Pennsylvania Public School Employees' Retirement System

June 30, 2019 Valuation
Board Presentation
December 6, 2019

BUCK

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). This document provides key results of the June 30, 2019 actuarial valuation. Interested parties may refer to the full June 30, 2019 Actuary's Report, which is scheduled to be released in January 2020, for a detailed explanation regarding data, assumptions, methods, and plan provisions that underlie the valuation results. In the interim, interested parties may refer to the full Actuary's Report on the June 30, 2018 actuarial valuation for a detailed explanation regarding assumptions, methods, plan provisions, and certain risks that underlie the valuation.

The material contained herein is based on census and financial data, actuarial assumptions and methods, and plan provisions applicable to the June 30, 2019 actuarial valuation of PSERS. Where presented, historical information is based on the parameters of the corresponding actuarial valuation. No third party recipient of Buck's work product should rely upon Buck's work product absent involvement of Buck or without our approval.

Future actuarial measurements may differ significantly from current measurements due to plan 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 plan provisions or applicable law. An analysis of the potential range of future results is beyond the scope of this valuation.

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 plan if the plan were to settle (i.e., purchase annuities to cover) a portion or all of its liabilities.

David L. Driscoll is a Fellow of the Society of Actuaries and a Member of the American Academy of Actuaries. Edward Quinn and Salvador Nakar are Members 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 2018 - 2019 fiscal year
- Report on June 30, 2019 valuation results

Overview of 2018/2019 Fiscal Year

- The time-weighted rate of return on the market value of assets was 6.68% *(per Aon)*
  - Expected return for the period July 1, 2018 to June 30, 2019 was 7.25%
  - 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 7.18%, which reflects continued recognition of past investment gains and losses
  - The asset loss from 2008/2009 (Great Recession) was fully recognized in the June 30, 2018 valuation
- The proportion of eligible participants who are assumed to elect Premium Assistance coverage for determination of the Premium Assistance contribution rate remained at 63%
- The assumed proportions of membership elections under Act 5* among new system members in fiscal 2020/2021 are:
  - 65% elect Class T-G membership,
  - 30% elect Class T-H membership and
  - 5% elect DC-only membership

* These are the assumptions used in the development of the cost note for the passage of Act 5.

Results of Actuarial Valuation

- Employer contribution rate
  - The fiscal year 2020/2021 actuarially required employer contribution rate is 34.51%
    - 33.51% Pension plus
    - 0.82% Premium Assistance plus
    - 0.18% Act 5 DC contribution*
  - The Act 120 minimum employer pension rate is the normal cost rate of 7.37%
  - The fiscal year 2019/2020 actuarially required employer contribution rate is 34.29%
    - 33.36% Pension plus
    - 0.84% Premium Assistance plus
    - 0.09% 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 Class DC-only membership.

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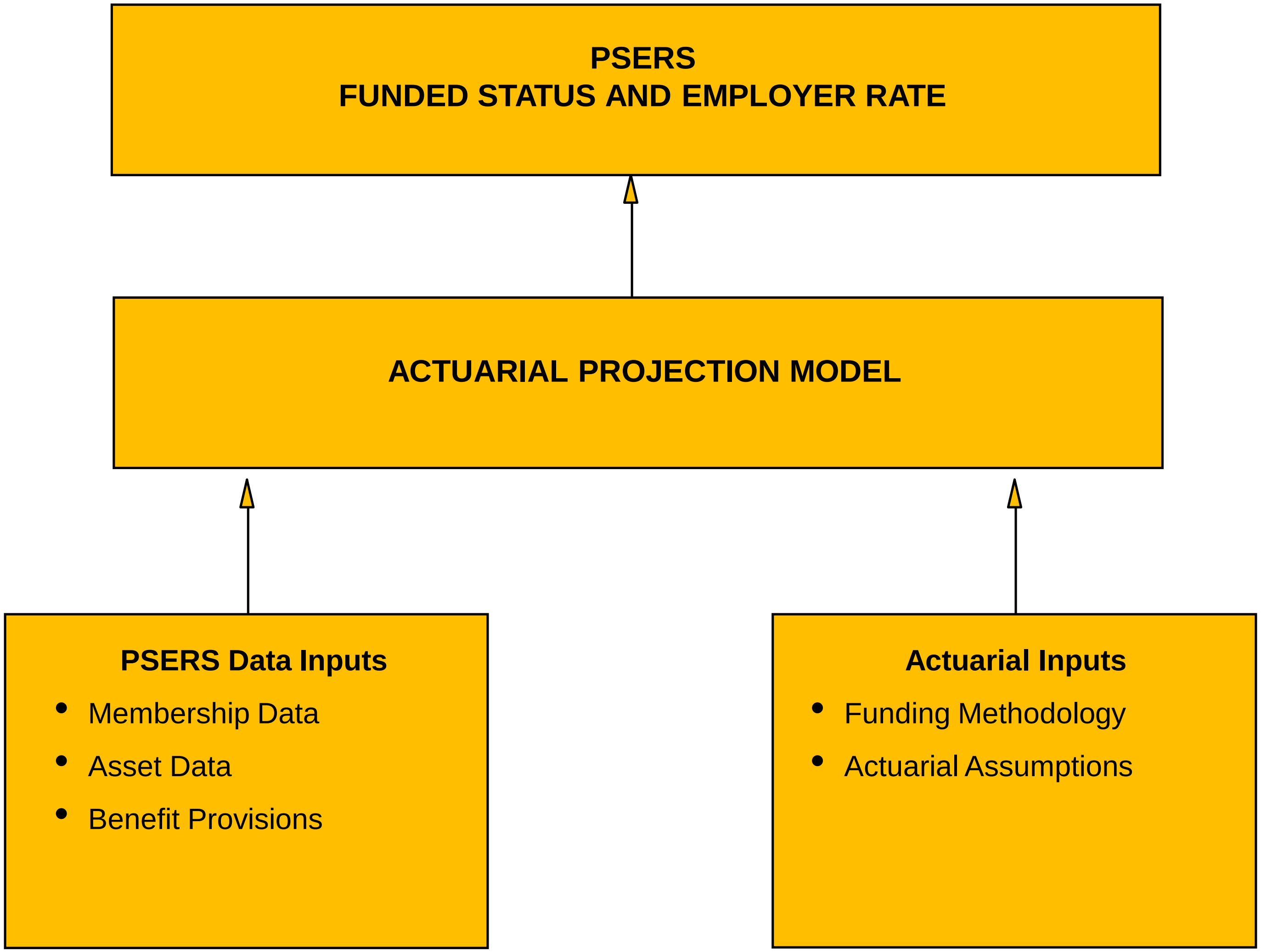
Results of Actuarial Valuation

- Security of promised benefits
  - Accrued liability exceeds actuarial value of assets by $44.1 billion
    - As of June 30, 2018, the accrued liability exceeded actuarial value of assets by $44.9 billion
    - First decrease in unfunded accrued liability in over a decade
  - Funded status based on the System's actuarial value of assets is 58.1%
    - Funded status as of June 30, 2018 based on the System's actuarial value of assets was 56.5%
    - First significant increase in funded status in over a decade

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

- Reduction of Unfunded Actuarial Accrued Liability due to 2019 Net Actuarial (Gain)
  - Comparison of actual experience to expected
  - Experience (gain) for fiscal year ended June 30, 2019 is ($0.528) billion
    - Actuarial asset loss of $0.040 billion
    - Actuarial liability (gain) of ($.568) billion
  - The fiscal year 2019 actuarially required employer contribution rate was received. There was no actuarial experience due to (over)/under-contribution.


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 2019		June 2018
Class T - C	3,010		3,216
Class T - D	167,118		175,975
Class T - E	70,521		63,880
Class T - F	15,100		13,291
Total Number	255,749		256,362
	-0.24	%	
Annualized salaries	$ 13.672	Bil	$ 13.379 Bil
(Total salaries)	+2.19	%	
Average compensation	$ 53,458		$ 52,188
	+2.43	%	
Average age	45.4	Yrs.	45.3 Yrs.
Average service	11.7	Yrs.	11.5 Yrs.
Funding year	2020-2021		2019-2020
Total employer payroll (est.)	$ 14.078	Billion	$ 13.880 Billion

Annuitant Membership Statistics

Item	June 2019	June 2018
Number		
Annuitants	216,326	212,712
Survivors and beneficiaries*	11,860	11,409
Disabled annuitants	9,153	9,167
Total	237,339	233,288
	+1.74 %	
Annual annuities		
Annuitants	$ 5.690 Bil	$ 5.579 Bil
Survivors and beneficiaries	0.176 Bil	0.164 Bil
Disabled annuitants	0.186 Bil	0.184 Bil
Total	$ 6,052 Bil	$ 5.927 Bil
	+2.11 %	
Average annuities		
Annuitants	$ 26,300	$ 26,225
Survivors and beneficiaries	$ 14,847	$ 14,406
Disabled annuitants	$ 20,348	$ 20,607
Total	$ 25,498	$ 25,405
	+0.37 %	

* Excludes 1,595 beneficiaries in 2019 and 1,752 beneficiaries in 2018 who are only entitled to a lump sum distribution.

Market Value of Assets

Item	June 2019	June 2018
Beginning of year	$ 56.486 Bil	$ 53.199* Bil
Contributions	5.666	5.388
Benefits	(6.874)	(6.767)
Investment income	3.581	4.666
End of year	$ 58.859 Bil	$ 56,486 Bil
Rate of return	6.68 % *(per Aon)*	9.27 % *(per Aon)*
Expected rate of return**	7.25 %	7.25 %

* Beginning of the year assets adjusted by ($.08) bil for accounting adjustment

** Based on prior year's valuation interest rate

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Actuarial Value of Assets
Ten-year asset smoothing method

1. Market value of assets June 30, 2019 $ 58.859 Bil

2. Determination of deferred gain (loss)

Fiscal Year	Gain (Loss)	Recognized Amount – FY18/19	Percent Deferred	Deferred Amount
2018/2019	$ (0.600) Bil	$ (0.060) Bil	90.00 %	$ (0.540) Bil
2017/2018	0.551	0.055	80.00	0.440
2016/2017	0.847	0.085	70.00	0.593
2015/2016	(3.794)	(0.379)	60.00	(2.276)
2014/2015	(2.918)	(0.292)	50.00	(1.459)
2013/2014	2.864	0.286	40.00	1.146
2012/2013	(0.153)	(0.015)	30.00	(0.046)
2011/2012	(3.246)	(0.325)	20.00	(0.649)
2010/2011	4.598	0.460	10.00	0.460
2009/2010	1.449	0.145	0.00	0.000
	$ (0.402) Bil	$ (0.040) Bil		$ (2.331) Bil

3. Preliminary actuarial value of assets June 30, 2019: (1) – (2) $ 61.190 Bil

Actuarial Value of Assets

Ten-year asset smoothing method

- Per Act 5 of 2017, the Actuarial Value of Assets must be in a 30% range of the Market Value of Assets:

    1. Preliminary Actuarial Value of Assets = $61.190 Billion
    2. 70% of the Market Value of Assets = .70 x $58.859 Billion = $41.201 Billion
    3. 130% of the Market Value of Assets = 1.30 x $58.859 Billion = $76.517 Billion
    4. Actuarial Value of Assets = (1) not less than (2) nor greater than (3) = $61.190 Billion

<u>Notes:</u>

- 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 2019	June 2018
Annuitants and Inactives	$ 59.672 Billion	$ 58.835 Billion
Active members	45.528	44.156
Accrued Liability Pension	$ 105.200	$ 102.991
Healthcare payments	0.125	0.123
Total Accrued liability	$ 105.325 Billion	$ 103.114 Billion

Unfunded Accrued Liability and Funded Status

Item	June 2019	June 2018
Accrued Liability Pension	$105.200 Bil	$102.991 Bil
Healthcare Payments	0.125	0.123
Total Accrued liability	$105.325 Bil	$103.114 Bil
Assets		
Market value of assets	$58.859 Bil	$56.486 Bil
Actuarial value of assets	$61.190 Bil	$58.258 Bil
Unfunded accrued liability		
Market value of assets*	$46,466 Bil	$46.628 Bil
Actuarial value of assets**	$44.135 Bil	$44.856 Bil
Funded status		
Market value of assets	55.9%	54.8%
Actuarial value of assets	58.1%	56.5%

* Similar to GASB 67 Net Pension Liability.

** Act 120 amortization is over a period of 24 years with amounts increasing as a level percent of compensation.

Employer Contribution Rate

Item	June 2019 (FY20/21)	June 2018 (FY19/20)
Normal cost rate	14.98%	15.08%
Member rate (average)	(7.61)	(7.59)
Employer normal cost rate	7.37%	7.49%
Unfunded accrued liability rate	26.14	25.87
Total pension rate*	33.51%	33.36%
Health insurance rate	0.82	0.84
Act 5 DC contribution rate**	0.18	0.09
Total***	34.51%	34.29%

* The total pension rate can not 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 Class DC-only membership.

*** 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 which increase 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 2019 (FY20/21)	June 2018 (FY19/20)
Accrued liability rate	11.27%	11.04%
Supplemental liability rate	0.00	0.00
Experience adjustment factor	14.87	14.83
Unfunded accrued liability rate	26.14%	25.87%

2019 Net Actuarial (Gain)

1.	Investment return loss[1]	$	40 Mil
2.	Experience (gains) and losses[2]		
	- New entrants and pickups		250
	- Individual salary increases		(576)
	- Mortality		(10)
	- Terminations (retirement/disability/terminations)		(114)
	- Miscellaneous		(118)
	- Total	$	(568) Mil
3.	Net actuarial experience (gain): (1) + (2)	$	(528) Mil

1 7.18% actuarial rate of return vs. 7.25% expected. Actuarial rate of return based on 10-year averaging of (gains)/losses.

2 Experience (gains) reduce the System's unfunded accrued liability and experience losses increase the System's unfunded accrued liability.

Health Insurance Account 2020/2021 Employer Rate

Estimated number of eligible annuitants in FY 2021/2022		156,500
Estimated number of eligible annuitants who elect coverage		98,595
1. Estimated balance at 6/30/2020	$	124.4 Mil
2. Disbursements FY 2020/2021	$	119.0
3. Disbursements FY 2021/2022	$	120.4
4. Required contribution: (2) + (3) – (1)	$	115.0
5. FY 2020/2021 membership payroll	$	14,078 Mil
6. Health insurance employer rate: (4) ÷ (5) (rounded up)		0.82%

Notes:

1. 63% of eligible annuitants are assumed to elect coverage. This is the same assumption used in the prior valuation.
2. Actuarial Accrued Liability disclosed under GASB 74 as of June 30, 2019 is $2,252 million, based on a discount rate of 2.79%.

ASOP 51 Disclosures

New Actuarial Standard of Practice on Risk Assessment

The Actuarial Standards Board approved a new Actuarial Standard of Practice No. 51 (ASOP 51 or Standard) regarding risk assessment when performing a funding valuation for a pension plan. Implementation of the new ASOP 51 is effective with the June 30, 2019 actuarial valuation.

ASOP 51 requires actuaries to identify risks that "may reasonably be anticipated to significantly affect the plan's future financial condition". Investment risk, asset/liability mismatch risk, interest rate risk, longevity and other demographic risks and contribution risk are cited as examples in ASOP 51. The Standard does not require the actuary to evaluate the likelihood of contributing entities to make contributions when due, nor does it require the actuary to assess the likelihood or consequences of future changes in applicable law.

The actuary's assessment can be qualitative or quantitative (e.g., based on numerical demonstrations). The actuary may use non-numerical methods for assessing risks that might take the form of commentary about potential adverse experience and the likely effect on future results. While the Standard does not require that every valuation include a quantitative risk assessment, the actuary may recommend that a more detailed risk assessment be performed. When making that decision, the actuary will take into account such factors as the System's design, maturity, size, funded status, asset allocation, cash flow, possible insolvency and current market conditions.

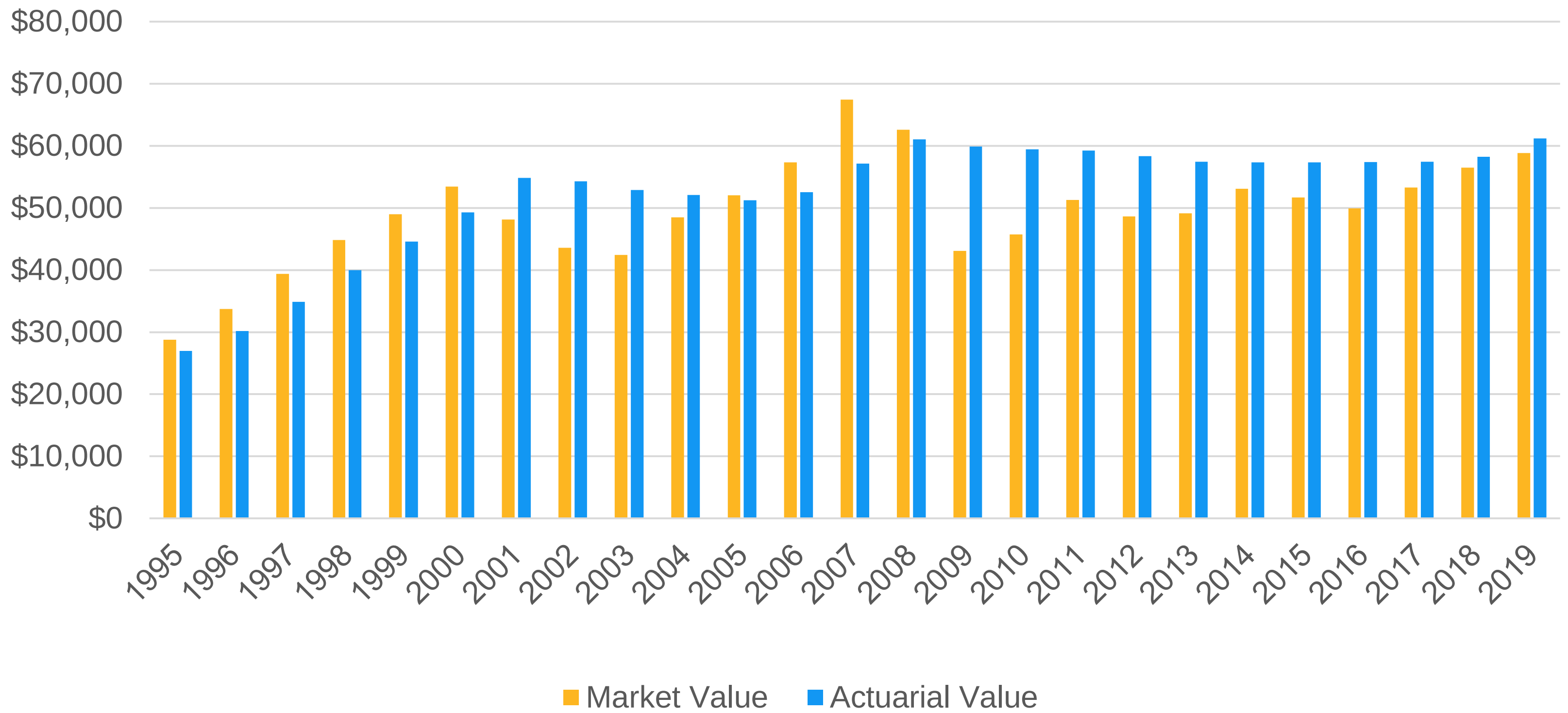
The Standard also requires disclosure of System maturity measures and other historical information that are significant to understanding the risks associated with the System. This information will be included in June 30, 2019 Valuation Report.

ASOP 51 Disclosures

- **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
- **Salary increases** – Salaries greater than expected would lead to higher liabilities, larger unfunded liabilities and larger employer contributions. 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
- **Declining active workforce -** Employer contributions are based on a percentage of 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

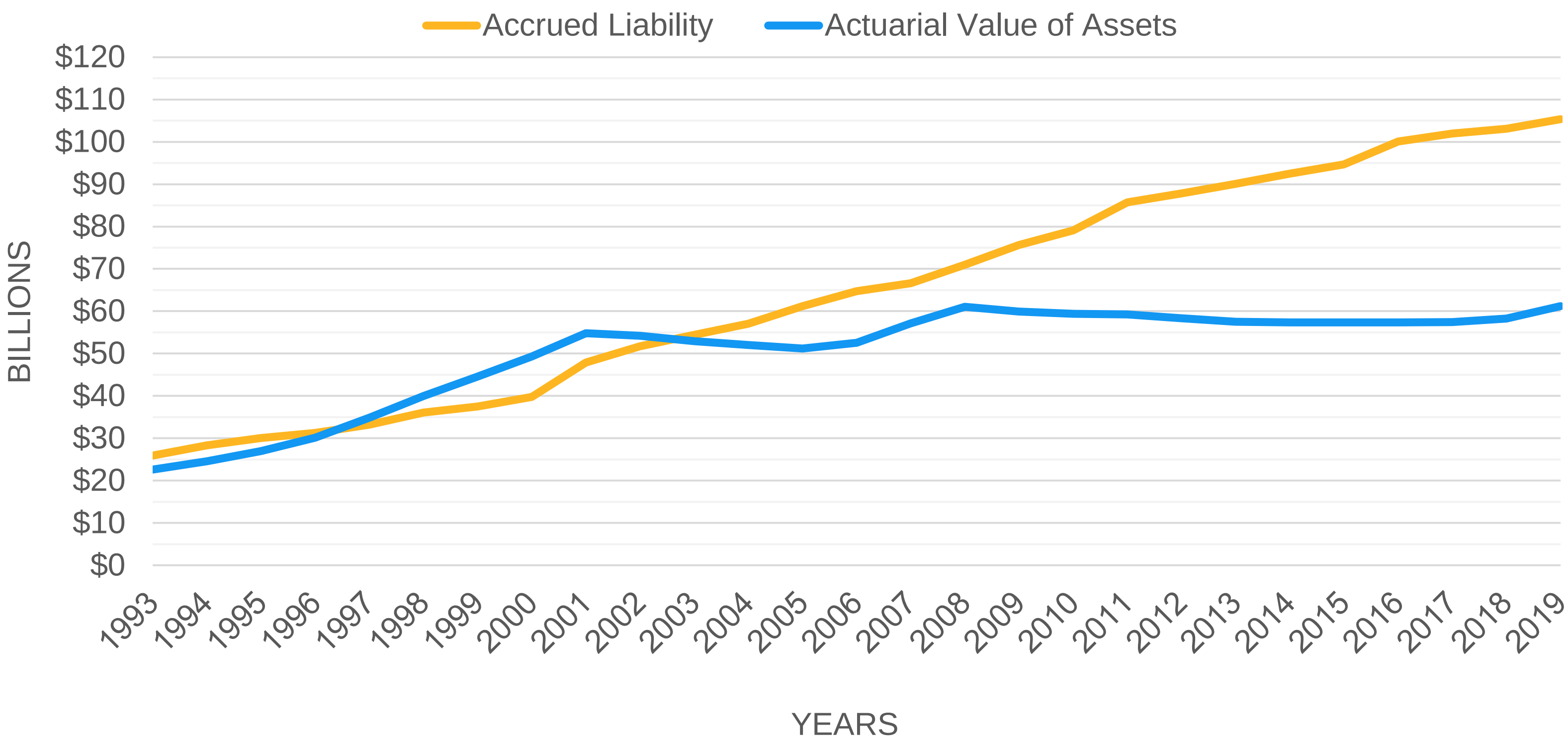
Appendices

Comparison of Asset Values ($ Millions)



Note: Beginning with the 2010 valuation, the actuarial value of assets reflects the 10-year asset smoothing method enacted by Act 120.

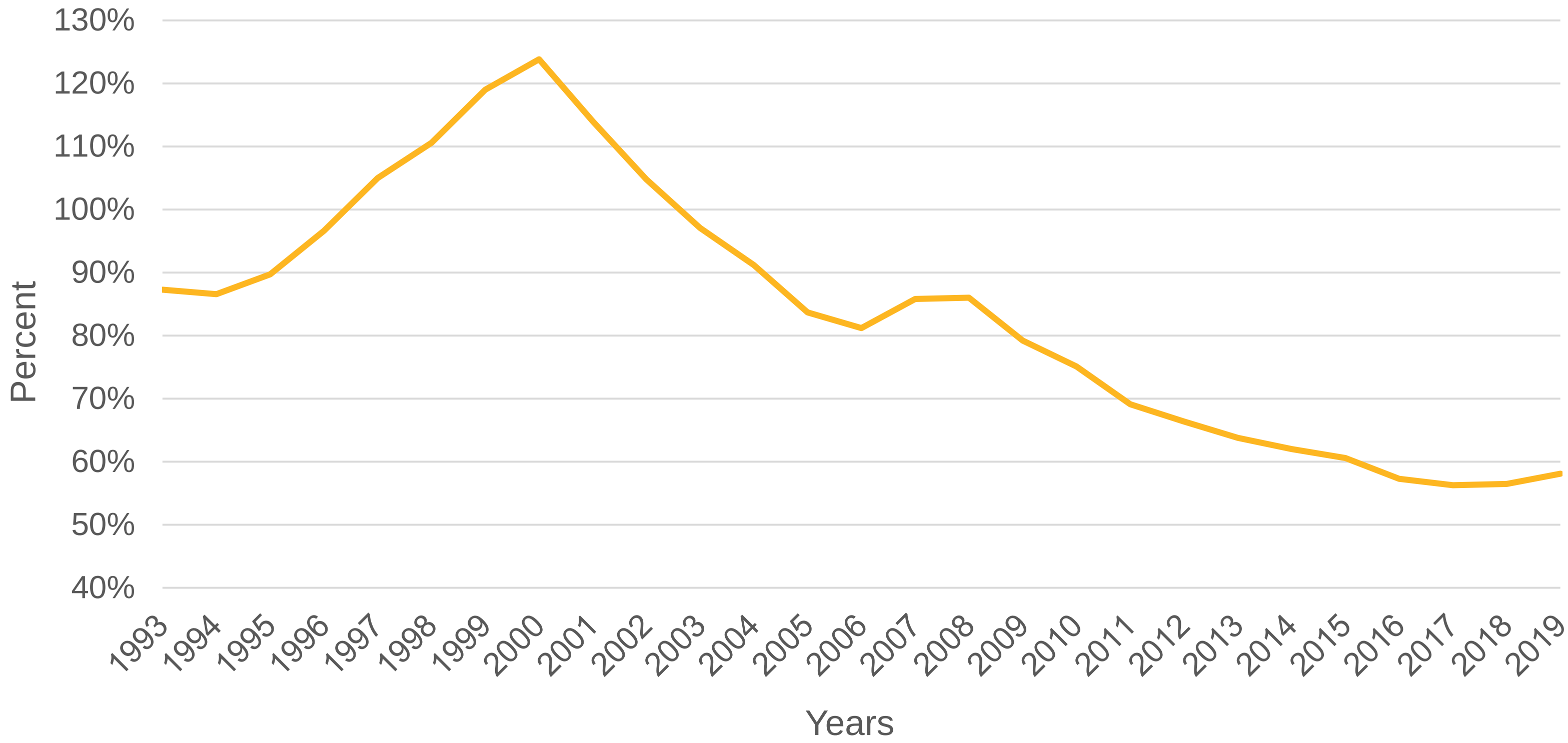
Accrued Liability and Actuarial Value of Assets: 1993 - 2019



Note: Beginning with the 2010 valuation, the actuarial value of assets reflects the 10-year asset smoothing method enacted by Act 120.

Financial Position Funded Status

Actuarial Value of Assets as a % of Accrued Liability: 1993 - 2019



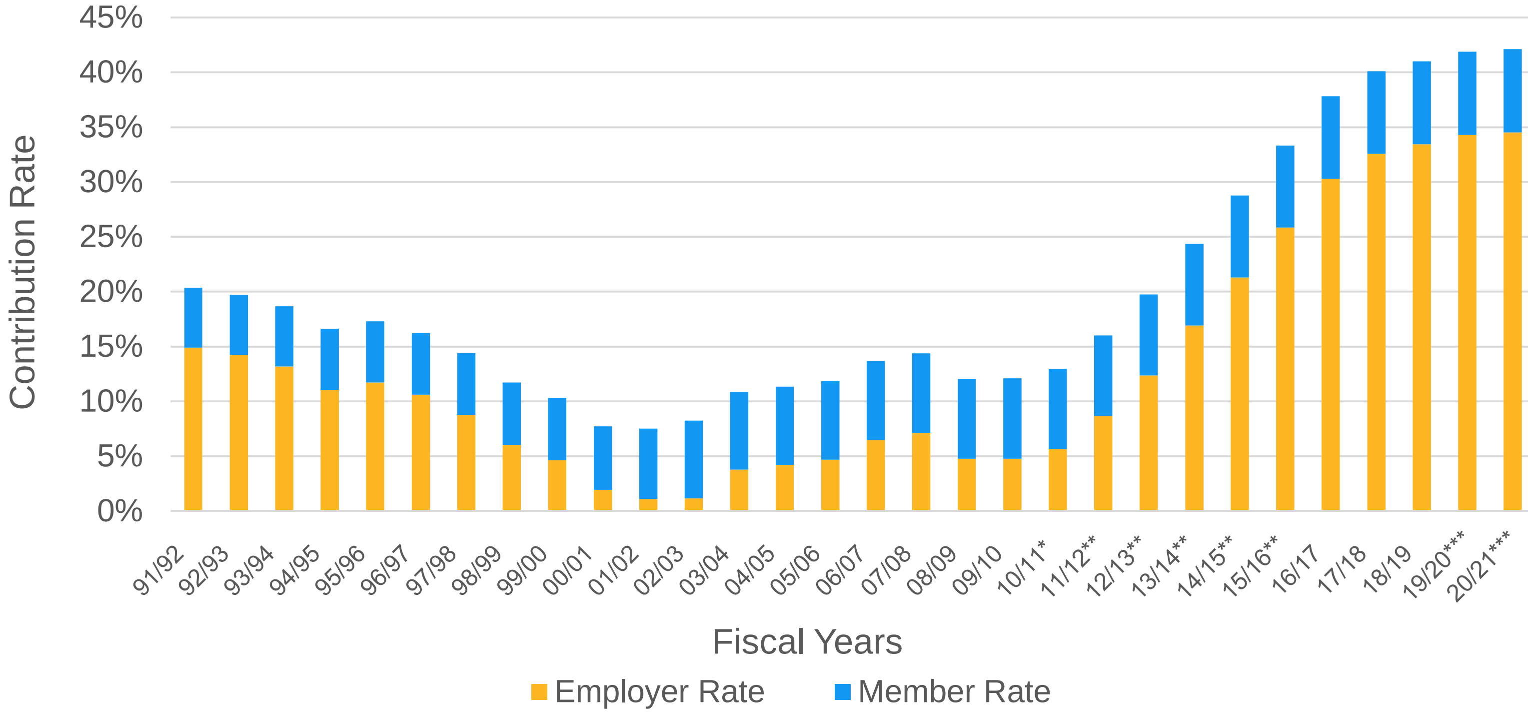
Note: Beginning with the 2010 valuation, the actuarial value of assets reflects the 10-year asset smoothing method enacted by Act 120.

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
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
97/98	6.44	2.17	.15	N/A	8.76	5.65	14.41

1. Act 9 member rate change took effect January 1, 2002. Act 120 member rate change took effect July 1, 2011.
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.