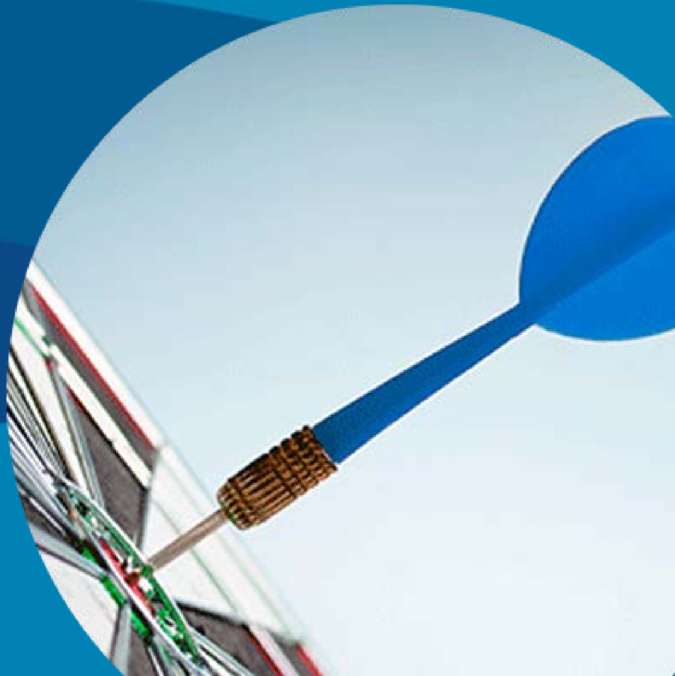
Texas Municipal Retirement System Actuarial Valuation Report as of December 31, 2018

May 30-31, 2019

Mark Randall
Joe Newton



Today’s Agenda

- Summary of System-wide Results & Experience
  - Benefit changes
  - Asset Performance
- Liabilities with Projections
- Funded Status with Projections
- Amortization Policy Example and Equivalent Single Periods
- Contribution Requirements with Projections
- Sustainability Checklist
- Summary

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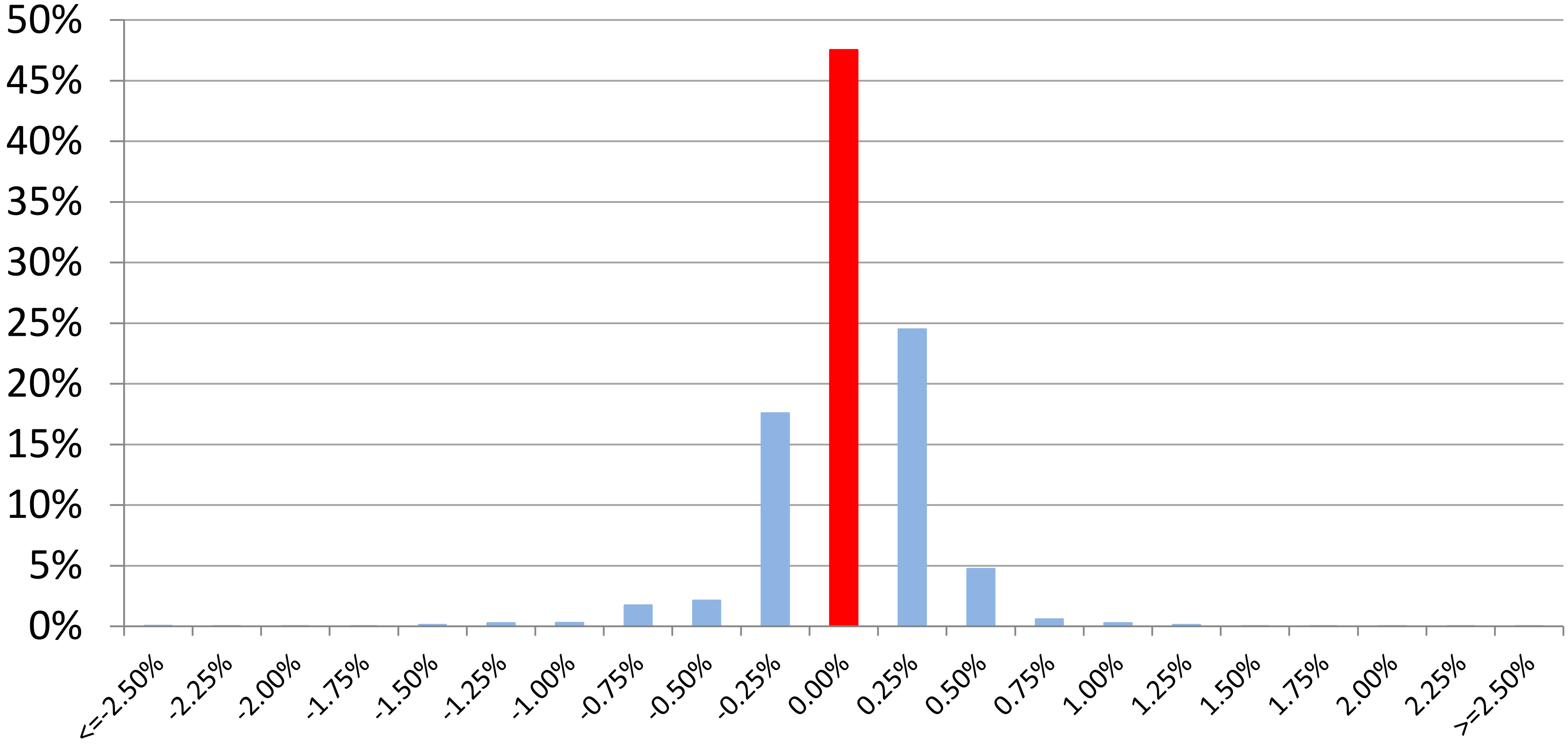
Distribution of Changes: Payroll Weighted Total Changes in Full Retirement Rate



Does not include impact from changes to benefits
Rounded to nearest 0.25% change in rate

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Summary of System-wide Results

$ amounts in millions	Dec 31, 2016 Valuation	Dec 31, 2017 Valuation	Dec 31, 2018 Valuation
Actuarial Accrued Liability (AAL)	$29,963	$31,812	$33,731
Actuarial Value of Assets	25,844	27,814	29,385
Unfunded Actuarial Accrued Liability (UAAL)	$4,119	$3,998	$4,346
Funded Ratio	86.3%	87.4%	87.1%
Average Funding Period (Years)	19.7	18.8	18.2
Full Contribution Rates:			
Straight Average	9.07%	8.89%	8.97%
Payroll Weighted Average	13.27%	13.09%	13.58%
Normal Cost %	8.41%	8.43%	8.61%
Prior Service %	4.86%	4.66%	4.97%

Down to 8 cities having a phase-in rate

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Aggregate BAF Valuation ($ in millions)

Reconciliation of Unfunded Actuarial Accrued Liability (“UAAL”)

	Change in UAAL	Impact on Funded Ratio	Impact on Full Rate
@ BOY	$3,998	87.4%	13.09%
Interest (6.75%)	270		
Amortization Payments	(303)	0.9%	-0.01%
Asset Performance	189	-0.6%	0.18%
Benefit Changes/New Cities	281	-0.8%	0.45%
Assumption/Method Changes	-	-	-
Contributions different than Actuarially Determined	(40)	0.1%	-0.03%
Liability (Gains)/Losses	(49)	0.1%	-0.04%
Payroll Growth			-0.06%
@ EOY	$4,346	87.1%	13.58%

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Non-Investment Experience

- Actual CPI of 1.91% was less than the 2.50% assumption, so liability for repeating COLAs was less than expected
  - System-wide, created a Liability Gain of about $35 million
  - 2017 CPI of 2.11% resulted in a system-wide gain of about $20 million
  - 2016 CPI of 2.07% resulted in a system-wide gain of about $20 million
  - 2015 CPI of 0.73% resulted in a system-wide gain of about $110 million
- Valuation uses 3-year smoothing on salaries
  - The 2017-2018 salary experience in aggregate was higher than expected (5.8% vs 5.0%), but this line item will vary based on who received what increase and if the City had USC
  - System-wide, created a liability loss of about $85 million
- For active employees:
  - Average age is unchanged from last year at 43.2 years
  - Average service decreased slightly from 10.6 years last year to 10.5

Summary of Benefit Changes

- Total Changes
  - 64 cities made changes that impacted the total retirement rate since the last valuation
    - Increases in Benefits 61 (49,45)
    - Decreases in Benefits 3 (5,2)
- Number of cities changing matching ratio, deposit rate, and/or eligibilities 42 (30,27)

Numbers in parentheses are the values for 2017 and 2016, respectively

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Summary of Benefit Changes (cont)

	’18	‘17	‘16
• USC Changes			
– Ad Hoc USC	11	11	12
– New/Increase Repeating USC	5	1	2
– Rescind/Decrease Repeating USC	2	4	1
• COLA Changes			
– Ad Hoc COLA	10	13	15
– Adopted/Increased Repeating COLA	4	2	1
– Rescind/Decrease Repeating COLA	3	3	1

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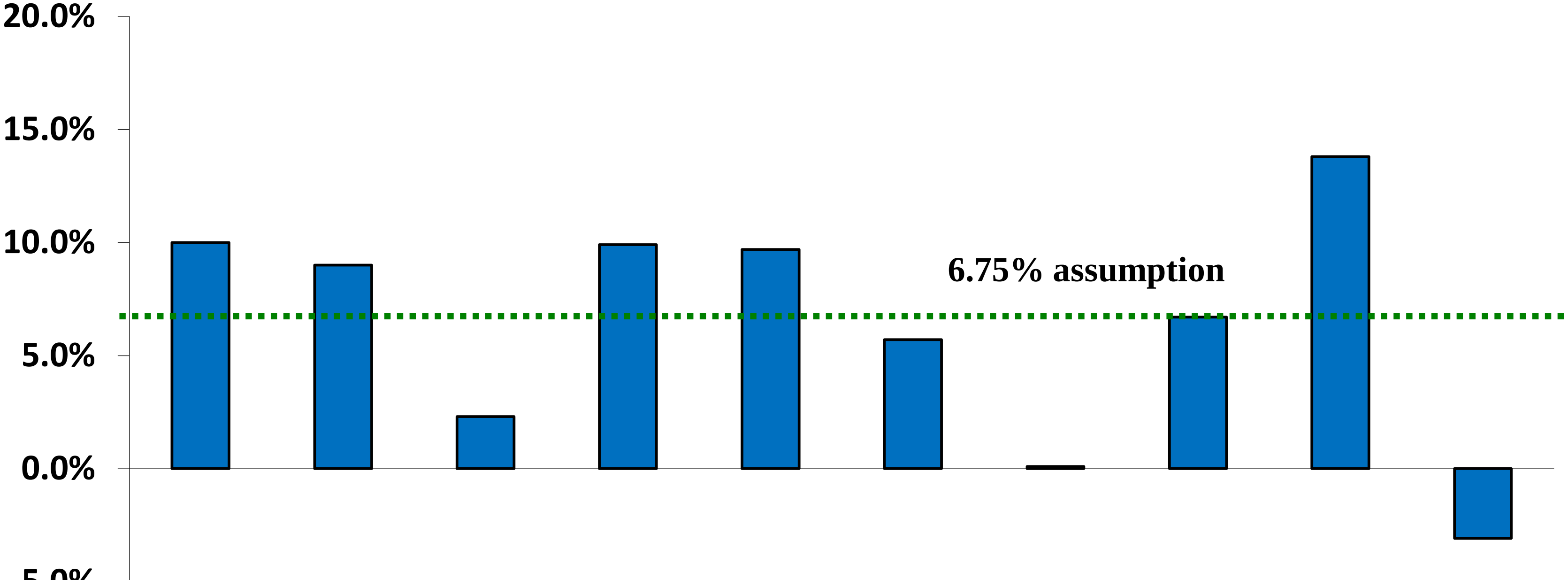
Yields based on Market Value of Assets



	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Market	10.0%	9.0%	2.3%	9.9%	9.7%	5.7%	0.1%	6.7%	13.8%	-3.1%

~ 6.3% average compound return (on market value) over last 10 years

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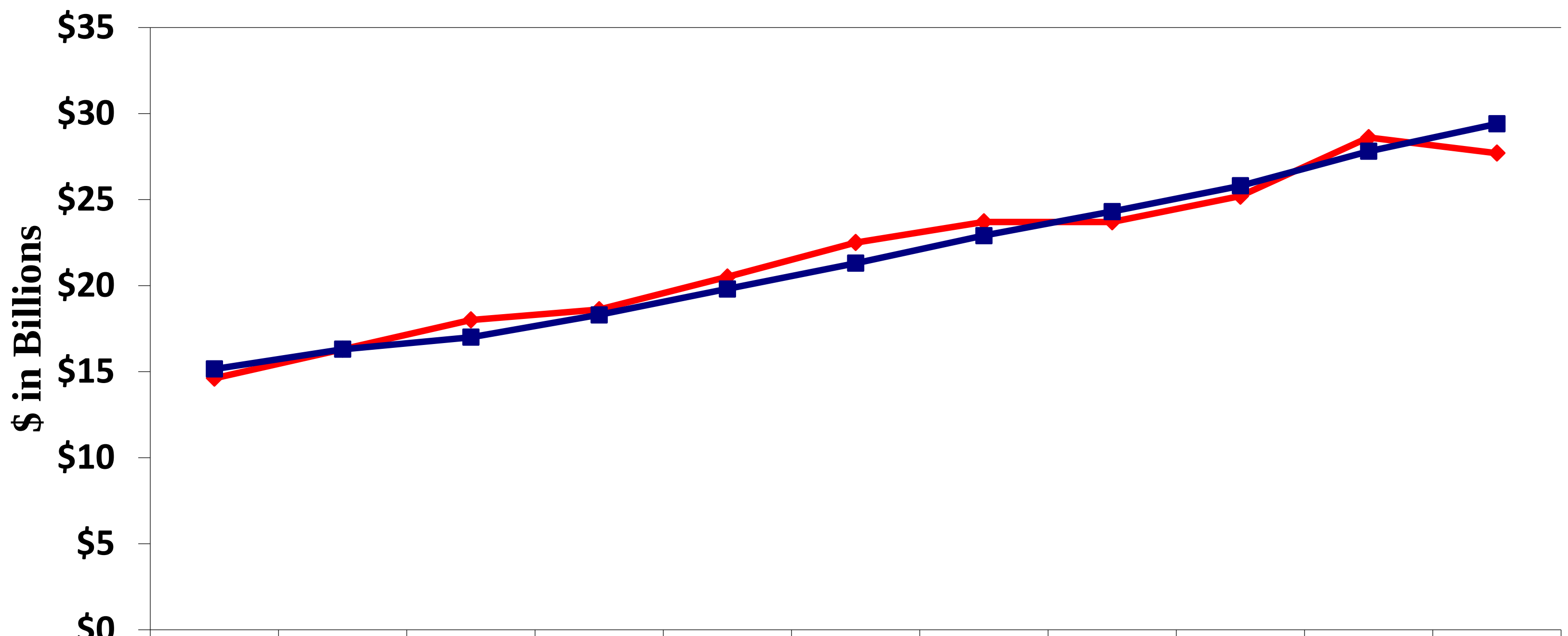
Market and Actuarial Values of Assets



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Market	$14.6	$16.3	$18.0	$18.6	$20.5	$22.5	$23.7	$23.7	$25.2	$28.6	$27.7
Actuarial	$15.1	$16.3	$17.0	$18.3	$19.8	$21.3	$22.9	$24.3	$25.8	$27.8	$29.4

- AVA is currently 106.1% of MVA, was 97.2% last year
  AVA was Book Value prior to 2009

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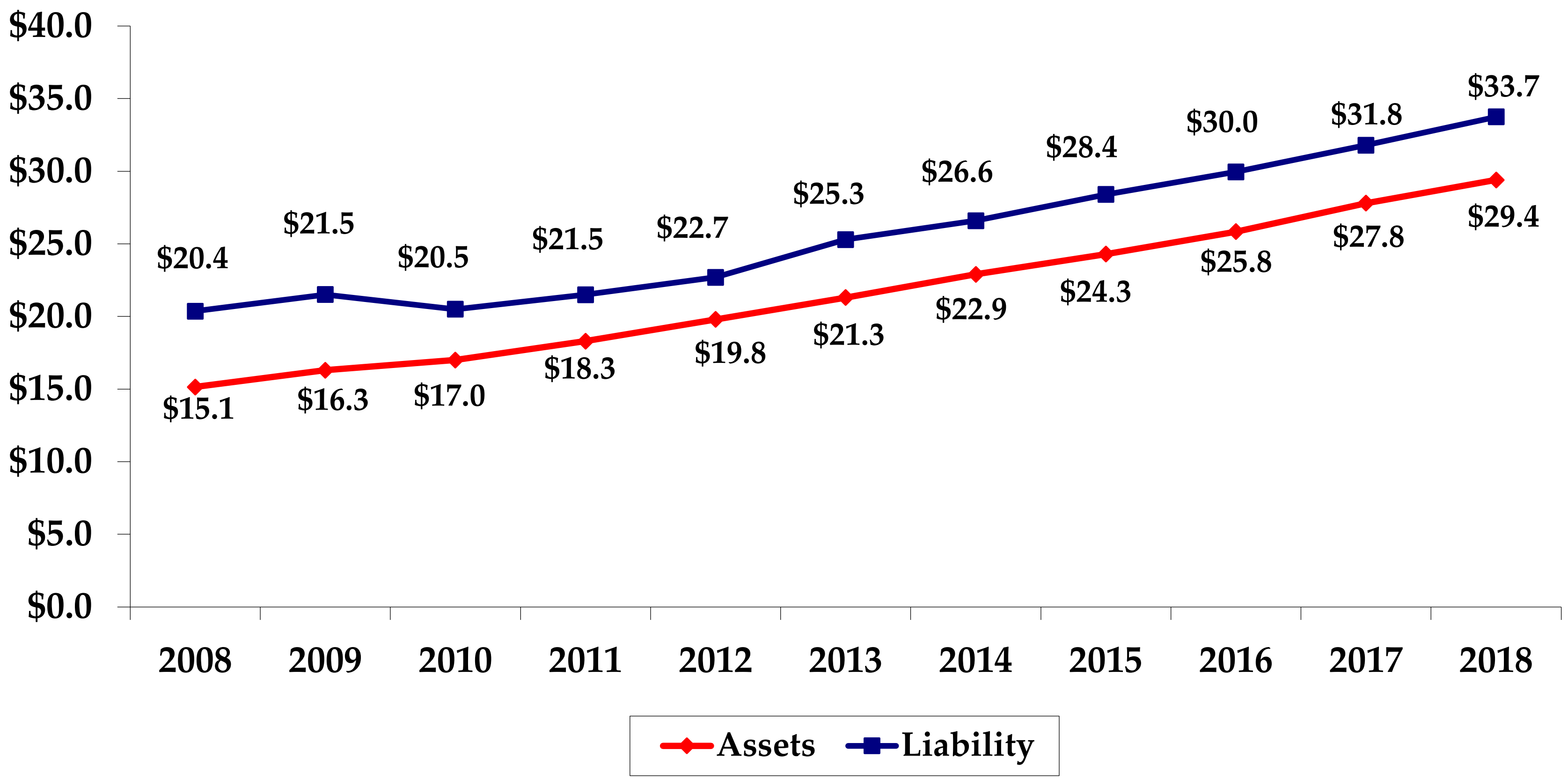
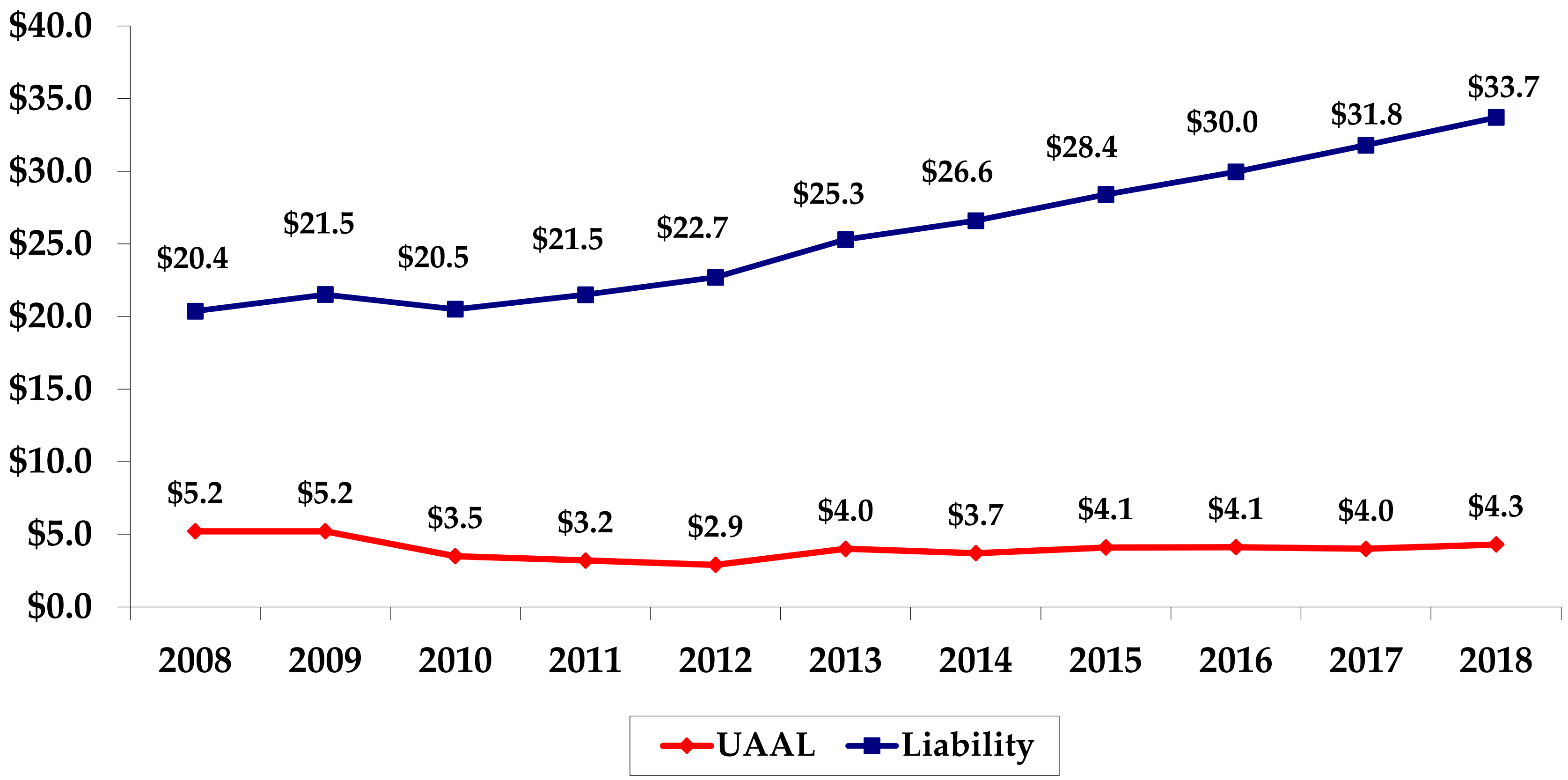
Actuarial Value of Assets (Smoothed) vs. Actuarial Accrued Liability (AAL)

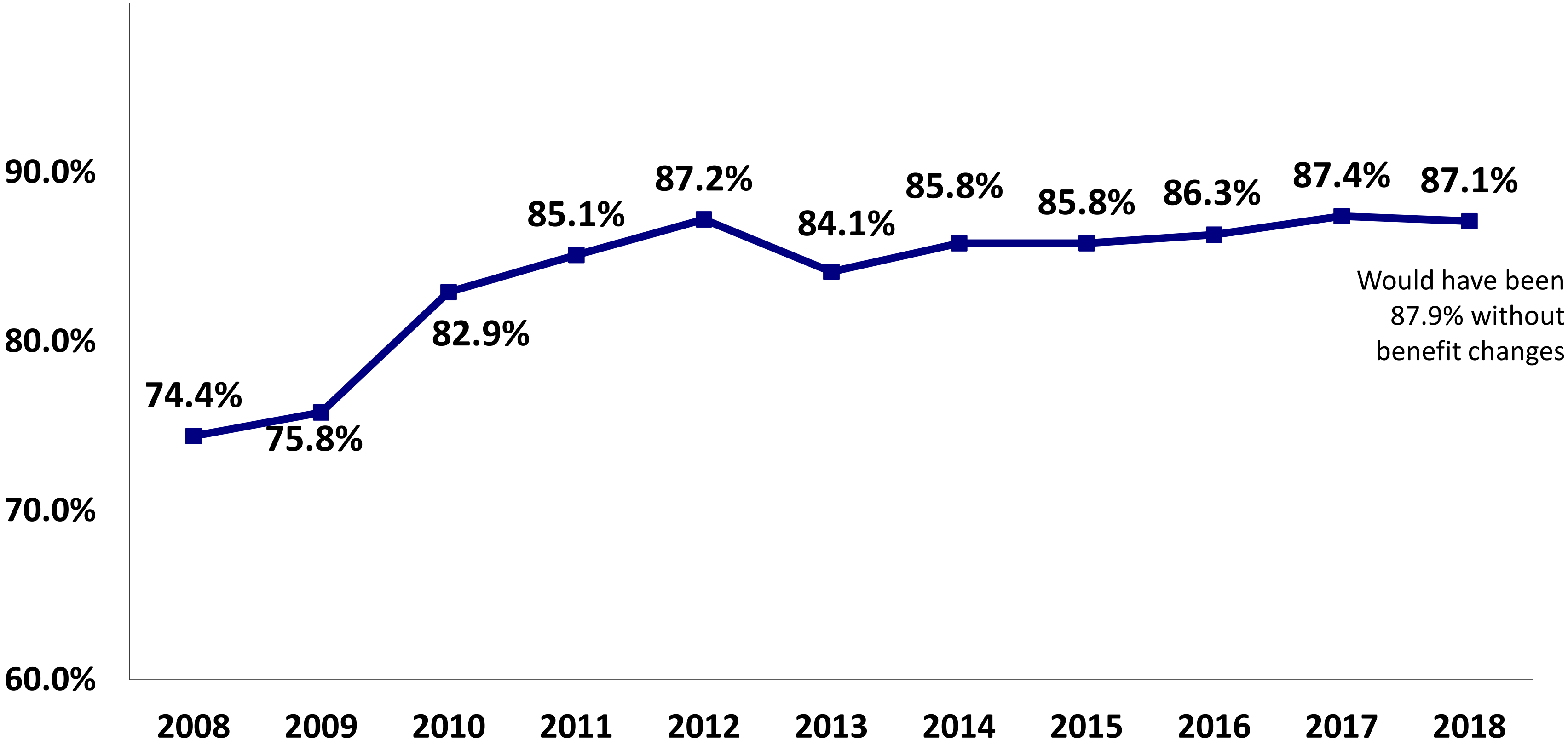


Liabilities for previous years reflect the previous structure before 2010, PUC cost method before 2013, and 7.00% discount rate before 2015

Relative Size of UAAL to AAL



Funded Ratio Percentages



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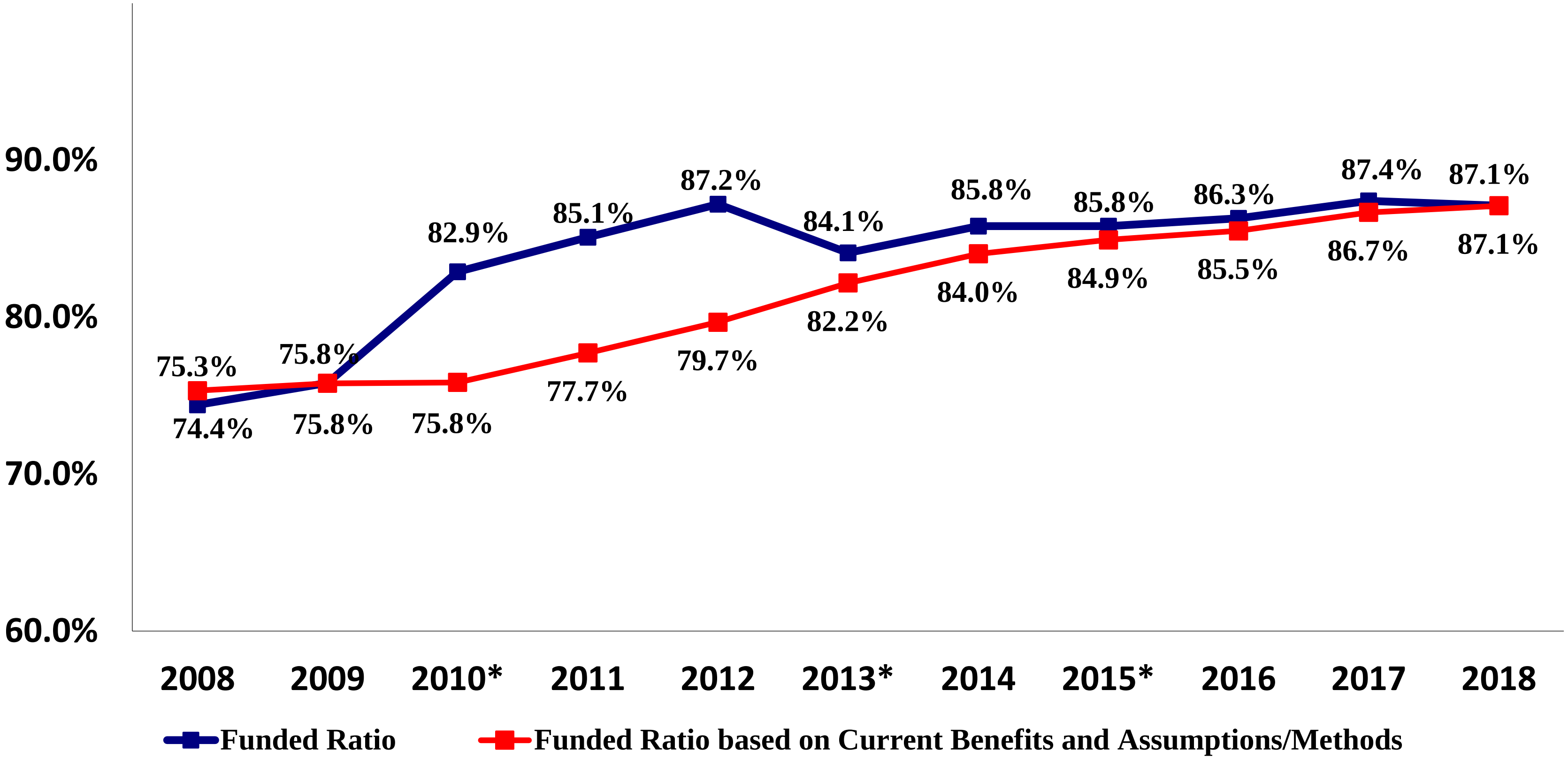
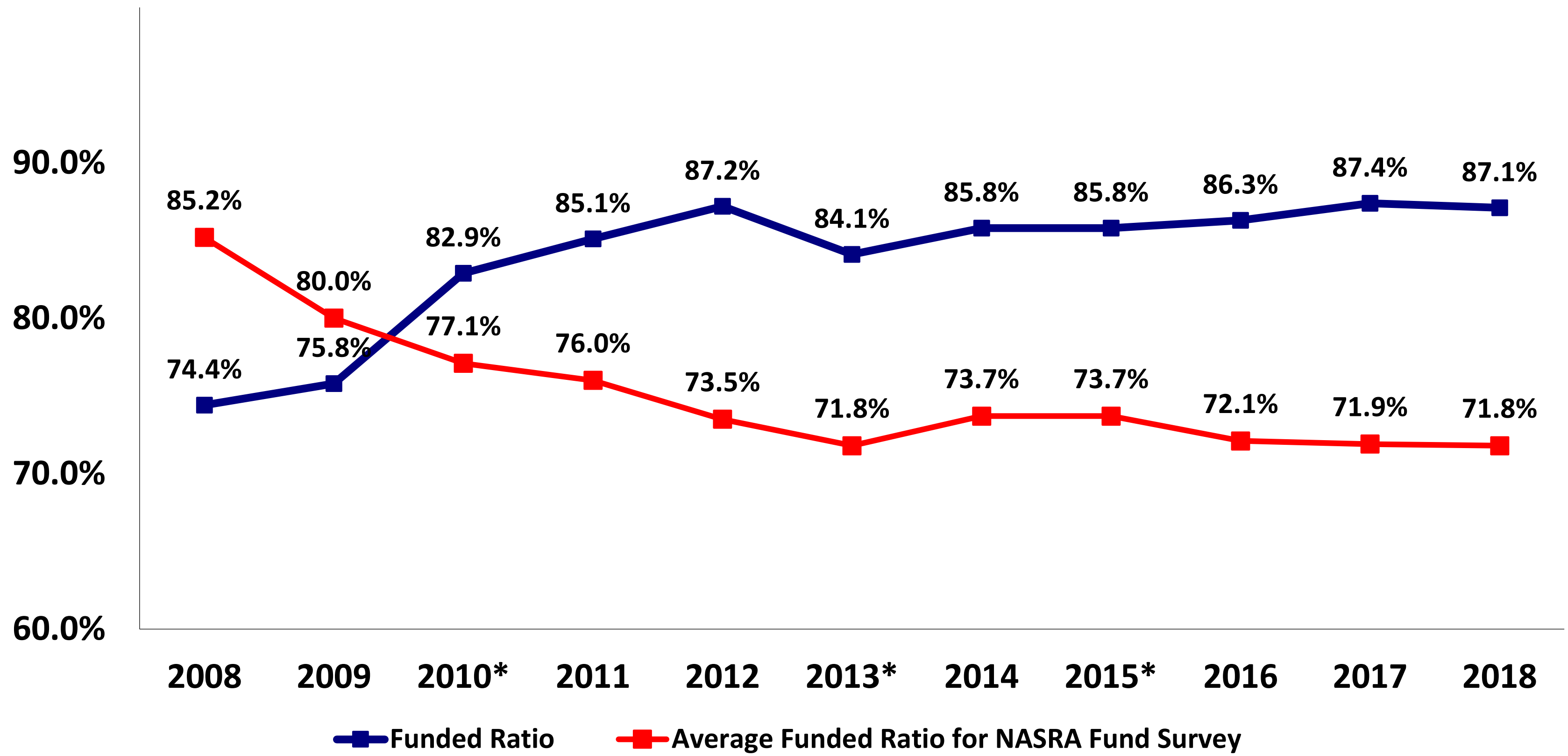
Funded Ratio Percentages:
Normalized to Current Assumptions and Benefits



* Restructure in 2010, Change to EAN in 2013, 6.75% Discount Rate in 2015

Funded Ratio Percentages:
Compared to Peers



- Restructure in 2010, Change to EAN in 2013, 6.75% Discount Rate in 2015

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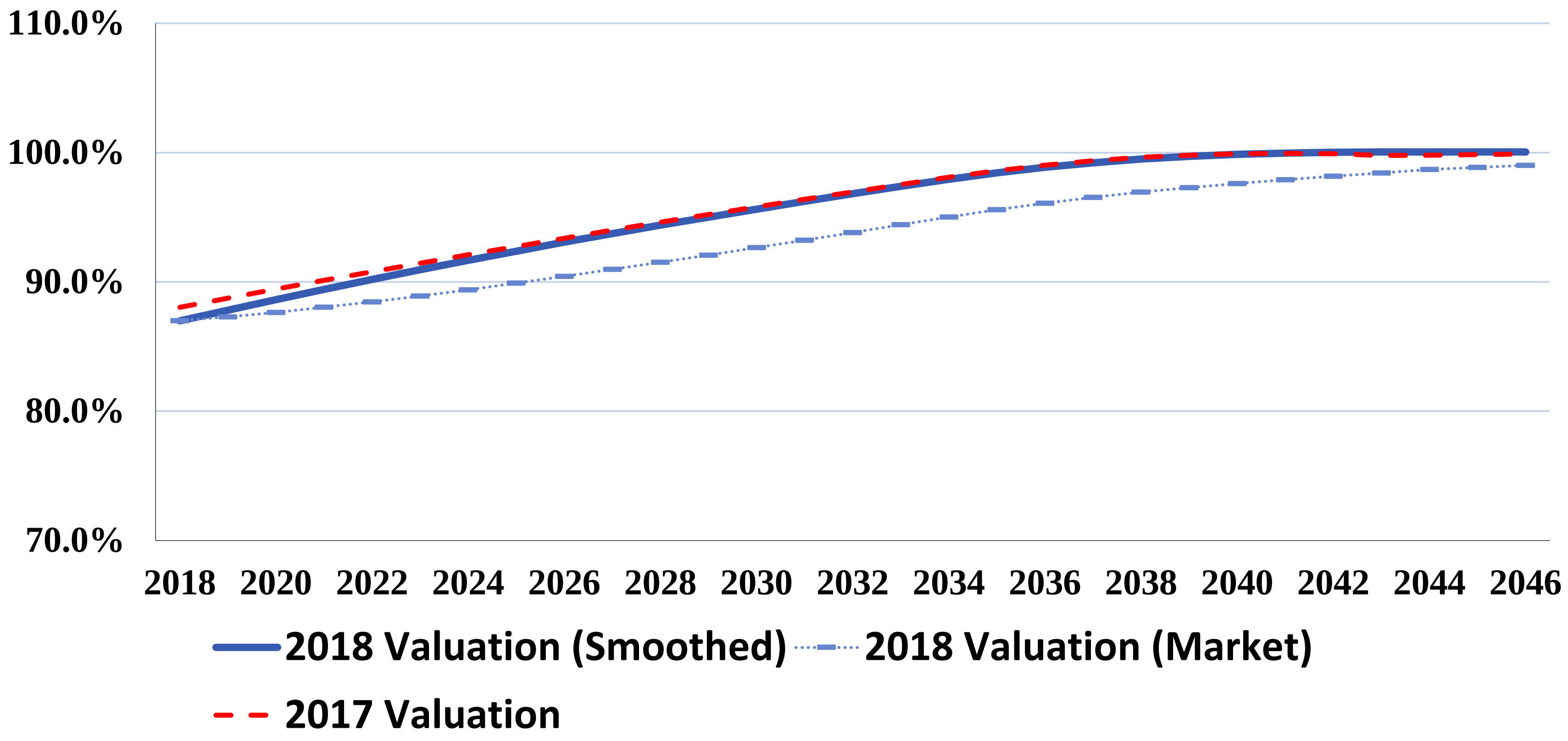
Projected Funded Ratio
(Longer Term)



Assumes all assumptions are met in future years, including earning 6.75% on the labeled value of assets

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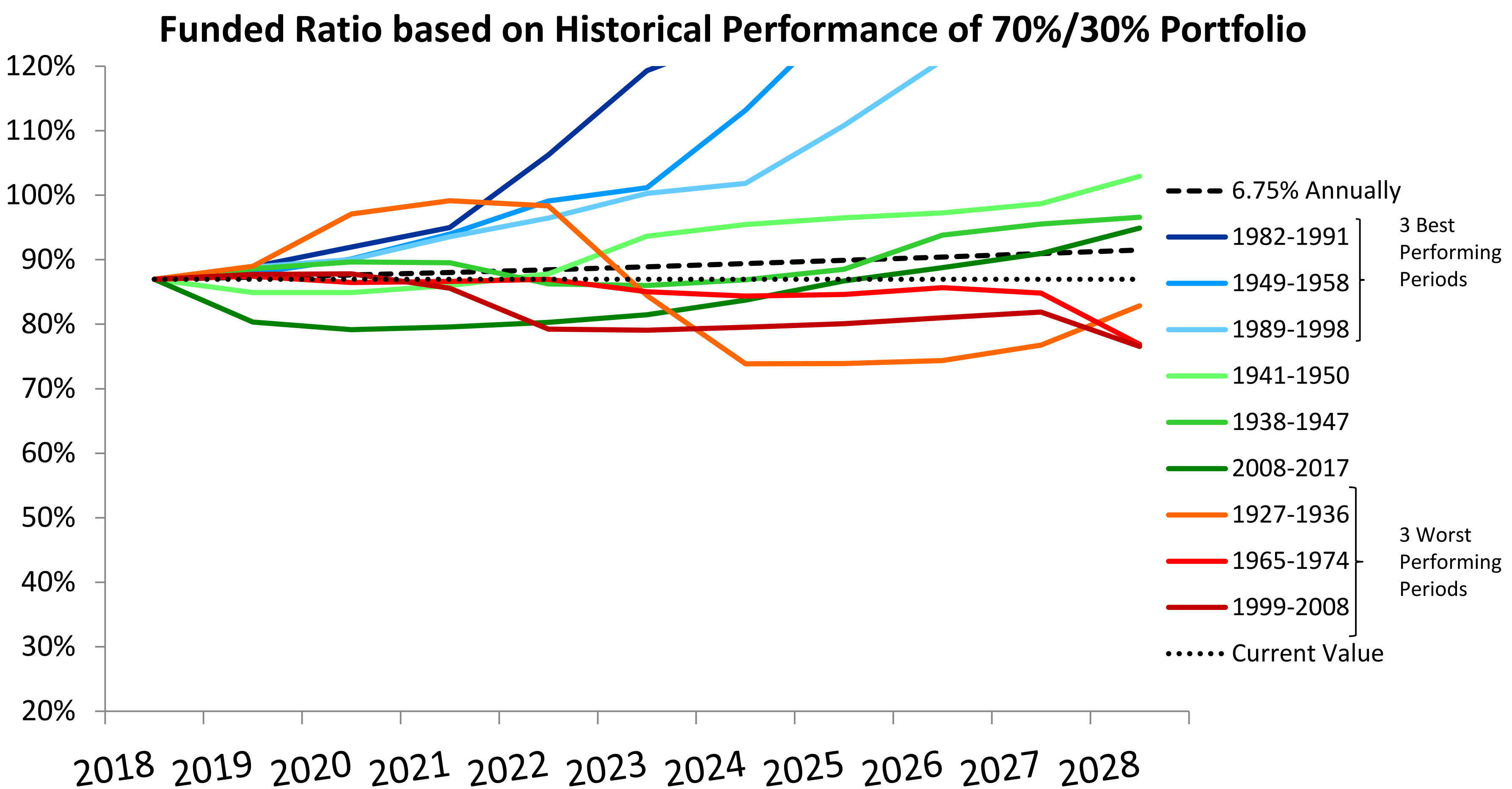
Projected Funded Ratio Based on Historical Scenarios



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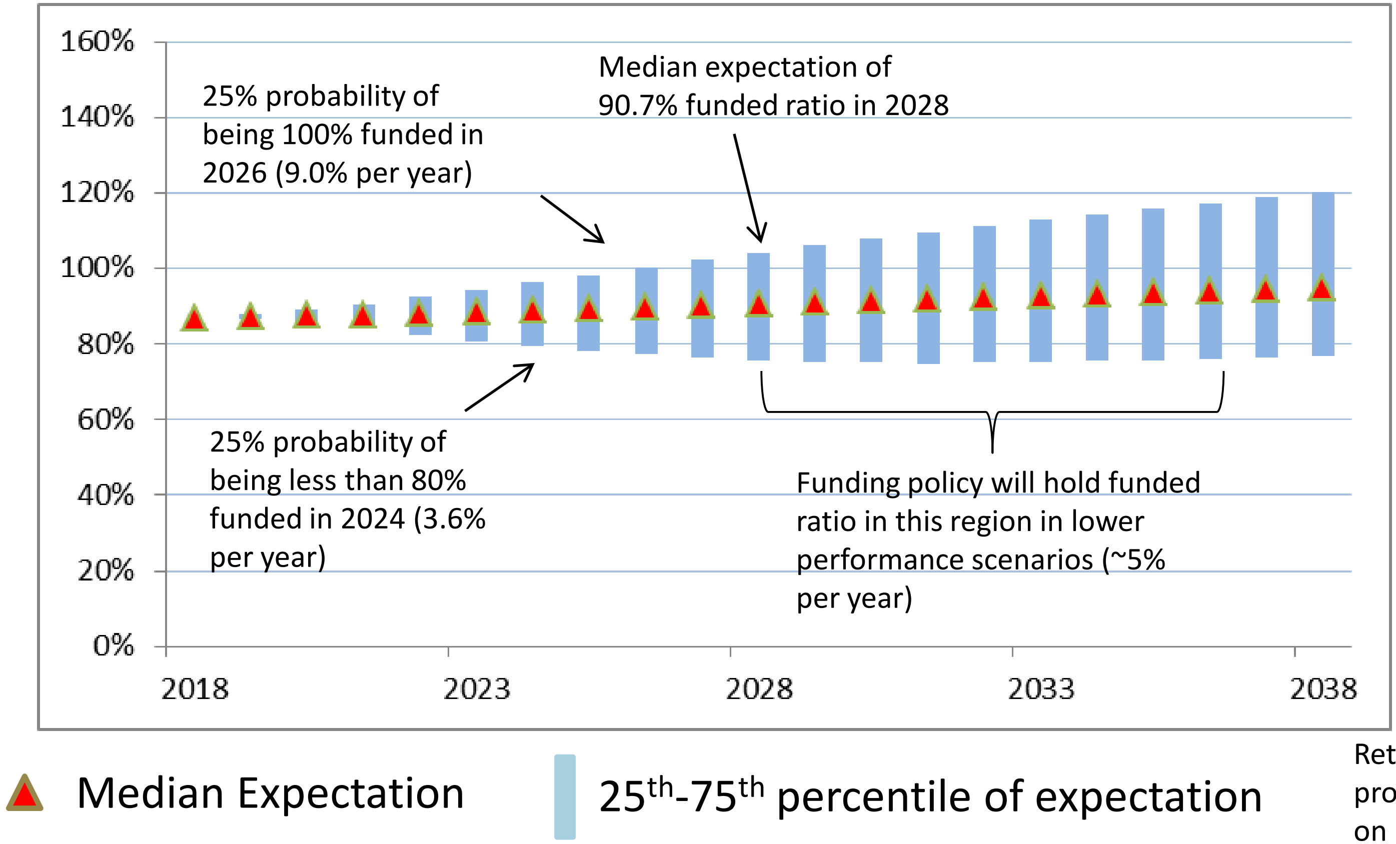
Projected Funded Ratio: System-wide



Returns and probabilities based on results of 2015 experience and asset allocation studies

- **Assumes ADEC met each year**
- **Assumes continuation of current amortization policy & payroll grows at 3.00% per year**
- **Investment returns are only variable in the stochastic process**

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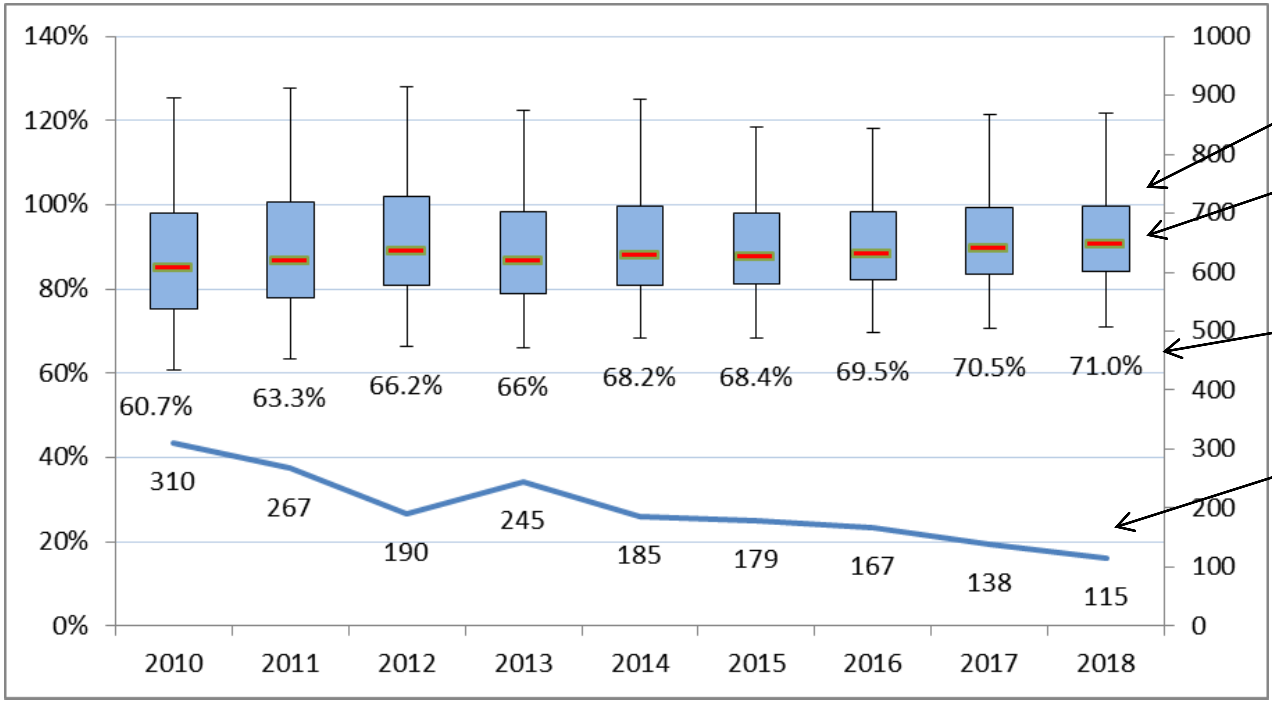
Distribution of Funded Ratio Percentages

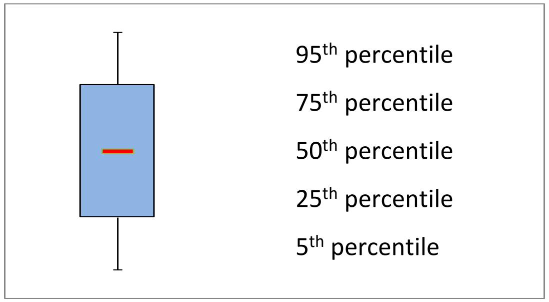


25% of units are fully funded!

Median over 90%

5th percentile Funded Ratio: 10% improvement over last 10 years

Number of Units with less than 80% Funded Ratio



The percentile represents the proportion of employers below the point. For example, the 75th percentile is 99.7%, meaning that 75% of cities have a funded ratio less than 99.7%. Conversely, 25% of the cities have a funded ratio of 99.7% or greater.

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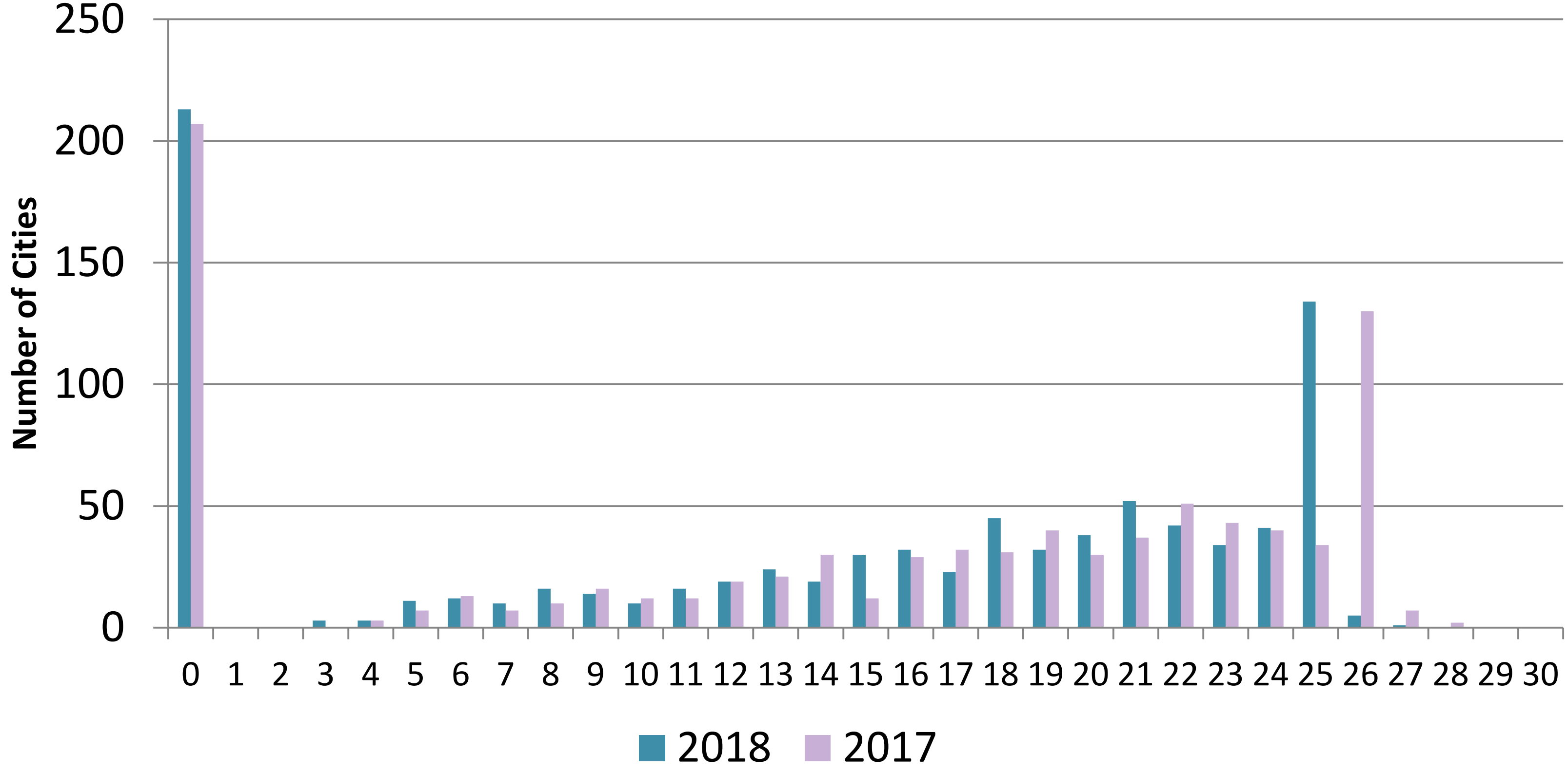
Amortization Layer Exhibit (Sample City)

Source	Original Balance	Remaining Balance as of December 31, 2018	Payment FY2019	Payment FY2020	Payment FY2021	Years Remaining
2013 Valuation (Fresh Start)	$ 25,099,074	$ 24,675,183	$ 1,886,498	$ 1,943,093	$ 2,001,386	18
2014 Experience	(1,320,133)	(1,295,929)	(99,078)	(102,050)	(105,112)	18
2015 Experience	475,691	489,202	28,669	29,529	30,415	27
2015 Actuarial Changes	(138,287)	(135,808)	(10,383)	(10,694)	(11,015)	18
2016 Experience	1,484,334	1,493,926	96,693	99,594	102,582	23
2017 Experience	(355,659)	(352,621)	(26,959)	(27,768)	(28,601)	18
2018 Experience	(154,344)	(154,344)	(11,800)	(12,154)	(12,519)	18
Unfunded Actuarial Accrued Liability		**$ 24,719,609**	**$ 1,863,640**	**$ 1,919,550**	**$ 1,977,136**	
Projected Payroll			**$ 28,398,811**	**$ 29,250,775**	**$ 30,128,298**	
Amortization Payment as a Percent of Payroll			**6.56%**	**6.56%**	**6.56%**	

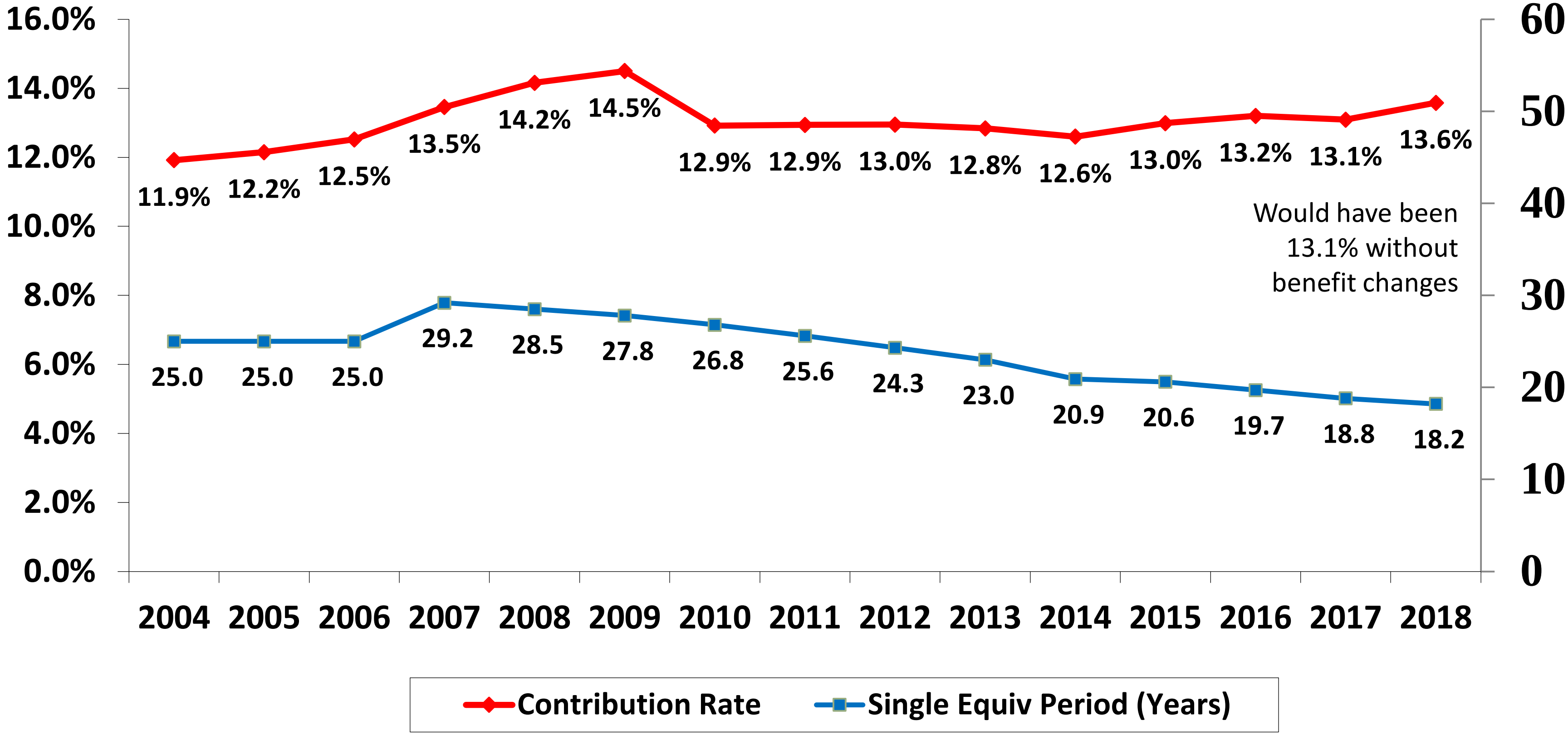
Equivalent Single Amortization Period = 18.4 years

Distribution of Single Equivalent Amortization Periods



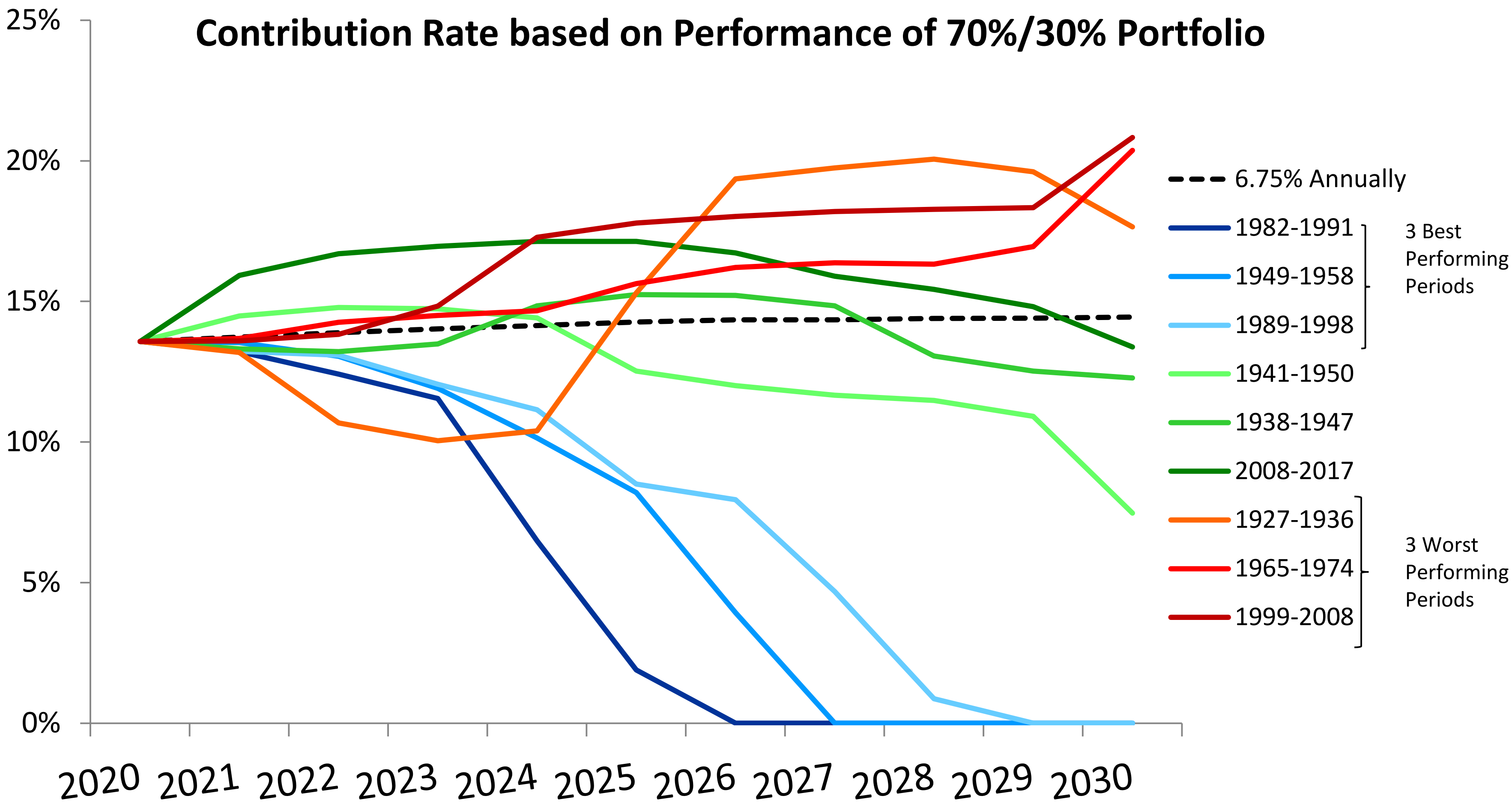
Remaining average period in years
0 would be overfunded

Historical Dollar Weighted Contribution Rates for TMRS



Contributions represent aggregate phase in minimums

Projected Dollar Weighted Contribution Rates Based on Historical Scenarios



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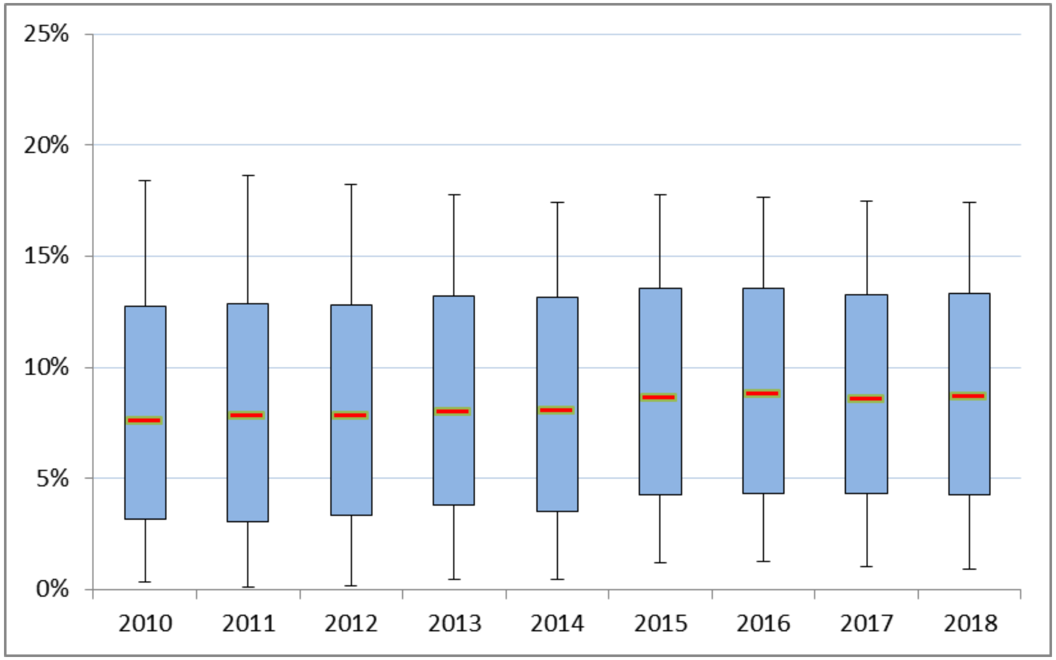
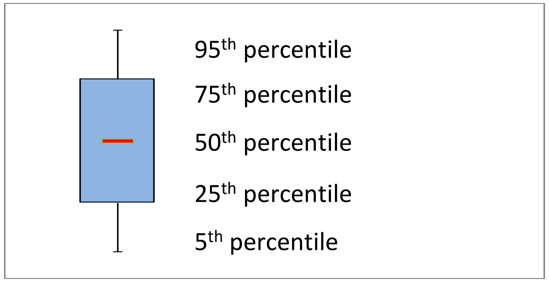
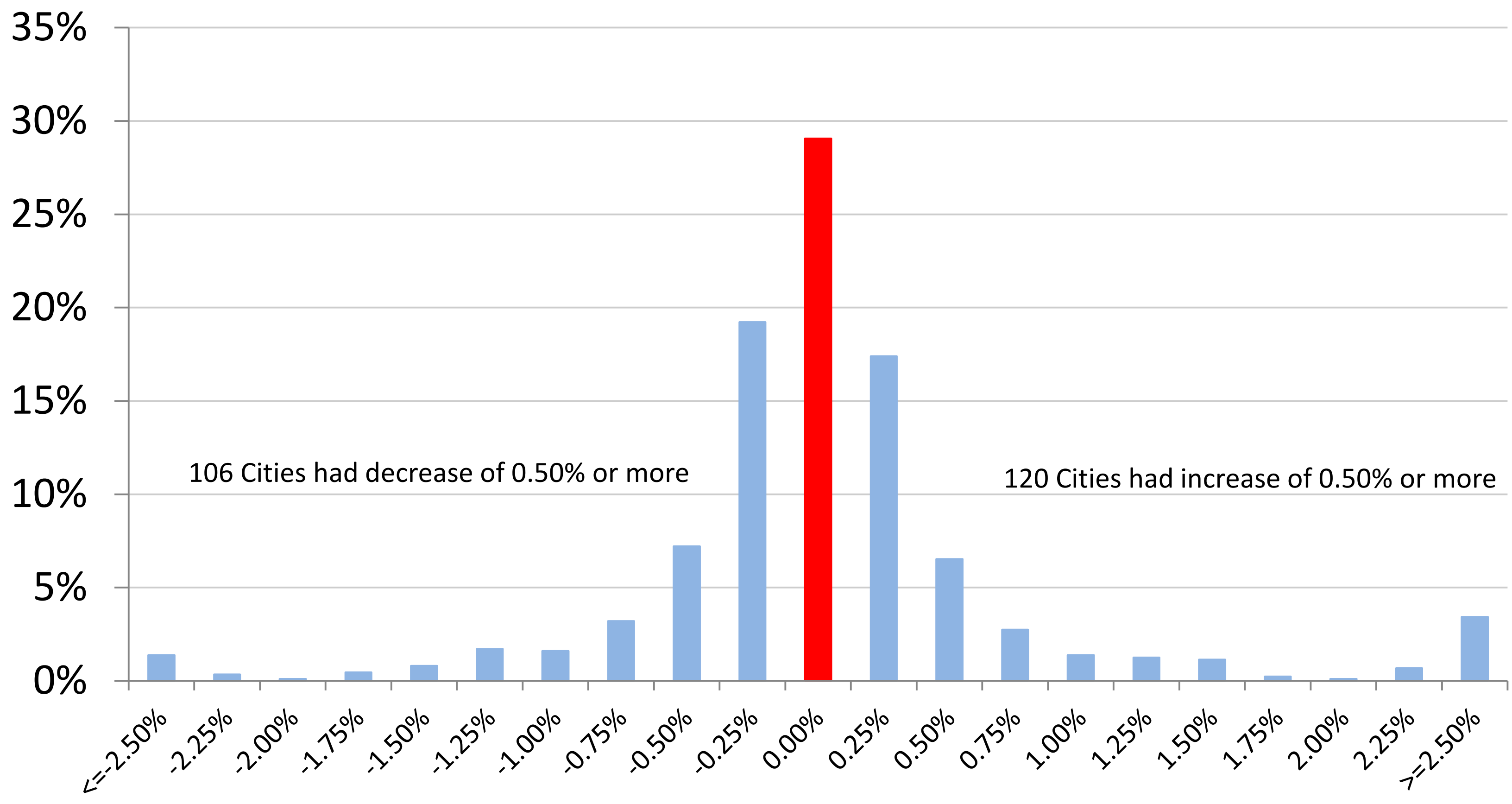
Distribution of Full Retirement Rate





The percentile represents the proportion of employers below the point. For example, the 75th percentile is 13.35%, meaning that 75% of cities have a rate less than 13.35%.

Distribution of Changes: By City
Total Changes in Full Retirement Rate



Rounded to nearest 0.25% change in rate

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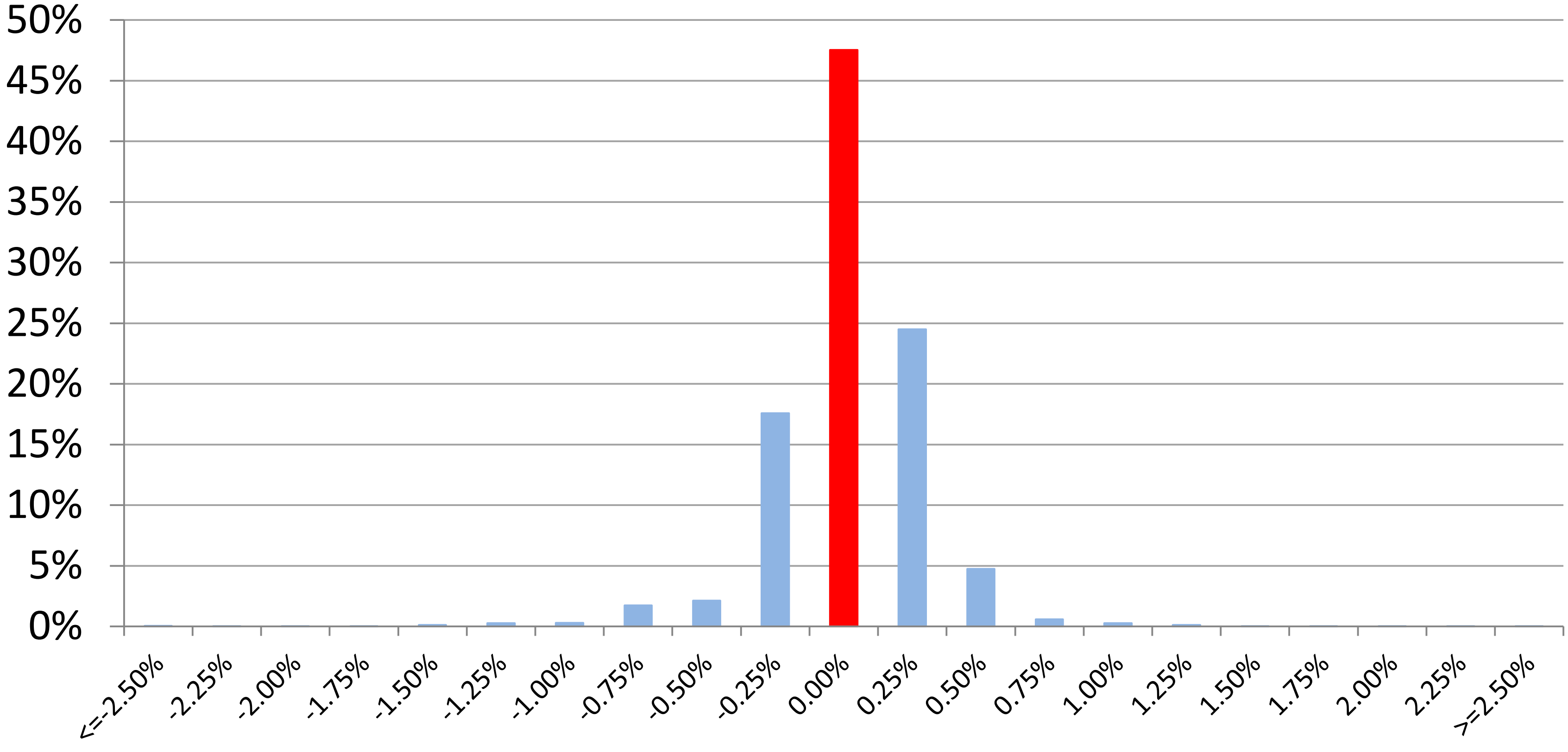
Distribution of Changes: Payroll Weighted Total Changes in Full Retirement Rate



Does not include impact from changes to benefits
Rounded to nearest 0.25% change in rate

Sustainability Checklist

- The following is a list of metrics that can be used to assess the sustainability of a pension plan.
- This can be used to gain a larger picture of sources of risk on a pension plan
- 5 star would be absolute best practice. 4 star is very good and usually sustainable. Below 3 stars are items that are either making sustainability more difficult or not adding in a positive way.
- Please note the aggregate results are much more meaningful than the impact of any one item.
- Also, it is unnecessary to achieve a 5 star result on each item to be considered sustainable. In fact, that type of result may suggest too much conservatism

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Sustainability Checklist: Priorities

	Stars	Comment
Are there automatic adjustments to the program as experience unfolds?	6	Sum of next two items needs to be at least 6 stars
Contributions automatically adjust per statute or non-discretionary policy	★★★★	25 Year layered amortization, no employer discretion, minor negative amortization
Are any of the liabilities contingent on future experience?	★★	CPI COLA can provide slower growth during low inflation environments, benefits can be modified prospectively
Are there any benefits that are likely to be paid, but not reflected in the liabilities and contributions? Examples include ad hoc colas that occur regularly but are not advanced recognized, subsidized service purchases, or pay spiking patterns.	★★★★★ ★★★	No Some employers utilize ad hoc cola provisions, but there is a reasonable financing requirement. Employers have ability to enhance benefits, amortization period for retrospective benefit enhancements is 25 years.
Has the sponsor demonstrated a 10-year history of meeting an actuarially appropriate, required contribution?	★★★★★ ★★★	Most have 100% Some used forms of phase in
What is your ratio of non-contingent accrued liability to payroll?	★★★★	5.0
What is your longer term ratio of non-contingent accrued liability to payroll?	★★★	~7.0+
What is your short – intermediate term negative cash flow as a % of assets?	★★★★★	<1%
What is your longer term negative cash flow as a % of assets?	★★★★★	3-4%

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Sustainability Checklist: Other Factors

	Stars	Comment
Based on current practices and assumptions, is your UAAL expected to be lower 10 years from now?	★★★★★ ★★★	Smoothed: Yes - About 25% smaller Market: No, almost
What is the amortization period for the current UAAL based on the required contribution?	★★★★★	18 Years, Positive Amortization
What is the sum of the smoothing period and amortization period for new losses?	★★★	35 Years
Is your funded ratio higher than it was 10 years ago?	★★★★★	Yes
Does the contribution as a percentage of payroll change each year regardless of experience?	★★★	Yes, will increase or decrease based on formula and results from that year
Does the Board regularly review actuarial assumptions?	★★★★	All assumptions reviewed every 4 years (5 star would include a macro economic every 2 years)
What is the likelihood of meeting or exceeding the assumed return assumption over the next 20 years based on analysis?	★★★★	** for Between Arithmetic and Geometric Mean (45-50%) and ** for being in lower quartile of public funds
Assumed rate of payroll growth for amortization purposes?	★★★★	Equal to the wage inflation assumption with a stable active population and supported by historical 10-year average of past payroll growth, and adjustments if population declining (5 star would be price inflation)
What is the annual percent change in active population last 10 years?	★★★★★ ★★	+1% system-wide 234 cities have a trend of a declining population
What is your current active to retiree ratio?	★★★★	1.7 (1.6 to 1.9)
What is your longer term active to retiree ratio?	★★	1.1-1.3

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Sustainability Checklist

- TMRS grades out very well on the checklist
  - Required, actuarially determined contributions
  - Current UAAL in positive amortization
  - Reasonable payroll growth assumptions
  - Manageable short and long term cash flow needs

- Items to pay attention to
  - Amortization periods for new losses or benefit enhancements are in the industry acceptable range, but do allow for negative amortization
  - Capital market expectations continue to contract, continues to become more difficult to generate safe/passive earnings
  - Longer term liability (or asset) to payroll ratios will increase contribution rate volatility

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In Summary

- Overall System-wide “health” continues to improve
  - Median funded level continue to improve
  - Contributions rates have remained relatively stable
- The expectation is for a slowly increasing funded ratio over the next few valuations and continued stability in the contribution rates, System-wide
- 2019 Experience Study to be presented over the summer for reflection in December 31, 2019 valuation

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