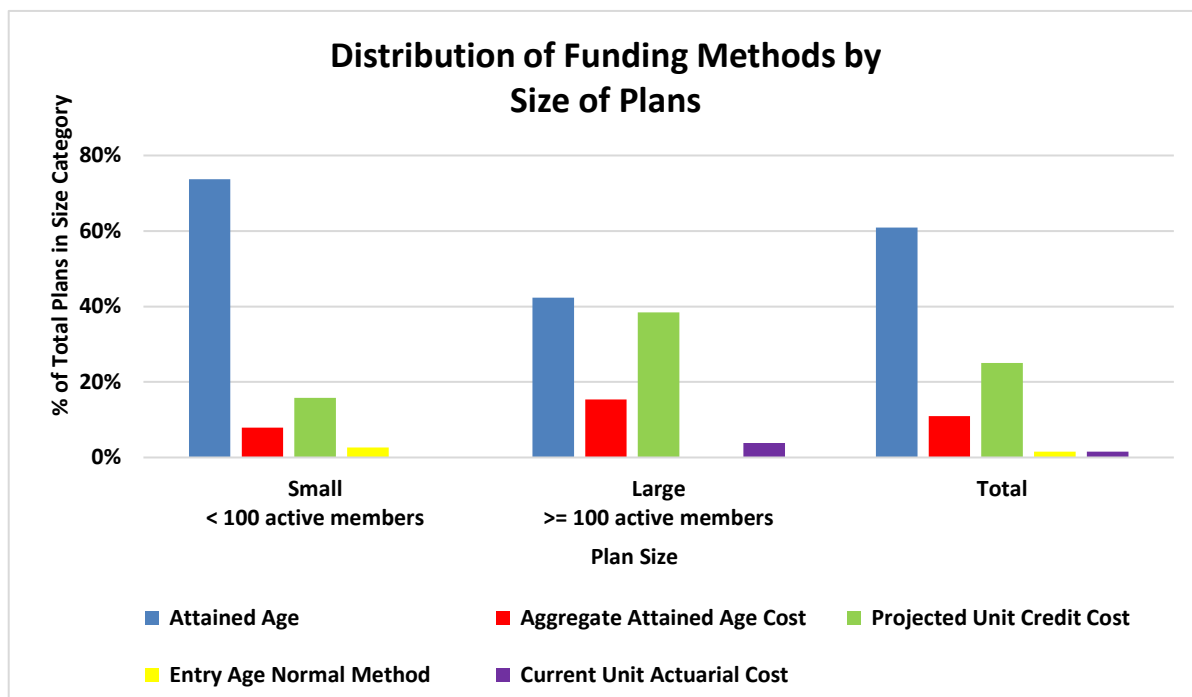
³ An Ordinary Member is an Actuary who is practicing or is resident in a Caribbean Country.
How to Become a Member: Caribbean Actuarial Association (caribbeanactuaries.com)

Section 4: Funding Methodology

The Funding Method of a pension plan represents the payment or budgetary framework through which benefit payments are financed⁴. It does not alter the overall true cost of the plan; rather, it serves as a mechanism for distributing the actuarial present value of projected benefits (and expenses, if applicable) over time, typically in the form of a normal cost and an actuarial accrued liability⁵. The normal cost is influenced by factors such as the chosen funding methodology and the demographic composition of the plan’s membership (e.g., age, gender, pensionable salary). These variables vary over time and ultimately lead to fluctuations in the normal cost.

In the valuations surveyed, five distinct funding methodologies were identified: the Attained Age (AA) method, Aggregate Attained Age (AAA) Method, Current Unit Actuarial Cost (CUC) Method, Projected Unit Cost (PUC) Method and Entry Age Normal (EAN) Method. Kindly refer to **Appendix 3** for explanations of the different funding methodologies used by the actuaries in the study.

Graph 2 illustrates the distribution of funding methods among the surveyed plans categorized by membership size. Among small plans, the AA Method was the preferred methodology, representing 73.7% of the funding methodology of small plans (used 2.8 times more than the other funding techniques combined). Among large plans, the AA method retained its dominance, however, by a small margin. The PUC method was used 38% of the time, the same level recorded in the 2022 study. The EAN and CUC methods were each used in only one plan.



Graph 2: Distribution of Funding Methods by Size of Membership

⁴ Fundamentals of Pension Funding (soa.org) : <https://www.soa.org/globalassets/assets/files/resources/essays-monographs/50th-anniversary/m-av99-1-02.pdf>

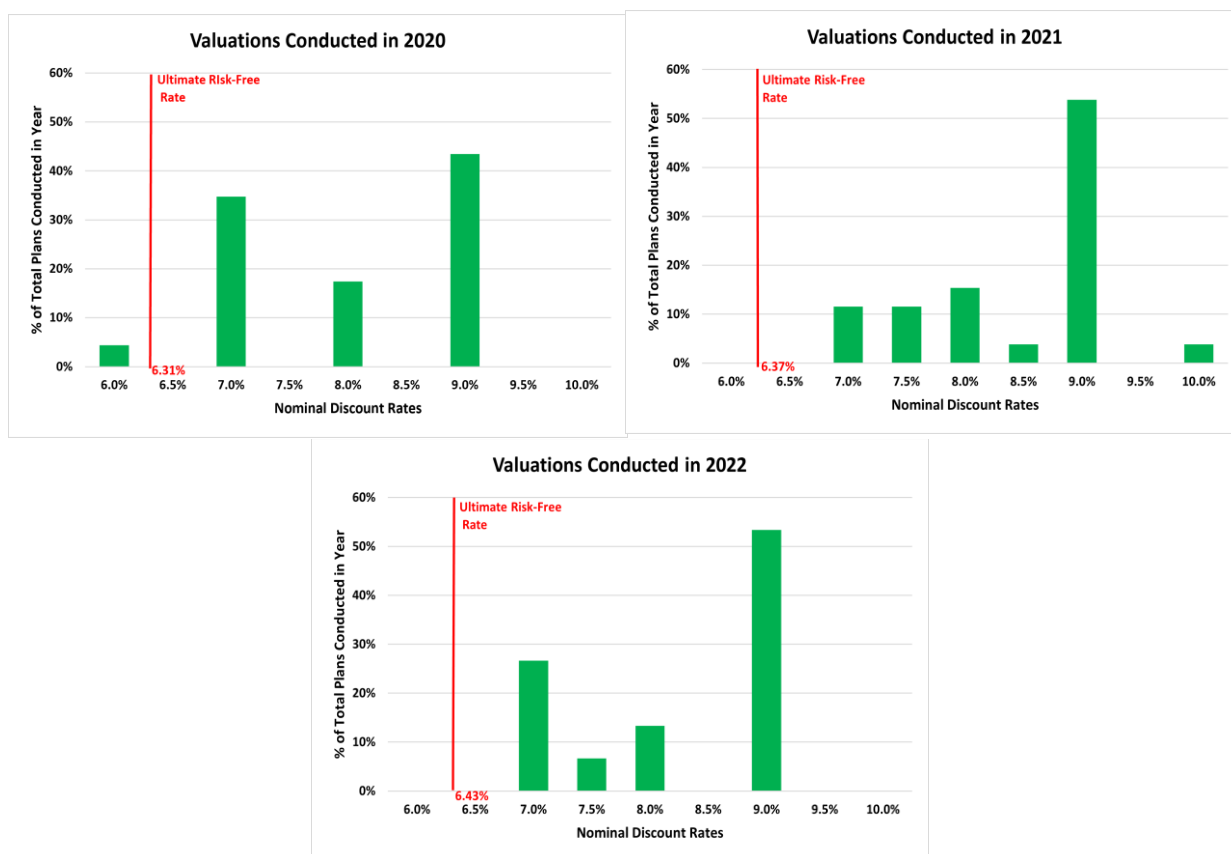
⁵ <http://www.actuarialstandardsboard.org/asops/asop-no-4-measuring-pension-obligations-and-determining-pension-plan-costs-or-contributions/#section-2-definitions>

Section 5: Discount Rate

In actuarial valuations, the discount rate plays an important role in computing plan liabilities, that is, determining the present value of future benefits. Employing a rate that is excessively high may reduce the estimate of plan liabilities and decrease required contributions, however, it will also increase the risk that the plan might fail to meet its future obligations whenever they become due. Conversely, utilizing an overly conservative rate has the advantage of enhancing benefit security, but leads to the possibility of imposing undue financial 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 indicated in its Statement of Investment Policies and Procedures (SIPP), the expected long-term return/yield of plan assets, expected investment expenses, and economic indicators such as long-term nominal and real interest rates and inflation.

Graphs 3-5 provide a comparative analysis of the assumed nominal net discount rates for the years 2020, 2021 and 2022 against the FSC’s ultimate risk-free rate⁶ (URFR) as at the end of the respective years. Given the pension funds’ diversified nature with substantial holdings in equities and corporate debentures, it is not surprising to observe assumed long-term discount rates which compare favourably to the URFR. Also, as one moves from Graph 3 to 4 discount rates trend upwards, a move that is consistent with Jamaica’s post pandemic economic environment which features higher rates of inflation and rising interest rates.



Graphs 3-5: Nominal Discount Rates by Valuation Year

⁶ A theoretical interest rate that investors could earn on an investment with zero risk over an infinite time horizon. The URFR developed by the FSC is based on historical GDP growth and midpoint of target inflation as set by the BOJ.

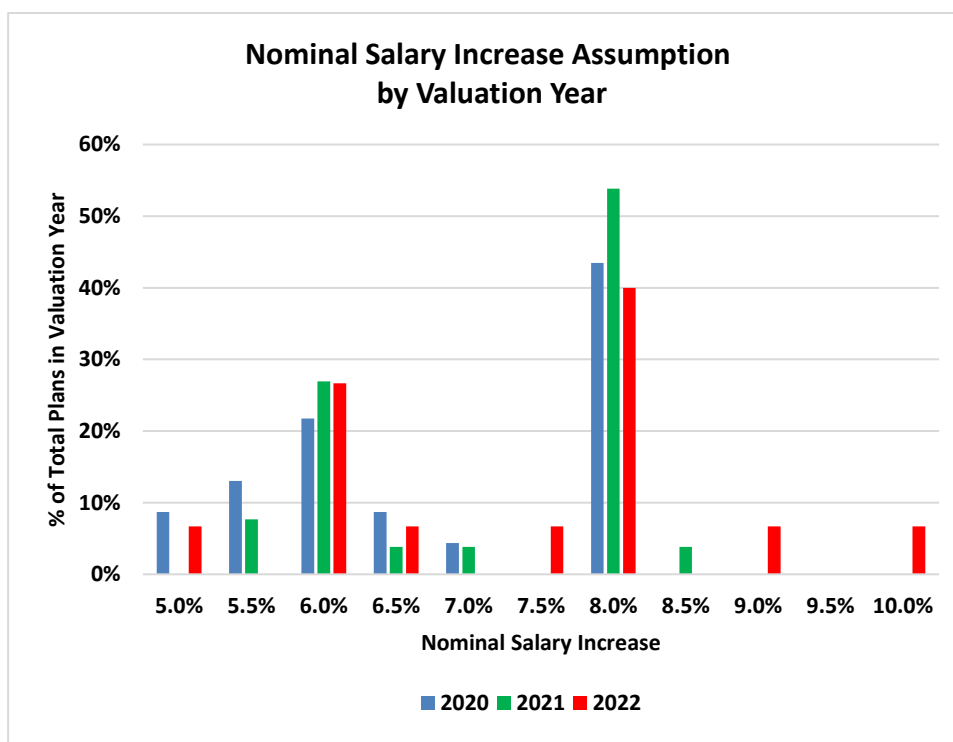
Section 6: Salary Increase

Rate of salary increase is the pay increase assumption used to project the future pay levels of each current active plan participant.⁷ The rate reflects expected salary experience based on information supplied by a sponsor. This assumption is the second most important assumption made in connection with a pension valuation. A higher salary increase assumption will lead to a higher expected value of future benefits which ultimately results in an elevated defined benefit obligation. The salary increase assumption can be influenced by, among others, the following factors:

- Inflation
- Promotional increases
- Other ad-hoc/performance related increments

In setting the nominal salary increase assumption, the most popular approach applied was to follow the assumptions used in IAS 19 valuations which were either in line with, or a margin above inflation. In three or 4.7% of AVRs, actuaries explicitly stated that salary analyses and experience studies were performed to determine the nominal salary increase assumption.

In the AVRs, nominal salary escalation rates varied considerably with rates ranging between 5% and 10%, with the medians being 6.5%, 8.0% and 8.0% for 2020, 2021 and 2022, respectively. Eight percent (8.0%) was the most frequently used assumption across all years. Plans with a 2022 valuation date had the highest nominal salary increase assumptions of 9.0% and 10.0%. These plans are the ones for which salary experience analyses were conducted. **Graph 6** is a pictorial representation of the data.



Graph 6: Distribution of Nominal and Real Rates of Salary Increase

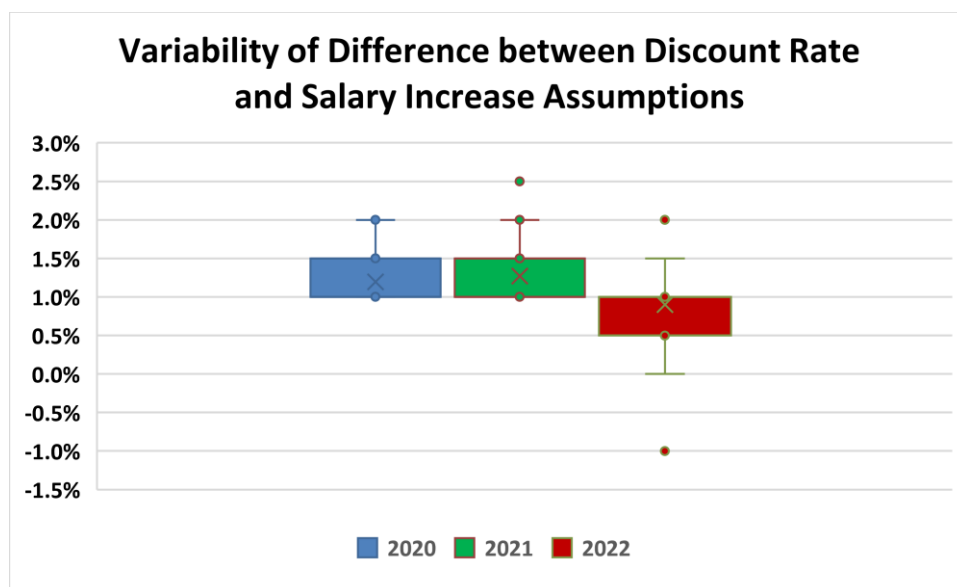
⁷ <https://www.soa.org/globalassets/assets/files/edu/edu-2009-fall-ea-assess-sn.pdf>

Section 7: Relationship Between Discount Rate and Salary Increase Assumption

Some actuarial assumptions are inter-related.

For the valuation of defined benefit plans, the discount rate net of salary increase assumption is as important as each of the assumptions on their own. If the salary increase assumption exceeds the discount rate assumption, it implies that future pension obligations are growing at a faster pace than the rate at which they are discounted. This scenario may lead to higher pension liabilities, increased funding requirements for the plan sponsor and erosion of surplus. Conversely, if the discount rate assumption surpasses the salary increase assumption, pension liabilities and funding requirements may be reduced.

Graph 7 is a grouped boxplot that displays the distributions of the difference between the two assumptions by valuation year.



Graph 7: Relationship Between Discount Rate and Salary Increase Assumptions

It shows that the 2022 boxplot has shifted downwards with the mean (X on boxplot) falling from 1.27% to 0.9%. The shift reflects the expectation of higher salary increases relative to discount rates and the greater burden being placed on sponsors to fund the liabilities. Across the three years, the net rates ranged from -1.0% to 2.5%.

Section 8: 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.⁸ Mortality rates vary by factors such as age, gender and type of retirement (healthy or disabled).⁹

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.¹⁰ If a plan is large and its data credible, the actuary may opt to construct mortality tables based on the plan's own experience. To account for how mortality rates improve over time, projection scales, fixed-year projections, setbacks (adjusting for age by using younger ages to reference mortality rates in tables) or fixed margins to existing mortality rate tables may be used.

Table 1 details the pre- and post-retirement mortality assumptions used in the valuations examined in the study. Across valuations, pensioner mortality assumptions were consistently derived from standard mortality tables, while a combination of standard tables and rates provided by the actuary were utilized for active members.

In 26 valuations, actuaries assumed no pre-retirement mortality. Twenty-two of these plans were small. In 25 of the AVRs, the actuaries changed their post-retirement mortality assumption table from the table used in the previous valuation. Eleven (11) of the changes were from the GAM94 to the GAM94S table, while 14 were from the GAM94 to RP-2014 Pensioner table.

Mortality Table	Pre-Retirement (Active Members)	Post-Retirement (Pensioner)
None assumed	26	-
Retirement Plan 2014 Employee Rates (RP-2014 Emp)	16	-
Retirement Plan 2014 Pensioner Rates (RP-2014 Pens)	-	16
1994 Group Annuity Mortality Table (GAM94)	-	18
1994 Group Annuity Mortality Table Static (GAM94S)	7	30
Tables supplied by actuary	13	-
A1967-70 Table for Assured Lives	2	-
Total	64	64

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

⁸ <https://www.cdc.gov/csels/dsepd/ss1978/lesson3/section3.html>

⁹ 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>

¹⁰ IBID

A comparison of the mortality tables used in the valuations is outlined in **Table 2**. The rates supplied by the plan actuary are heavier than those in the standard tables, and, at the higher ages (i.e. 60 years and over), the older GAM94 and GAM94S tables have higher rates than the RP-2014 Pensioner table.

And Age (yrs.)	Mortality Rates per 1000 lives									
	Males					Females				
	Rates supplied	RP-2014 Emp.	RP-2014 Pen.	GAM94	GAM94S	Rates Supplied	RP-2014 Emp.	RP-2014 Pens.	GAM94	GAM94S
25	0.8	0.5		0.7	0.7	0.6	0.2		0.3	0.3
30	0.9	0.5		0.9	0.8	0.7	0.2		0.4	0.4
35	1.1	0.5		0.9	0.9	0.9	0.3		0.5	0.5
40	1.5	0.6		1.2	1.1	1.4	0.4		0.8	0.7
45	2.7	1.0		1.7	1.6	1.9	0.7		1.0	1.0
50	5.4	1.7	4.1	2.8	2.6	3.2	1.1	2.8	1.5	1.4
55	8.7	2.8	5.7	4.8	4.4	5.3	1.7	3.6	2.5	2.3
60	14.0	4.7	7.8	8.6	8.0	8.6	2.4	5.2	4.8	4.4
65		8.3	11.0	15.6	14.5		3.7	8.0	9.3	8.6
70		13.9	16.8	25.5	23.7		6.3	12.9	14.8	13.7
75		23.2	26.8	40.0	37.2		10.8	20.9	24.4	22.7
80		38.8	44.7	66.7	62.0		18.4	34.8	42.4	39.4
85			77.5	104.6	97.2			60.5	72.8	67.7
90			135.9	164.4	152.9			107.1	125.0	186.2

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 20 valuations. Five (5) valuations used the mortality improvement that is already loaded in the GAM94S table¹¹. For post-retirement mortality, explicit assumptions were made in 34 valuations while 27 used the improvement included in the GAM94S table. Three AVRs used the GAM94 table as the base table with no post-retirement improvements.

Mortality Improvement	Pre-Retirement (Active Members)	Post-Retirement (Pensioner)
SOA MP-2014 Scale	16	16
Age Rated Down by 4 years	2	-
Age Rated Down by 5 years	2	18
Included in GAM94S	5	27
None Assumed	39	3
Total	64	64

Table 3: Pre- and Post- Retirement Mortality Improvement Assumptions Across 64 DB Plans

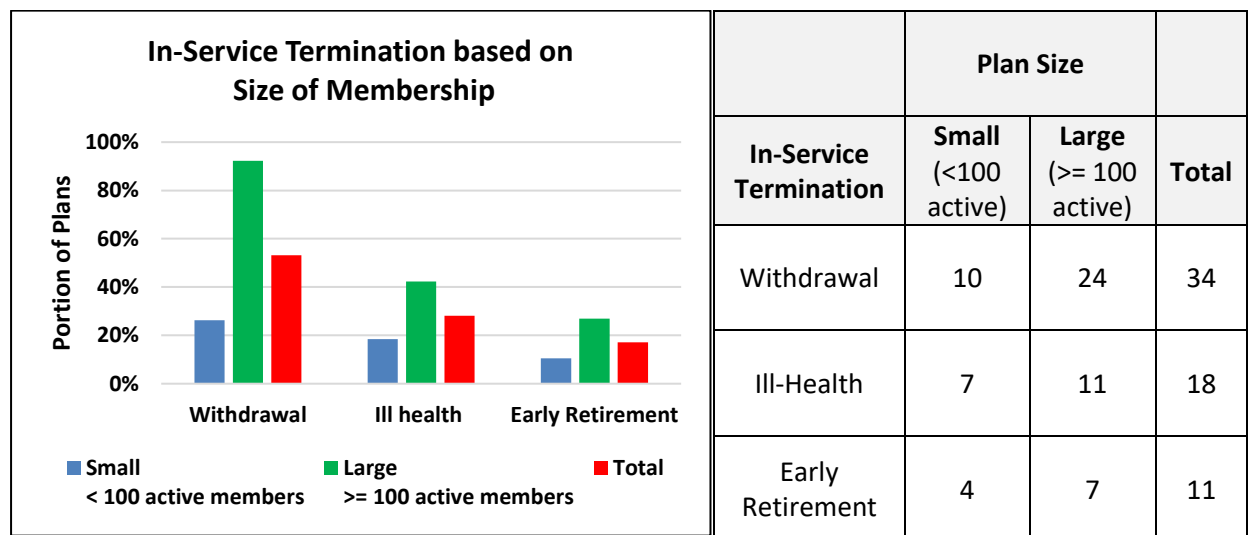
¹¹ The two valuations that had a pre-retirement mortality improvement of rating down age by 5 years also used GAM94S as the base pre-retirement table.

Section 9: 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 termination rates for the plan. From our review, we observed that:

- Among the AVRs examined, 53.1% made provisions for withdrawals. Withdrawal assumptions were less prevalent in small plans with 28 out of 38 valuations of small plans assuming no in-service termination. Only 2 of the 26 large plans assumed no withdrawals. The assumptions were based on specimen rates developed by the actuaries.
- Approximately twenty-eight per cent (28.1%) of valuations made provisions for ill-health retirement, with larger plans constituting a greater proportion of the valuations with the ill-health retirement option. The assumptions were based on specimen rates developed by the actuaries.
- Only 17.2% of plans had an early retirement assumption. Of this total, the percentage of large plans with an assumption was more than twice the proportion of smaller plans with an early retirement provision. 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 AVRs that allowed for payment of both reduced and unreduced benefits at early retirement.
- None of the valuations surveyed made provisions for late retirement as benefits at late retirement were assumed to be actuarially equivalent to the benefit at normal retirement.

Graph 8 and **Table 4** outline the in-service termination rates other than mortality.



Graph 8 and Table 4: In-Service Termination Rates

Section 10: Pension Increase

The Pensions (Superannuation Funds and Retirement Schemes) Act and corollary 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.

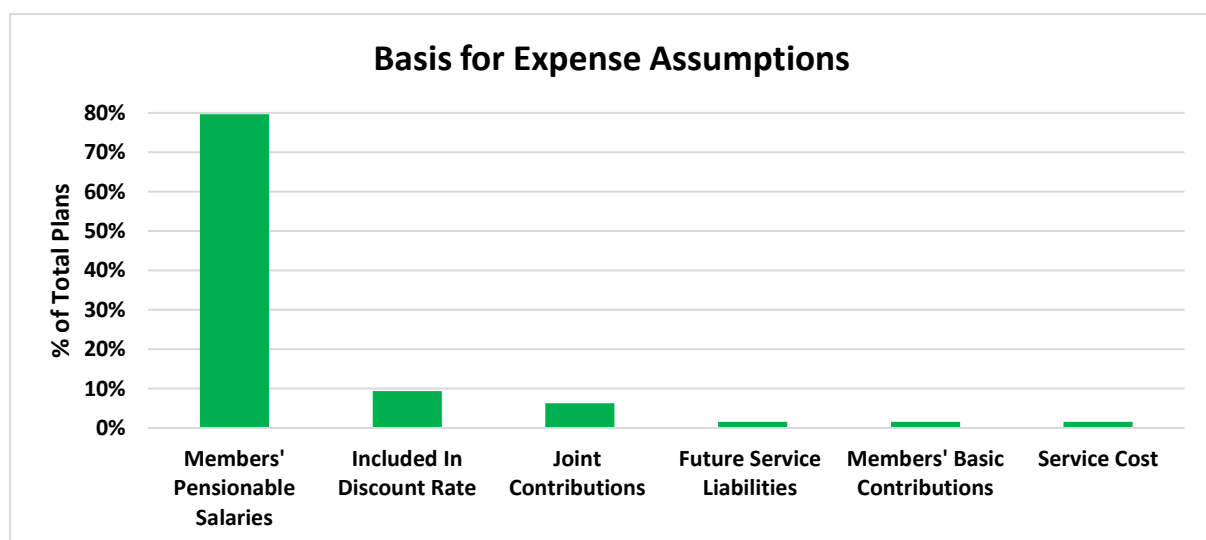
Twelve plans (18.8%) guaranteed a pension increase in their Trust Deeds and Rules; with rates ranging from 1.0% to 5.0%. The remaining 52 plans did not guarantee increases, so no uplifts were assumed.

Section 11: Administrative 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 administrative 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 64 AVRs surveyed, 58 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, (iv) future service liabilities or (v) plan’s service cost. For the remaining 6 plans, the discount rate assumed included an adjustment for expenses. **Graph 9** shows the distribution of the expense bases used.

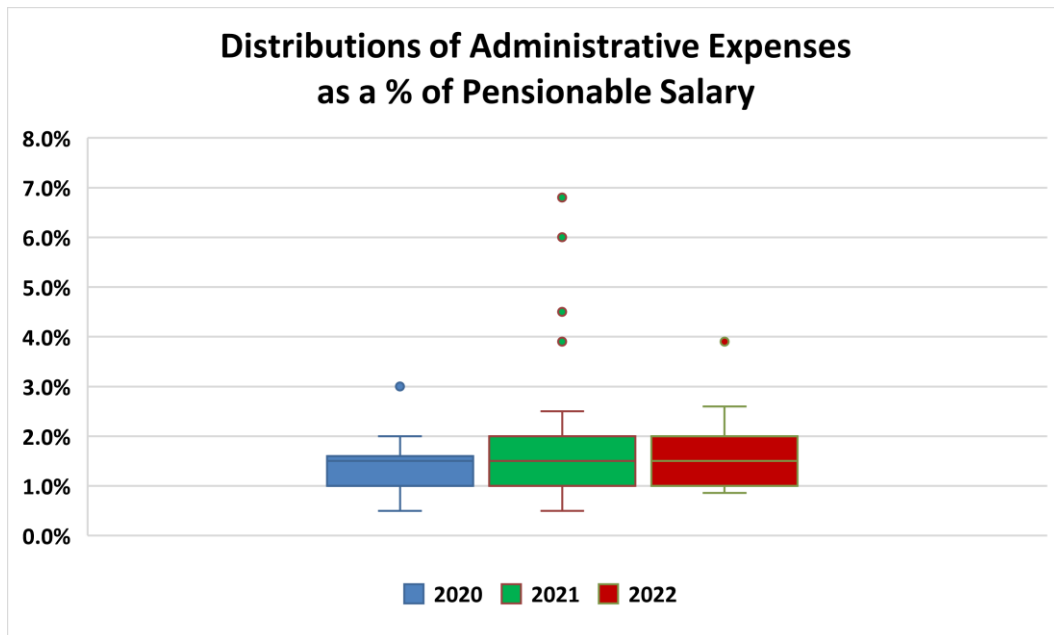


Graph 9: Bases for Expense Assumptions

To compare expense assumptions, the bases were converted to the percent of members’ salaries. The range of percentages are shown in the boxplots in **Graph 10**. The plots shows that the percentages range from 0.5% to 6.8%. **Table 5** below outlines the mean, median, minimum, and maximum percentages across each year as illustrated in **Graph 10**. The small circles above the boxplots represent outliers (observations that deviate significantly from other data points).

	2020	2021	2022	Triennial Period (2020-2022)
	(%)	(%)	(%)	(%)
Mean	1.4	2.1	1.6	1.7
Median	1.5	1.5	1.5	1.5
Minimum	0.5	0.5	0.9	0.5
Maximum	3.0	6.8	3.9	6.8

Table 5: Statistical Properties of Administrative Expenses Expressed as a % of Members’ Pensionable Salaries in DB Plans



Graph 10: Administrative Expense Assumptions expressed as a Percentage of Members' Pensionable Salaries

From **Graph 10** and **Table 5** it is noticeable that the median expense assumption is consistent at 1.5% across all 3 years. However, there is a general increase in the administrative expenses as a percentage of pensionable salaries after 2020. This indicates that expenses are rising faster than pension salaries and is consistent with increased inflation¹² experienced during the period.

¹² Inflation » Bank of Jamaica (boj.org.jm) : <https://boj.org.jm/statistics/real-sector/inflation/>

Section 12: 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.

Appendix 1 – Data Set (Demographic Data)

Actuarial Valuation Reports Conducted in 2020

Plan	Active Members	Assets (millions)	Funding Ratio (%)
1	12	519	169.1
2	170	1,377	142.4
3	200	2,767	98.5
4	823	3,077	123.0
5	90	95	152.9
6	312	33,408	100.5
7	1,549	76,105	176.7
8	145	2,086	238.2
9	70	1,095	111.4
10	54	746	128.1
11	105	754	201.0
12	922	13,079	172.1
13	50	326	113.0
14	388	8,221	140.9
15	57	875	102.8
16	104	3,731	169.2
17	80	5,777	210.2
18	64	518	127.9
19	246	4,441	129.2
20	68	220	133.1
21	266	2,264	161.0
22	202	1,939	106.4
23	84	769	144.0

Actuarial Valuation Reports Conducted in 2021

Plan	Active Members	Assets (millions)	Funding Ratio (%)
24	55	293	178.2
25	7	67	130.3
26	22	94	118.1
27	52	457	205.9
28	65	1,987	571.6
29	26	787	185.4
30	51	381	101.8
31	239	1,800	118.1
32	19	441	202.0
33	36	446	241.8
34	40	1,145	145.2
35	9	330	150.7
36	129	7,209	155.5
37	136	1,180	139.1
38	49	3,215	253.4
39	54	3,050	267.9
40	515	4,321	132.1
41	44	1,154	192.2
42	90	2,044	259.7
43	232	14,670	108.0
44	16	454	79.6
45	80	802	94.6
46	92	6,776	149.0
47	106	2,514	145.7
48	26	1,214	218.7
49	50	872	152.2

Actuarial Valuation Reports Conducted in 2022

Plan	Active Members	Assets (millions)	Funding Ratio (%)
50	79	395	169.2
51	452	2,202	124.2
52	326	4,285	70.9
53	1,265	5,321	124.0
54	172	3,822	189.0
55	39	512	241.4
56	29	171	119.1
57	46	379	109.2
58	9	224	76.5
59	545	7,519	135.5
60	45	1,401	116.1
61	59	927	100.3
62	63	330	95.1
63	431	29,466	141.6
64	167	1,597	109.0

Appendix 2 – Data Set (Methodologies & Assumptions)

Actuarial Valuation Reports Conducted in 2020

Plan	Funding Method	Inflation Rate	Nominal Discount Rate	Mortality - pre-retirement	Mortality - post-retirement	Withdrawal from Service	Ill-health	Early Retirement	Nominal Salary Increases	Nominal Pension Increase	Administrative Expense
1	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	2% of salary
2	Attained Age Method	7.0%	9.0%	GAM94S	GAM94S	specimen rates	none assumed	none	8.0%	0.0%	1% of salary
3	Projected Unit Credit Cost	5.0%	7.0%	specimen rates	GAM94	specimen rates	specimen rates	none	5.5%	0.0%	1.2% of members' pensionable earnings
4	Projected Unit Credit Cost	not stated	7.0%	RP-2014 Employee rates	RP-2014 Annuitant rates	none assumed	none assumed	none	6.0%	0.0%	included in discount rate
5	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	1% of salary
6	Projected Unit Credit Cost	4.0%	6.0%	RP-2014 Employee rates	RP-2014 Annuitant rates	specimen rates	none assumed	NRA reduced	5.0%	2.5%	included in discount rate
7	Aggregate Attained Age	not stated	8.0%	RP-2014 Employee rates	RP-2014 Annuitant rates	specimen rates	specimen rates	specimen rates	7.0%	3.8%	1.25% Pensionable Salaries
8	Projected Unit Credit Cost	5.0%	7.0%	specimen rates	GAM94	specimen rates	none assumed	none	5.5%	0.0%	1.6% of members'

Plan	Funding Method	Inflation Rate	Nominal Discount Rate	Mortality - pre-retirement	Mortality - post-retirement	Withdrawal from Service	Ill-health	Early Retirement	Nominal Salary Increases	Nominal Pension Increase	Administrative Expense
											pensionable earnings
9	Projected Unit Credit Cost	5.0%	7.0%	specimen rates	GAM94	specimen rates	none assumed	none	6.0%	0.0%	2% of members' pensionable earnings
10	Attained Age Method	7.0%	9.0%	none	GAM94	none assumed	none assumed	none	8.0%	0.0%	1.5% of salary
11	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	1.5% of salary
12	Aggregate Attained Age	not stated	8.0%	RP-2014 Employee rates	RP-2014 Annuitant rates	specimen rates	specimen rates	none	6.5%	3.0%	included in discount rate
13	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	1.5% of salary
14	Current Unit Actuarial Cost Method	5.0%	7.0%	specimen rates	GAM94	specimen rates	specimen rates	none	6.0%	0.0%	0.5% of members' pensionable earnings
15	Entry Age Normal Method	5.0%	7.0%	specimen rates	GAM94	specimen rates	specimen rates	5% loading	5.5%	0.0%	1.6% of members' pensionable earnings
16	Projected Unit Credit Cost	5.0%	7.0%	A67/70	GAM94	specimen rates	specimen rates	none	6.0%	2.5%	1.5% of members'

Plan	Funding Method	Inflation Rate	Nominal Discount Rate	Mortality - pre-retirement	Mortality - post-retirement	Withdrawal from Service	Ill-health	Early Retirement	Nominal Salary Increases	Nominal Pension Increase	Administrative Expense
											pensionable earnings
17	Projected Unit Credit Cost	5.0%	7.0%	specimen rates	GAM94	specimen rates	specimen rates	none	5.0%	3.0%	3% of members' pensionable earnings
18	Projected Unit Credit Cost	not stated	8.0%	RP-2014 Employee rates	RP-2014 Annuitant rates	specimen rates	none assumed	none	6.0%	0.0%	30% members' basic contributions
19	Projected Unit Credit Cost	not stated	8.0%	RP-2014 Employee rates	RP-2014 Annuitant rates	specimen rates	none assumed	none	6.5%	0.0%	1.5% members' pensionable earnings
20	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	2% of salary
21	Attained Age Method	7.0%	9.0%	GAM94S	GAM94S	specimen rates	none assumed	none	8.0%	0.0%	1% of salary
22	Attained Age Method	7.0%	9.0%	none	GAM94S	specimen rates	none assumed	none	8.0%	0.0%	0.5% of salary
23	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	1% of salary

Actuarial Valuation Reports Conducted in 2021

Plan	Funding Method	Inflation Rate	Nominal Discount Rate	Mortality - pre-retirement	Mortality - post-retirement	Withdrawal from Service	Ill-health	Early Retirement	Nominal Salary Increases	Nominal Pension Increase	Administrative Expense
24	Aggregate Attained Age	not stated	7.5%	RP-2014 Employee rates	RP-2014 Annuitant rates	none assumed	none assumed	none	6.0%	0.0%	5% of future service liabilities
25	Attained Age Method	7.0%	9.0%	GAM94S	GAM94S	none assumed	none assumed	none	8.0%	0.0%	1.5% of salary
26	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	4.5% of salary
27	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	2% of salary
28	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	2% of salary
29	Attained Age Method	5.0%	7.0%	specimen rates	GAM94	specimen rates	specimen rates	10% loading	6.0%	5.0%	6% members' pensionable earnings
30	Projected Unit Credit Cost	not stated	8.0%	RP-2014 Employee rates	RP-2014 Annuitant rates	none assumed	none assumed	none	6.5%	0.0%	4% of joint contributions
31	Attained Age Method	7.0%	9.0%	none	GAM94	specimen rates	none assumed	none	8.0%	0.0%	1% of salary
32	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	2% of salary

Plan	Funding Method	Inflation Rate	Nominal Discount Rate	Mortality - pre-retirement	Mortality - post-retirement	Withdrawal from Service	Ill-health	Early Retirement	Nominal Salary Increases	Nominal Pension Increase	Administrative Expense
33	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	2% of salary
34	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	1.3% of salary
35	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	1% of salary
36	Projected Unit Credit Cost	not stated	8.0%	RP-2014 Employee rates	RP-2014 Annuitant rates	specimen rates	specimen rates	specimen rates	7.0%	0.0%	included in discount rate
37	Attained Age Method	7.0%	9.0%	GAM94S	GAM94S	specimen rates	none assumed	none	8.0%	0.0%	1% of salary
38	Aggregate Attained Age	not stated	8.5%	RP-2014 Employee rates	RP-2014 Annuitant rates	specimen rates	none assumed	specimen rates	6.0%	0.0%	included in discount rate
39	Aggregate Attained Age	not stated	8.0%	RP-2014 Employee rates	RP-2014 Annuitant rates	none assumed	none assumed	none	6.0%	10% p.a. for the first 5 years after start of pension, 2.5% after	included in discount rate
40	Aggregate Attained Age	not stated	8.0%	RP-2014 Employee rates	RP-2014 Annuitant rates	specimen rates	loading of NRA Liability	2% loading	5.5%	3.8%	2% members' pensionable salaries

Plan	Funding Method	Inflation Rate	Nominal Discount Rate	Mortality - pre-retirement	Mortality - post-retirement	Withdrawal from Service	Ill-health	Early Retirement	Nominal Salary Increases	Nominal Pension Increase	Administrative Expense
41	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	1.5% of salary
42	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	1% of salary
43	Attained Age Method	7.0%	9.0%	GAM94S	GAM94S	specimen rates	none assumed	none	8.0%	0.0%	0.5% of salary
44	Attained Age Method	5.0%	7.5%	specimen rates	GAM94	none assumed	specimen rates	none	5.5%	5.0%	3.9% members' pensionable earnings
45	Attained Age Method	5.0%	7.0%	specimen rates	GAM94	specimen rates	specimen rates	none	6.0%	0.0%	0.9% of members' pensionable earnings
46	Attained Age Method	5.0%	7.0%	specimen rates	GAM94	specimen rates	specimen rates	10% loading	6.0%	5.0%	6.8% members' pensionable earnings
47	Projected Unit Credit Cost	6.5%	10.0%	specimen rates	GAM94	specimen rates	specimen rates	none	8.5%	1.0%	2.5% members' pensionable earnings
48	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	2% of salary
49	Attained Age Method	5.0%	7.5%	none	GAM94S	none assumed	none assumed	none	6.0%	0.0%	1.5% of salary

Actuarial Valuation Reports Conducted in 2022

Plan	Funding Method	Inflation Rate	Nominal Discount Rate	Mortality - pre-retirement	Mortality - post-retirement	Withdrawal from Service	Ill-health	Early Retirement	Nominal Salary Increases	Nominal Pension Increase	Administrative Expense
50	Projected Unit Credit Cost	not stated	8.0%	RP-2014 Employee rates	RP-2014 Annuitant rates	specimen rates	none assumed	none	6.0%	0.0%	7.5% of Joint Contributions
51	Attained Age Method	5.0%	7.5%	none	GAM94	specimen rates	loading of NRA Liability	none	6.0%	0.0%	1.5% of members' pensionable salaries
52	Attained Age Method	7.0%	9.0%	GAM94S	GAM94S	specimen rates	none assumed	NRA reduced	10.0%	0.0%	1% of salary
53	Attained Age Method	7.0%	9.0%	GAM94S	GAM94S	specimen rates	none assumed	none	8.0%	0.0%	2% of salary
54	Projected Unit Credit Cost	5.0%	7.0%	specimen rates	GAM94	specimen rates	specimen rates	10% loading	6.0%	0.0%	2.6% members' pensionable earnings
55	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	2% of salary
56	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	1% of salary
57	Attained Age Method	5.0%	7.0%	specimen rates	GAM94	specimen rates	specimen rates	none	5.0%	0.0%	3.9% of members' pensionable earnings

Plan	Funding Method	Inflation Rate	Nominal Discount Rate	Mortality - pre-retirement	Mortality - post-retirement	Withdrawal from Service	Ill-health	Early Retirement	Nominal Salary Increases	Nominal Pension Increase	Administrative Expense
58	Projected Unit Credit Cost	not stated	7.0%	RP-2014 Employee rates	RP-2014 Annuitant rates	none assumed	none assumed	none	6.0%	0.0%	5% of Joint Contributions
59	Aggregate Attained Age	5.5%	8.0%	RP-2014 Employee rates	RP-2014 Annuitant rates	specimen rates	none assumed	none	7.5%	0.0%	7.5% of Joint Future Contributions
60	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	1.5% of salary
61	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	1% of salary
62	Attained Age Method	7.0%	9.0%	none	GAM94S	none assumed	none assumed	none	8.0%	0.0%	1.5% of salary
63	Attained Age Method	6.5%	9.0%	A67/70	GAM94	specimen rates	specimen rates	none	9.0%	5% (if exit or retire before March 31, 2021), 0% after	1.5% of members' pensionable earnings
64	Projected Unit Credit Cost	not stated	7.0%	RP-2014 Employee rates	RP-2014 Annuitant rates	specimen rates	none assumed	NRA reduced	6.5%	0.0%	15% of Service Cost

Appendix 3 – Definitions of Funding Methodologies Used by Actuaries

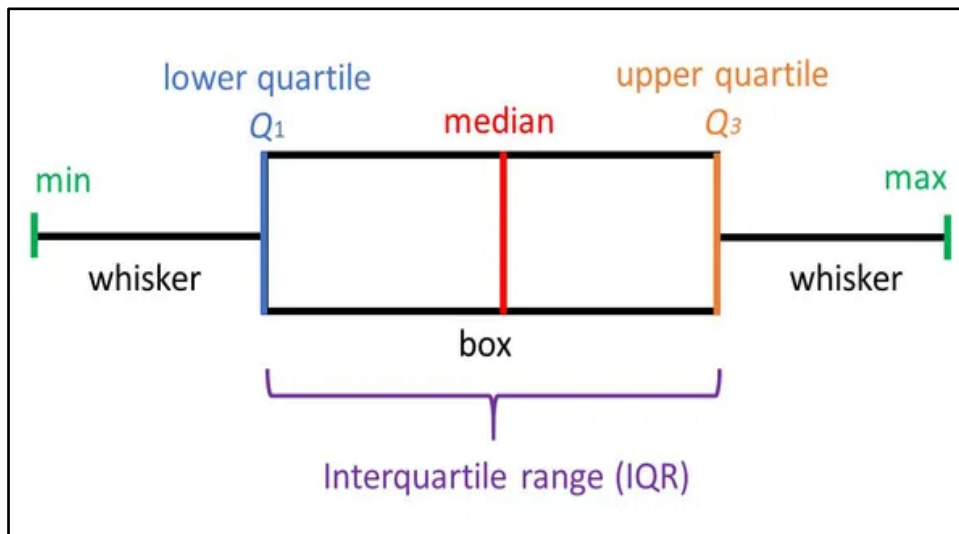
1. Attained Age Method¹³: A method under which the excess of the actuarial present value of projected benefits over the actuarial accrued liability in respect of each individual included in an actuarial valuation is allocated on a level basis over the earnings or service of the individual between the 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. (ASOP No. 4)
2. Projected and Current Unit Cost Methods: 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 $t+1$.
3. Entry Age Normal Method¹⁴: Under this method, the cost of each individual's pension is allocated on a level percent of payroll between the time employment starts (entry age) and the assumed retirement date. The goal is to spread the cost over the career of the member as a level percentage of payroll.

¹³ Attained Age Actuarial Cost Method - Actuarial Standards Board :
<https://www.actuarialstandardsboard.org/glossary/attained-age-actuarial-cost-method>

¹⁴ Entry Age Normal Funding (imrf.org) : https://www.imrf.org/AManual/Online_AA_Manual/7.20_a.htm

Appendix 4– How to Read a Box and Whisker Plot

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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

¹⁵ <https://www.simplypsychology.org/boxplots.html>