Texas Municipal Retirement System Actuarial Valuation Report as of December 31, 2016

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Mark Randall
Joseph Newton

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Gabriel Roeder Smith & Company
Consultants & Actuaries
www.gabrielroeder.com

Today's Agenda

- Summary of System-wide Results
- Asset Performance
- Funded Status
- Contribution Requirements
- Future Expectations
- Summary

Summary of System-wide Results

$ amounts in millions	Dec 31, 2015 Valuation	Dec 31, 2016 Valuation
Actuarial Accrued Liability (AAL)	$28,379	$29,963
Actuarial Value of Assets	$24,348	$25,844
Unfunded Actuarial Accrued Liability (UAAL)	$4,031	$4,119
Funded Ratio	85.8%	86.3%
Full Contribution Rates:		
Straight Average	9.02%	9.07%
Payroll Weighted Average	13.24%	13.27%
Normal Cost %	8.41%	8.41%
Prior Service %	4.83%	4.86%

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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	$4,031	85.8%	13.24%
Interest (6.75%)	274		
Amortization Payments*	(291)	0.9%	-0.08%
Asset Performance	76	-0.3%	0.08%
Benefit Changes	27	-0.1%	0.06%
Assumption/Method Changes	0	0.0%	0.00%
Contributions different than Actuarially Determined	10	0.0%	-0.02%
Liability (Gains)/Losses	(8)	0.0%	-0.01%
UAAL @ EOY	4,119	86.3%	13.27%

*No longer have "negative" amortization as the funding period has reached approximately 20 years

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Non-Investment Experience

- Actual CPI of 2.07% 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
  - 2015 CPI of 0.73% resulted in a system-wide gain of about $110 million
  - 2014 CPI of 0.76% resulted in a system-wide gain of about $100 million
- Valuation uses 3-year smoothing on salaries
  - The 2015-2016 salary experience in aggregate was close to expected, 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 $50 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

  47 cities made changes that impacted the total retirement rate since the last valuation

  - Increases in Benefits 45
  - Decreases in Benefits 2

- Number of cities changing matching ratio, deposit rate, and eligibilities 27

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Summary of Benefit Changes (cont)

- USC Changes
  - Ad Hoc USC 12
  - New Repeating USC 2
  - Rescind/Decrease Repeating USC 1
- COLA Changes
  - Ad Hoc COLA 15
  - New Repeating COLA 1
  - Rescind/Decrease Repeating COLA 1

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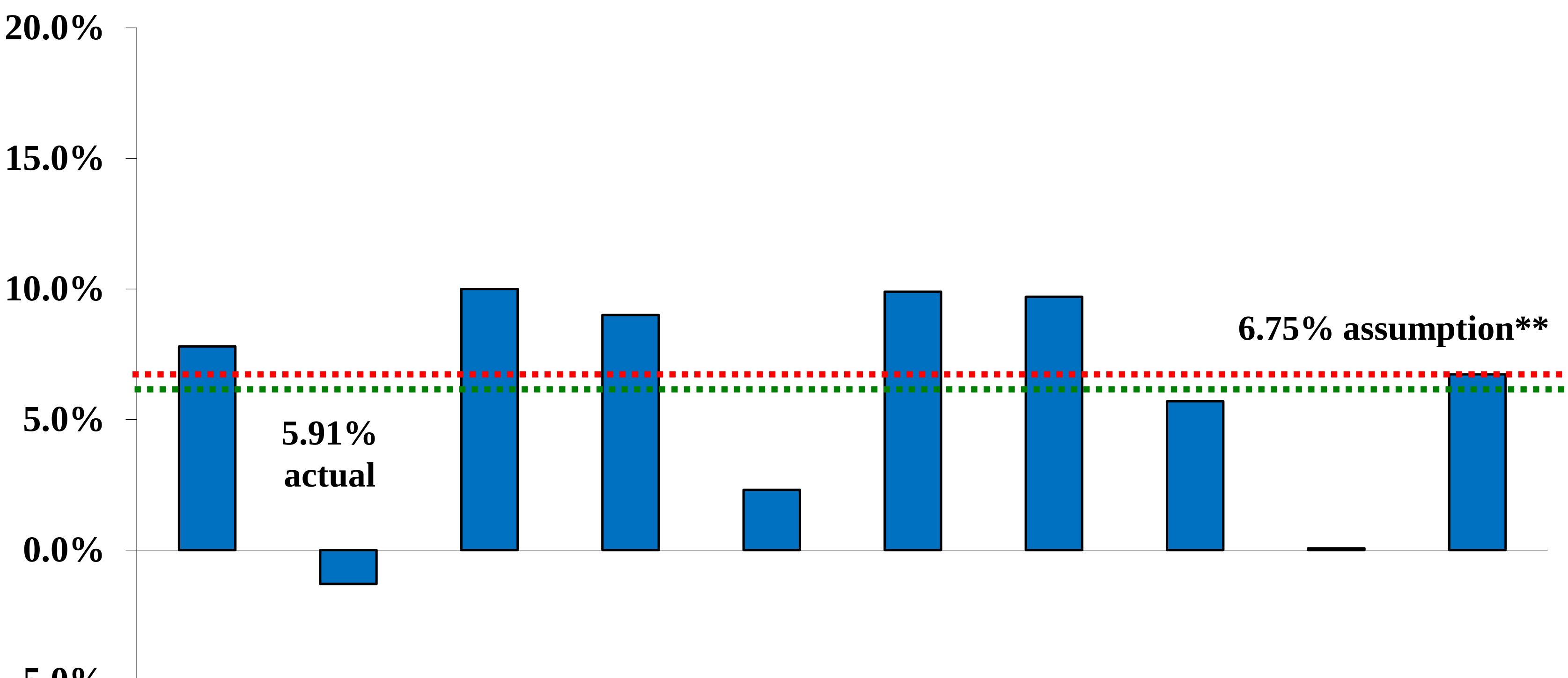
Yields based on Market Value of Assets



	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016*
Market	7.8%	-1.3%	10.0%	9.0%	2.3%	9.9%	9.7%	5.7%	0.1%	6.7%

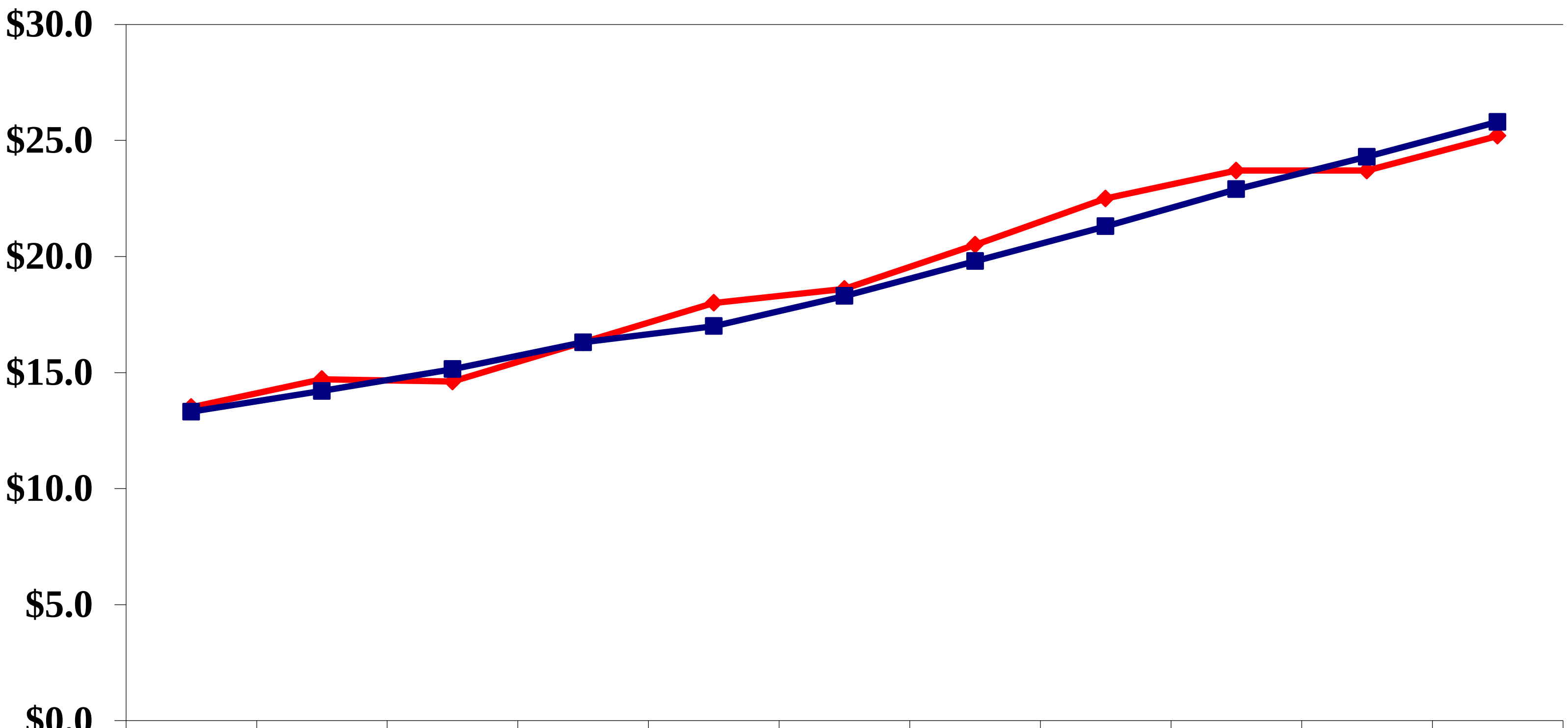
5.91% average compound return (on market value) over last 10 years

* Estimated

** Assumption was 7% from 2007 - 2015

Market and Actuarial Values of Assets

$ amounts are in Billions



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016*
Market	$13.5	$14.7	$14.6	$16.3	$18.0	$18.6	$20.5	$22.5	$23.7	$23.7	$25.2
Actuarial	$13.3	$14.2	$15.1	$16.3	$17.0	$18.3	$19.8	$21.3	$22.9	$24.3	$25.8

* Estimated

- AVA is currently 102.4% of MVA, was 102.5% last year

  AVA was Book Value prior to 2009

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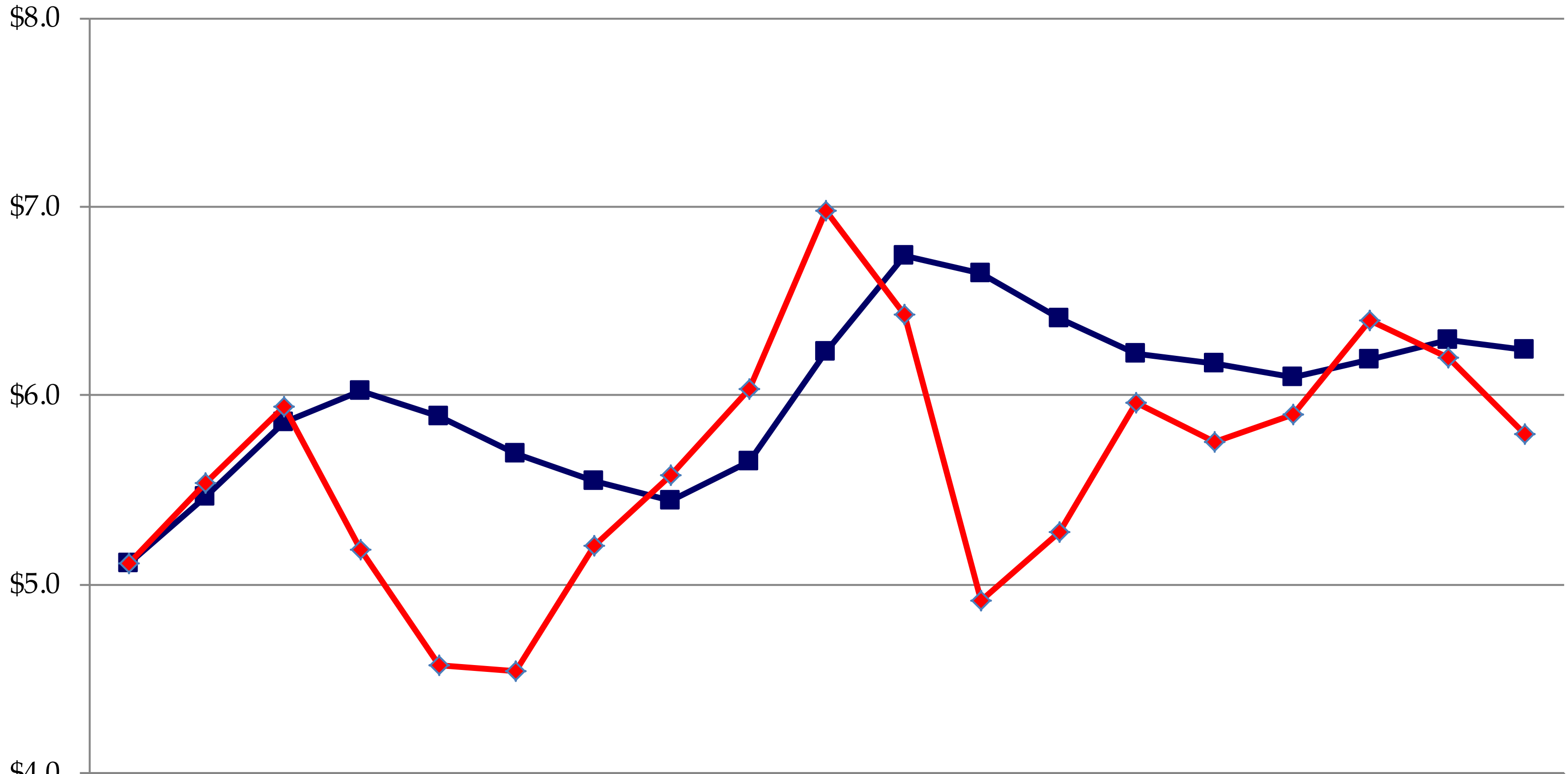
Illustrated from Another Client



	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
AVA	5.1	5.5	5.9	6.0	5.9	5.7	5.5	5.4	5.7	6.2	6.7	6.7	6.4	6.2	6.2	6.1	6.2	6.3	6.2
MVA	5.1	5.5	5.9	5.2	4.6	4.5	5.2	5.6	6.0	7.0	6.4	4.9	5.3	6.0	5.8	5.9	6.4	6.2	5.8

MVA: Market Value of Assets
AVA: Actuarial Value of Assets

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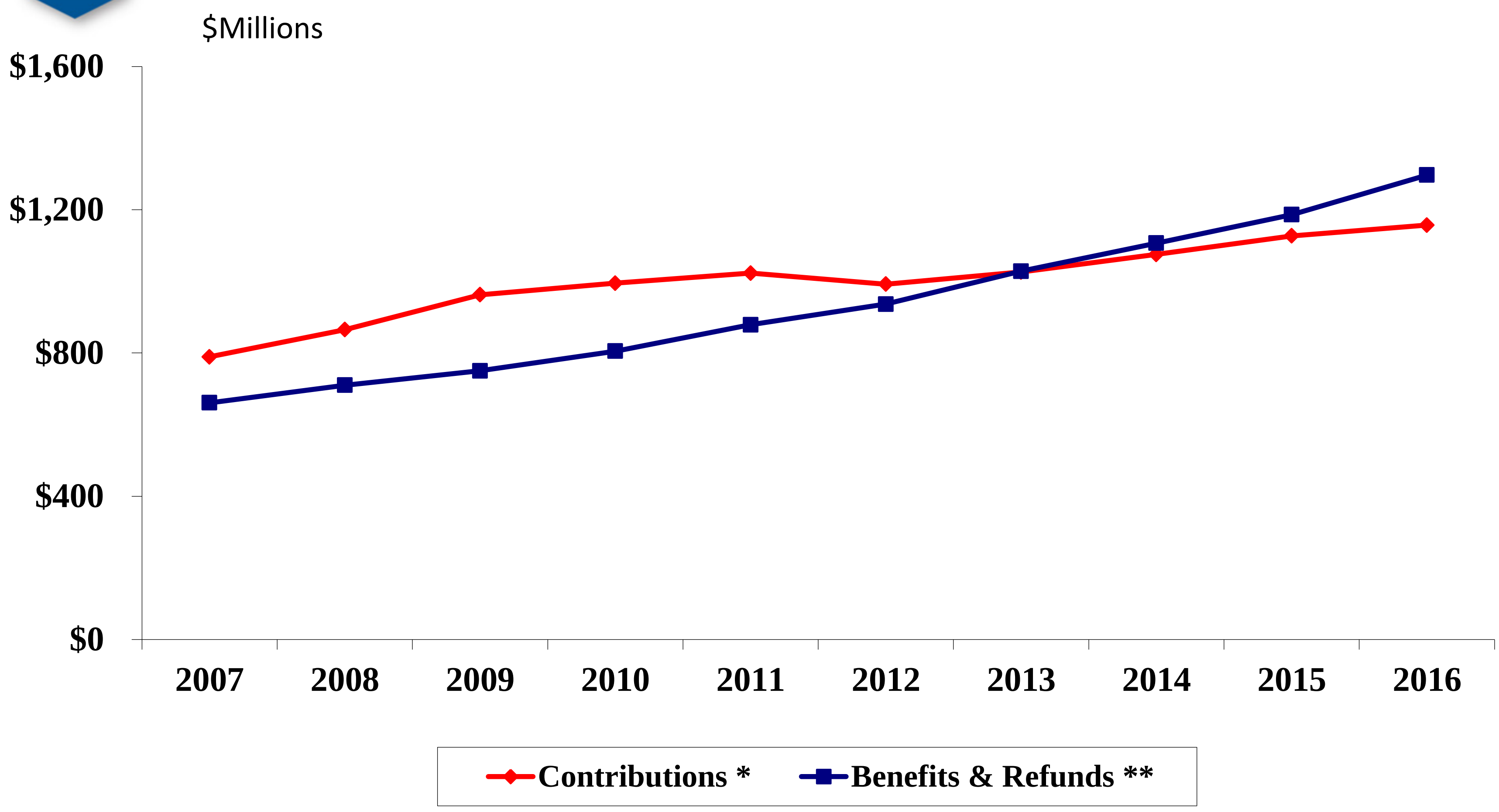
Contributions vs. Benefits and Refunds



* Includes member and employer contributions

** Includes administrative and investment expenses

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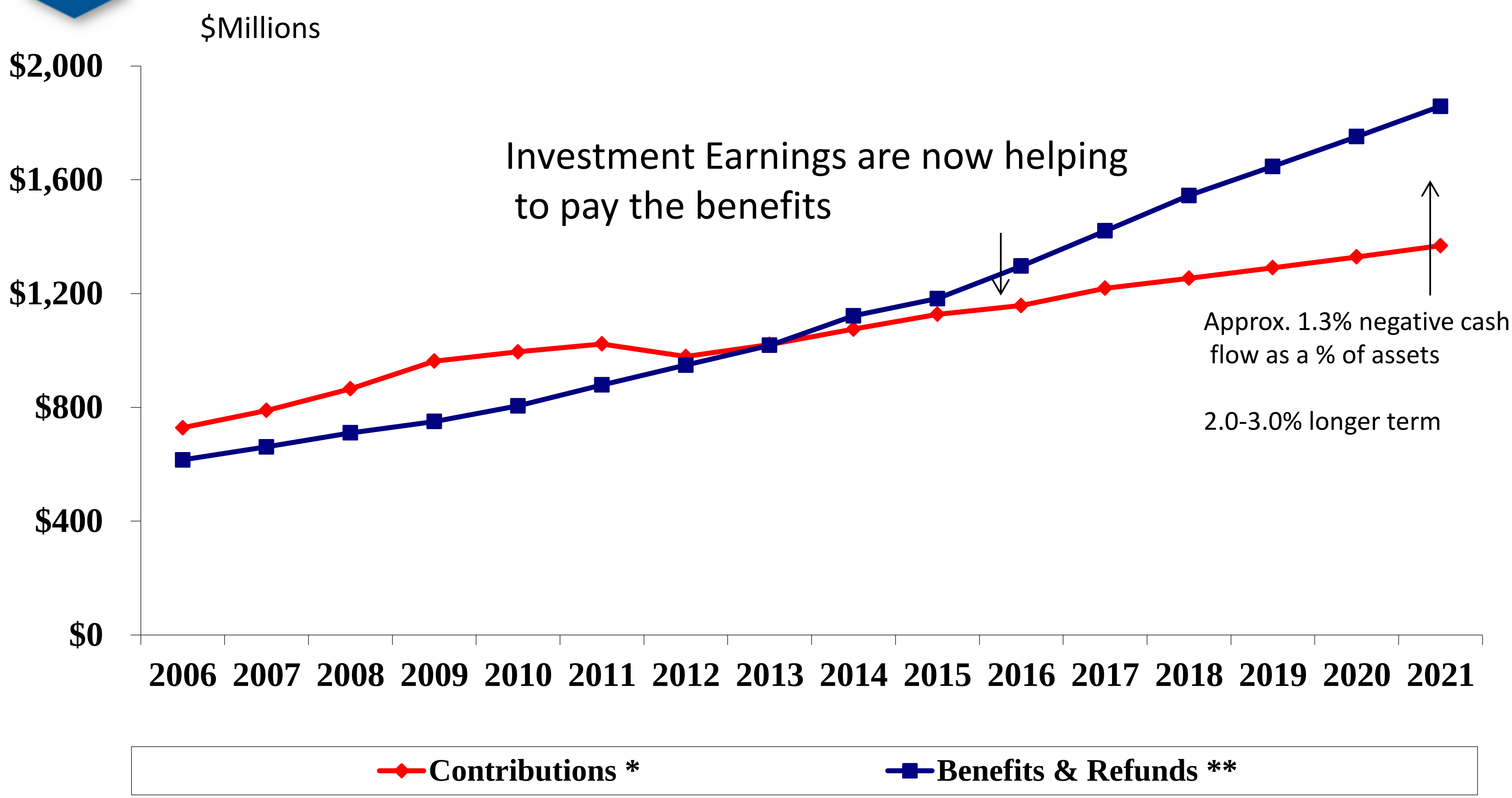
Projected Contributions vs. Benefits and Refunds

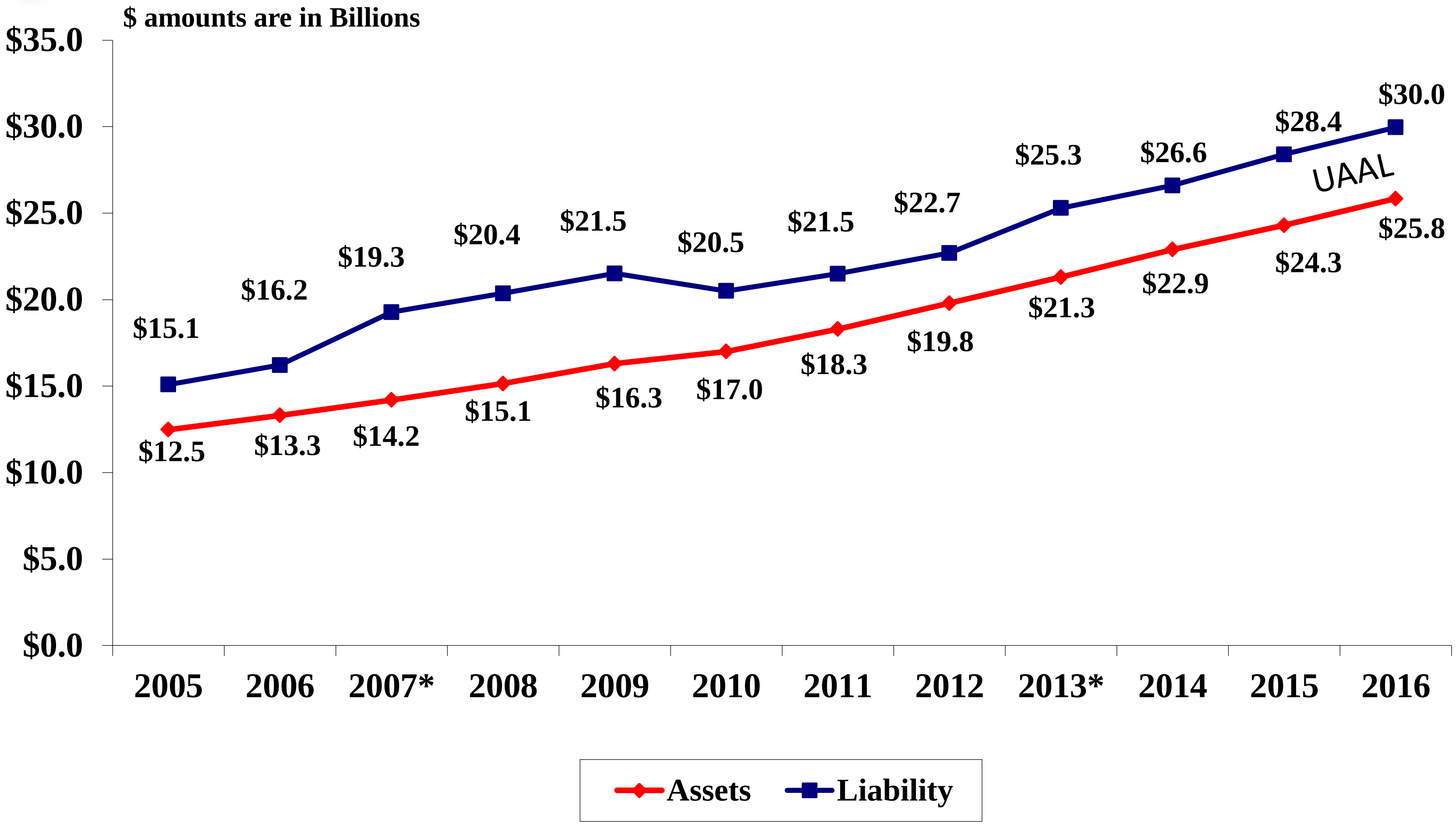


* Includes member and employer contributions

** Includes administrative and investment expenses

Assumes no recognition of current deferred investment gains/losses

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



*Liabilities for years prior to 2013/2007 reflect PUC/UC method and prior assumptions

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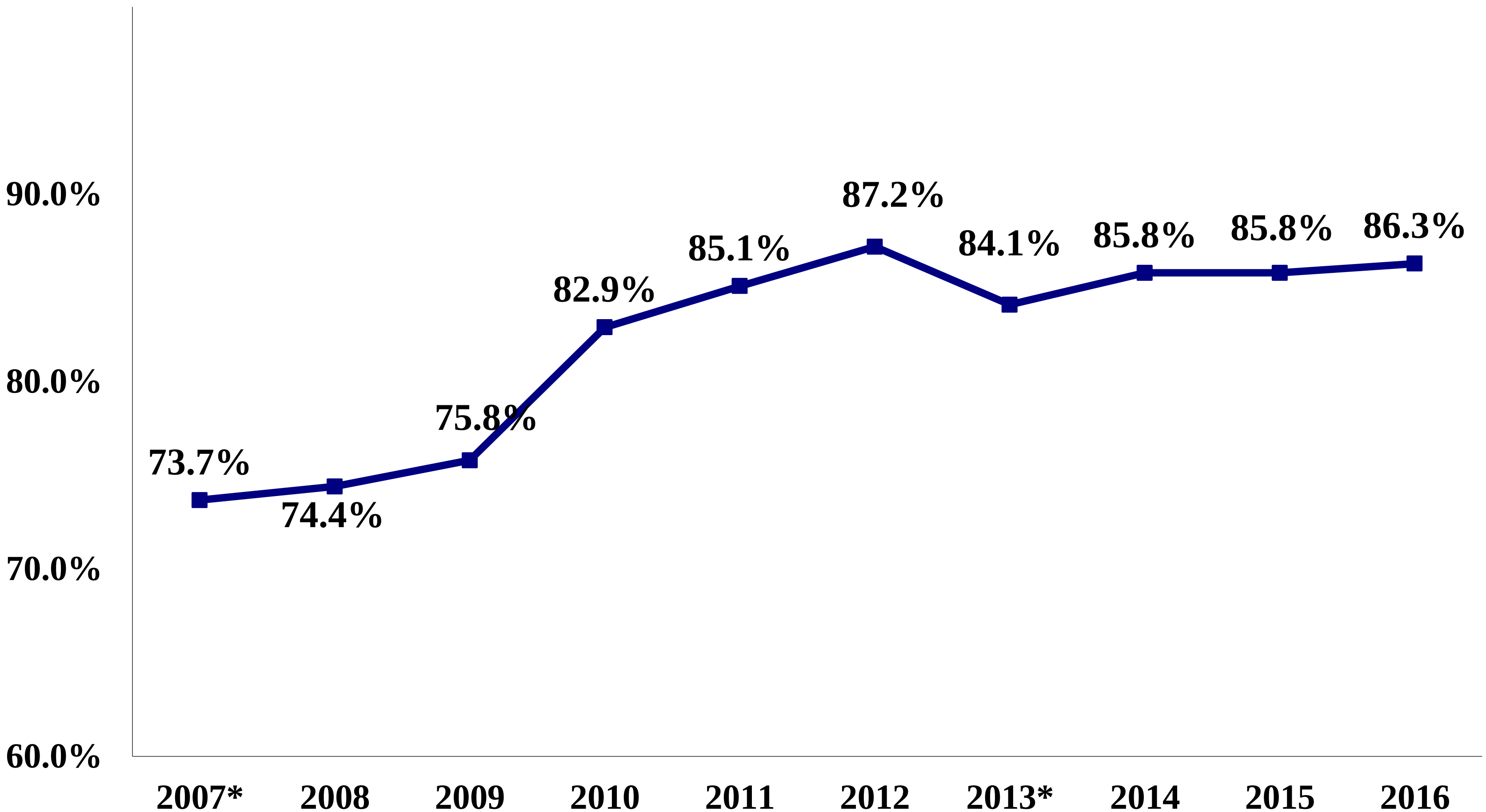
Funded Ratio Percentages



*Years prior to 2013/2007 reflect PUC/UC method and prior assumptions

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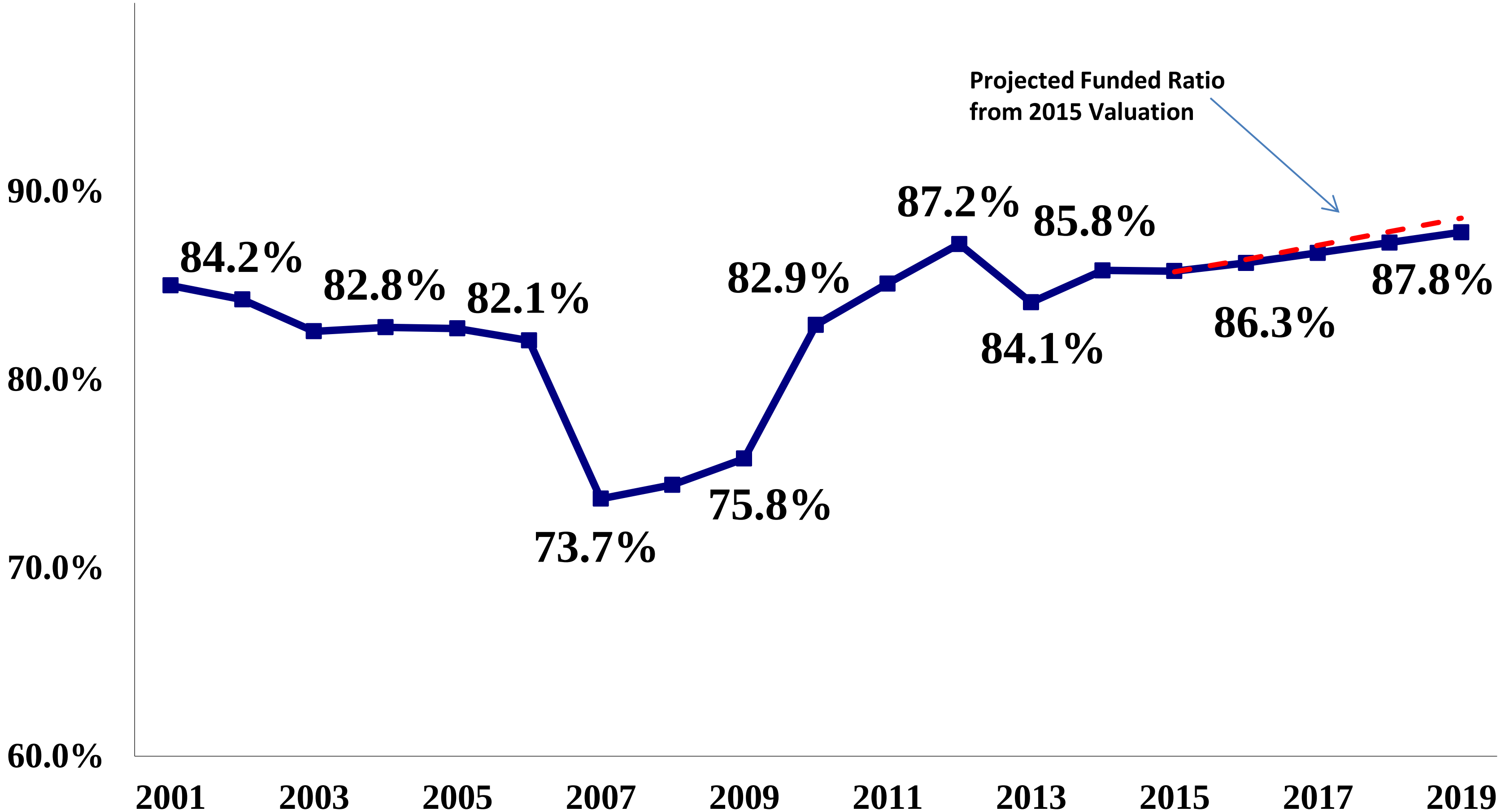
Projected Funded Ratio



Assumes all assumptions are met in future years

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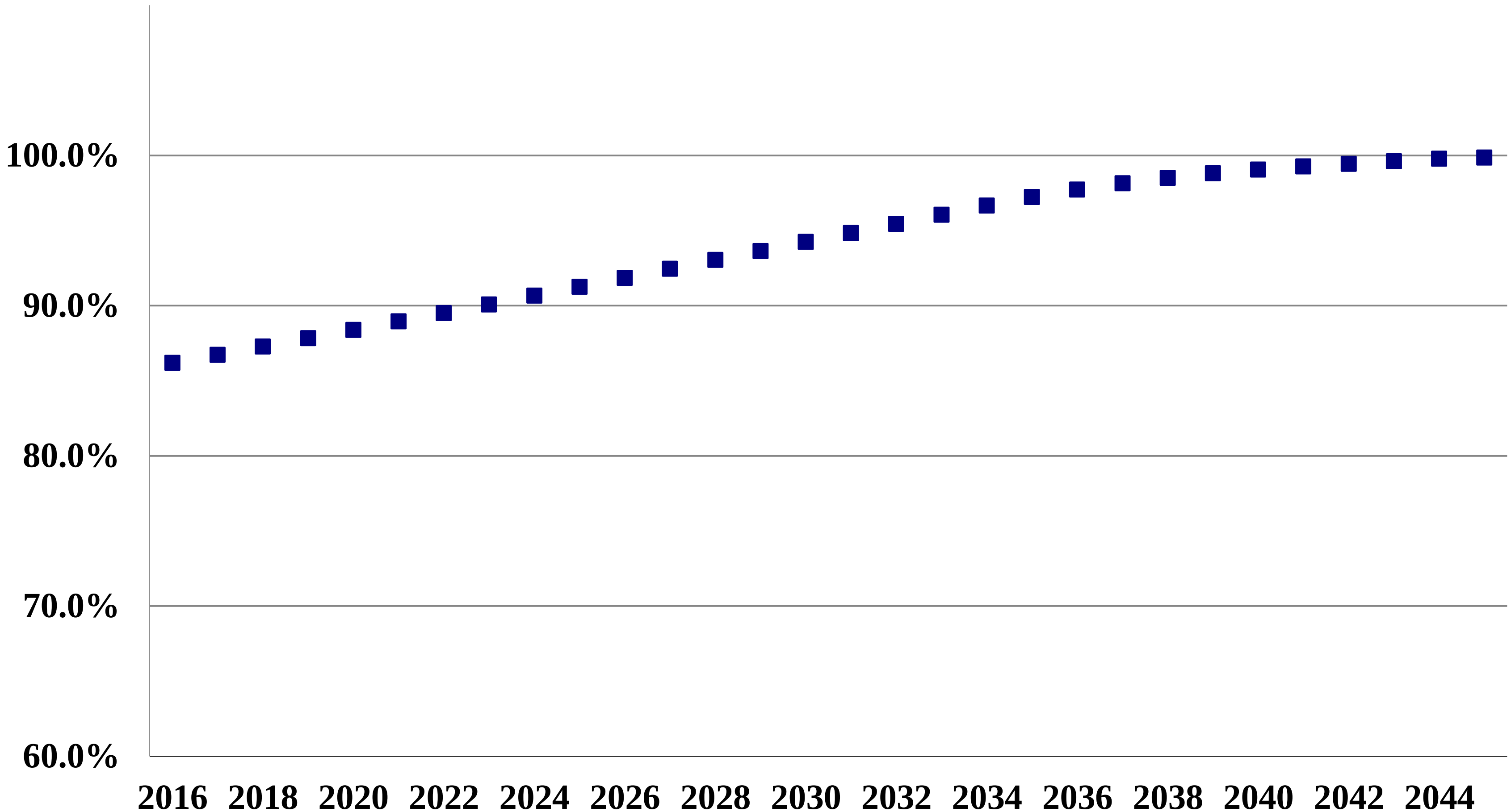
Projected Funded Ratio
(Longer Term)



Assumes all assumptions are met in future years

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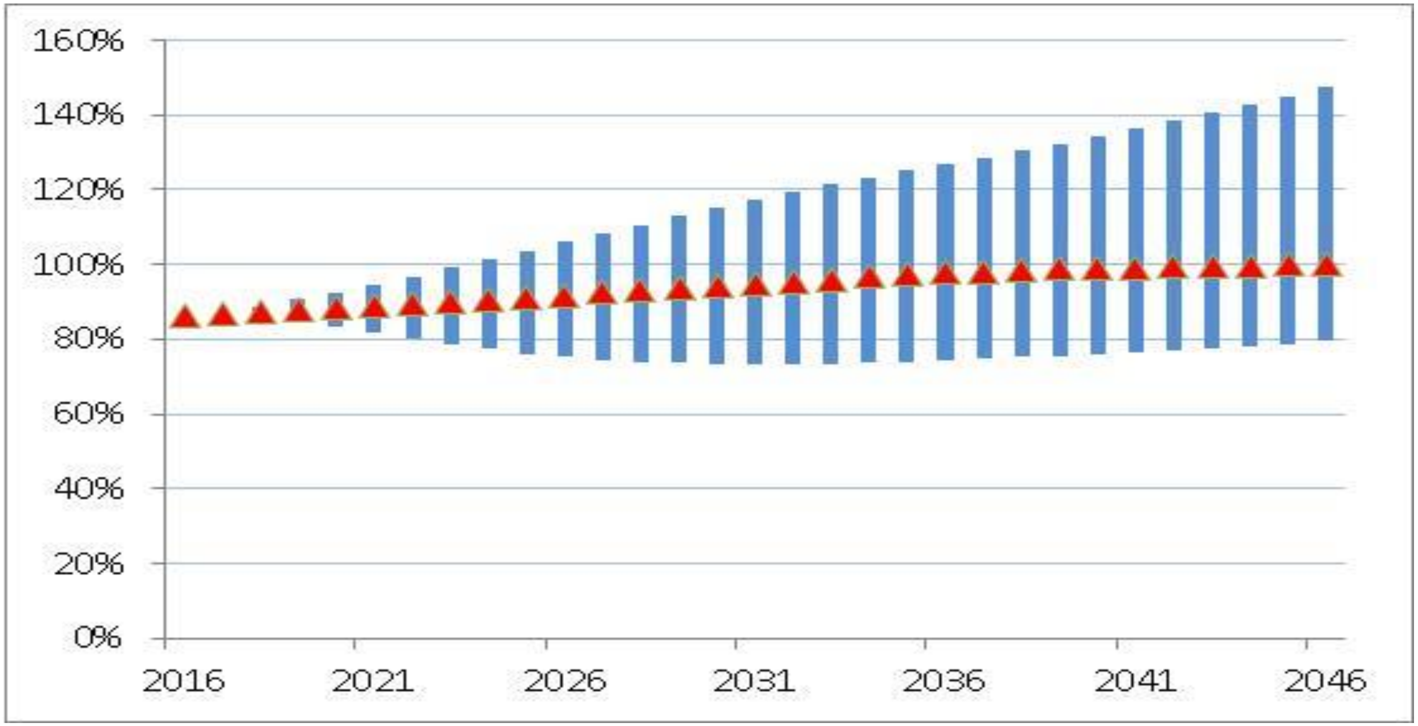
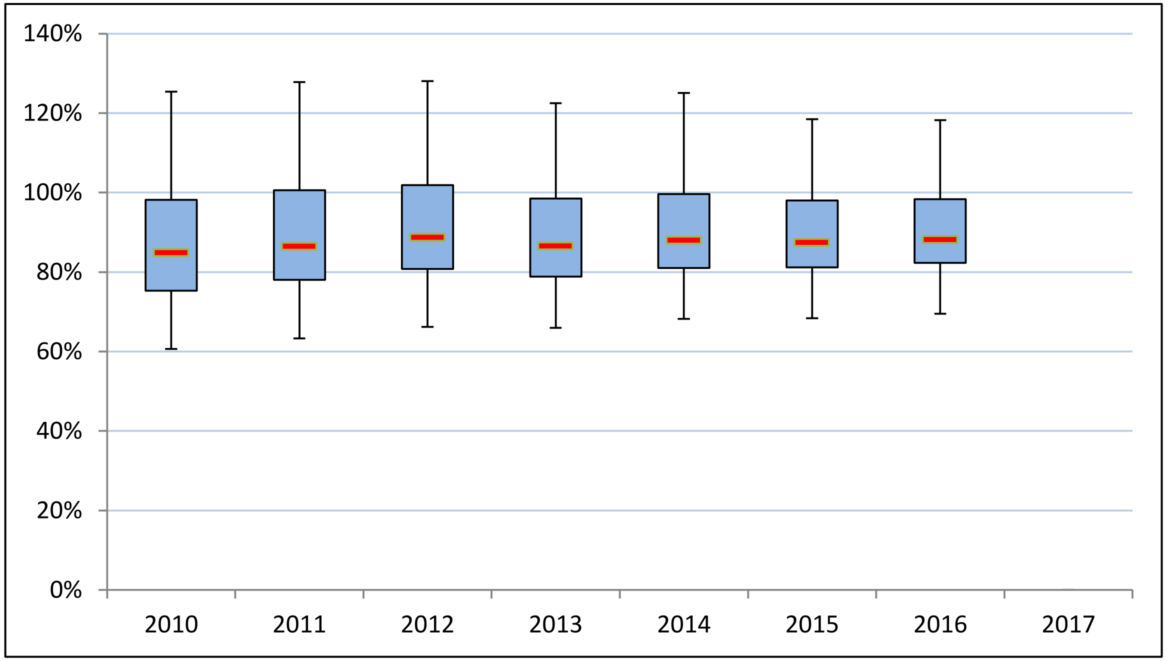
Projected Funded Ratio: System-wide

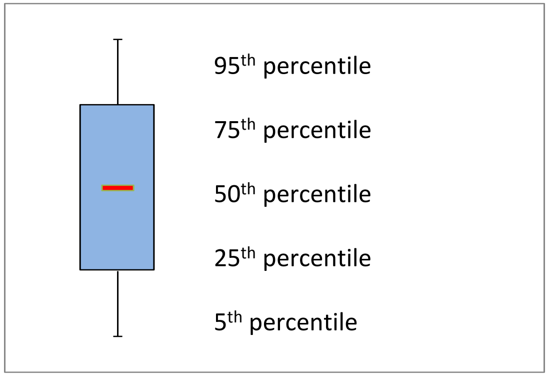


Median Expectation
25th-75th percentile of expectation

- **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 98%, meaning that 75% of cities have a funded ratio less than 98%. Conversely, 25% of the cities have a funded ratio of 98% or greater.

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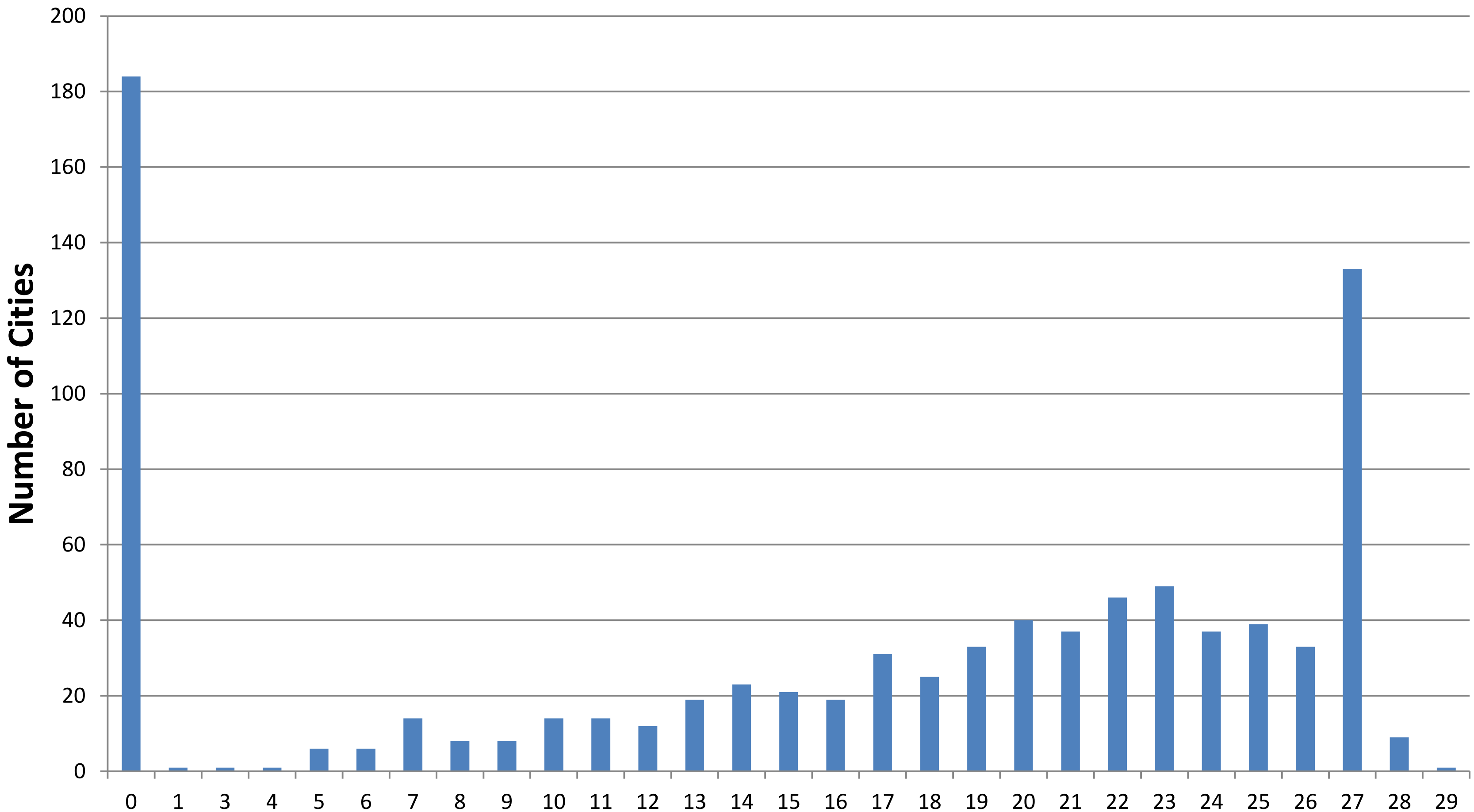
Distribution of Single Equivalent Amortization Periods



Remaining average period in years

0 would be overfunded

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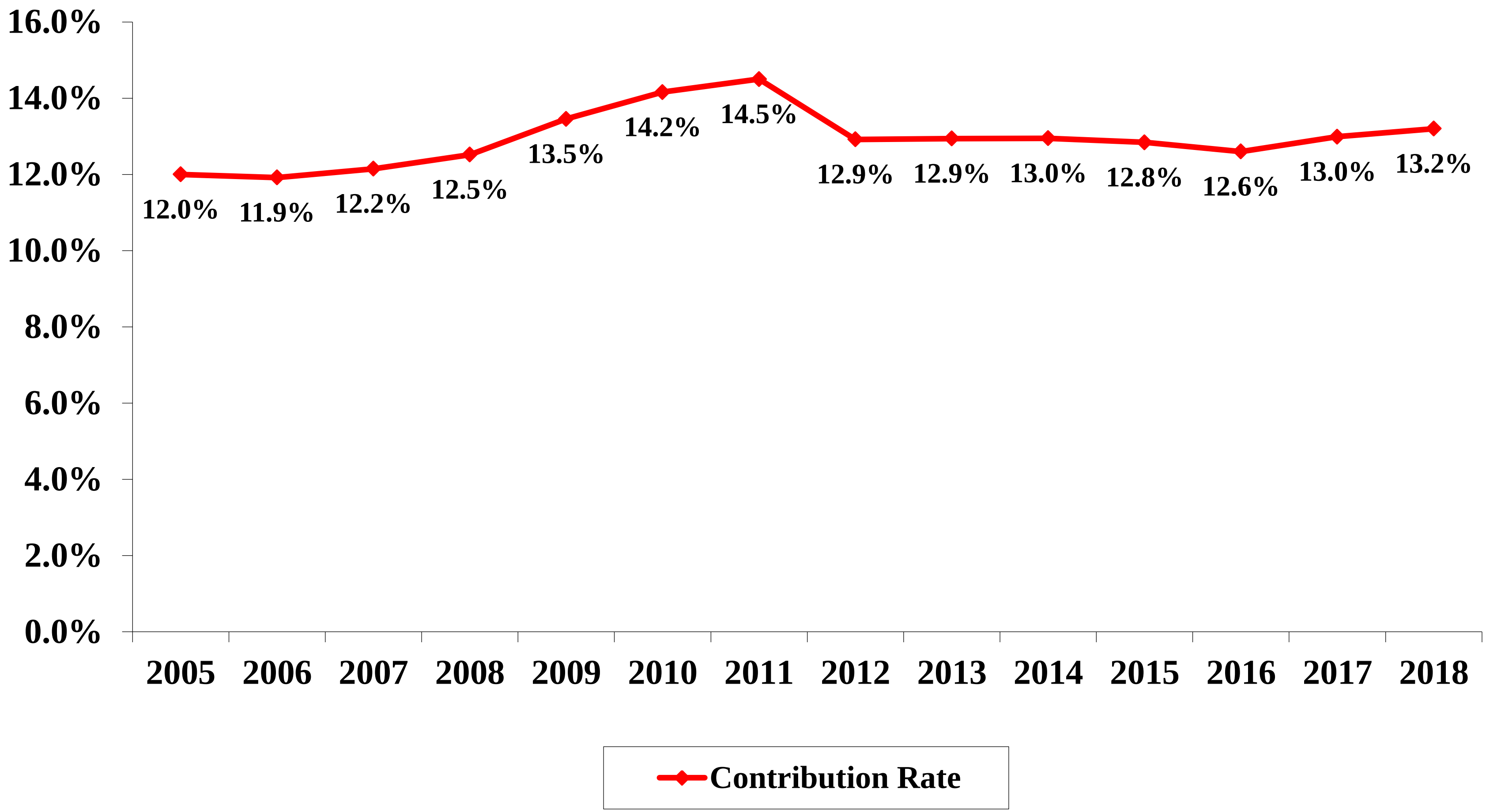
Historical Dollar Weighted Contribution Rates for TMRS



2017 and 2018 are projected rates based upon phase-in minimum

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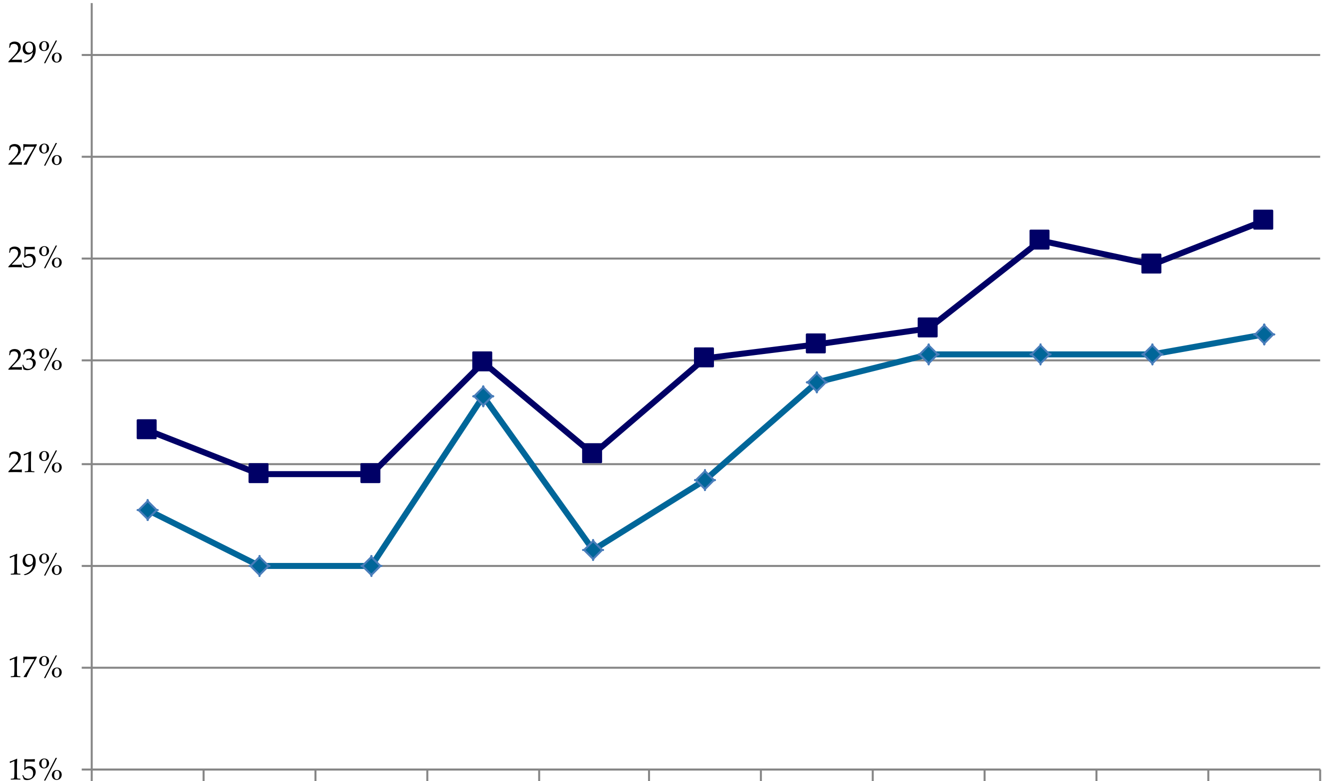
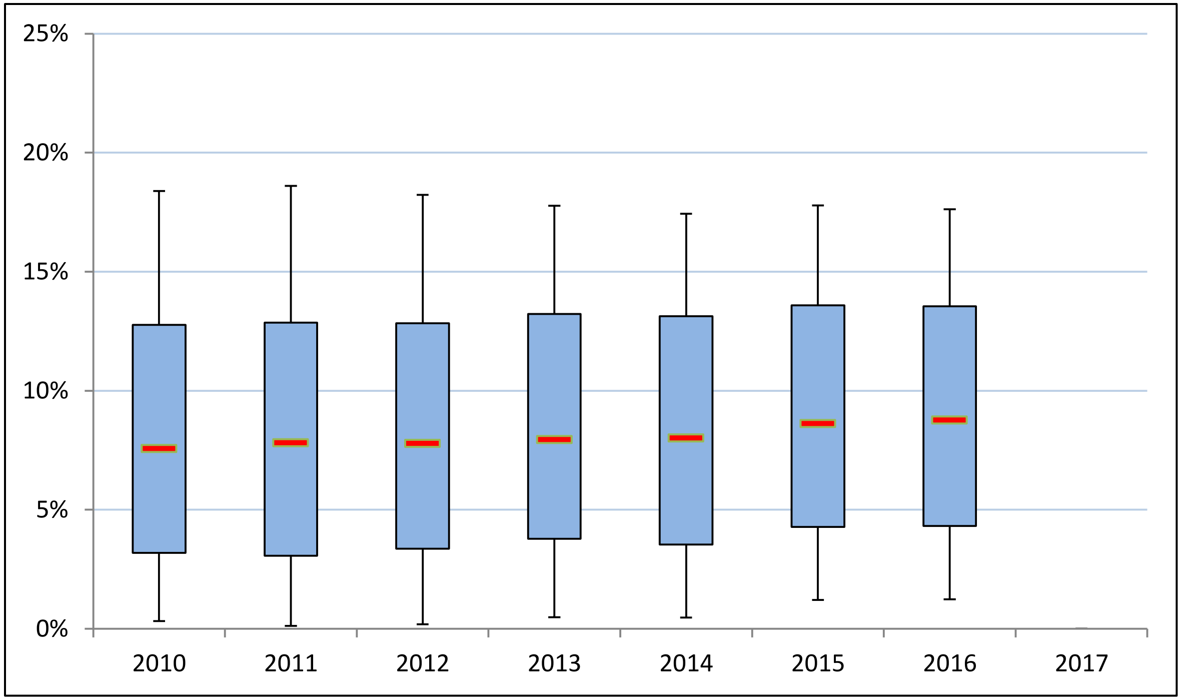
Illustrated from Another Client

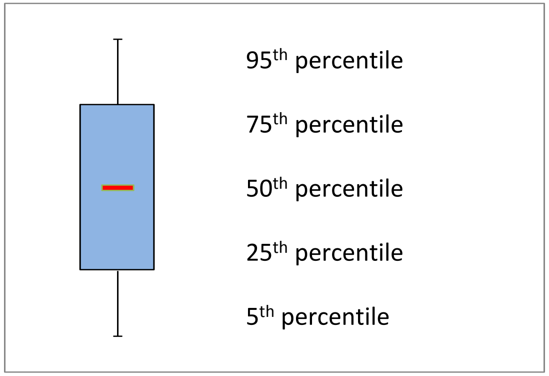
Employer Contribution Rate



	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
State Employees	21.64%	20.78%	20.78%	22.98%	21.18%	23.05%	23.33%	23.64%	25.34%	24.87%	25.75%
Teachers	20.07%	19.01%	19.01%	22.32%	19.29%	20.68%	22.60%	23.14%	23.13%	23.13%	23.51%

Distribution of Full Retirement Rate





The percentile represents the proportion of employers below the point. For example, the 75th percentile is 13.55%, meaning that 75% of cities have a rate less than 13.55%.

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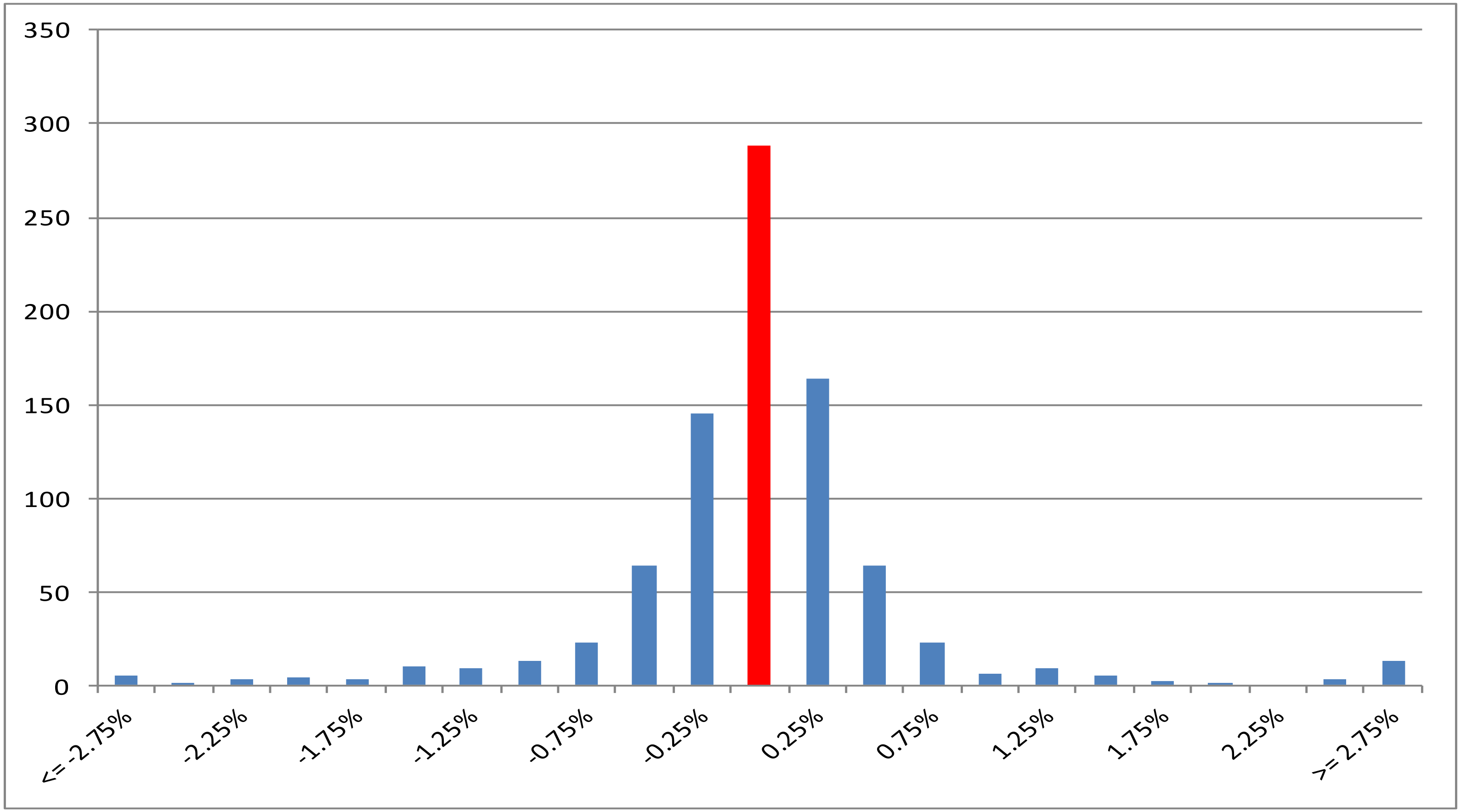
Distribution of Changes: By City
Total Changes in Full Retirement Rate



Rounded to nearest 0.25% change in rate

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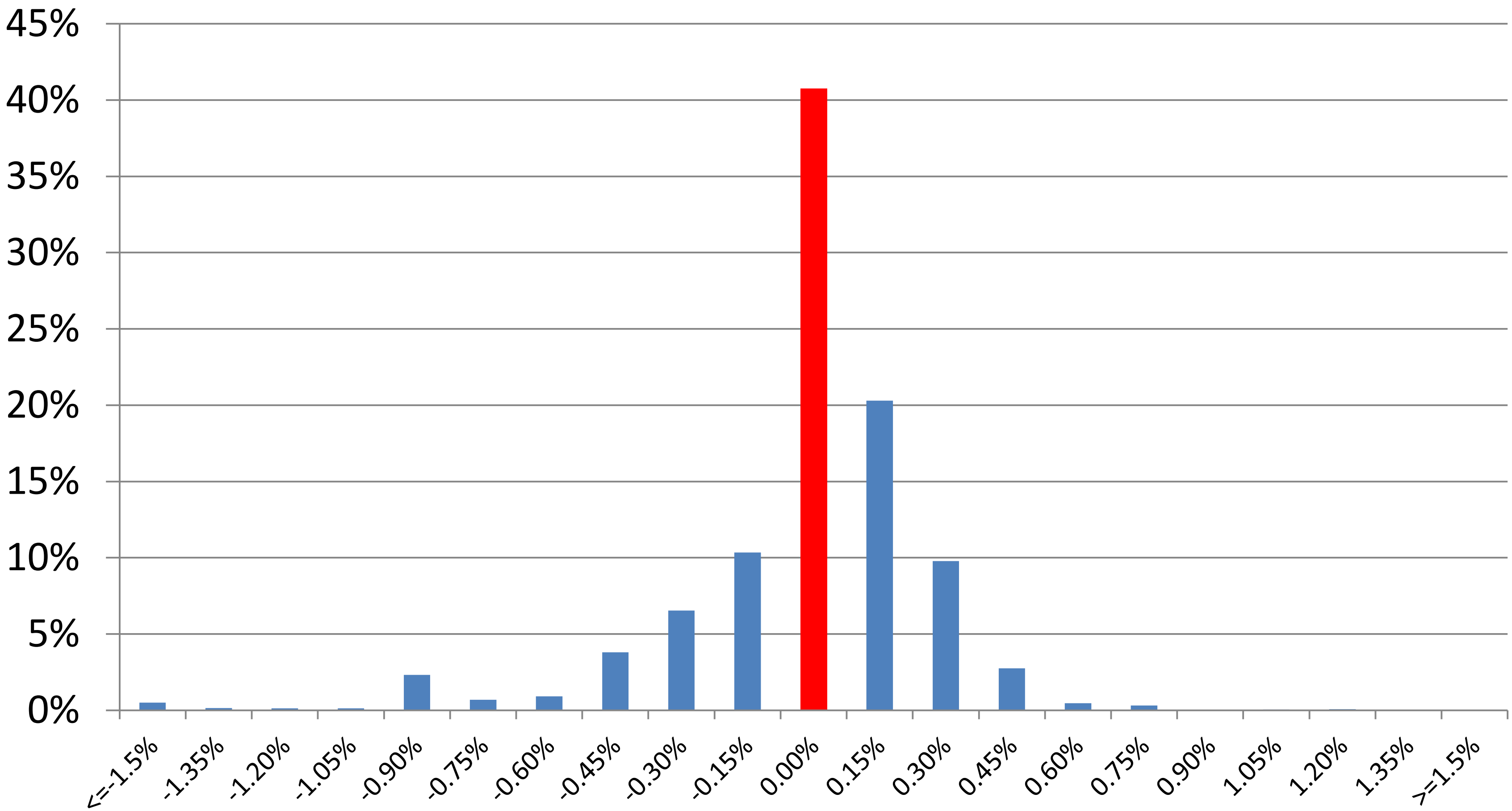
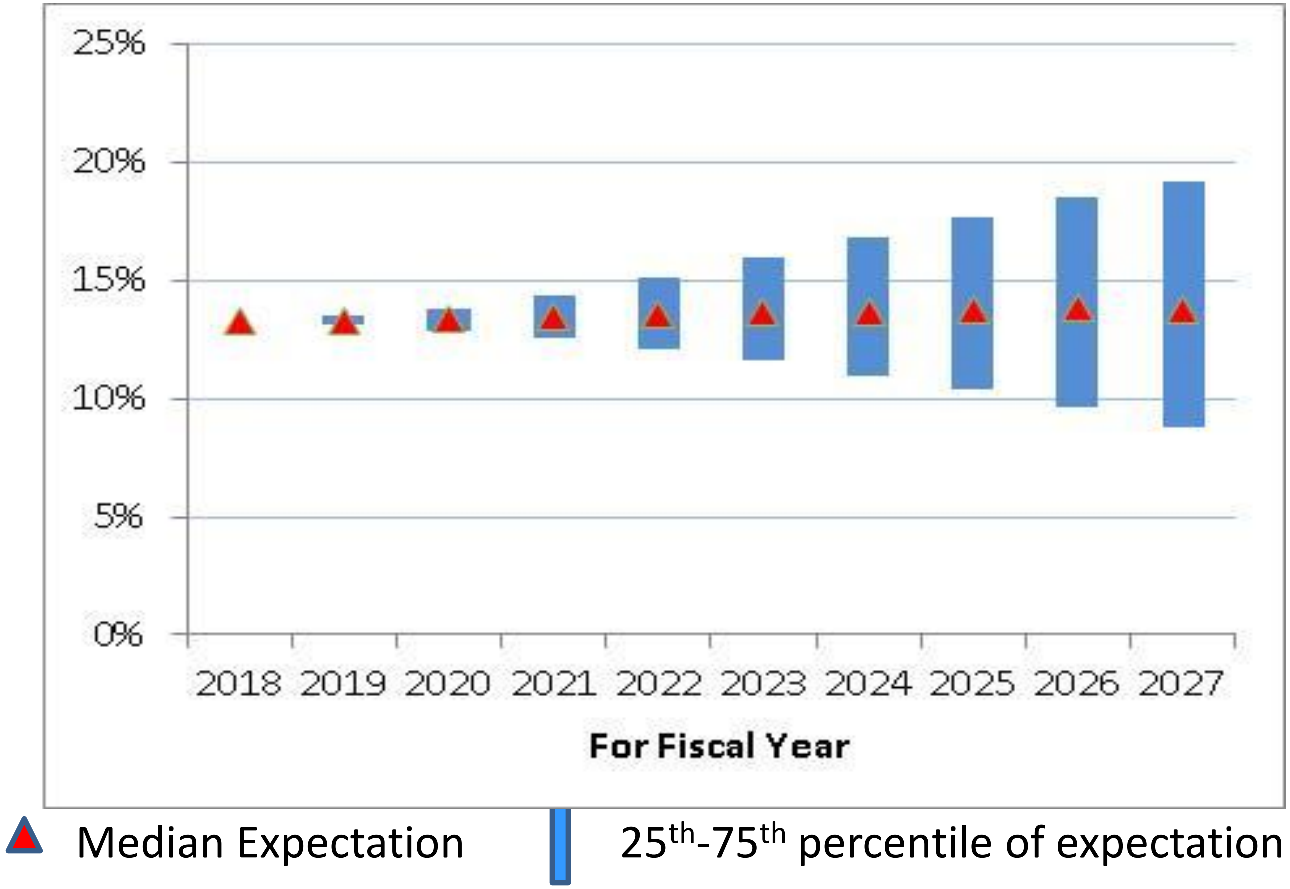
Distribution of Changes: Payroll Weighted Total Changes in Full Retirement Rate



Rounded to nearest 0.15% change in rate

Projected Aggregate Employer Contribution Rate



- **Assumes ADEC met each year, projected from market value of assets as of December 31, 2016**
- **Assumes continuation of current amortization policy & payroll grows at 3.00% per year**
- **Investment returns are variable in the stochastic process**

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Phase-In

- As of the prior valuation, 431 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.
  - 113 cities have a phase-in rate this year
  - Lower than last year's expected due to experience gains
  - Expected Runoff:
    - 36 cities with a phase-in in 2017 valuation (3% of overall payroll)
    - 11 cities with a phase-in in 2018 valuation (0% of overall payroll)
    - 5 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

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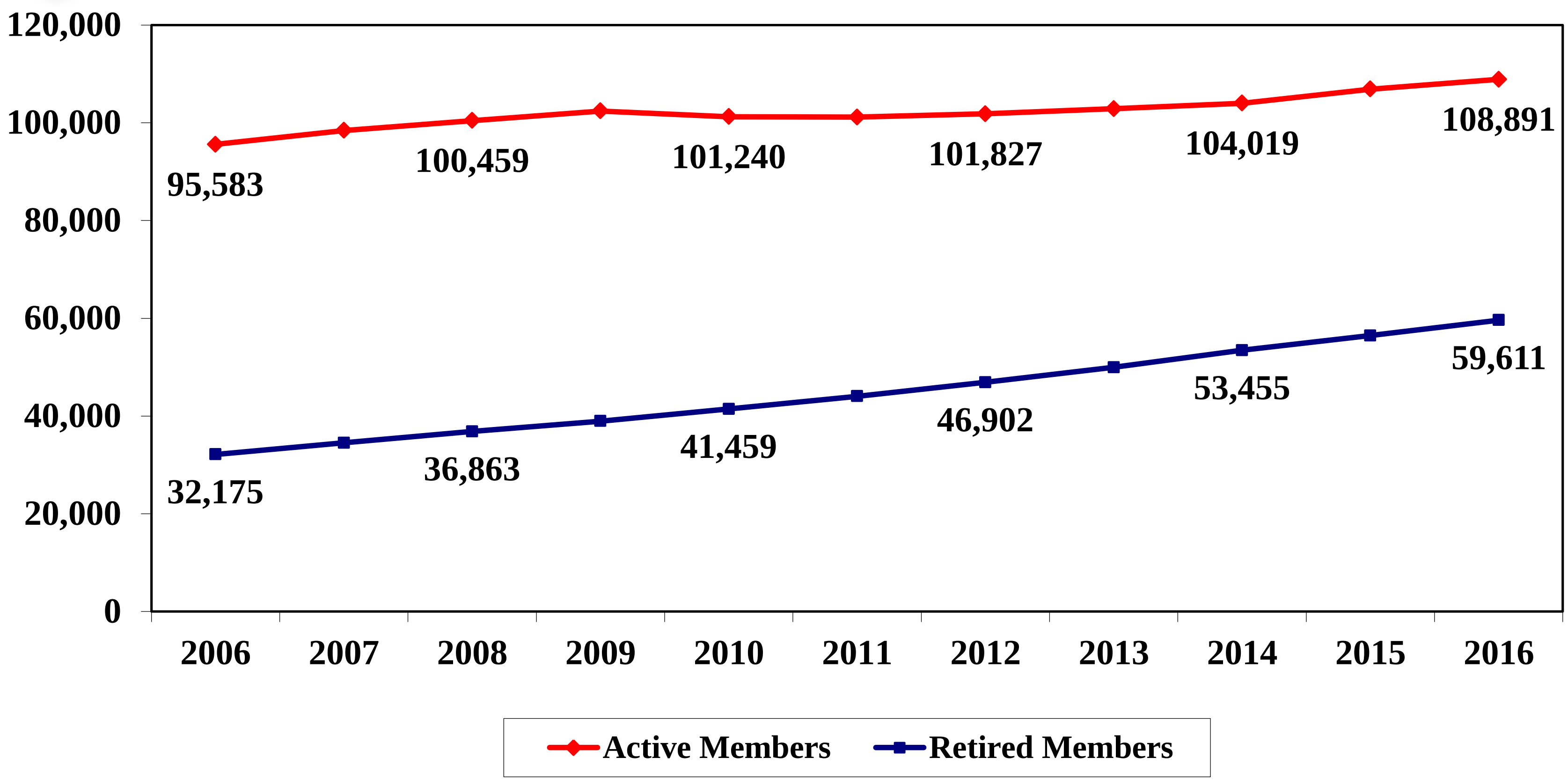
Active Members & Retired Members



1.31% average increase in active members since 2006; 1.9% increase in 2016

6.36% average increase in retired members since 2006; 5.5% increase in 2016

There are currently 1.8 actives for every retiree, down from 3.0 in 2006

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Measures of Leverage

- As the plan matures, the ratio of assets to payroll will continue to climb, and could eventually double compared to today's ratio
- This ratio correlates with how large a potential loss could be in relation to the impact on the contribution rates
- Example: $1,000,000 asset; 10% loss yields:
  - $1,000,000 * .1 = $100,000 / amortization factor 16.29 = increase in annual contribution of $6,140
  - If payroll is $250,000 (4.0 ratio), this is 2.46% of payroll
  - If payroll is $150,000 (6.7 ratio), this is 4.09% of payroll

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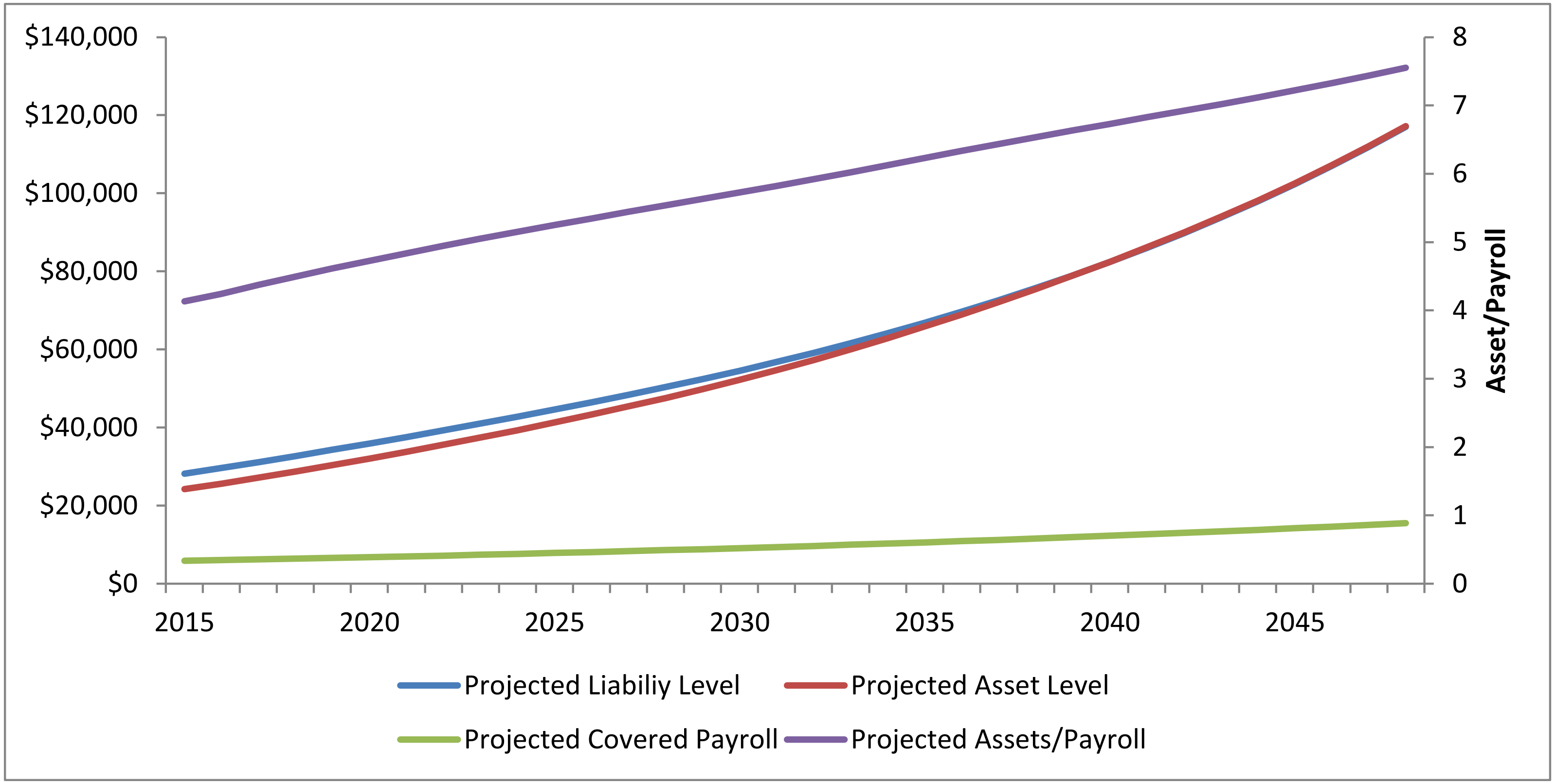
Measures of Leverage



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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.

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	*****
Have you met the required contribution each year over the past 10 years?	Yes	*****
What is the amortization period for the current UAAL based on the required contribution?	19.7 Years	*****
What is the amortization period for new losses?	25 Years	*****
What is the sum of your amortization period and asset smoothing period?	35 Years	****
What is your investment return assumption?	6.75%	*****
Does your current investment policy and target asset allocation support the current assumption?	Yes	****
What is your payroll (revenue) growth assumption?	3.00%	****
Are there any benefits, that are likely to be paid, not reflected in the liabilities and contributions?	Yes^	***
Are any of the liabilities contingent on future experience?	No#	***
What is your short – intermediate term negative cash flow as a % of assets?	0-1%	*****
What is your longer term negative cash flow as a % of assets?	2-3%	*****
What is your current active to retiree ratio?	1.8	****
What is your longer term active to retiree ratio?	1.0-1.3	**
What is your ratio of accrued liability to payroll?	4.9	****
What is your longer term ratio of accrued liability to payroll?	6.5-7.0	**

^ It is possible to get interest credits to member accounts higher than 5%. Also, ad hoc COLAs are possible, but have a strong funding policy.
# COLAs are tied to actual CPI, which is usually correlated to economic growth. Annuity Purchase Rates adjust to reflect changes in mortality.

Sustainability Checklist

- TMRS grades out well on the checklist
  - Required actuarial contributions
  - Closed amortization periods in the 20-25 year range
  - Reasonable investment return and payroll growth assumptions
  - Manageable short and long term cash flow needs
  - Benefit that automatically adjusts to changing mortality patterns

- Items to pay attention to
  - Longer term liability (or asset) to payroll ratios will increase contribution rate volatility
  - As the System achieves higher funded ratios, could be pressure to enhance benefits in ways not currently anticipated in the funding policy
    - May or may not be based on good experience

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In Summary

- Overall System-wide "health" continues to improve
  - Overall funded levels continue to improve
  - Even with the lower discount rate, 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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