Texas Municipal Retirement System Actuarial Valuation Report as of December 31, 2017

May 24-25, 2018

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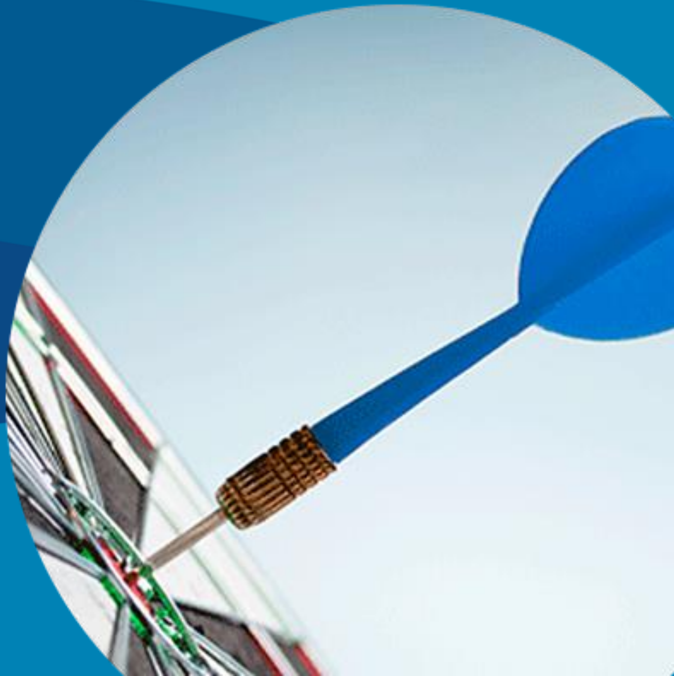

Today's Agenda

- Summary of System-wide Results & Experience
  - Benefit changes
  - Asset Performance
- Liabilities with Projections
- Funded Status with Projections
  - Amortization policy example
- Contribution Requirements with Projections
- Sustainability Checklist
- Summary

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Summary of System-wide Results

$ amounts in millions	Dec 31, 2015 Valuation	Dec 31, 2016 Valuation	Dec 31, 2017 Valuation
Actuarial Accrued Liability (AAL)	$28,379	$29,963	$31,812
Actuarial Value of Assets	24,348	25,844	27,814
Unfunded Actuarial Accrued Liability (UAAL)	$4,031	$4,119	$3,998
Funded Ratio	85.8%	86.3%	87.4%
Average Funding Period (Years)	20.6	19.7	18.8
Full Contribution Rates:			
Straight Average	9.02%	9.07%	8.89%
Payroll Weighted Average	13.24%	13.27%	13.09%
Normal Cost %	8.41%	8.41%	8.43%
Prior Service %	4.83%	4.86%	4.66%

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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
UAAL @ BOY	$4,119	86.3%	13.27%
Interest (6.75%)	280		
Amortization Payments	(305)	0.7%	-0.06%
Asset Performance	(93)	0.3%	-0.12%
Benefit Changes	32	-0.1%	0.06%
Assumption/Method Changes	-	-	-
Contributions different than Actuarially Determined	(22)	0.1%	-0.01%
Liability (Gains)/Losses	(13)	0.1%	-0.05%
UAAL @ EOY	$3,998	87.4%	13.09%

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Non-Investment Experience

- Actual CPI of 2.11% was less than the 2.50% assumption, so liability for repeating COLAs was less than expected
  - System-wide, created a Liability 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 2016-2017 salary experience in aggregate was higher than expected (6.4% 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 $70 million
- For active employees:
  - Average age is unchanged from last year at 43.2 years
  - Average service is 10.6 years and is unchanged from last year

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Summary of Benefit Changes

- Total Changes
  - 54 cities made changes that impacted the total retirement rate since the last valuation
    - Increases in Benefits 49 (45,45)
    - Decreases in Benefits 5 (2,3)
- Number of cities changing matching ratio, deposit rate, and/or eligibilities 30 (27,28)

Numbers in parentheses are the values for 2016 and 2015, respectively

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Summary of Benefit Changes (cont)

	'17	'16	'15
• USC Changes			
– Ad Hoc USC	11	12	13
– New Repeating USC	1	2	0
– Rescind/Decrease Repeating USC	4	1	2
• COLA Changes			
– Ad Hoc COLA	13	15	11
– Adopted/Increased Repeating COLA	2	1	1
– Rescind/Decrease Repeating COLA	3	1	2

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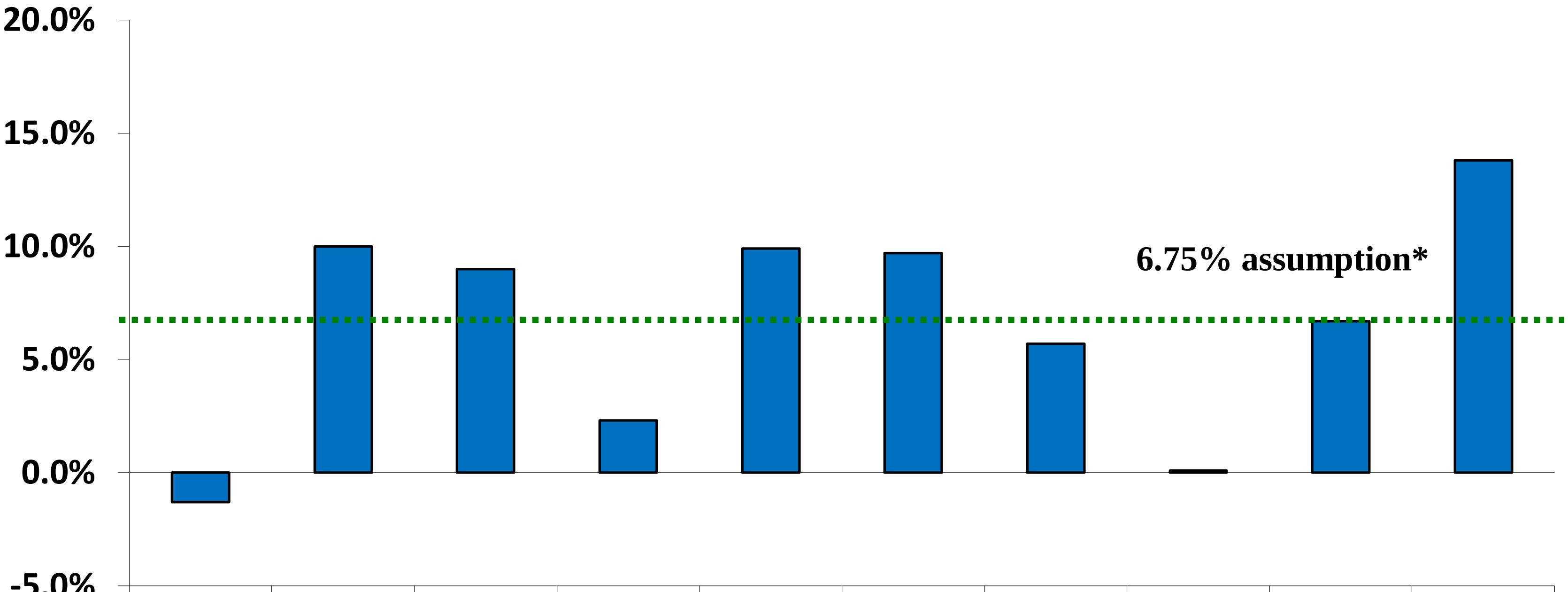
Yields based on Market Value of Assets



	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Market	-1.3%	10.0%	9.0%	2.3%	9.9%	9.7%	5.7%	0.1%	6.7%	13.8%

~ 6.5% average compound return (on market value) over last 10 years

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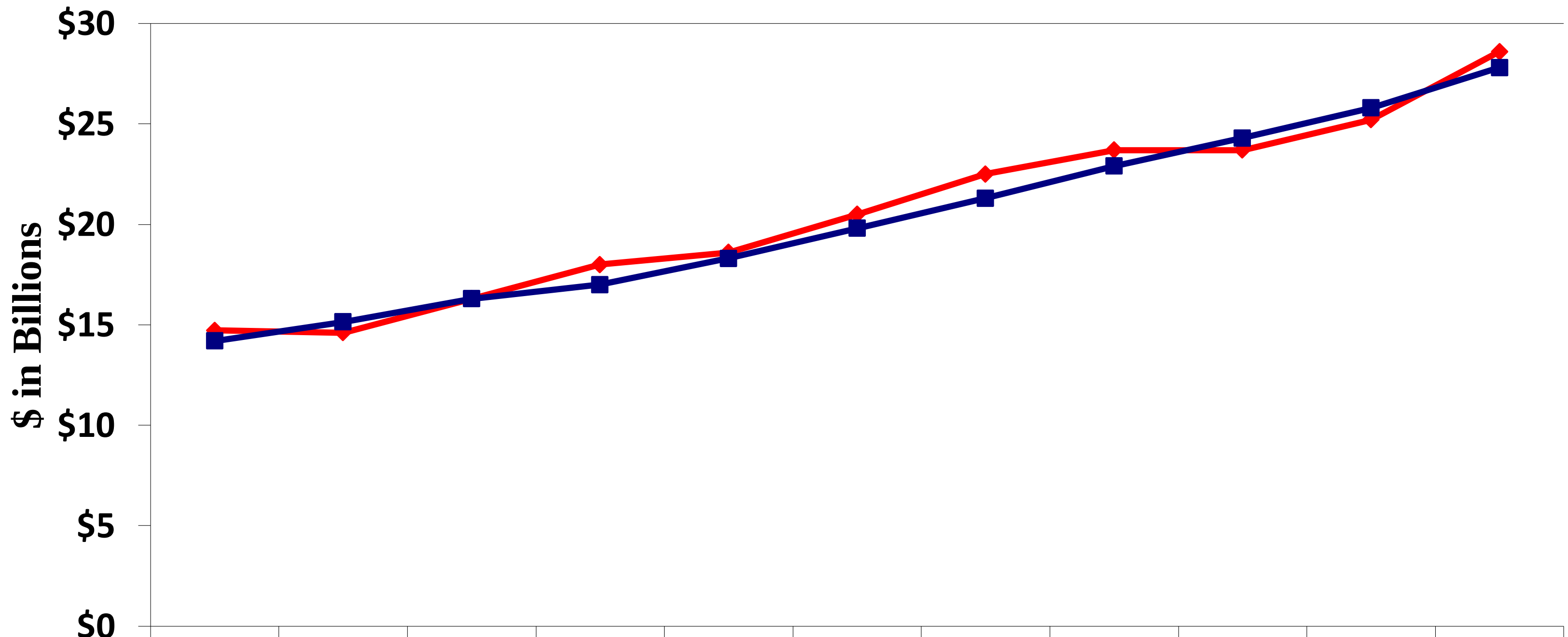
Market and Actuarial Values of Assets



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Market	$14.7	$14.6	$16.3	$18.0	$18.6	$20.5	$22.5	$23.7	$23.7	$25.2	$28.6
Actuarial	$14.2	$15.1	$16.3	$17.0	$18.3	$19.8	$21.3	$22.9	$24.3	$25.8	$27.8

- AVA is currently 97.2% of MVA, was 102.4% last year
  AVA was Book Value prior to 2009

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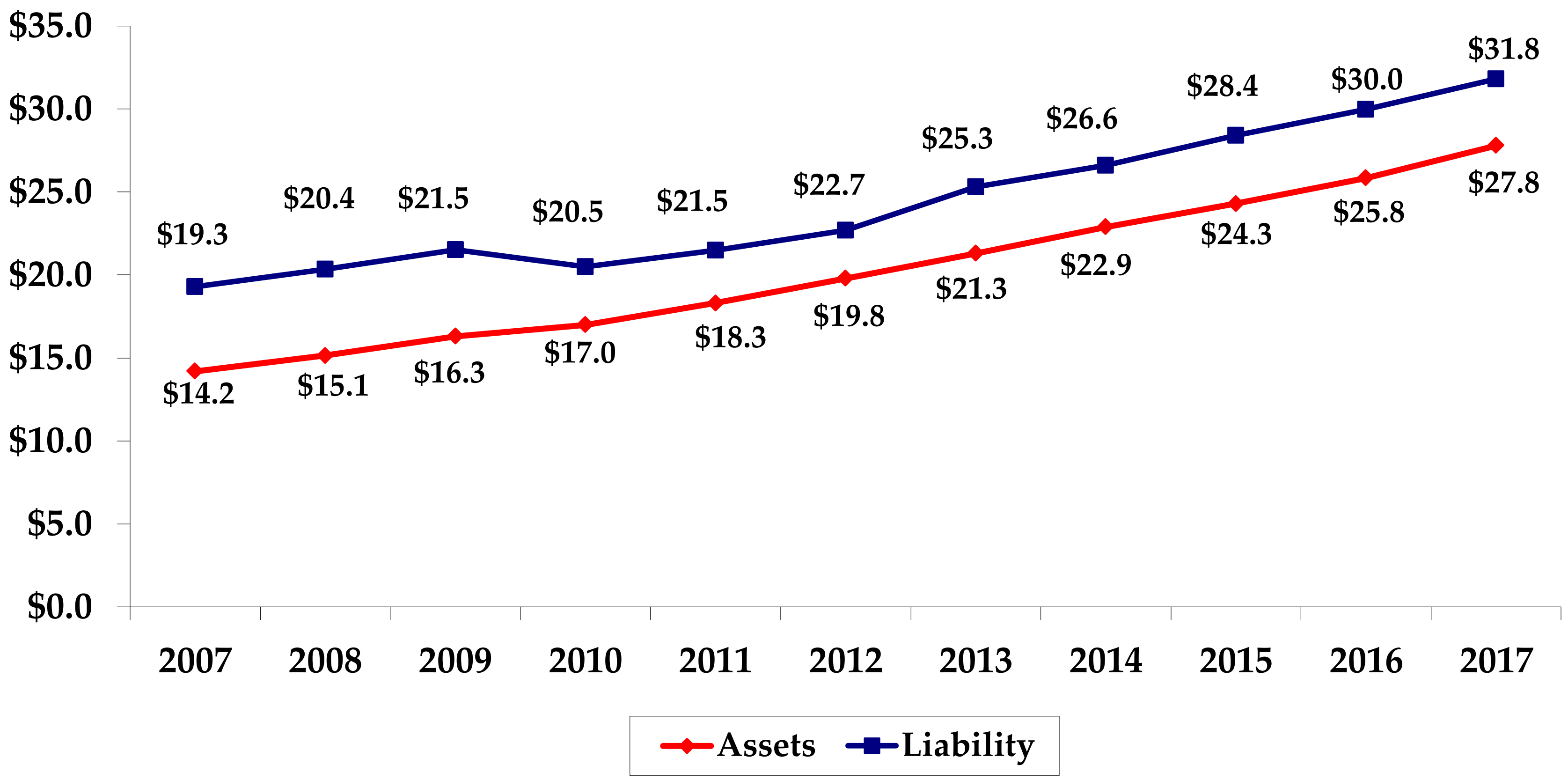
Actuarial Value of Assets (Smoothed) vs. Actuarial Accrued Liability (AAL)



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

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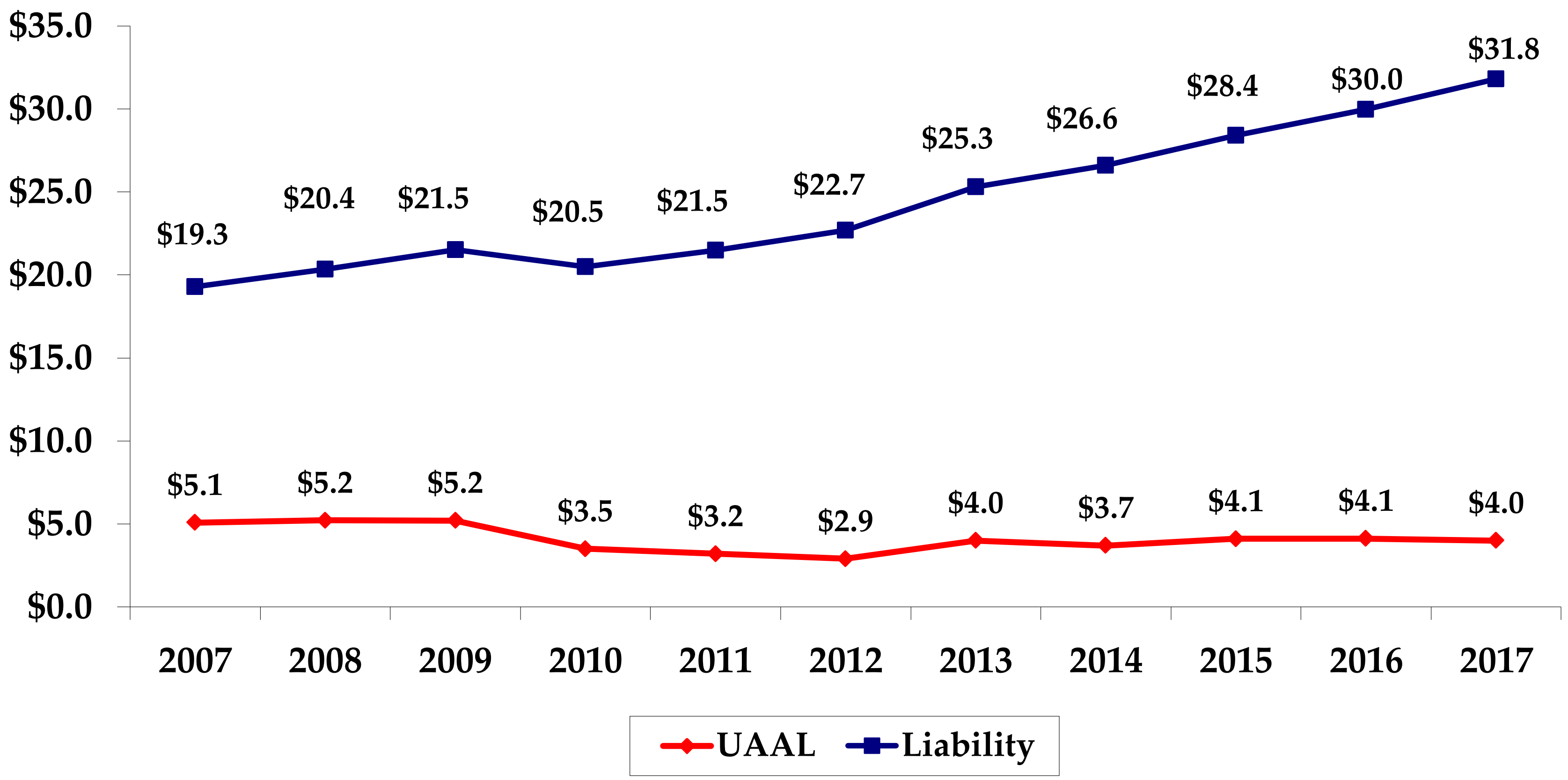
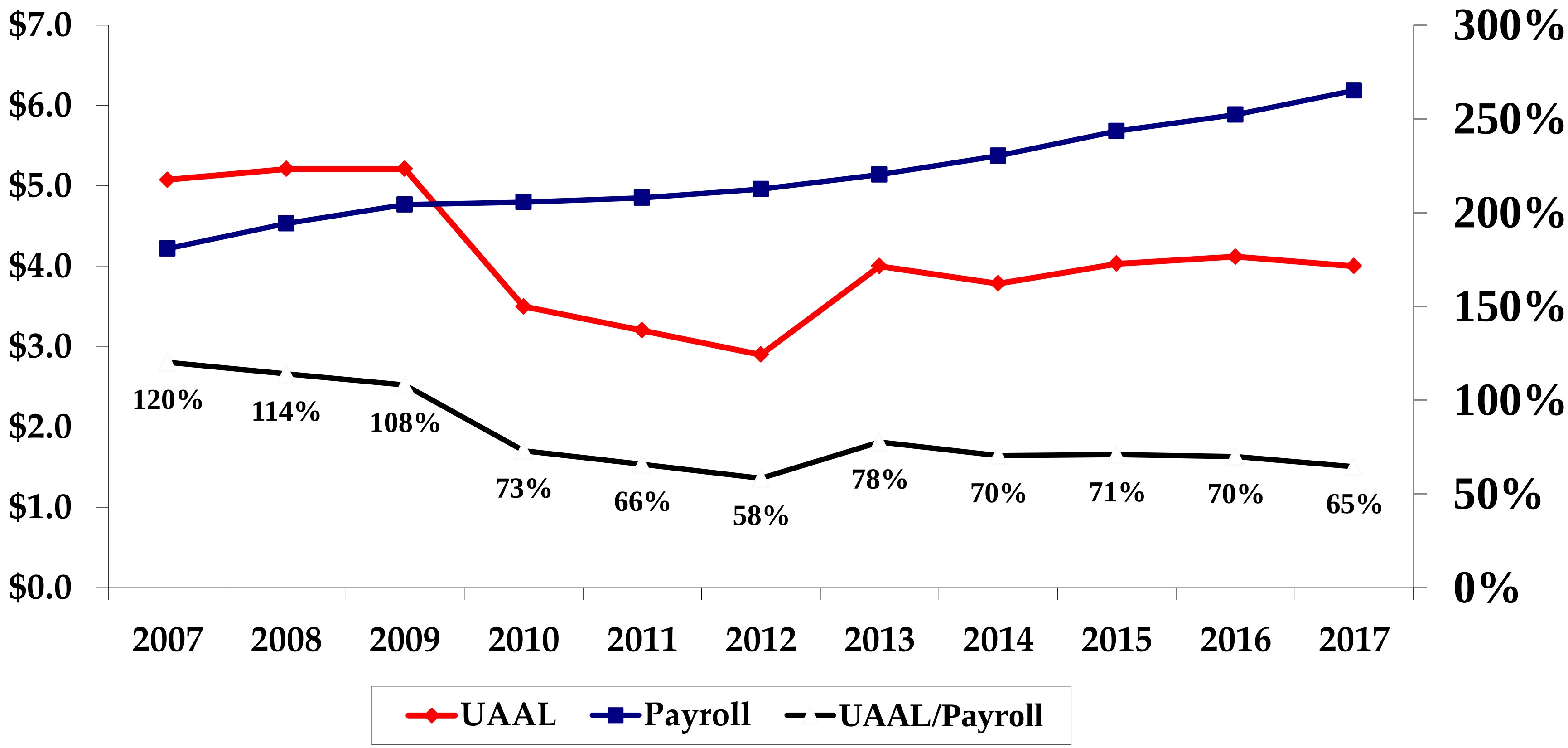
Relative Size of UAAL to AAL



Relative Size of UAAL to Payroll



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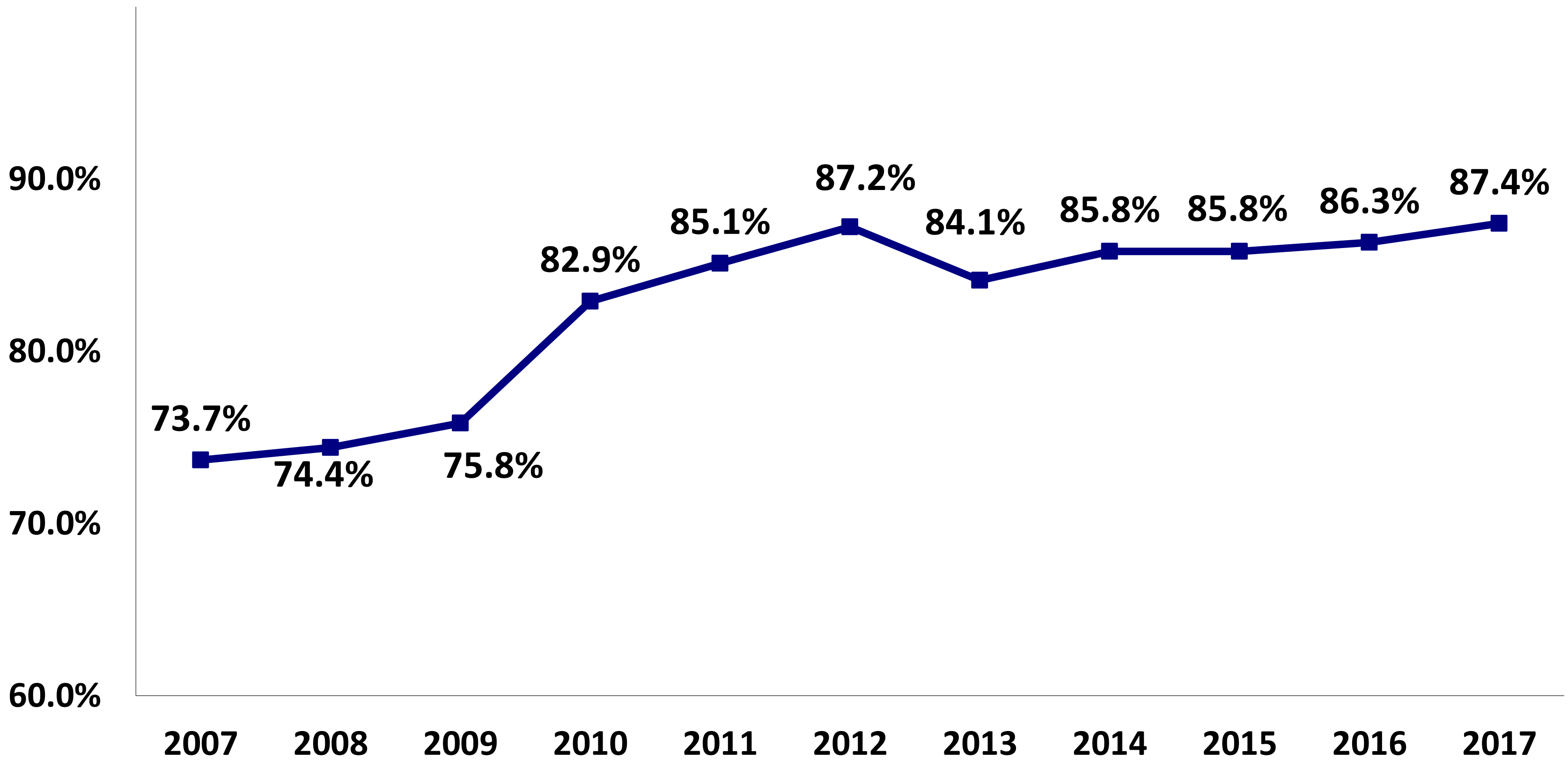
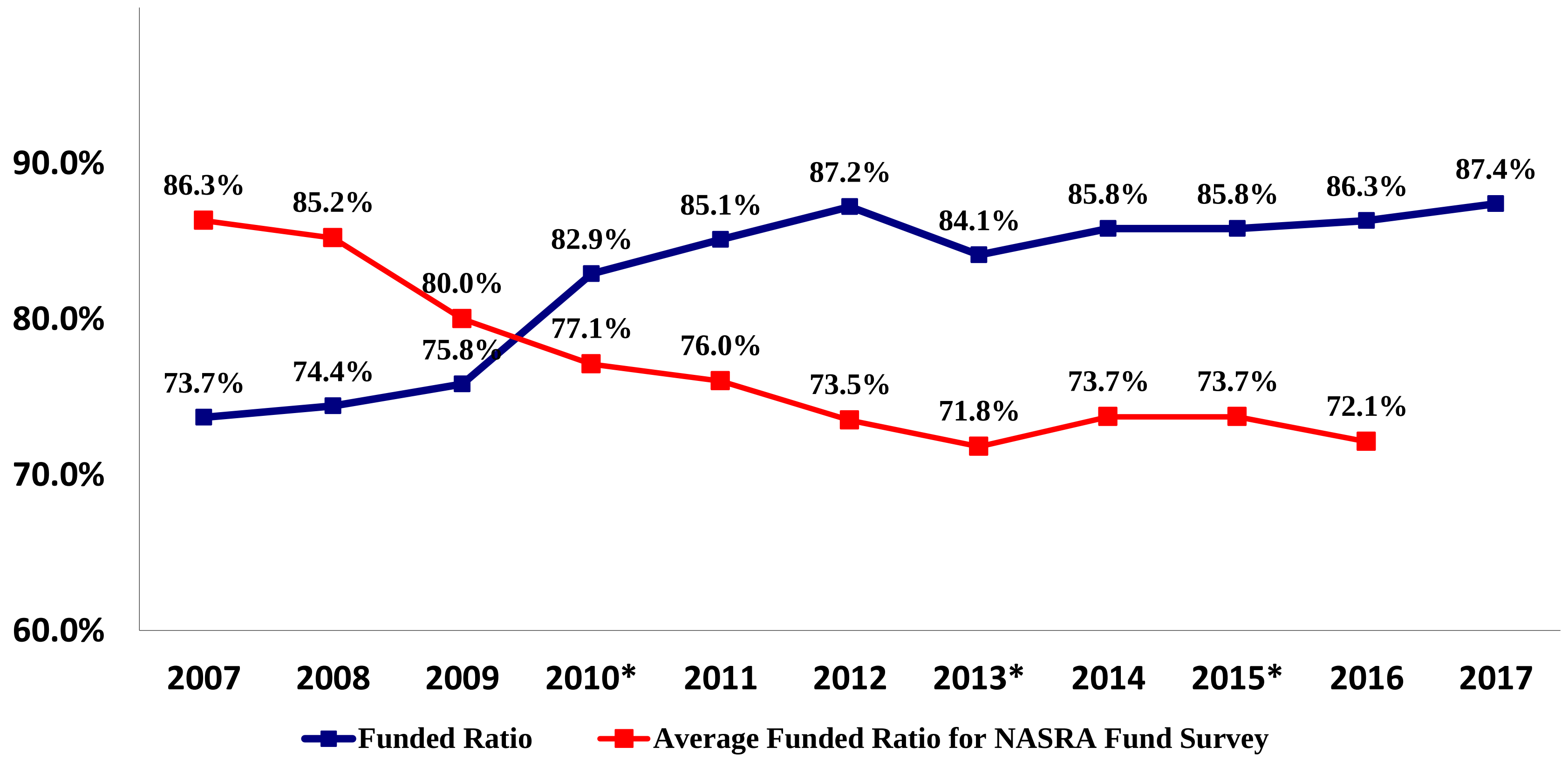
Funded Ratio Percentages



Funded Ratio Percentages:
Compared to Peers



- Restructure in 2010, Change to EAN in 2013, 6.75% Discount Rate in 2015
- 2017 Fund Survey Not Yet Available

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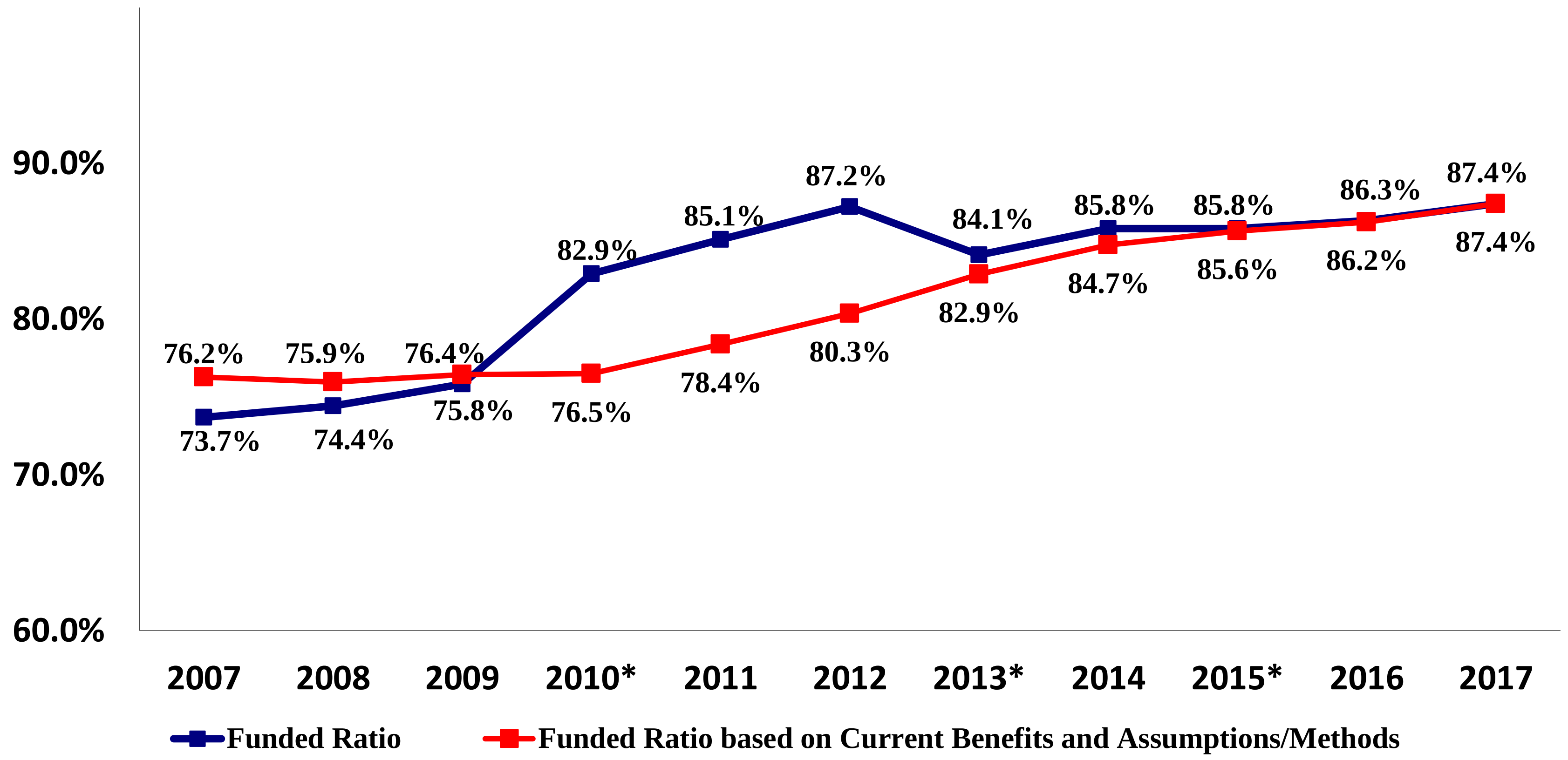
Funded Ratio Percentages:
Normalized to Current Assumptions and Benefits



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

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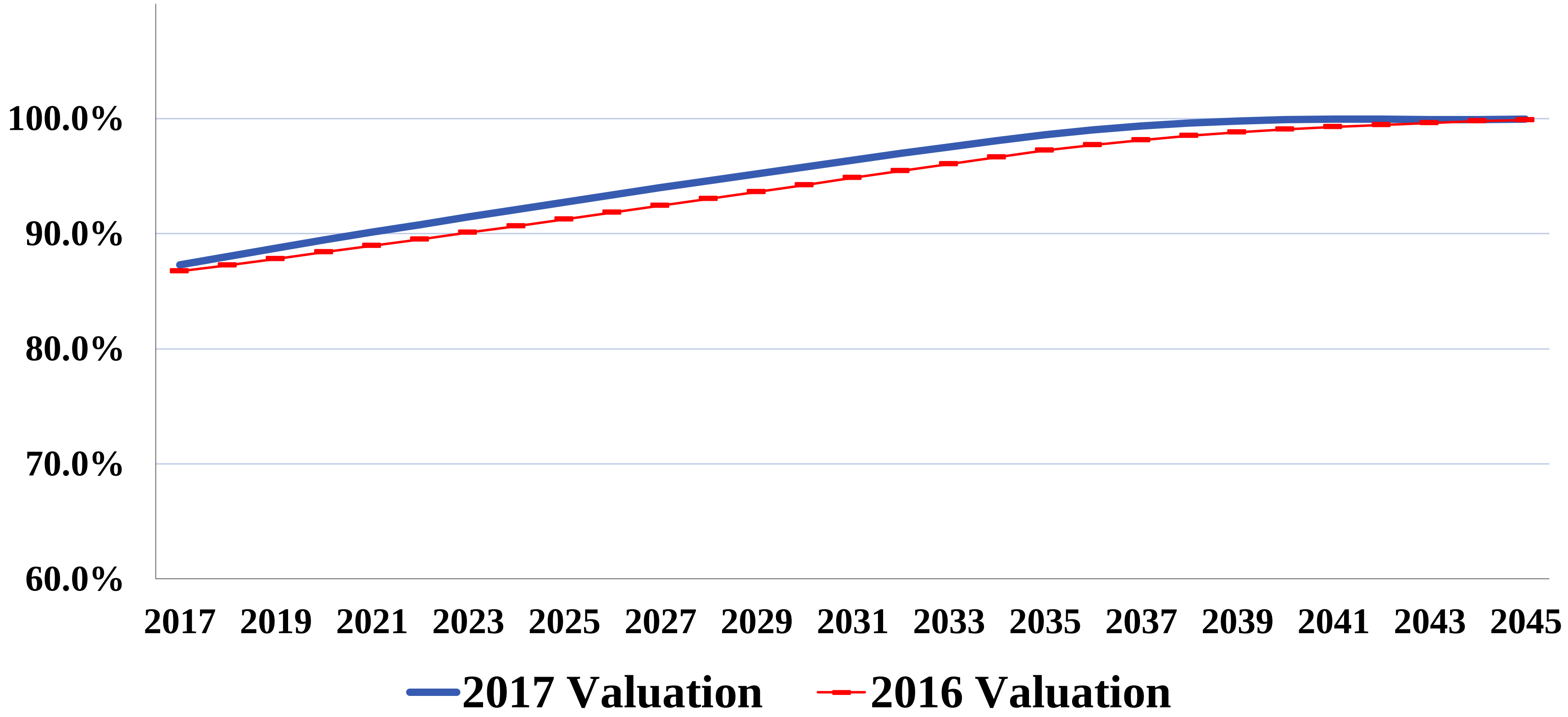
Projected Funded Ratio
(Longer Term)



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

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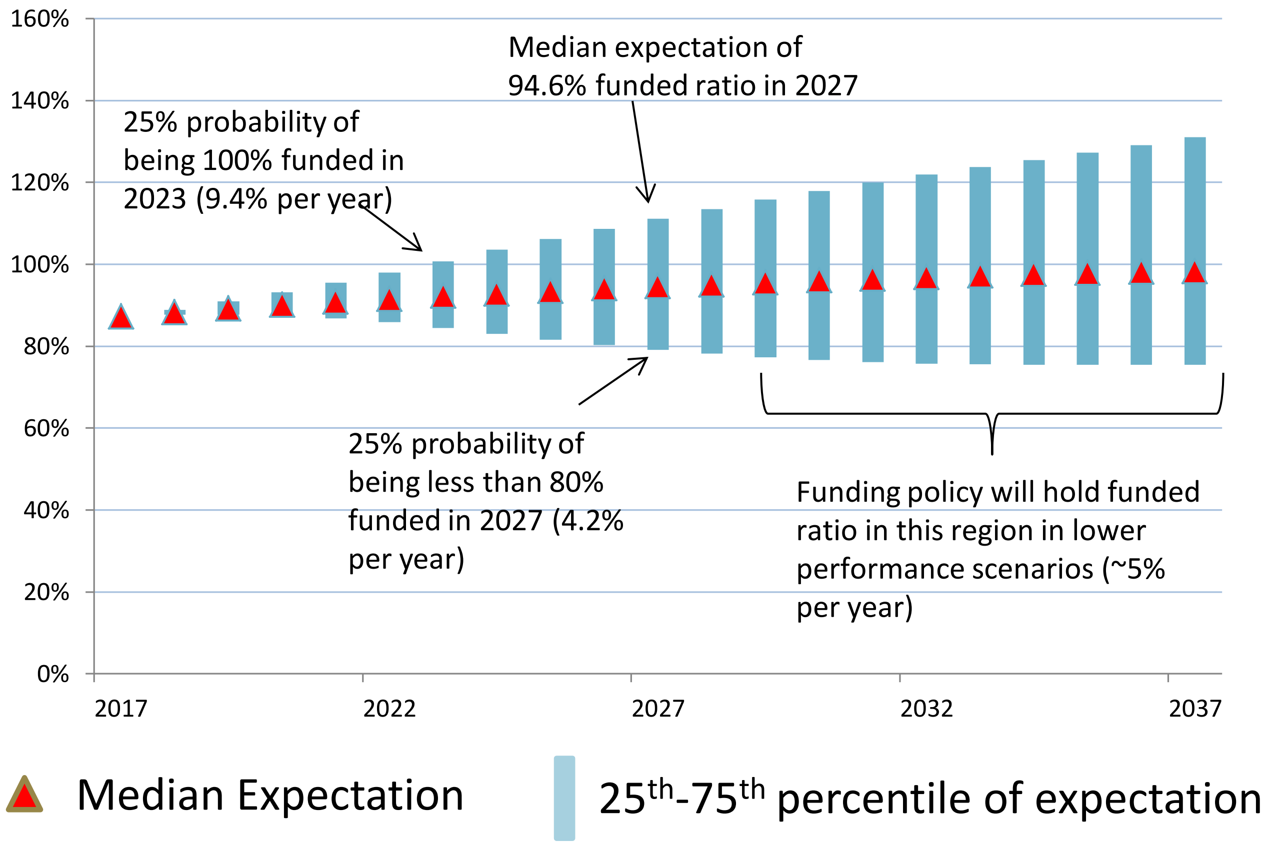
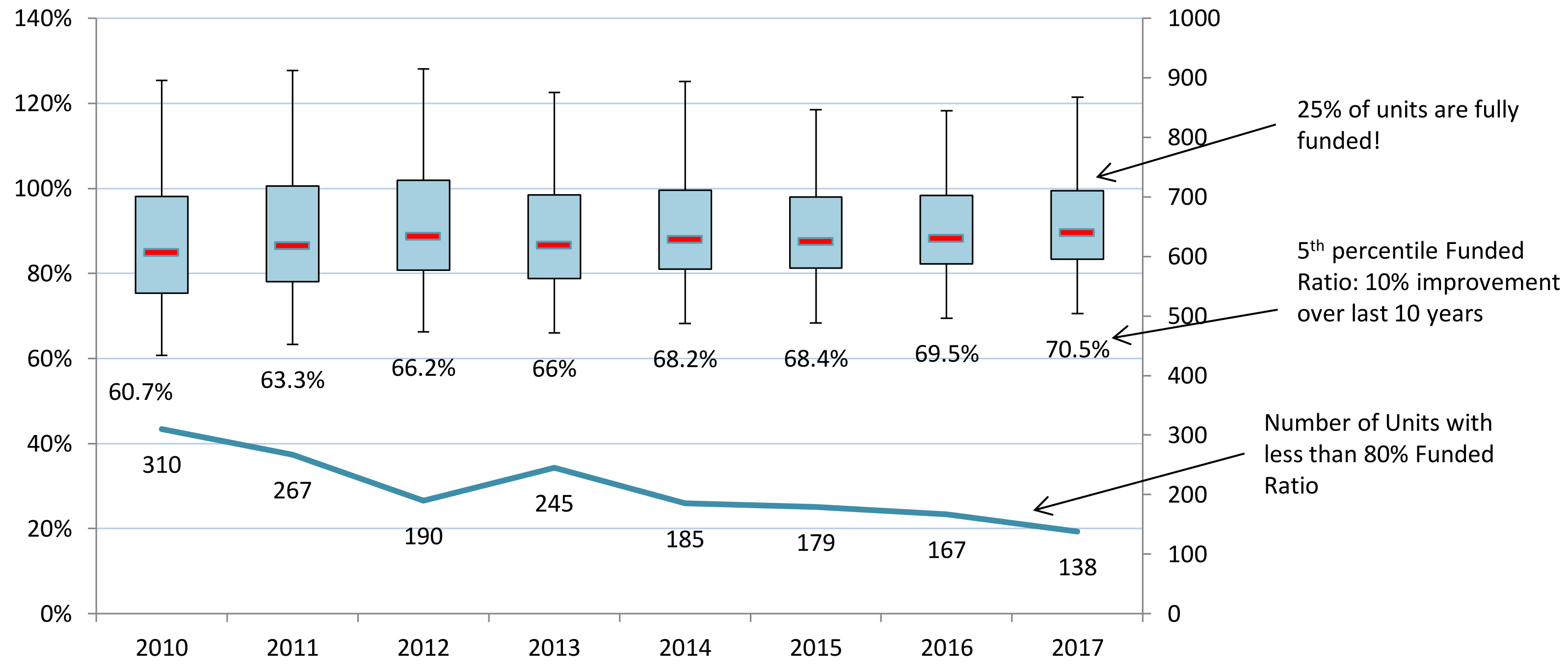
Projected Funded Ratio: System-wide

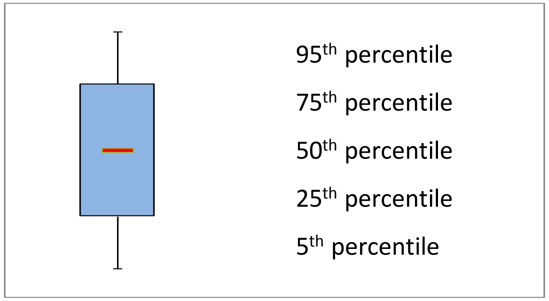


Returns and probabilities based on results of 2015 experience and asset allocation studies

- **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**

Distribution of Funded Ratio Percentages





The percentile represents the proportion of employers below the point. For example, the 75th percentile is 99%, meaning that 75% of cities have a funded ratio less than 99%. Conversely, 25% of the cities have a funded ratio of 99% or greater.

Amortization Layer Exhibit (Sample City)

Source	Original Balance	Remaining Balance as of December 31, 2017	Payment FY2018	Payment FY2019	Payment FY2020	Years Remaining
2013 Valuation (Fresh Start)	$ 25,099,074	$ 24,887,934	$ 1,831,551	$ 1,886,498	$ 1,943,092	19
2014 Experience	(1,320,133)	(1,307,100)	(96,192)	(99,078)	(102,050)	19
2015 Experience	475,691	485,214	27,834	28,669	29,529	28
2015 Actuarial Changes	(138,287)	(136,985)	(10,081)	(10,383)	(10,695)	19
2016 Experience	1,484,334	1,490,344	93,877	96,693	99,594	24
2017 Experience	(355,659)	(355,659)	(26,174)	$ (26,959)	$ (27,768)	19
Unfunded Actuarial Accrued Liability		**$ 25,063,748**	**$ 1,820,815**	**$ 1,875,440**	**$ 1,931,703**	
Projected Payroll			**$ 27,941,147**	**$ 28,779,381**	**$ 29,642,763**	
Amortization Payment as a Percent of Payroll			**6.52%**	**6.52%**	**6.52%**	

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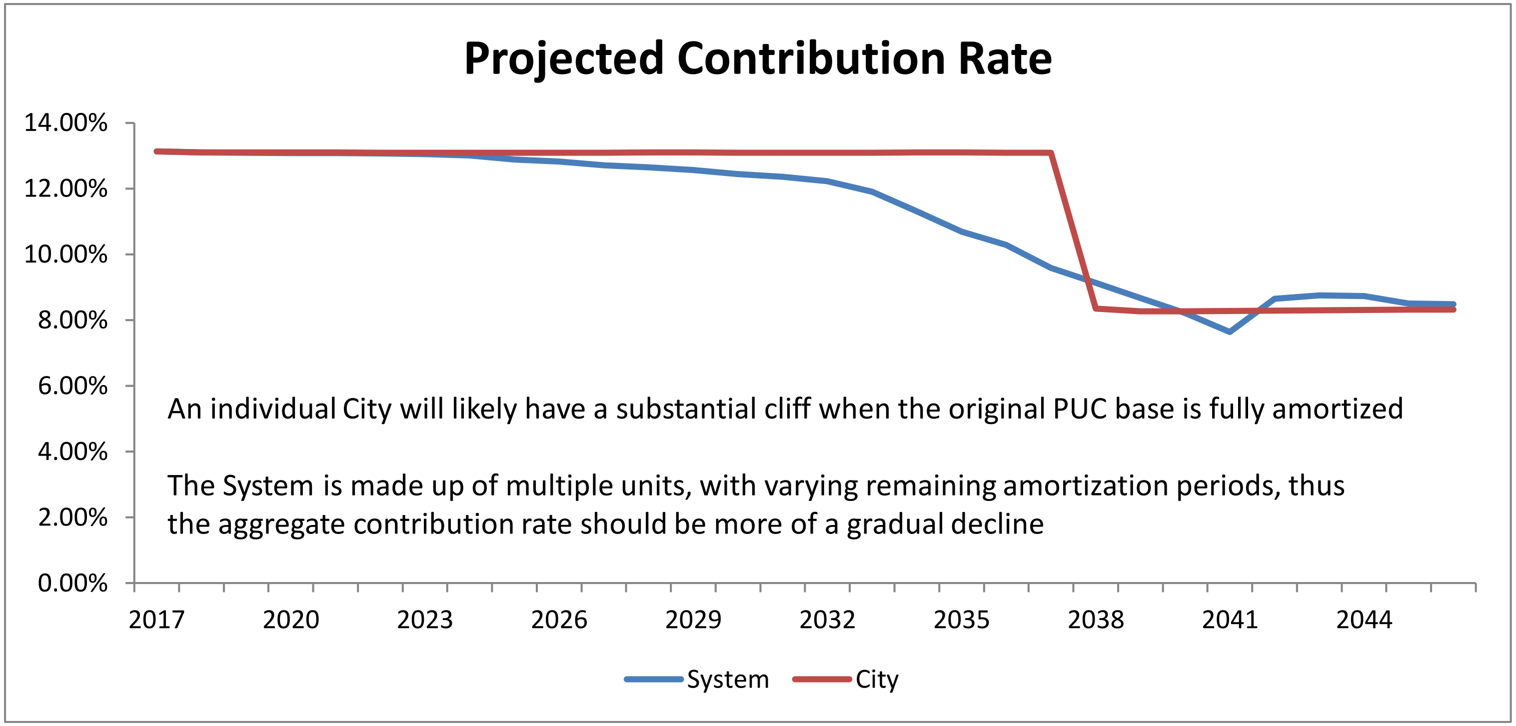
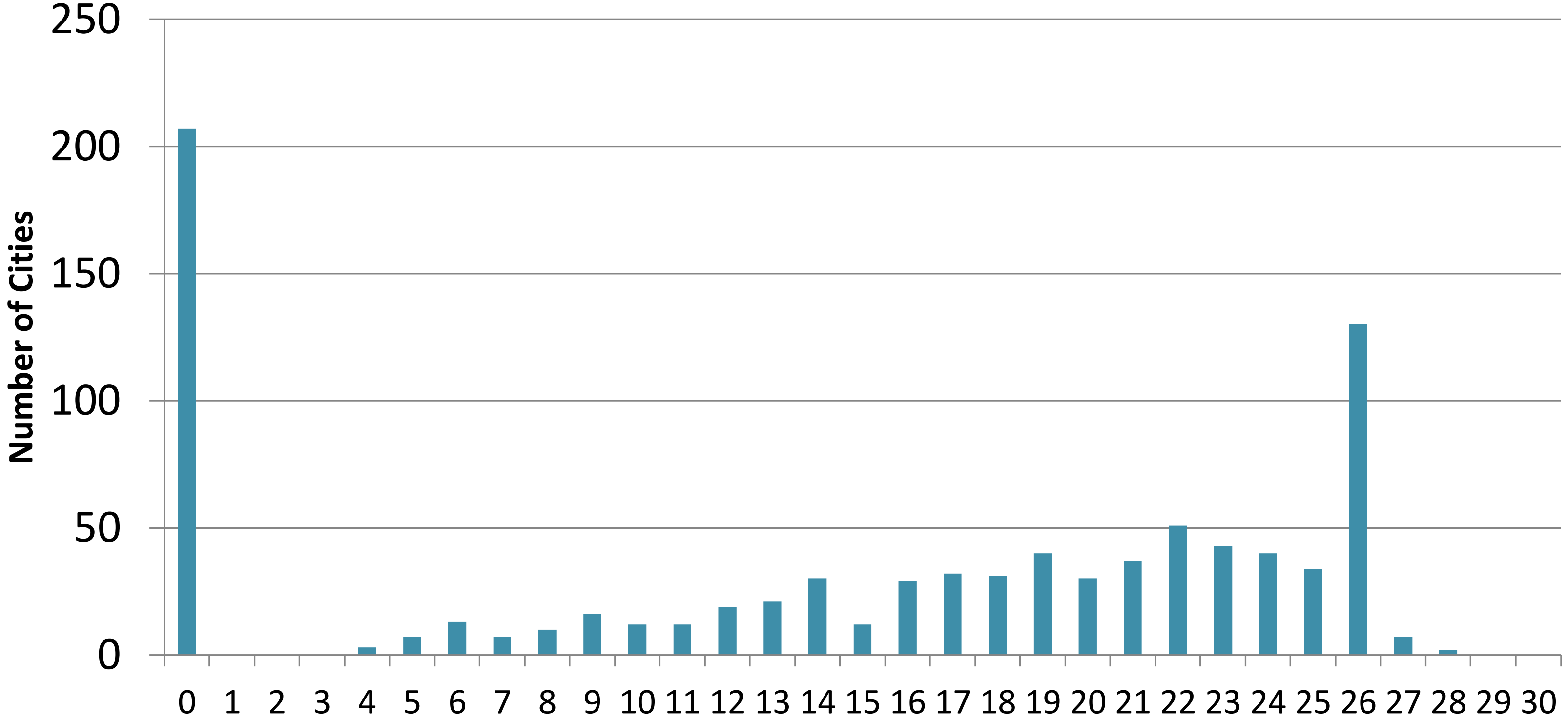
Total System vs Individual City



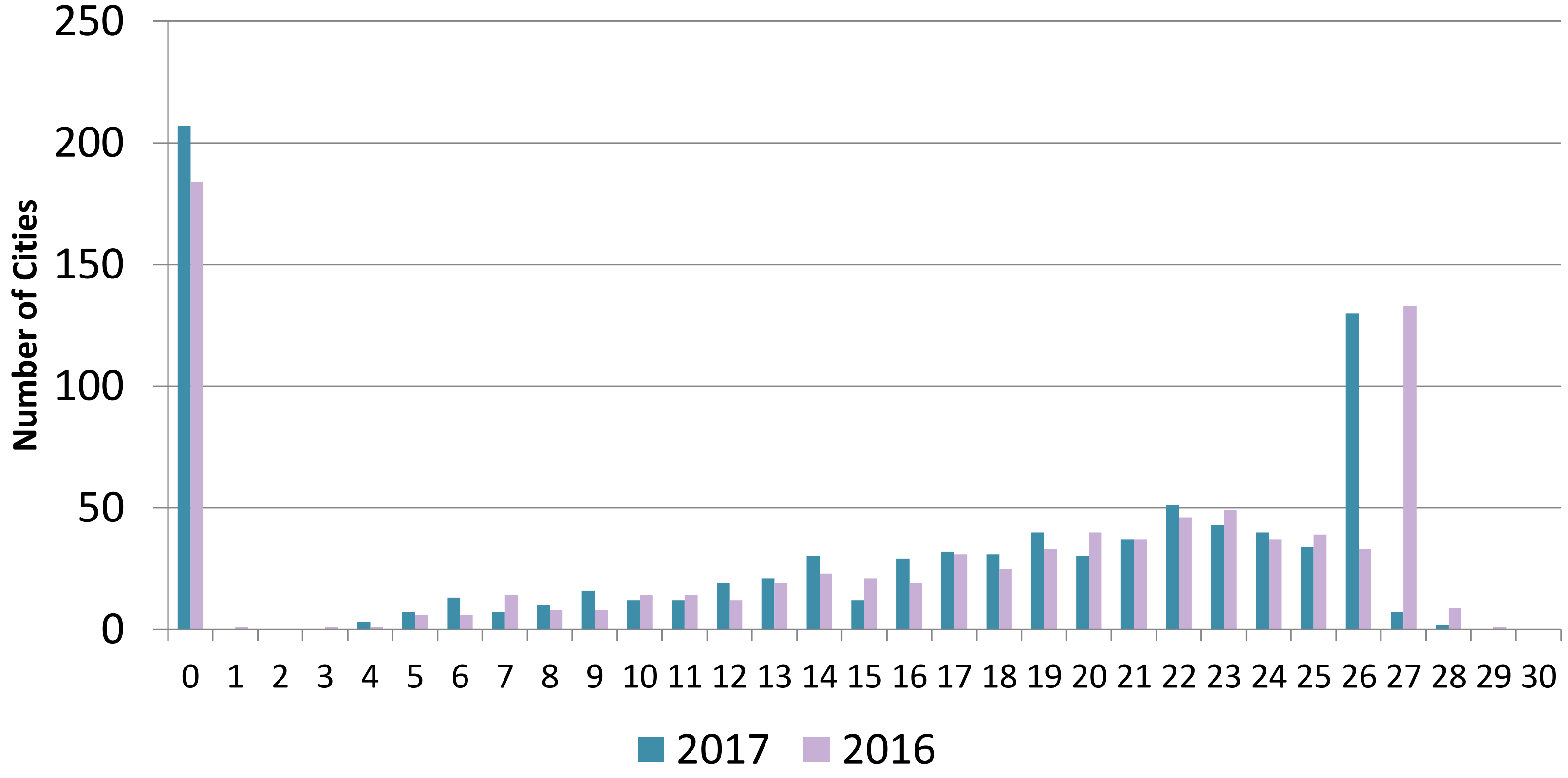
Projected from current smoothed assets

Distribution of Single Equivalent Amortization Periods



Remaining average period in years
0 would be overfunded

Distribution of Single Equivalent Amortization Periods



Remaining average period in years
0 would be overfunded

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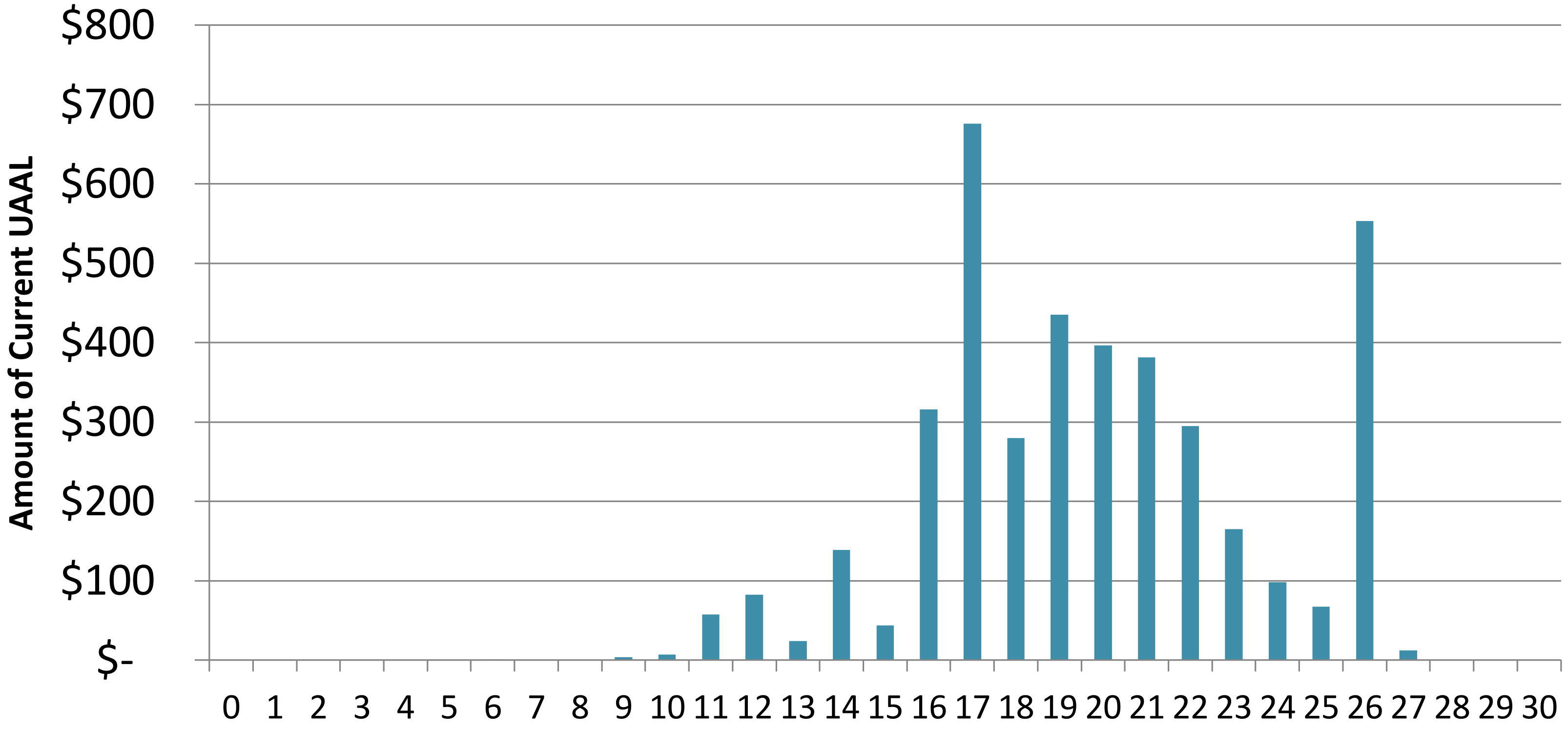
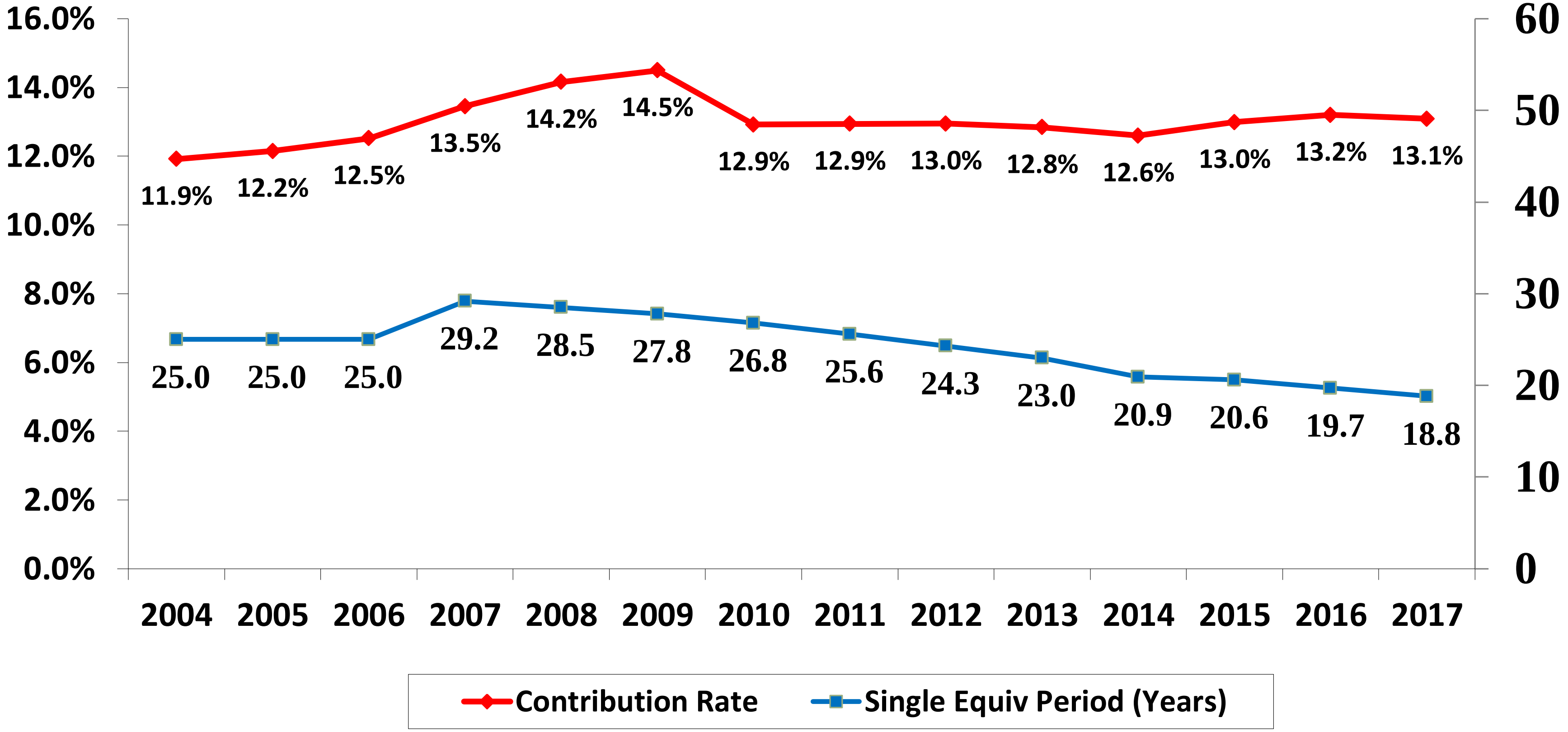
Distribution of Single Equivalent Amortization Periods: Weighted by UAAL



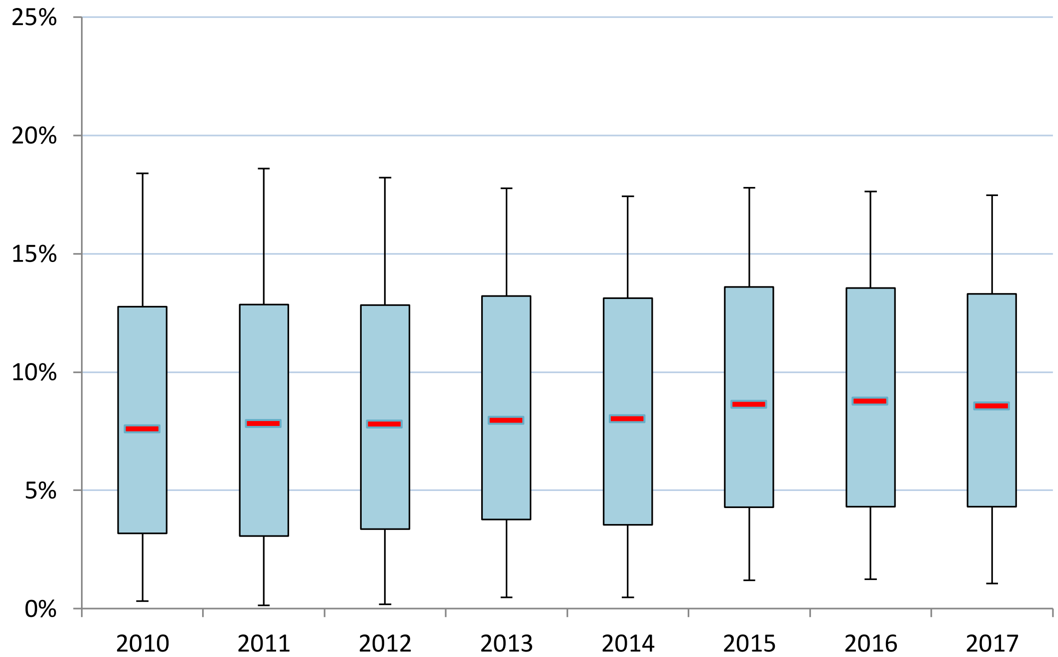
$ in millions
Remaining average period in years
0 would be overfunded

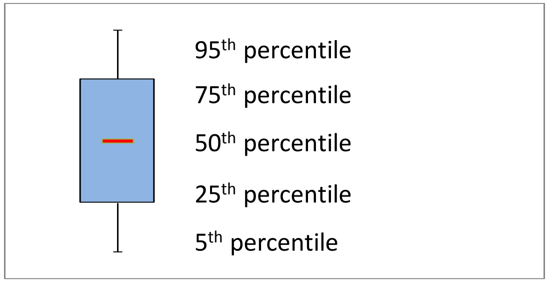
Historical Dollar Weighted Contribution Rates for TMRS



Contributions represent aggregate phase in minimums

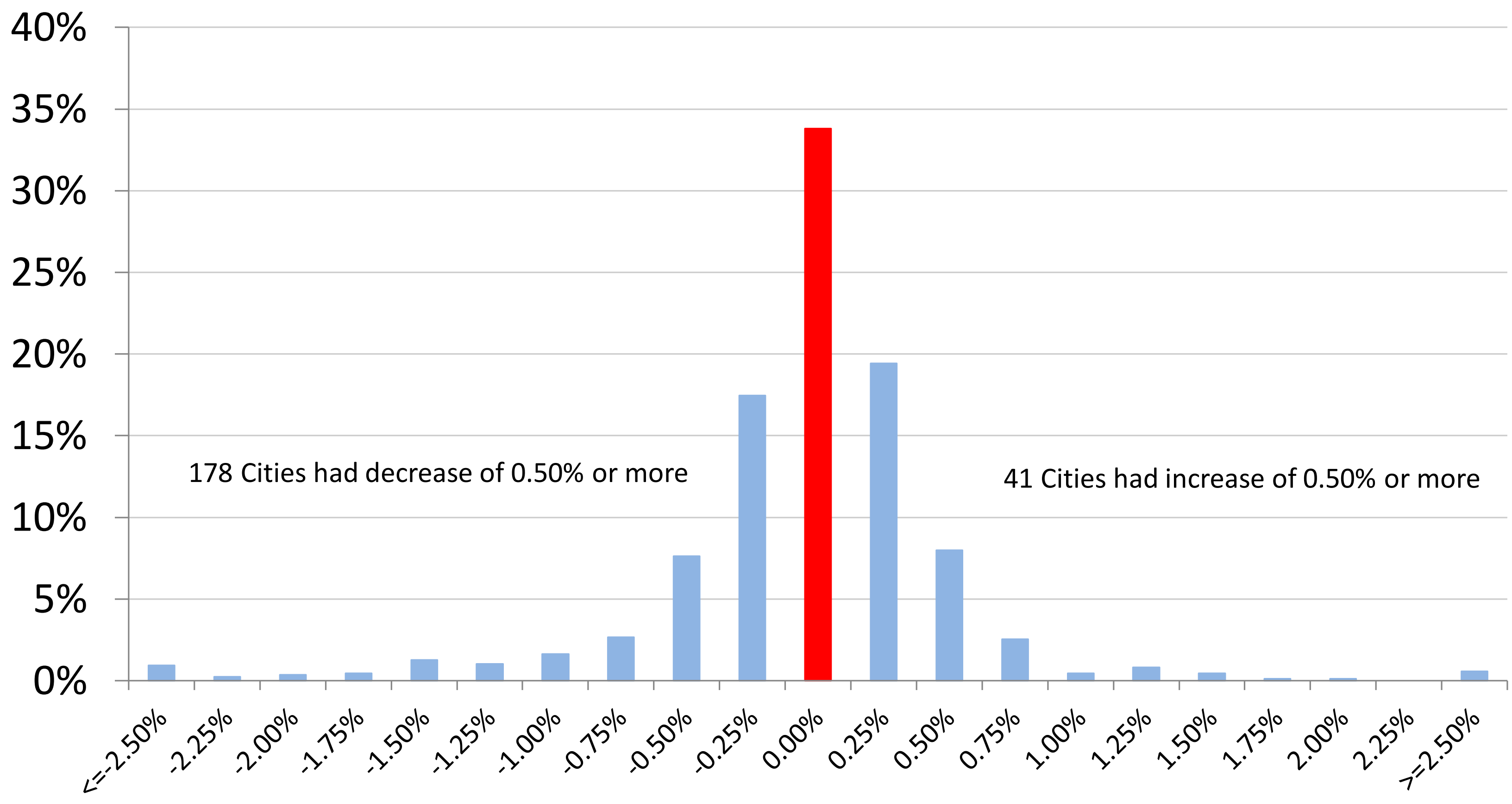
Distribution of Full Retirement Rate





The percentile represents the proportion of employers below the point. For example, the 75th percentile is 13.30%, meaning that 75% of cities have a rate less than 13.30%.

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



Rounded to nearest 0.25% change in rate

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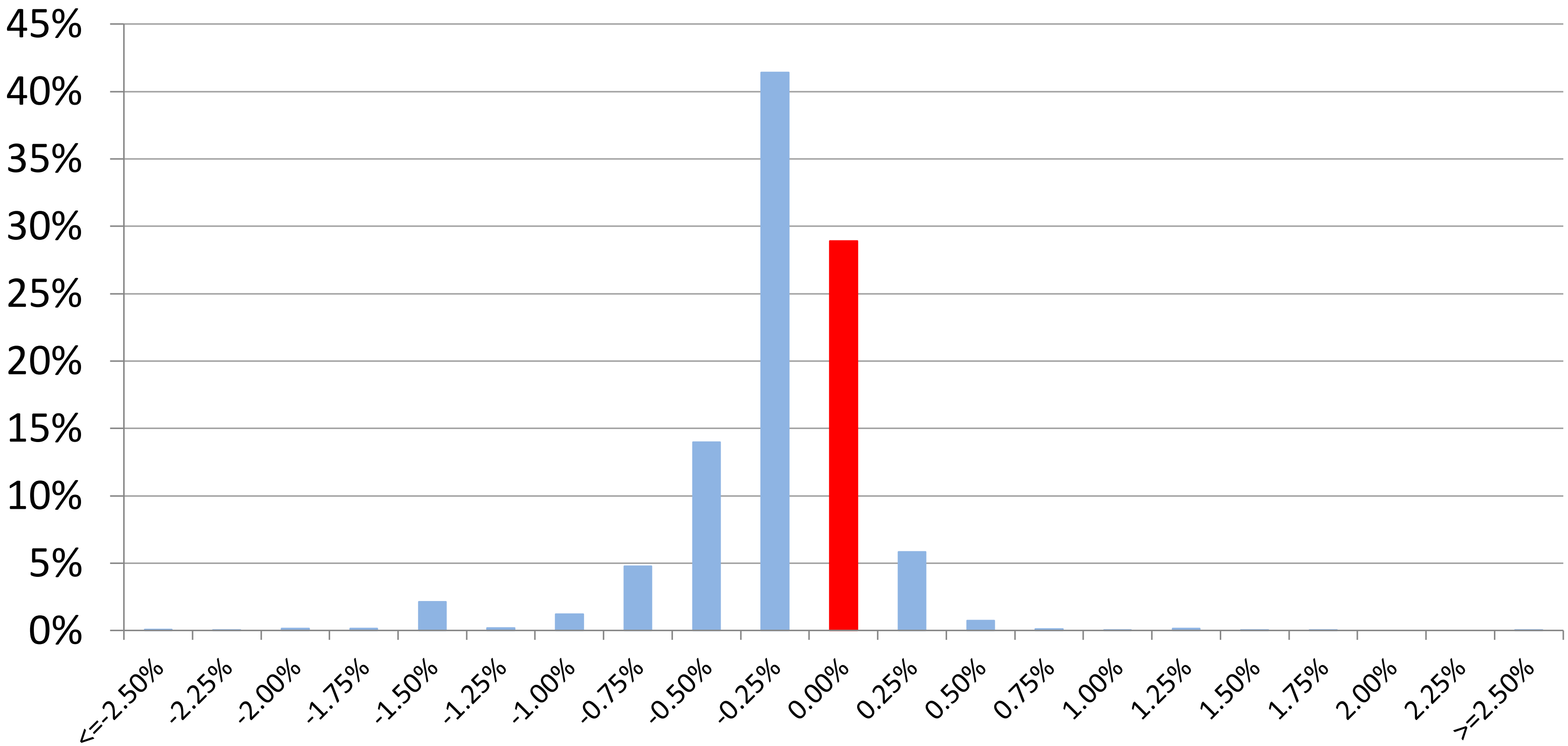
Distribution of Changes: Payroll Weighted Total Changes in Full Retirement Rate



Rounded to nearest 0.25% change in rate

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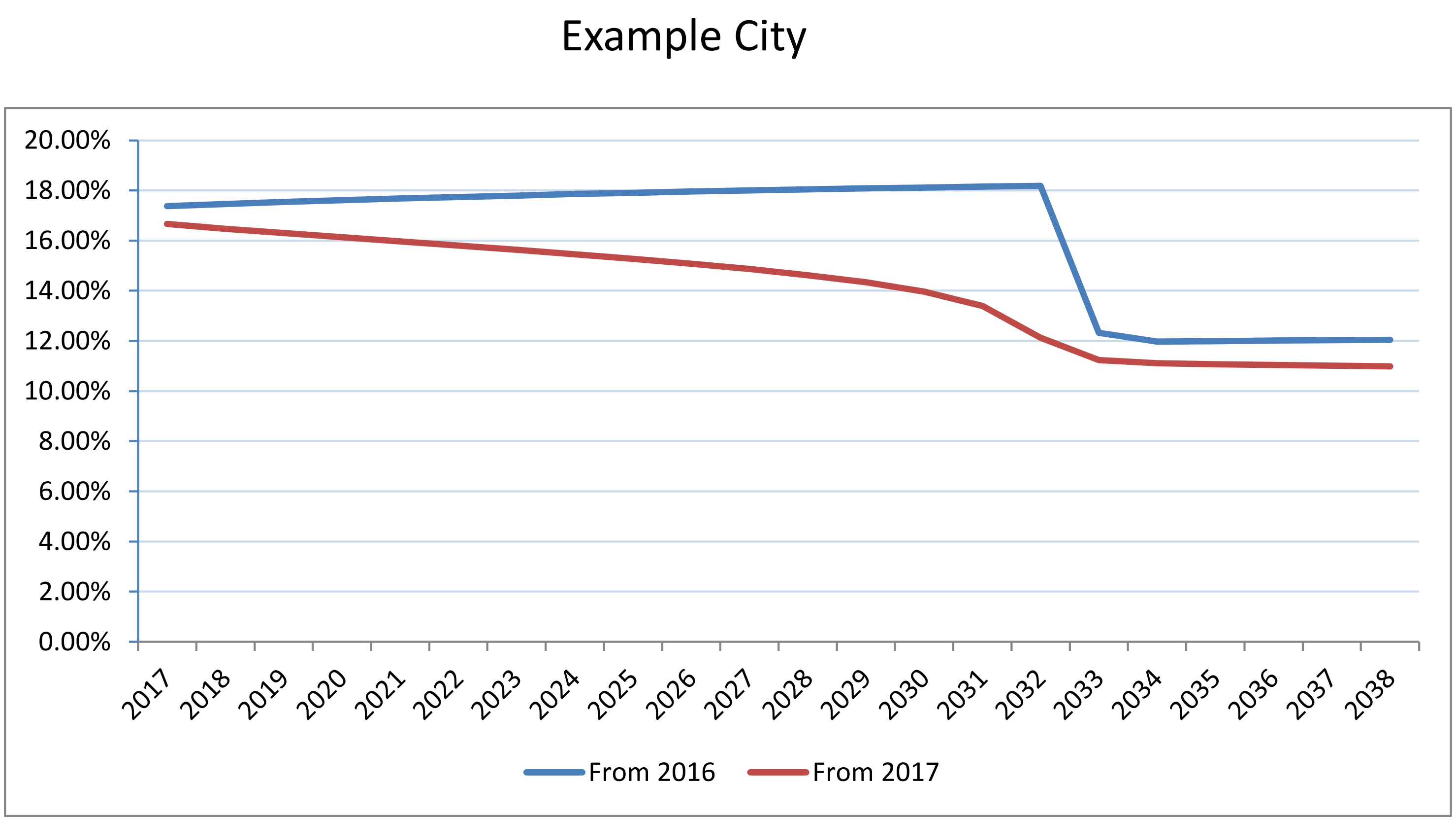
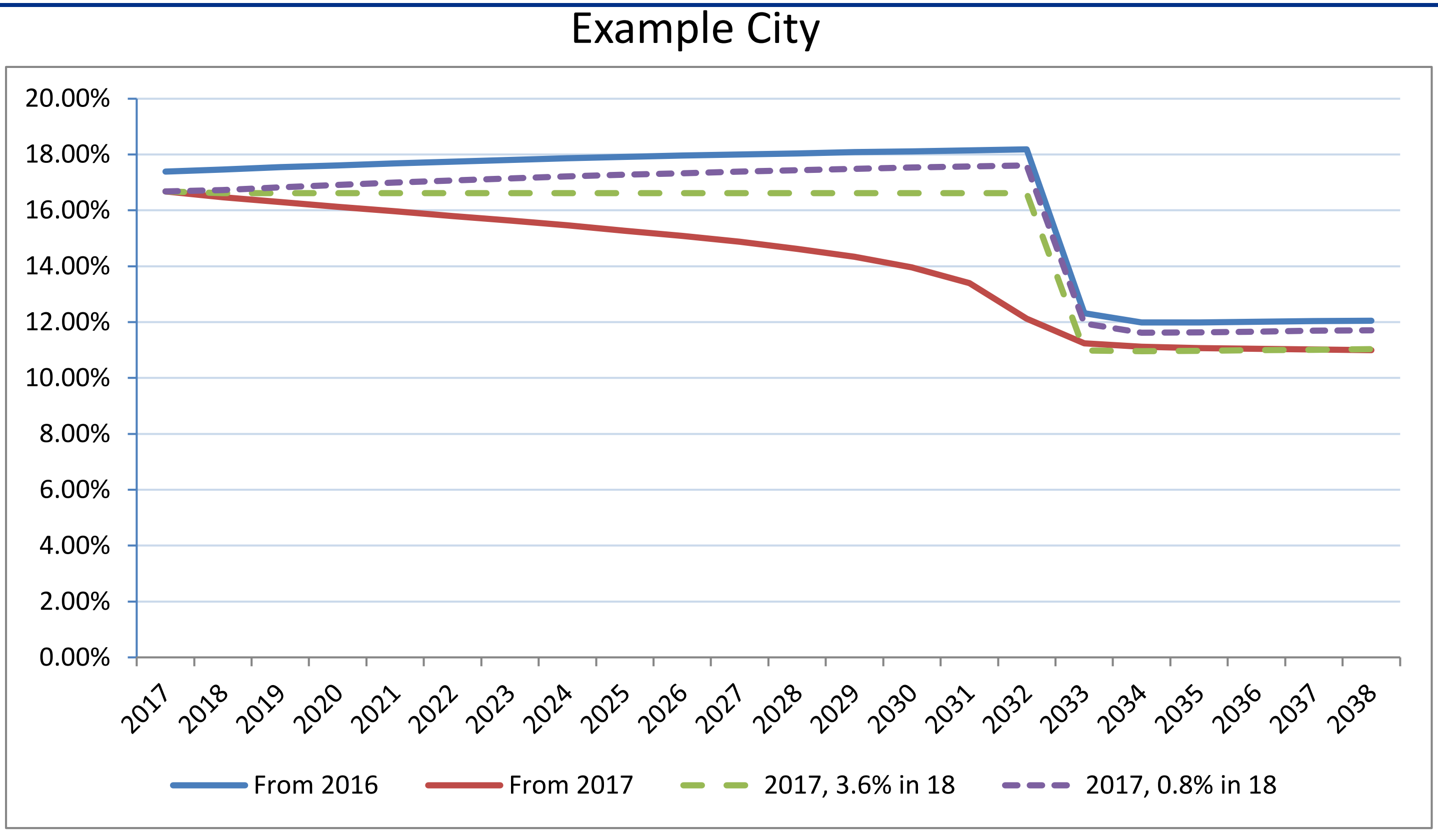
Impact of Strong Performance on Projected Contribution Rates



Projected from current market assets

Impact from Illustrated Adverse Experience in 2018



A 3.6% return in 2018 would offset current deferred excess and hold rates mostly steady throughout the period
A 0.8% return in 2018 would more than push the trajectory back towards last year's projections

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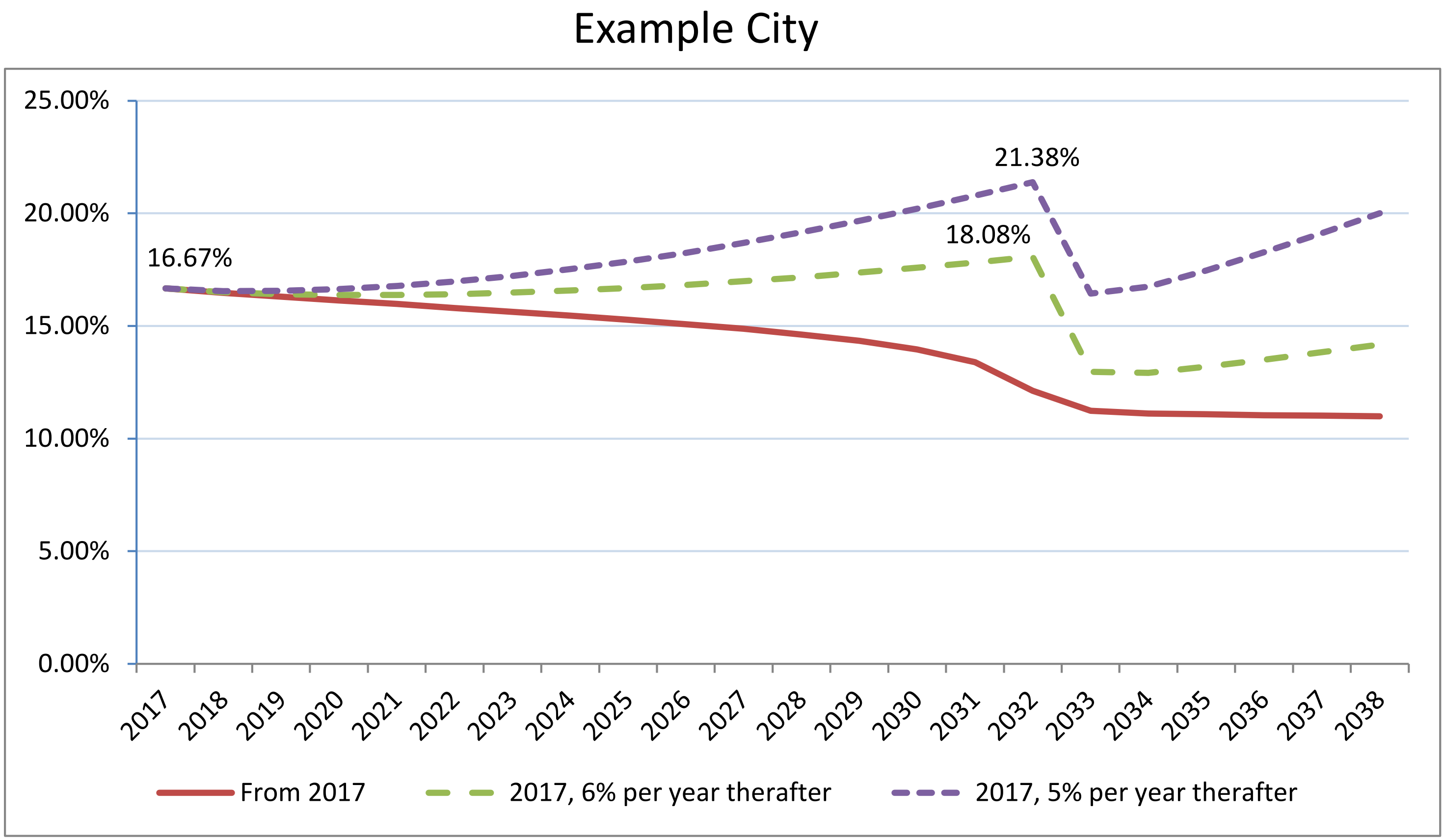
Impact from Longer Term Adverse Experience



Phase-In

- As of the prior valuation, 113 TMRS cities were eligible to pay a phase-in rate due to changes in 2013 and 2015
- The remaining base is phased in by 0.50% per year and further decreased by experience gains, if any.
  - 17 cities have a phase-in rate this year
    - Lower than last year's expected 36 due to experience gains
  - Expected Runoff:
    - 9 cities with a phase-in in 2018 valuation (0% of overall payroll)
    - 4 cities with a phase-in in 2019 valuation (0% of overall payroll)
    - 2 cities with a phase-in in 2020 valuation (0% of overall payroll)
- We continue to recommend cities contribute their full 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
- 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

	Answer	Stars
Do you have a legally required contribution amount based on accepted actuarial practices?	Yes	*****
Does the contribution amount automatically adjust if certain minimums are not met?	Yes	*****
Has the sponsor demonstrated a 10-year history of meeting the required contribution?	Yes	**** (>90%, Phase In)
Is your funded ratio higher than it was 10 years ago?	Yes	*****
Based on current practices and assumptions, is your UAAL expected to be lower 10 years from now?	Yes	*****
What is the amortization period for the current UAAL based on the required contribution?	18.8	***** (<20, positive amortization)
What is the amortization period for new losses?	25	***** (<25)
What is the sum of your amortization period and asset smoothing period?	35	*** (<35)
What is the amortization period for benefit enhancements?	25/15	**1/2 (20 years or less for retirees (ad hoc)/25 years or less for active (repeating))
What is the likelihood of meeting or exceeding the assumed return assumption over the next 20 years based on actuarial analysis?	45-50%	** (Between Arithmetic and Geometric Mean)
Does the Board regularly review actuarial assumptions?	Yes	***** (at least every 4 years)
What is the assumed rate of payroll growth for amortization purposes?	3.00%	***** (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)
What is the annual percent change in active population last 10 years?	~1.00%	***** (>0.5%)
Are any of the liabilities contingent on future experience?	Yes/No	*** (COLA is CPI based, benefits can be discretionally adjusted prospectively)
What is your current active to retiree ratio?	1.8	***** (1.7 or higher)
What is your longer term active to retiree ratio?	1.1-1.4	**
What is your short – intermediate term negative cash flow as a % of assets?	<1.0%	***** (<3.0%)
What is your longer term negative cash flow as a % of assets?	~3.0%	***** (<3.0%)

Sustainability Checklist

- TMRS grades out very well on the checklist
  - Required actuarial contributions
  - Closed amortization periods in the 18-25 year range
  - Reasonable payroll growth assumptions
  - Manageable short and long term cash flow needs
  - Benefit that automatically adjusts to changing mortality patterns

- Items to pay attention to
  - 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
  - Amortization periods for benefit enhancements are slightly longer than optimal

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In Summary

- Overall System-wide "health" continues to improve
  - Overall funded levels continue to improve
  - Contributions rates have remained relatively stable
- With no changes in assumptions, the expectation is for an increasing funded ratio over the next few valuations and continued stability in the contribution rates, System-wide

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