Pennsylvania Public School Employees' Retirement System

June 30, 2023 Valuation
Board Presentation
December 14, 2023

Disclosures

The information contained herein is developed for the Board of Trustees and Staff of the Pennsylvania Public School Employees' Retirement System (PSERS) by Buck Global, LLC (Buck) using actuarial principles and techniques in accordance with all applicable Actuarial Standards of Practice (ASOPs). The purpose of this document is to provide key results of the June 30, 2023 actuarial valuation for discussion at the Board meeting attended by the actuaries. Interested parties may refer to the full June 30, 2023 Actuary's Report, which is scheduled to be released in 2024, for a detailed explanation regarding data, assumptions, methods, and System provisions that underlie the valuation results. In the interim, interested parties may refer to the full Actuary's Report on the June 30, 2022 actuarial valuation for a detailed explanation regarding assumptions, methods, System provisions, and certain risks that underlie the valuation.

The material contained herein is based on census and financial data, actuarial assumptions and methods, and System provisions applicable to the June 30, 2023 actuarial valuation of PSERS. Where presented, historical information is based on the parameters of the corresponding actuarial valuation.

Use of this presentation for any other purpose than as stated may not be appropriate and may result in mistaken conclusions because of failure to understand applicable assumptions, methods, or inapplicability of the presentation for that purpose. No third-party recipient of Buck's work product should rely upon Buck's work product absent involvement of Buck or without our approval.

Where presented, references to "funded ratio" and "unfunded accrued liability" are to measurements made on the basis of the actuarial value of assets. It should be noted that the same measurements made using the market value of assets would result in different funded ratios and unfunded accrued liabilities. Moreover, the funded ratios presented are appropriate for evaluating the need for and level of future contributions but provide no indication of the funded status of the System if the System were to settle (i.e., purchase annuities to cover) a portion or all of its liabilities.

Disclosures

Future actuarial measurements may differ significantly from current measurements due to System experience differing from that anticipated by the economic and demographic assumptions, increases or decreases expected as part of the natural operation of the methodology used for these measurements, and changes in System provisions or applicable law. An analysis of the potential range of future results is beyond the scope of this valuation.

Actuarial Standard of Practice No. 56 ("ASOP 56") provides guidance to actuaries when performing actuarial services with respect to designing, developing, selecting, modifying, using, reviewing, or evaluating models. Buck uses:

Third-party software in the performance of annual actuarial valuations and projections to calculate the liabilities associated with the provisions of the System using data and assumptions as of the measurement date under the funding methods specified in this report. An internally developed model that applies applicable funding methods and policies to the liabilities derived from the output of the third-party software and other inputs, such as System assets and contributions, to generate many of the exhibits found in this report.

Buck has an extensive review process whereby the results of the liability calculations are checked using detailed sample output, changes from year to year are summarized by source, and significant deviations from expectations are investigated. Other outputs and the internal model are similarly reviewed in detail and at a high level for accuracy, reasonability and consistency with prior results. Buck also reviews the third-party model when significant changes are made to the software or model. The review is performed by experts within the company who are familiar with applicable funding methods as well as the manner in which the model generates its output. If significant changes are made to the internal model, extra checking and review are completed.

David L. Driscoll and Maria E. Simmers are Fellows of the Society of Actuaries and Members of the American Academy of Actuaries. Salvador Nakar is a Member of the American Academy of Actuaries. We meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. We are available to answer any questions on the material contained herein, or to provide explanations or further details as may be appropriate.

Agenda

- Overview of 2022/2023 fiscal year
- Review of Shared Risk determination
- Report on June 30, 2023 valuation results
- Risk Information
- Actuarial Standards of Practice Nos. 27 & 35

Overview of 2022/2023 Fiscal Year

- The time-weighted rate of return on the market value of assets was 3.54% (per Aon)
  - Expected return for the period July 1, 2022 to June 30, 2023 was 7.00%
  - Due to the asset smoothing method approach for determining the Actuarial Value of Assets (AVA), the AVA rate of return for the year was approximately 6.50%, which reflects continued recognition of past investment gains and losses

- The proportion of eligible participants who are assumed to elect Premium Assistance coverage for determination of the Premium Assistance contribution rate decreased from 61% to 60% for fiscal year 2023/2024 and thereafter.

- The assumed proportions of membership elections among new System members in fiscal year 2023/2024 and thereafter are:

  98% elect Class T-G membership,
  1% elect Class T-H membership and
  1% elect DC-only participation

Note: As discussed with PSERS staff, the new member class election assumptions is to remain the same as of June 30, 2022 valuation.

Overview of 2022/2023 Fiscal Year

- An overview of the economic assumptions since their adoption effective with the June 30, 2021 actuarial valuation

  - Expected rate of return on assets (EROA) of 7.0% - Based on Verus' Capital Market Assumptions, the expected return is 7.4%. Based on Buck's 2022 fourth quarter Capital Market Assumptions, an expected return of approximately 7.7% was developed. Both rates exceed the current 7.0% EROA.

  - Payroll growth assumption of 3.25% - The actual increase in the total payroll assumption for the last two valuation years are as follows:

Valuation Year	Contribution for Fiscal Year	Total Payroll	Increase
June 30, 2023	2024/2025	$15.590 Bil	2.2%
June 30, 2022	2023/2024	$15.260 Bil	5.3%
June 30, 2021	2022/2023	$14.497 Bil	

  - Salary increase assumption of an average of 4.5% - The actual average salary increase among continuing actives for the fiscal year 2022/2023 was approximately 5.4%.

  - While we recognize the System's policy of completing an experience study every five years, we believe that these assumptions should continue to be monitored to determine that they do not significantly differ from what the actuary deems reasonable for the purpose of the measurement.

  - We have reviewed these assumptions along with recent experience and have determined that these assumptions do not significantly conflict with what, in our professional judgement, are reasonable for the purpose of the measurement.

Shared Risk Determination - July 1, 2024 to June 30, 2027

Act 5-2017 Class T-E, Class T-F, Class T-G and Class T-H Shared Risk Contributions

- Commencing with the annual actuarial valuation for the period ending June 30, 2014, and every three years thereafter, the Board compares the actual investment rate of return, net of fees, to the annual interest rate adopted by the Board for the calculation of the normal contribution rate, based on the market value of assets, for the prior ten-year period.

- If the actual time-weighted investment rate of return, net of fees, is less than the annual interest rate adopted by the Board by an amount of 1.00% or more, the shared risk contribution rate of Class T-E and Class T-F members will increase by 0.50% and the shared risk contribution rate for Class T-G and Class T-H members will increase by 0.75%.
  - If the actual time-weighted investment rate of return, net of fees, is equal to or exceeds the annual interest rate adopted by the Board by less than 1.00%, the shared risk contribution rate of Class T-E and Class T-F members will decrease by 0.50% and the shared risk contribution rate for Class T-G and Class T-H members will decrease by 0.75% provided the total member contribution rate on the date of the actuarial valuation is above the member’s basic contribution rate.

- If the actual time-weighted investment rate of return, net of fees, is more than the annual interest rate adopted by the Board by an amount of 1.00% or more, the shared risk contribution rate of Class T-E and Class T-F members will decrease by 0.50% and the shared risk contribution rate for Class T-G and Class T-H members will decrease by 0.75%.
  - If the actual time-weighted investment rate of return, net of fees, is equal to or below the annual interest rate adopted by the Board by less than 1.00%, the shared risk contribution rate of Class T-E and Class T-F members will increase by 0.50% and the shared risk contribution rate for Class T-G and Class T-H members will increase by 0.75% provided the total member contribution rate on the date of the actuarial valuation is below the member’s basic contribution rate.

Shared Risk Determination - July 1, 2024 to June 30, 2027

Subject to the following provisions:

- If the Retirement System's total funded ratio based on the actuarial value of assets is at least 100% as of the measurement date, the shared risk contribution rate shall not be greater than zero.

- For any fiscal year in which the employer contribution rate is lower than the final contribution rate under section 8328(h), the total member contribution rate for Class T-E, Class T-F, Class T-G and Class T-H members shall be reset to the basic contribution rate provided the total member contribution rate is at or above the basic contribution rate.

- There shall be no increase in the member contribution rate if there has not been an equivalent increase to the employer contribution rate over the previous three-year period.

- Shared risk member contributions for Class T-E, Class T-F, Class T-G and Class T-H service shall not be made in any fiscal year in which the Commonwealth fails to make the annually required contribution to the fund as provided under section 8328.

None of the above provisions currently apply.

A summary of the Act 5-2017 shared risk provisions is supplied in the Appendix.

Shared Risk Determination - July 1, 2024 to June 30, 2027

Act 5-2017 Class T-E/T-F/T-G/T-H Shared Risk

- The geometric average time-weighted rate of return, net of fees, for the ten-year period ending June 30, 2023, is 7.46% per annum, as calculated by Aon

- Annual interest rates adopted by the Board for the ten annual actuarial valuations
  - June 30, 2014: 7.50%
  - June 30, 2015: 7.50%
  - June 30, 2016: 7.25%
  - June 30, 2017: 7.25%
  - June 30, 2018: 7.25%
  - June 30, 2019: 7.25%
  - June 30, 2020: 7.25%
  - June 30, 2021: 7.00%
  - June 30, 2022: 7.00%
  - June 30, 2023: 7.00%

- The geometric average of the annual interest rates adopted by the Board over the ten-year period is 7.22%.

If the annual interest rate adopted by the Board for the calculation of the normal contribution rate is changed during the period used to determine the shared risk contribution rate, the Board, with the advice of the actuary, shall determine the applicable rate during the entire period, expressed as an annual rate.

Shared Risk Determination - July 1, 2024 to June 30, 2027

- The June 30, 2023 shared risk valuation
  - The June 30, 2020 shared risk valuation increased the contribution rate of Class T-E and Class T-F members by 0.50% and the contribution rate of Class T-G and Class T-H members by 0.75%, effective July 1, 2021.
  - The geometric average time-weighted market rate of return, net of fees, of 7.46% is greater than 7.22% (average of the annual interest rates adopted by the Board over the same ten-year period) by less than 1.00%.
  - The shared risk contribution rate of Class T-E and Class T-F members will decrease by 0.50% and the shared risk contribution rate for Class T-G and Class T-H members will decrease by 0.75% resulting in a shared risk contribution rate of 0.00% for these classes.

- The contribution rates for Class T-E, Class T-F, Class T-G and Class T-H members will return to the basic rates of 7.50%, 10.30%, 5.50% and 4.50%, respectively, for the period 7/1/2024 to 6/30/2027.

- The next shared risk valuation is to be performed for the ten-year period ending June 30, 2026.

Results of Actuarial Valuation

Employer contribution rate

- The fiscal year 2024/2025 actuarially required employer contribution rate is 33.90%
  32.92% Pension plus;
  0.63% Premium Assistance plus;
  0.35% Act 5 DC contribution*

- The Act 120 minimum employer pension rate is the employer normal cost rate of 5.68%

- The fiscal year 2023/2024 actuarially required employer contribution rate is 34.00%
  33.09% Pension plus;
  0.64% Premium Assistance plus;
  0.27% Act 5 DC contribution*

* Estimated average DC contribution rate. The actual employer DC contribution rate will be based on each employer's Class T-G, Class T-H and DC-only membership/participation.

Results of Actuarial Valuation

- Security of promised benefits
  - Accrued liability exceeds actuarial value of assets by $42.3 billion
    - As of June 30, 2022, the accrued liability exceeded actuarial value of assets by $44.0 billion
  - Funded status based on the System's actuarial value of assets is 63.6%
    - Funded status as of June 30, 2022 based on the System's actuarial value of assets was 61.6%

  Note: The above funded ratios have no relationship to the possible funded position on a settlement-of-liabilities basis.

- Decrease of Unfunded Actuarial Accrued Liability due to 2023 Net Actuarial Gain
  - Comparison of actual experience to expected
  - Experience gain for fiscal year ended June 30, 2023 is $0.609 billion
    - Actuarial value of assets loss of $0.352 billion
    - Actuarial liability gain of $0.602 billion
    - The fiscal year 2022/2023 actuarially required employer contribution rate was received. However, greater than anticipated contribution amounts were credited to the System resulting in a gain of $0.359 billion.

PSERS
FUNDED STATUS AND EMPLOYER RATE

ACTUARIAL PROJECTION MODEL

PSERS Data Inputs

- Membership Data
- Asset Data
- Benefit Provisions

Actuarial Inputs

- Funding Methodology
- Actuarial Assumptions

Active Membership Statistics

Item	June 2023	June 2022
Class T-C	2,128	2,391
Class T-D	131,841	139,161
Class T-E	49,771	53,374
Class T-F	12,528	13,082
Class T-G	54,281	39,655
Class T-H	271	210
DC-Only Participants	912	520
Total Number	251,732	248,393
	1.13%	
Annualized salaries (in billions)	$ 15.031	$ 14.416
(Total salaries)	+ 4.27%	
Average compensation	$ 59,709	$ 58,036
	+2.88%	
Average age	45.4 Yrs.	45.4 Yrs.
Average service	11.9 Yrs.	12.0 Yrs.
Funding year	2024-2025	2023-2024
Total employer payroll (est. in billions)	$ 15.590	$ 15.260

Annutant Membership Statistics

Item	June 2023	June 2022
Number		
Annuitants	227,671	225,081
Survivors and beneficiaries*	13,438	13,100
Disabled annuitants	8,615	8,720
Total	249,724	246,901
	+1.14 %	
Annual annuities		
Annuitants	$ 6.132 Bil	$ 6.042 Bil
Survivors and beneficiaries	0.221	0.209
Disabled annuitants	0.189	0.188
Total	$ 6.542 Bil	$ 6.439 Bil
	+1.63 %	
Average annuities		
Annuitants	$ 26,934	$ 26,842
Survivors and beneficiaries	$ 16,429	$ 15,982
Disabled annuitants	$ 21,957	$ 21,526
Total	$ 26,197	$ 26,078
	+0.46 %	

* Excludes 2,433 beneficiaries in 2023 and 1,776 beneficiaries in 2022 who are only entitled to a lump sum distribution.

Market Value of Assets

Item	June 2023	June 2022
Beginning of year	$ 70.664 Bil	$ 72.100 Bil
Contributions	6.538	6.249
Benefits	(7.694)	(7.368)
Investment income*	2.745	(0.317)
End of year	$ 72.253 Bil	$ 70.664 Bil
Rate of return	3.54 % *(per Aon)*	2.23 % *(per Aon)*
Expected rate of return**	7.00 %	7.00 %

* Net of administrative and investment expenses

** Based on prior year's valuation interest rate

Actuarial Value of Assets
Ten-year asset smoothing method

1. Market value of assets June 30, 2023 $ 72.253 Bil

2. Determination of deferred gain (loss)

Fiscal Year	Gain (Loss)	Recognized Amount – FY22/23	Percent Deferred	Deferred Amount
2022/2023	$ (2.160) Bil	$ (0.216) Bil	90.00 %	$ (1.943) Bil
2021/2022	(4.985)	(0.499)	80.00	(3.988)
2020/2021	10.116	1.012	70.00	7.081
2019/2020	(3.440)	(0.344)	60.00	(2.064)
2018/2019	(0.600)	(0.060)	50.00	(0.300)
2017/2018	0.551	0.055	40.00	0.220
2016/2017	0.847	0.085	30.00	0.254
2015/2016	(3.794)	(0.379)	20.00	(0.759)
2014/2015	(2.918)	(0.292)	10.00	(0.292)
2013/2014	2.864	0.286	0.00	0.000
	$ (3.519) Bil	$ (0.352) Bil		$ (1.791) Bil

3. Preliminary actuarial value of assets June 30, 2023: (1) – (2) $ 74.044 Bil

Actuarial Value of Assets
Ten-year asset smoothing method

4. Per Act 5 of 2017, the Actuarial Value of Assets must be in a 30% range of the Market Value of Assets:
    a. Preliminary Actuarial Value of Assets = $74.044 Billion
    b. 70% of the Market Value of Assets = 0.70 x $72.253 Billion = $50.577 Billion
    c. 130% of the Market Value of Assets = 1.30 x $72.253 Billion = $93.929 Billion
    d. Actuarial Value of Assets = (a) not less than (b) nor greater than (c) = $74.044 Billion

Notes:

- The 30% corridor limits how far the 10-year asset smoothing method can depart from market value of assets.
- The corridor will (decrease)/increase the unfunded accrued liability contribution rate if the actuarial value of assets is (less than 70%)/greater than 130% of the market value of assets.

Actuarial Cost Method

- PSERS Cost Method
  - Entry Age Normal
  - Required by Code
- Entry age normal method: allocation of reserve over members’ working lifetimes
  - Pension benefit earned during year (normal cost)
  - Payment toward unfunded accrued liability
- Goal: full reserve at retirement

Accrued Liability

	June 2023	June 2022
Annuitants and Inactives	$ 65.482 Bil	$ 64.803 Bil
Active Members	50.761	49.674
Pension Accrued Liability	$ 116.243 Bil	$ 114.477 Bil
Healthcare Payments	0.141	0.135
Total Accrued Liability	$ 116.384 Bil	$ 114.612 Bil

Unfunded Accrued Liability and Funded Status

Item	June 2023	June 2022
Pension Accrued Liability	$116.243 Bil	$114.477 Bil
Healthcare Payments	0.141	0.135
Total Accrued Liability	$116.384 Bil	$114.612 Bil
Assets		
Market value of assets	$72.253 Bil	$70.664 Bil
Actuarial value of assets	$74.044 Bil	$70.647 Bil
Unfunded accrued liability		
Market value of assets*	$44.131 Bil	$43.948 Bil
Actuarial value of assets	$42.340 Bil	$43.965 Bil
Funded status		
Market value of assets	62.1%	61.7%
Actuarial value of assets	63.6%	61.6%

* Similar to GASB 67 Net Pension Liability.

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Employer Contribution Rate

Item	June 2023 (FY24/25)	June 2022 (FY23/24)
Normal cost rate	13.05%	13.30%
Member rate (average)	(7.37)	(7.44)
Employer normal cost rate	5.68%	5.86%
Unfunded accrued liability rate	27.24	27.23
Total pension rate*	32.92%	33.09%
Health insurance rate	0.63	0.64
Act 5 DC contribution rate**	0.35	0.27
Total***	33.90%	34.00%

* The total pension rate cannot be less than the employer normal cost rate .

** Estimated average DC contribution rate. The actual employer DC contribution rate will be based on each employer's Class T-G, Class T-H and DC-only membership/participation.

*** The total employer contribution rate is the sum of the final pension rate, health insurance rate and Act 5 DC contribution rate.

Funding Methodology

Goal - Full Reserve at Retirement

Benefit	Annual Cost	Rate Component
Projected Retirement Benefit	Level % Pay	Normal Cost Rate
Accrued Benefit:		
(1) Unfunded accrued liability as of the June 30, 2010 valuation	24-Year Amortization Level % Pay	Accrued Liability Rate
(2) Legislation that increases liability (e.g. COLAs or ERI windows)	10-Year Amortization Level % Pay	Supplemental Liability Rate
(3) Annual Actuarial Gains/Losses and Assumption Changes	24-Year Amortization Level % Pay	Experience Adjustment Factor

Unfunded Accrued Liability Rate

Rate Component	June 2023 (FY24/25)	June 2022 (FY23/24)
Accrued liability rate	11.60%	11.48%
Supplemental liability rate	0.00	0.00
Experience adjustment factor	15.64	15.75
Unfunded accrued liability rate	27.24%	27.23%

2023 Net Actuarial Gain

1.	Investment return loss[1]	$ 352 Mil
2.	Accrued liability experience (gains) and losses[2]	
	- New entrants, pickups, and rehires	351
	- Individual salary increases	(599)
	- Mortality	(46)
	- Retirement/disability/terminations	(207)
	- Miscellaneous	(101)
	- Total	$ (602) Mil
3.	Actual contributions greater than expected	$ (359) Mil
4.	Net actuarial experience gain: (1) + (2) + (3)	$ (609) Mil

1. 6.50% actual rate of return on the Actuarial Value of Assets vs. the assumed 7.00% rate of return.
2. Experience (gains) reduce the System's unfunded accrued liability and experience losses increase the System's unfunded accrued liability.

Health Insurance Account 2024/2025 Employer Rate

Estimated number of eligible annuitants in FY 2025/2026		159,200
Estimated number of eligible annuitants who elect coverage		95,520
1. Estimated balance at 6/30/2024	$	133.5 Mil
2. Disbursements FY 2024/2025	$	114.8
3. Disbursements FY 2025/2026	$	116.0
4. Required contribution: (2) + (3) – (1)	$	97.3
5. FY 2024/2025 membership payroll	$	15,590 Mil
6. Health insurance employer rate: (4) ÷ (5) (rounded up)		0.63%

Notes:
1. 60% of eligible annuitants are assumed to elect coverage.
2. Total OPEB Liability (Actuarial Accrued Liability) disclosed under GASB 74 as of June 30, 2023 is $1,950 million, based on a discount rate of 4.13%.
3. Estimated balance as of 6/30/2024 is based on a FY 2023/2024 total payroll of $15,474 Mil.

Risk Information

- **Investment risk** – Asset returns less than expected would lead to lower assets, higher unfunded liabilities and larger employer contributions
  - ➢ 10-year asset averaging helps to smooth out volatility due to the above-mentioned investment risk
  - ➢ Act 2020-128 requires annual System stress testing through 20-year projections, sensitivity analysis and simulations. Buck performed the 2022 stress test, while Aon performed the annual testing since the Act's enactment.
  - ➢ ASOP 4 requires the actuary to disclose a Low-Default-Risk Obligation Measure ("LDROM") of System liabilities and provide commentary to help intended users of this report understand the significance of the measure with respect to funded status, contributions, and member benefit security.
    - LDROM –
      - Based on "discount rates derived from low-default-risk fixed income securities whose cash flows are reasonably consistent with the pattern of benefits expected to be paid in the future."
      - Represents what the System's liability would be if the System invested its assets solely in a portfolio of high-quality bonds whose cash flows approximately match future benefit payments.
      - The difference between the LDROM and the Actuarial Accrued Liability can be thought of as representing the expected taxpayer savings / (cost) from investing in the System's diversified portfolio compared to investing only in high-quality bonds; the cost of reducing investment risk.
      - Is not an indicator of the System's funded status or progress, nor does it provide information on necessary System contributions.
    - As of June 30, 2023, the LDROM is $140.2* billion and is based on a 5.15% interest rate.
      - The interest rate was determined by calculating a single equivalent discount rate using projected benefit payments and the Buck Standard Yield Curve as of June 30, 2023.
      - The interest rate is based on bond yields applicable at the time of the measurement and will therefore vary for different measurement dates.
      - All other assumptions are the same as those used for valuation

* Excludes Health Insurance Premium Assistance.

Risk Information

- Security of member benefits
  - If this System were to be funded on an LDROM basis, member benefits currently accrued as of the measurement date may be considered more secure as investment risk may be significantly reduced.
  - Assets being invested in a diversified portfolio does not mean the participant benefits are not secure. Security of member benefits relies on a combination of the assets in the System, the investment returns generated on those assets, and the promise of future contributions from the employers.
  - Reducing investment risk by investing solely in bonds may significantly increase Actuarially Determined Contributions and therefore increase contribution risk by decreasing the ability of the employers to make necessary contributions to fund the benefits. Unnecessarily high contribution requirements in the near term may not be affordable and could imperil System sustainability and benefit security.
  - Member benefits will remain secure if reasonable and appropriate contributions with managed risk are calculated and paid.

Salary increases – In general, salaries greater than expected would lead to higher liabilities, larger unfunded liabilities and larger employer contributions. Conversely, salaries less than expected would lead to lower liabilities but may increase employer contribution rates due to lower employer payroll.

Longevity risks – Members living longer than expected would increase the System's liabilities, the unfunded liability and the employer contributions

➢ The mortality assumption uses a mortality improvement scale that mitigates some of the risk associated with members living longer

Risk Information

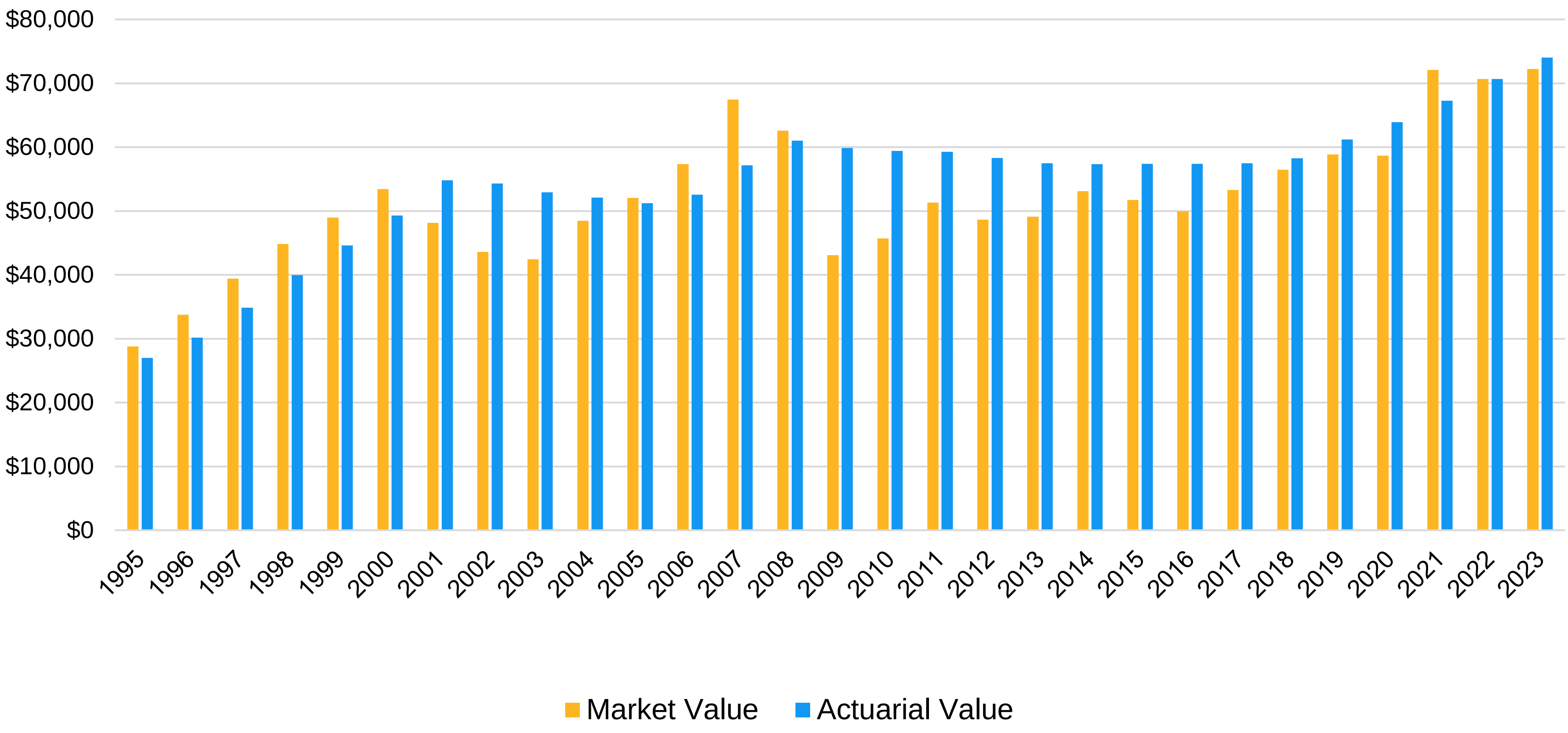
- **Declining active workforce -** Employer contributions are based on a percentage of members' and DC-only participants' salaries. If the required dollar amount of contributions remain level or increase, a declining active workforce will result in higher contribution rates in order to meet required contribution levels
- **Contribution risk** – Risk of not contributing an actuarially determined contribution. If future contributions are at levels below those presented in this report, the System may not be expected to achieve a fully funded position over the 24-year time horizon as contemplated in the statute based on the data, assumptions and methods used in the valuation

ASOPs 27 & 35 Disclosures

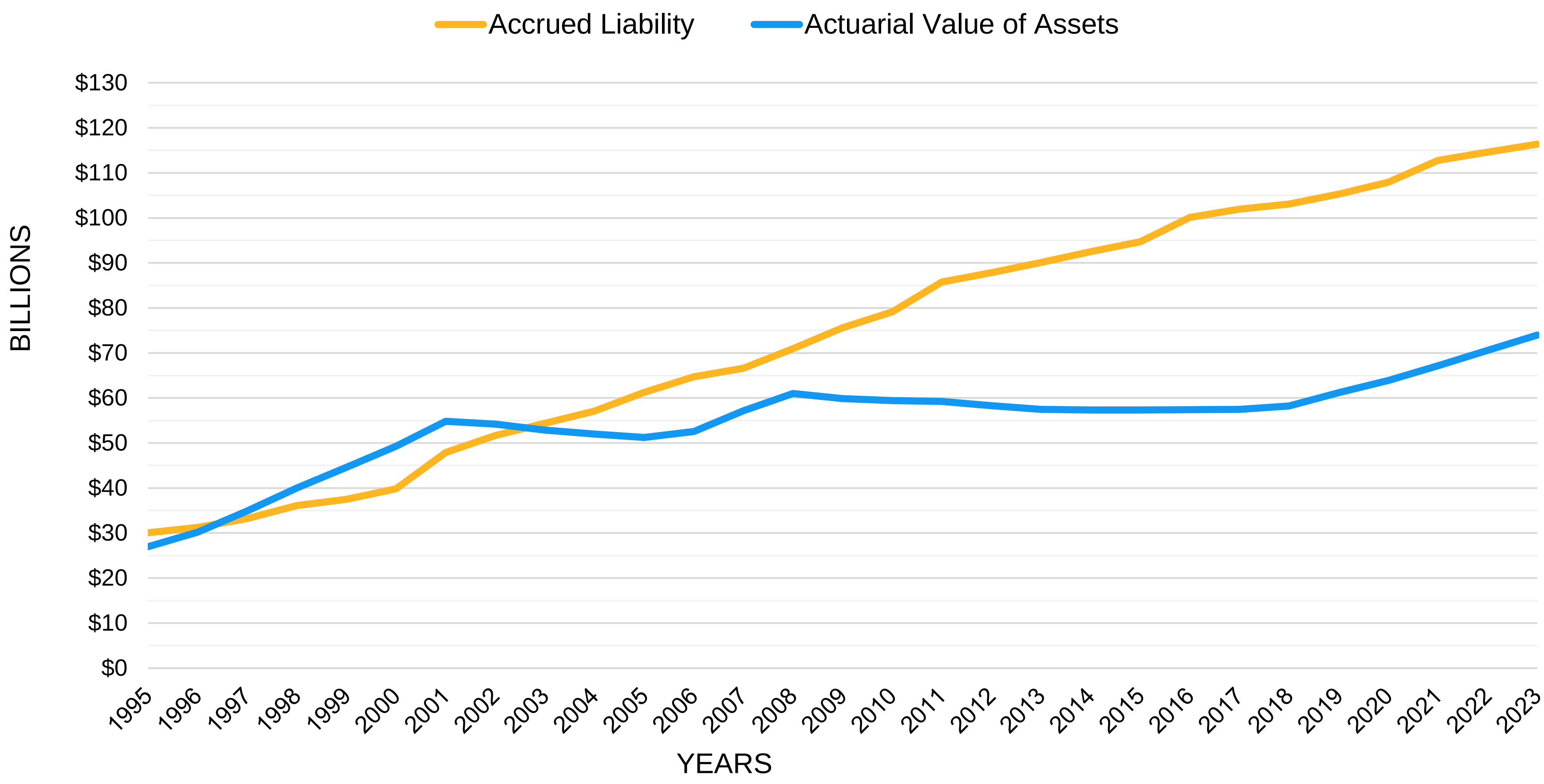
- Actuarial Standards of Practice Nos. 27 and 35 require the actuary to identify the economic and demographic assumptions that have a significant effect on the measurement and, for those that the actuary has not selected, to provide the information and analysis the actuary performed to determine that the assumption does not significantly differ from what the actuary deems reasonable for the purpose of the measurement.
- The material demographic assumptions were based on the recommendations outlined in our five-year experience study for the period July 1, 2015 to June 30, 2020, which were adopted by the Board effective with the June 30, 2021 actuarial valuation. We reviewed the assumptions along with recent experience and the assumptions are still reasonable for the current measurement.
- The material economic assumptions include the salary scale, payroll growth and expected return on assets ("EROA"). The current assumptions were based on the recommendations outlined in our five-year experience study for the period July 1, 2015 to June 30, 2020, which were adopted by the Board effective with the June 30, 2021 actuarial valuation.
  - We reviewed the salary scale and payroll growth assumptions along with recent experience and the assumptions are still reasonable for the current measurement.
  - In the case of the EROA:
    - We reviewed the analysis provided by Aon and Verus, the System's investment advisors
    - We analyzed the economic information using tools provided by Buck's Financial Risk Management ("FRM") practice
    - We have determined the EROA assumption is reasonable for the current measurement.

Appendices

Comparison of Asset Values ($ Millions)

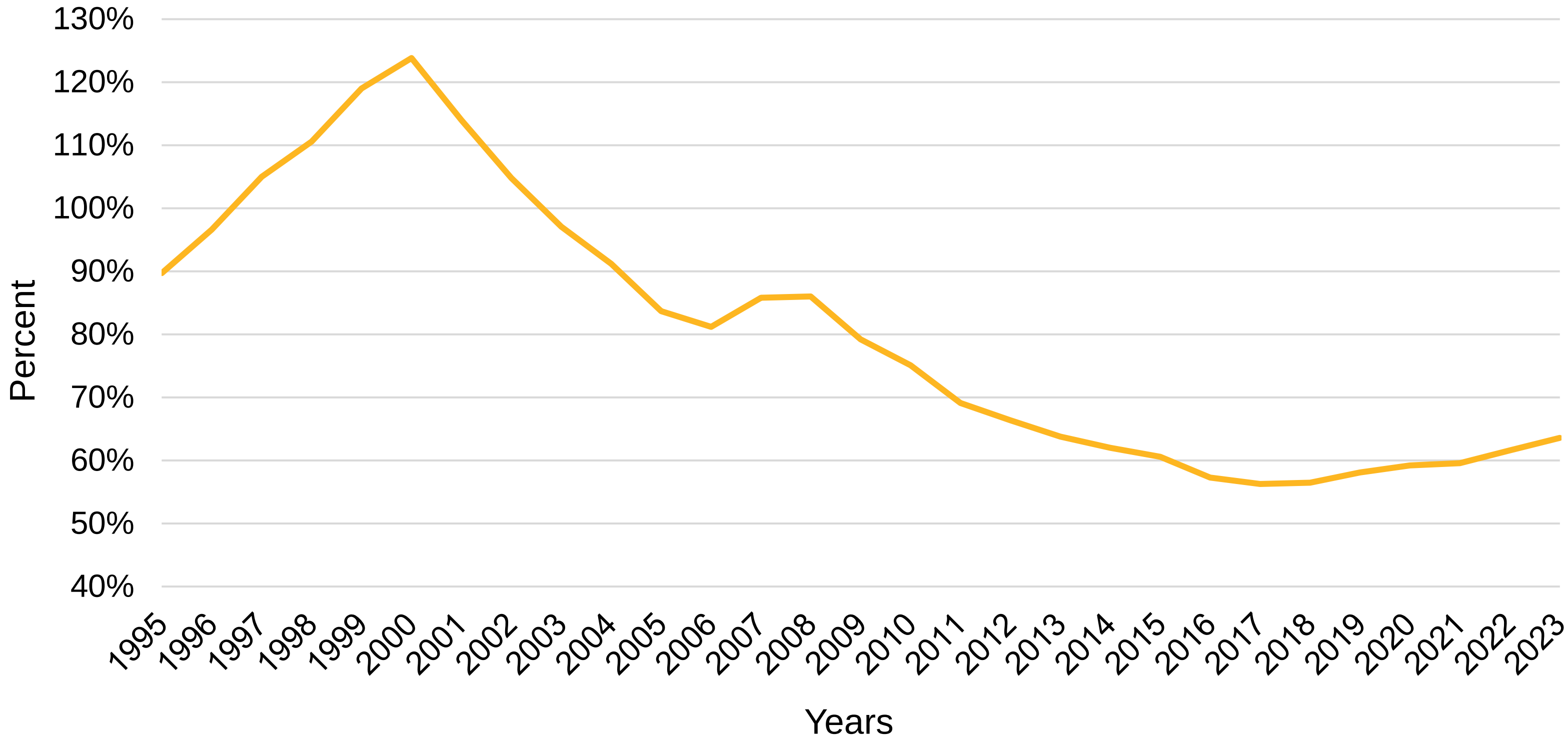


Accrued Liability and Actuarial Value of Assets: 1995 – 2023



Financial Position Funded Status

Actuarial Value of Assets as a % of Accrued Liability: 1995 - 2023

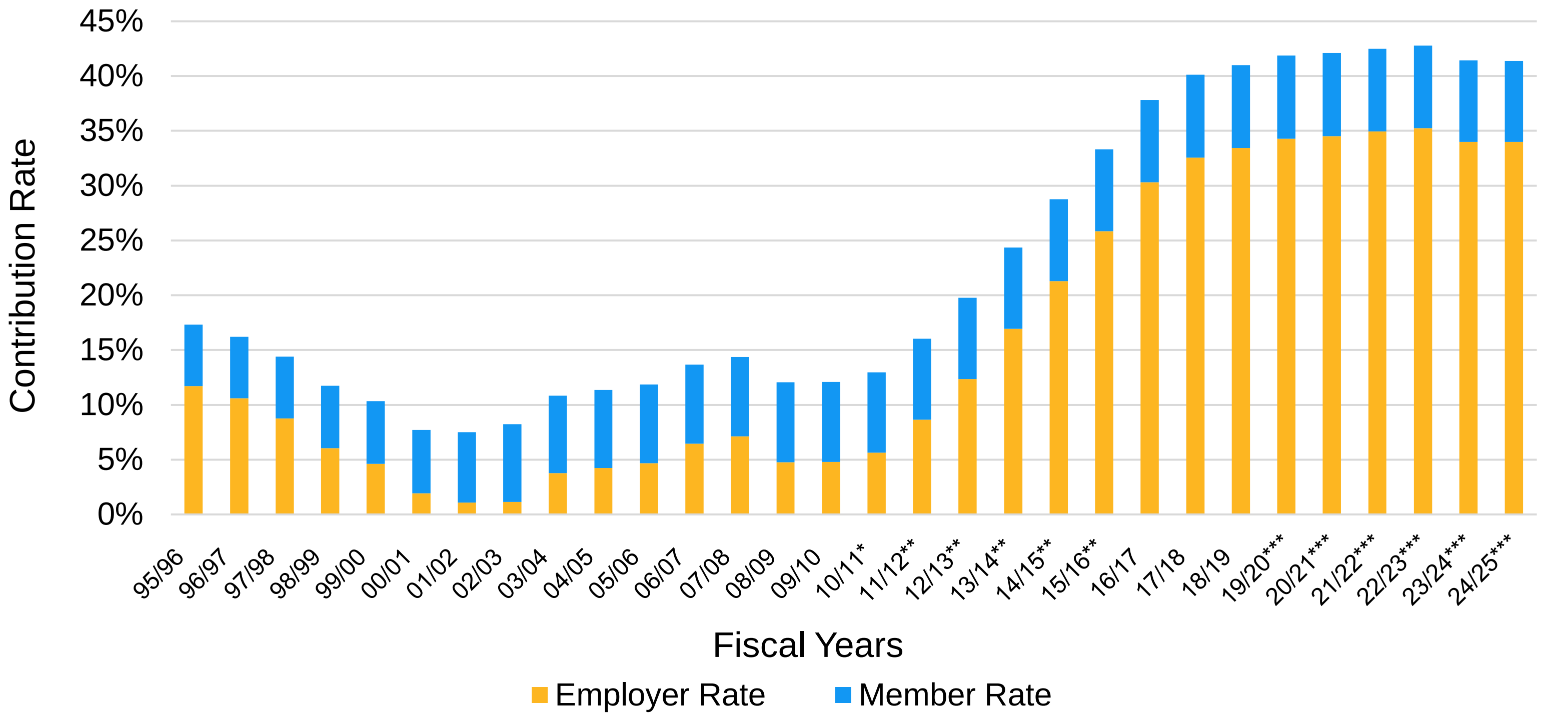


Total Contribution Rate

Fiscal Year	Normal Cost	Unfunded Accrued Liability	Health Care Contribution	DC Contribution (Average)[4]	Total Employer	Member Contribution (Average)[1]	Total Contribution Rate
24/25	5.68%	27.24%	.63%	.35%	33.90%	7.37%	41.27%
23/24	5.86	27.23	.64	.27	34.00	7.44	41.44
22/23	6.07	28.24	.75	.20	35.26	7.52	42.78
21/22	7.20	26.79	.80	.15	34.94	7.56	42.50
20/21	7.37	26.14	.82	.18	34.51	7.61	42.12
19/20	7.49	25.87	.84	.09	34.29	7.59	41.88
18/19	7.59	25.01	.83	N/A	33.43	7.57	41.00
17/18	7.70	24.04	.83	N/A	32.57	7.54	40.11
16/17	8.31	20.89	.83	N/A	30.03	7.52	37.55
15/16	8.38	19.44	.84	N/A	25.84[2]	7.49	33.33
14/15	8.46	17.51	.90	N/A	21.40[2]	7.46	28.86
13/14	8.57	15.25	.93	N/A	16.93[2]	7.43	24.36
12/13	8.66	12.99	.86	N/A	12.36[2]	7.40	19.76
11/12	8.12	10.15	.65	N/A	8.65[2]	7.37	16.02
10/11	8.08	(0.50)	.64	N/A	5.64[3]	7.34	12.98
09/10	7.35	(3.72)	.78	N/A	4.78	7.32	12.10
08/09	6.68	(3.37)	.76	N/A	4.76	7.29	12.05
07/08	6.68	(.24)	.69	N/A	7.13	7.25	14.38
06/07	6.62	(.95)	.74	N/A	6.46	7.21	13.67
05/06	7.61	(4.28)	.69	N/A	4.69	7.16	11.85
04/05	7.48	(7.10)	.23	N/A	4.23	7.12	11.35
03/04	7.25	(4.27)	.79	N/A	3.77	7.08	10.85
02/03	7.20	(10.03)	.97	N/A	1.15	7.10	8.25
01/02	5.63	(6.05)	1.09	N/A	1.09	6.43	7.52
00/01	6.29	(4.65)	.30	N/A	1.94	5.77	7.71
99/00	6.40	(2.04)	.25	N/A	4.61	5.72	10.33
98/99	6.33	(.44)	.15	N/A	6.04	5.69	11.73

1. Act 9 member rate change took effect January 1, 2002. Act 120 member rate change took effect July 1, 2011. Act 5 member rate change took effect July 1, 2019.
2. Act 120 limited the employer pension contribution of 27.82% to 25.00% for Fiscal Year 15/16 (prior rate of 20.50% + 4.50% collar), 25.97% to 20.50% for Fiscal Year 14/15 (prior rate of 16.00% + 4.50% collar), 23.82% to 16.00% for Fiscal Year 13/14 (prior rate of 11.50% + 4.50% collar), 21.65% to 11.50% for Fiscal Year 12/13 (prior rate of 8.00% + 3.50% collar) and18.27% to 8.00% for Fiscal Year 11/12 (prior rate of 5.00% + 3.00% collar).
3. Act 46 reduced the employer pension contribution from 7.58% to 5.00% for Fiscal Year 10/11.
4. Under Act 5, employers contribute 2.25% of pay for Class T-G members, 2.00% of pay for Class T-H members and 2.00% of pay for DC-only participants to the DC plan.

30-Year History of Member and Employer Contribution Rates



Notes:

* Act 46 reduced the employer pension contribution from 7.58% to 5.00% for Fiscal Year 10/11.

** Act 120 limited the employer pension contribution of 27.82% to 25.00% for Fiscal Year 15/16 (prior rate of 20.50% + 4.50 collar), 25.97% to 20.50% for Fiscal Year 14/15 (prior rate of 16.00% + 4.50% collar), 23.82% to 16.00% for Fiscal Year 13/14 (prior rate of 11.50% + 4.50% collar), 21.65% to 11.50% for Fiscal Year 12/13 (prior rate of 8.00% + 3.50% collar) and 18.27% to 8.00% for Fiscal Year 11/12 (prior rate of 5.00% + 3.00% collar).

*** Fiscal Years 2019/2020 and 2020/2021 include the anticipated Act 5 DC contribution based on the following new System Act 5 membership election: 65% elect Class T-G membership, 30% elect Class T-H membership and 5% elect DC-only participation. Fiscal Years 2021/2022 through 2024/2025 include the anticipated Act 5 DC contribution based on the following new System Act 5 membership election: 98% elect Class T-G membership, 1% elect Class T-H membership and 1% elect DC-only participation.

Summary of the Act 5-2017 Shared Risk Provisions

Act 5-2017 Class T-E, Class T-F, Class T-G and Class T-H shared risk contributions

- Commencing with the annual actuarial valuation for the period ending June 30, 2014, and every three years thereafter, the Board compares the actual investment rate of return, net of fees, to the annual interest rate adopted by the Board for the calculation of the normal contribution rate, based on the market value of assets, for the prior ten-year period.

Until the Retirement System has accumulated a ten-year period of investment rate of return experience following June 30, 2011, the look-back period used in this calculation will begin not earlier than June 30, 2011.

Summary of the Act 5-2017 Shared Risk Provisions

- If the actual time-weighted investment rate of return, net of fees, is less than the annual interest rate adopted by the Board by an amount of 1.00% or more, the shared risk contribution rate of Class T-E and Class T-F members will increase by 0.50% and the shared risk contribution rate for Class T-G and Class T-H members will increase by 0.75%.

    If the actual time-weighted investment rate of return, net of fees, is equal to or exceeds the annual interest rate adopted by the Board by less than 1.00%, the shared risk contribution rate of Class T-E and Class T-F members will decrease by 0.50% and the shared risk contribution rate for Class T-G and Class T-H members will decrease by 0.75% provided the total member contribution rate on the date of the actuarial valuation is above the member's basic contribution rate.

- If the actual time-weighted investment rate of return, net of fees, is more than the annual interest rate adopted by the Board by an amount of 1.00% or more, the shared risk contribution rate of Class T-E and Class T-F members will decrease by 0.50% and the shared risk contribution rate for Class T-G and Class T-H members will decrease by 0.75%.

    If the actual time-weighted investment rate of return, net of fees, is equal to or below the annual interest rate adopted by the Board by less than 1.00%, the shared risk contribution rate of Class T-E and Class T-F members will increase by 0.50% and the shared risk contribution rate for Class T-G and Class T-H members will increase by 0.75% provided the total member contribution rate on the date of the actuarial valuation is below the member's basic contribution rate.

Summary of the Act 5-2017 Shared Risk Provisions

- The total member contribution rate for:
  - Class T-E members shall not be less than 5.5%, nor more than 9.5%
  - Class T-F members shall not be less than 8.3%, nor more than 12.3%
  - Class T-G members shall not be less than 2.5% nor more than 8.5%
  - Cass T-H members shall not be less than 1.5% nor more than 7.5%

- If the Retirement System's total funded ratio based on the actuarial value of assets is at least 100% as of the measurement date, the shared risk contribution rate shall not be greater than zero.

- If the annual interest rate adopted by the Board for the calculation of the normal contribution rate is changed during the period used to determine the shared risk contribution rate, the Board, with the advice of the actuary, shall determine the applicable rate during the entire period, expressed as an annual rate.

- For any fiscal year in which the employer contribution rate is lower than the final contribution rate under section 8328(h), the total member contribution rate for Class T-E, T-F, T-G and T-H members shall be reset to the basic contribution rate provided the total member contribution rate is at or above the basic contribution rate.

- There shall be no increase in the member contribution rate if there has not been an equivalent increase to the employer contribution rate over the previous three-year period.

- Shared risk member contributions for Class T-E, Class T-F, Class T-G and Class T-H service shall not be made in any fiscal year in which the Commonwealth fails to make the annually required contribution to the fund as provided under section 8328.

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A Gallagher Company