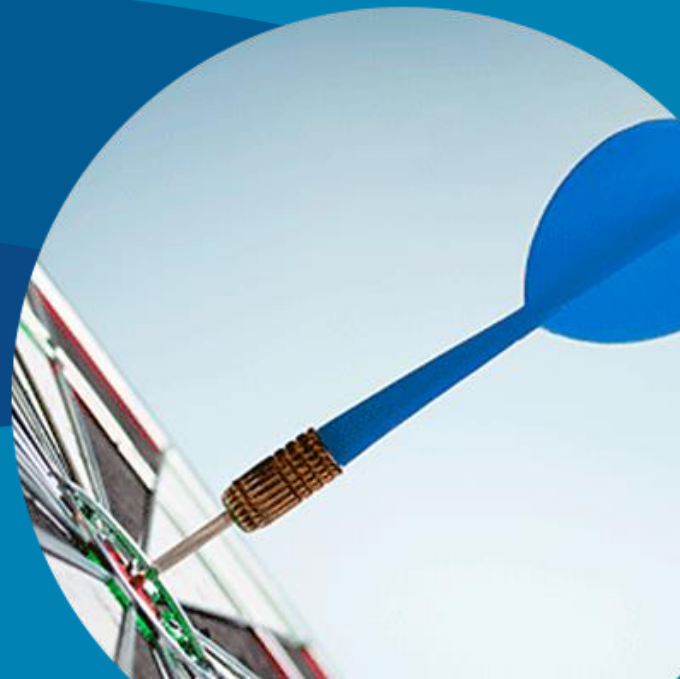




Michigan State Police Retirement System

Pension Actuarial Valuation Results
as of September 30, 2019



September 30, 2019 Valuation

- Purpose of the September 30, 2019 valuation is twofold:
 - Determine the employer contribution for fiscal year 2022
 - Measure the System's funding progress
- Reflects the Dedicated Gains Policy adopted by the Board of Trustees
 - Investment return assumption remains at 6.80% for the Non-Hybrid Plan and 6.85% for the Hybrid Plan
 - Market rate of return on assets for FY 2019 too low to trigger the provisions of the Dedicated Gains Policy

September 30, 2019 Valuation

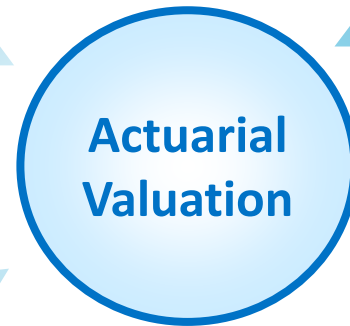
- Reflects these provisions of Public Act 674 of 2018
 - Gradual transition from level percent of payroll amortization of Unfunded Actuarial Accrued Liabilities (UAAL) to level dollar amortization
 - 2.25% payroll growth assumption for the September 30, 2019 valuation for amortization purposes only
- Employer contribution rates included in this presentation do not incorporate the “contribution floor” provisions of Public Act 674 of 2018

Actuarial Valuation Process

Member Data



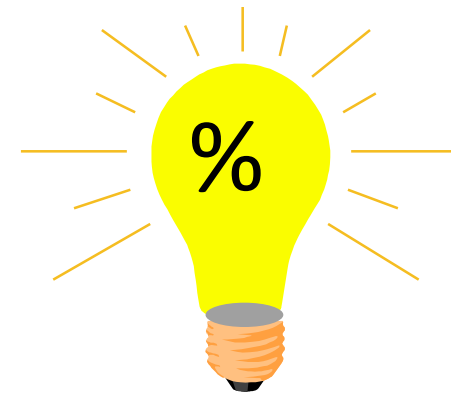
Financial Data



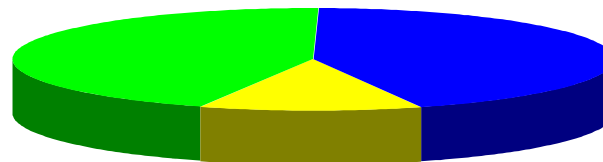
Plan Provisions



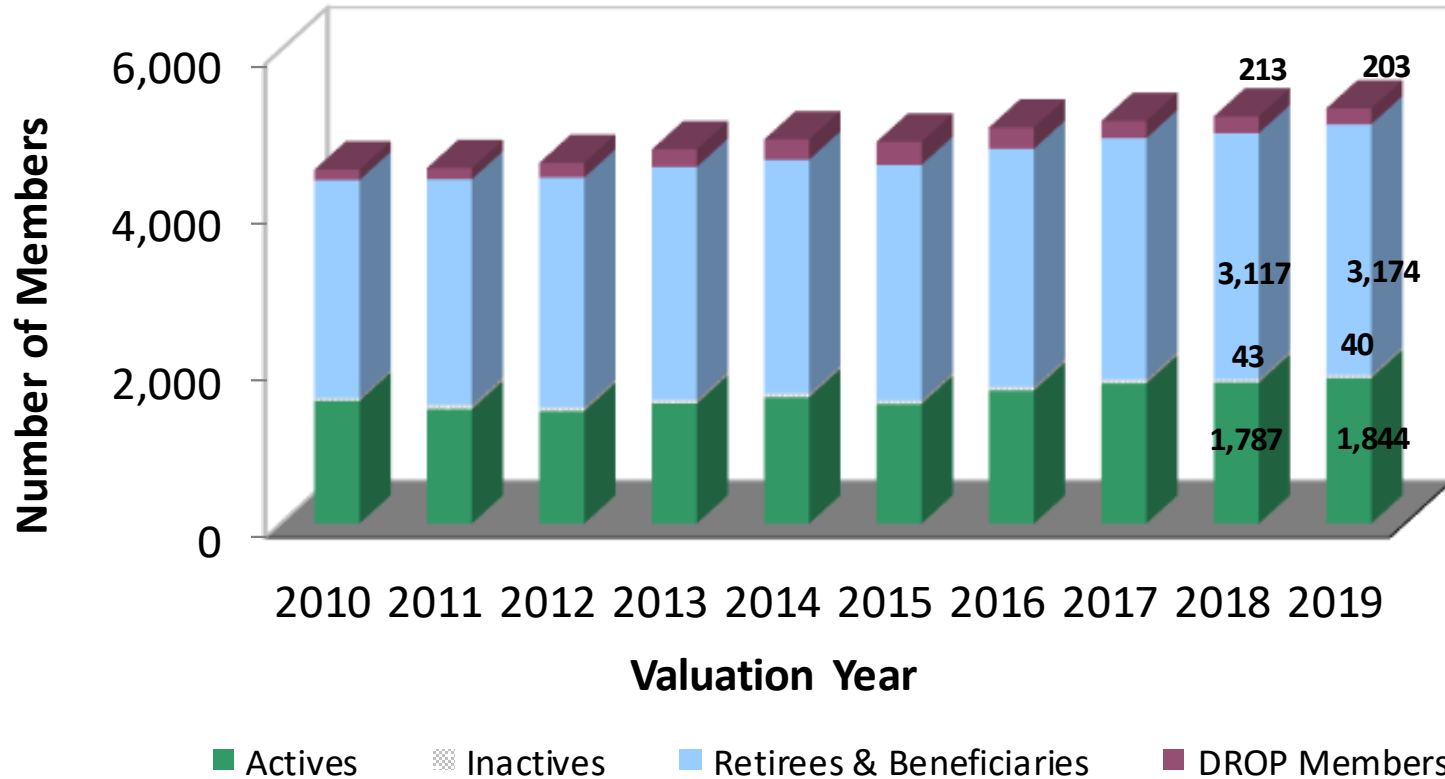
Actuarial Assumptions



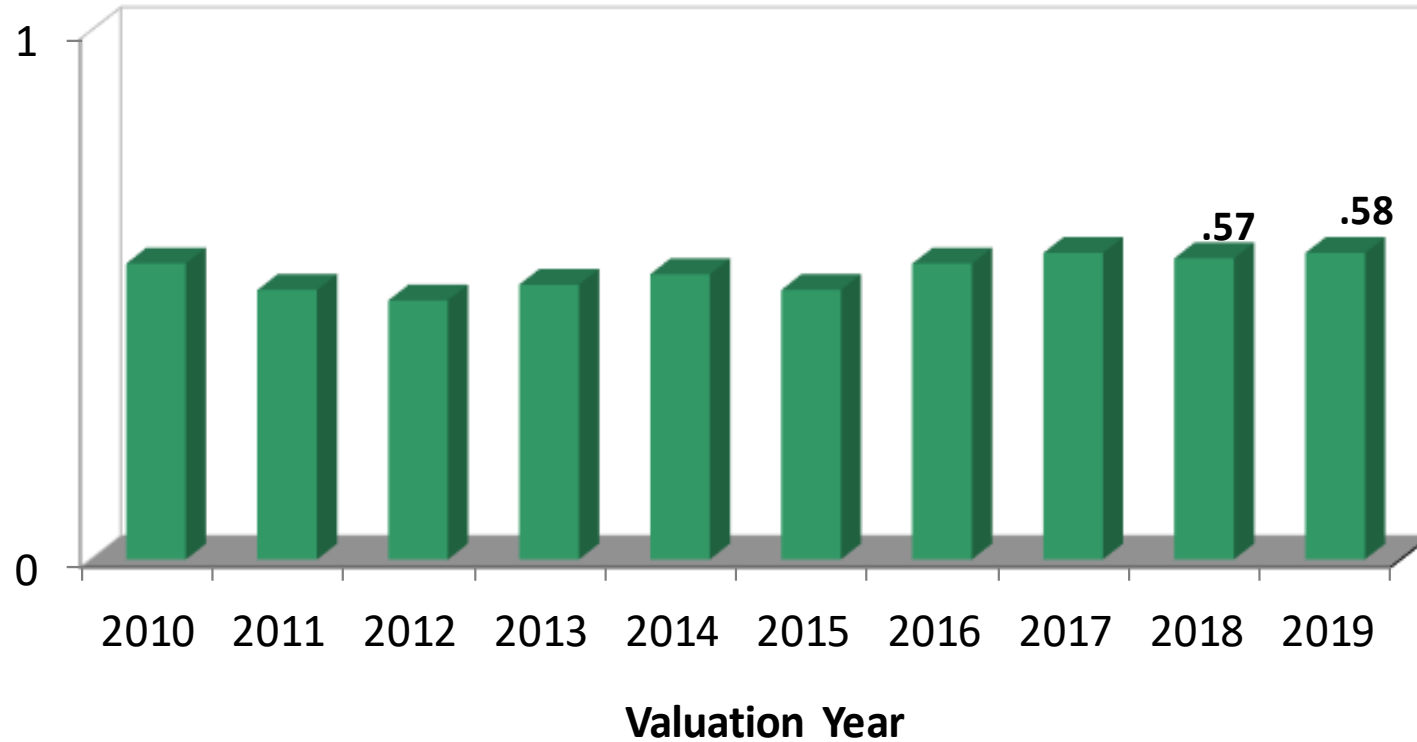
Actuarial Cost Method



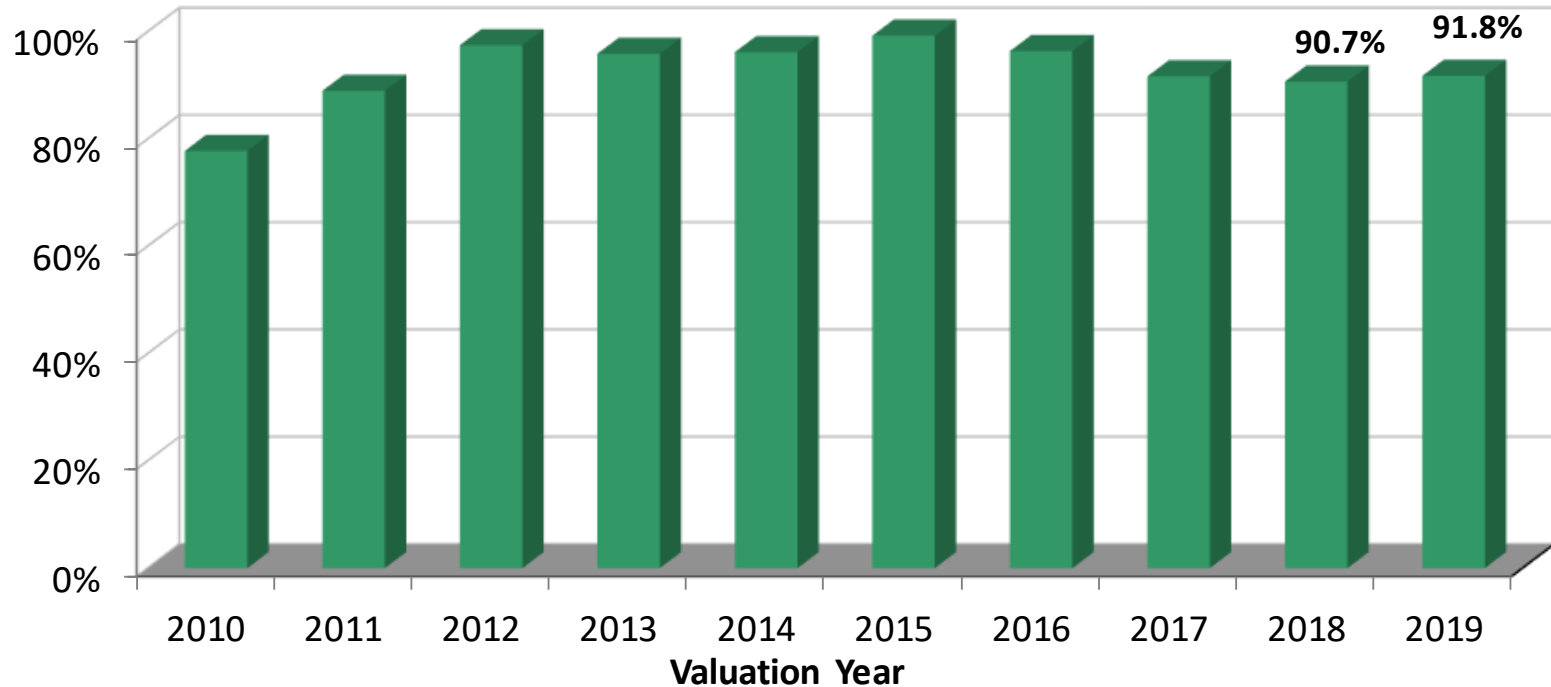
Membership Data



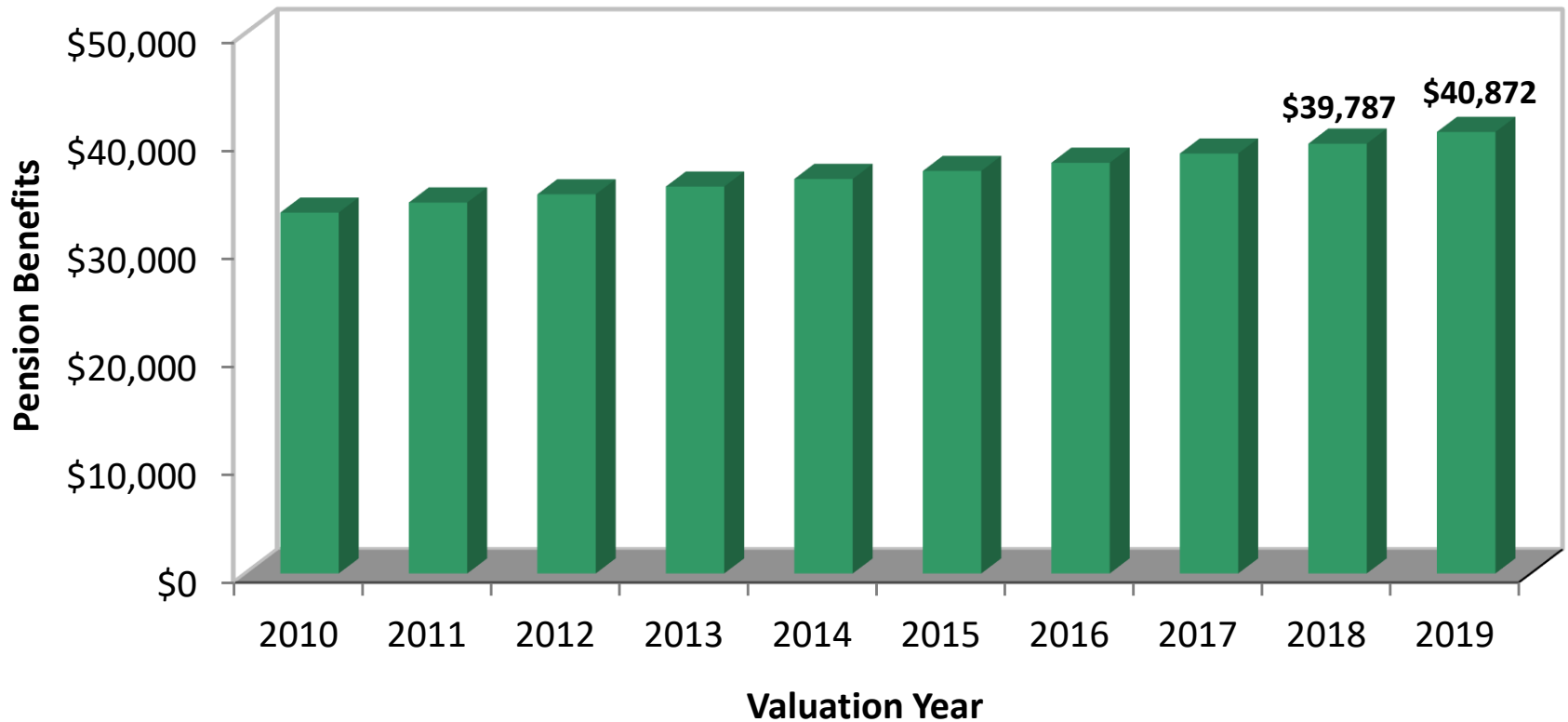
Ratio of Active Members to Pension Benefit Recipients



Pension Benefits Expressed as %'s of Active Member Pay

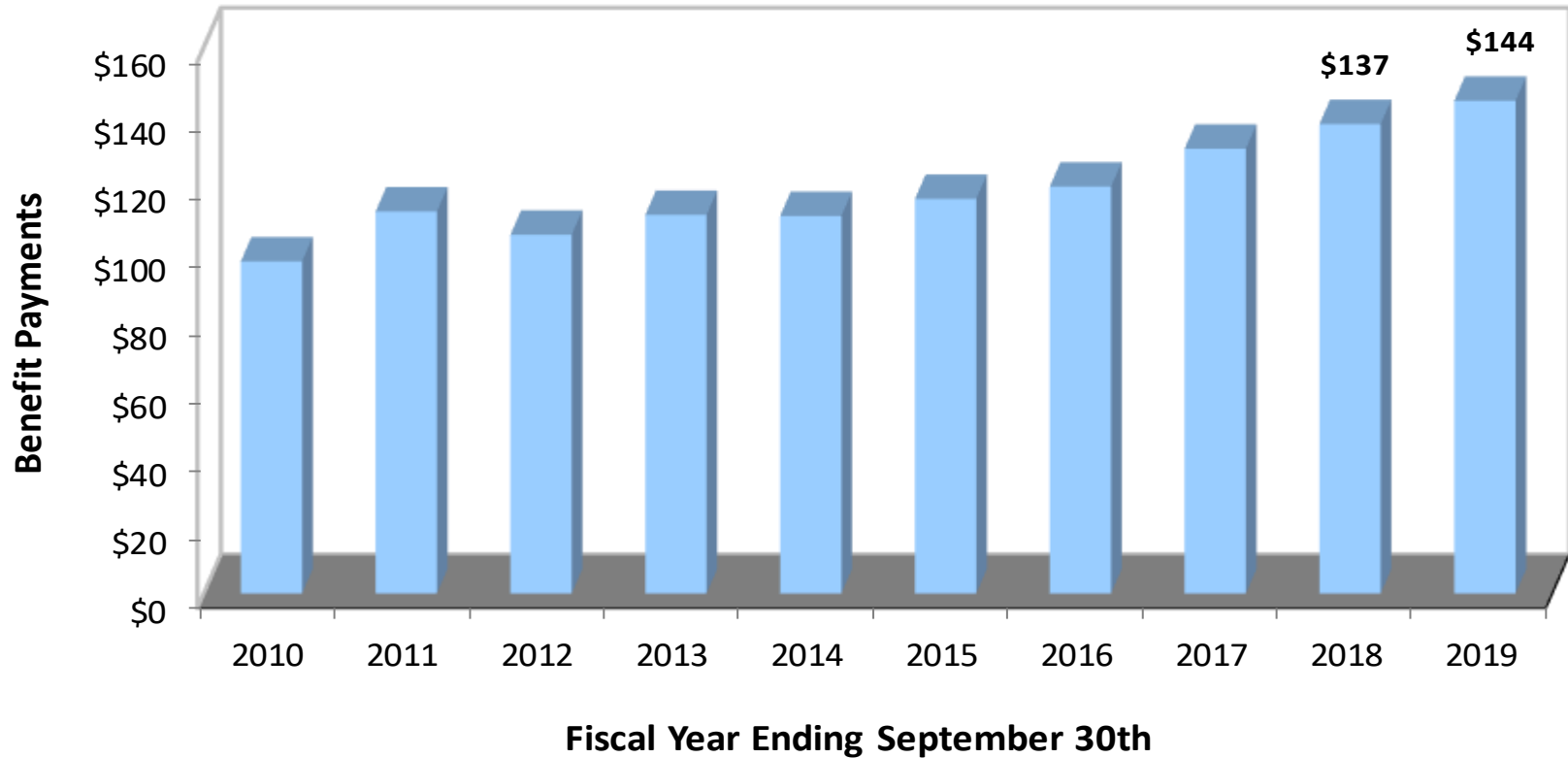


Average Annual Pensions



Actual Pension Benefit Payments by Fiscal Year *

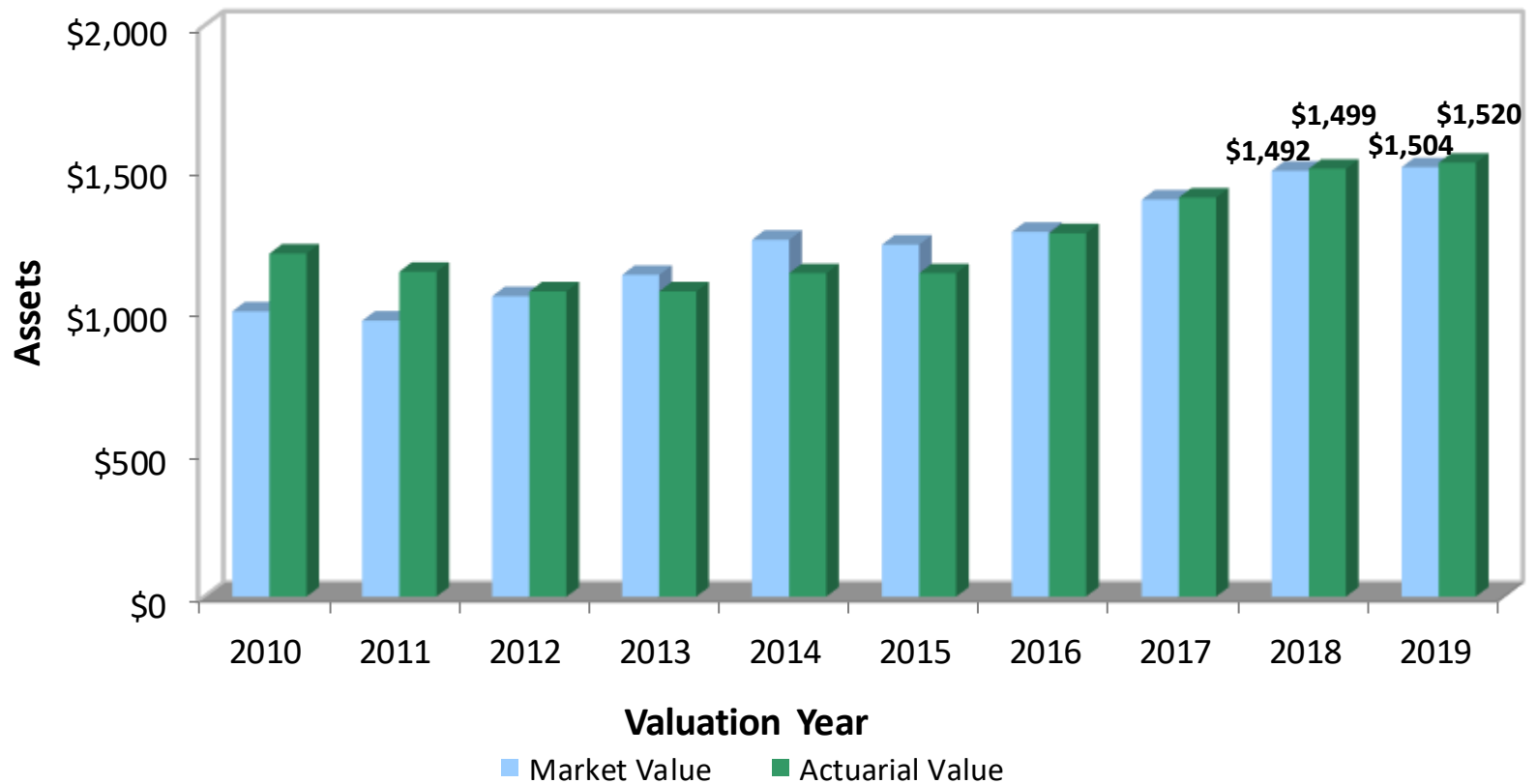
(Amounts in Millions)



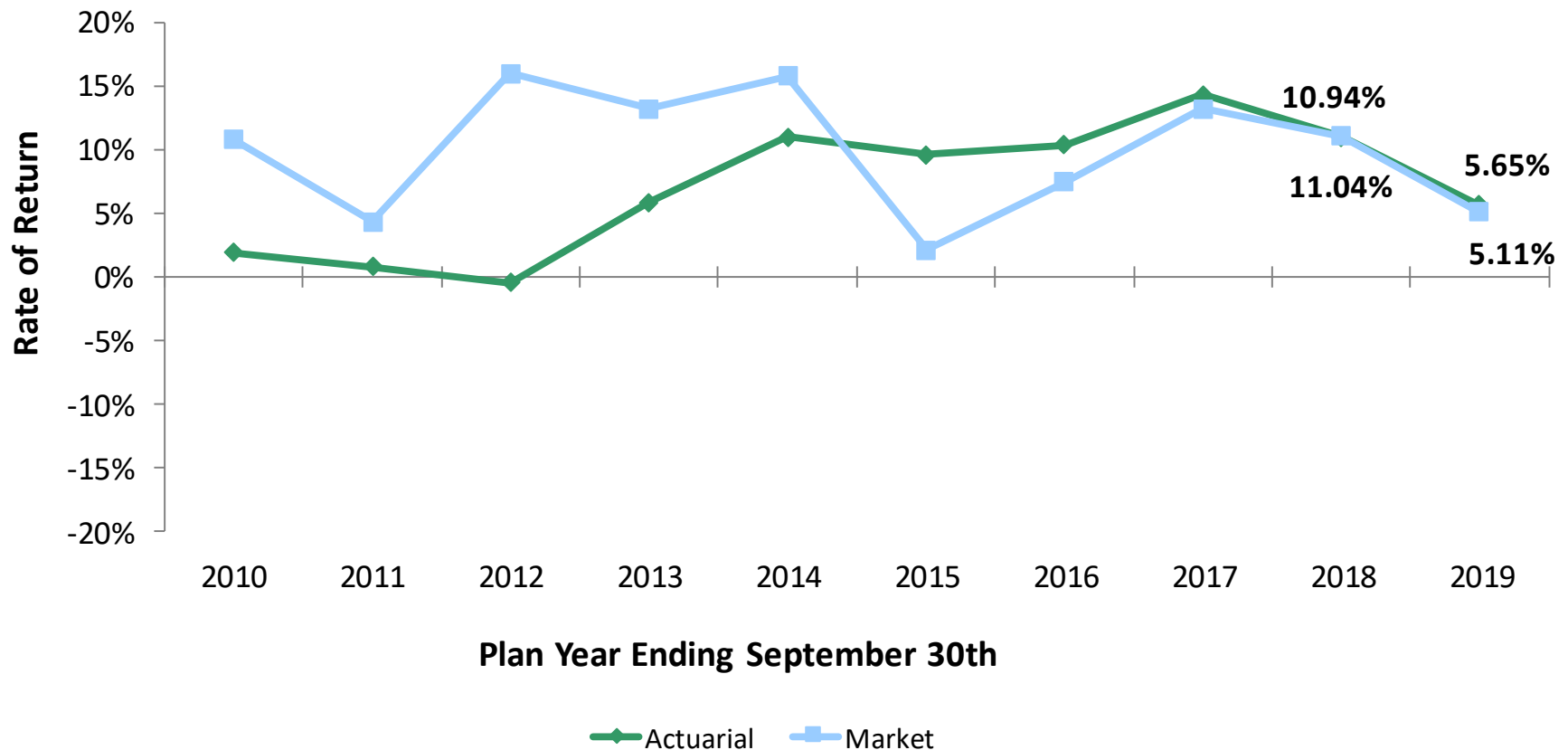
* Includes the payment of DROP account balances

Pension Assets

(Amounts in Millions)



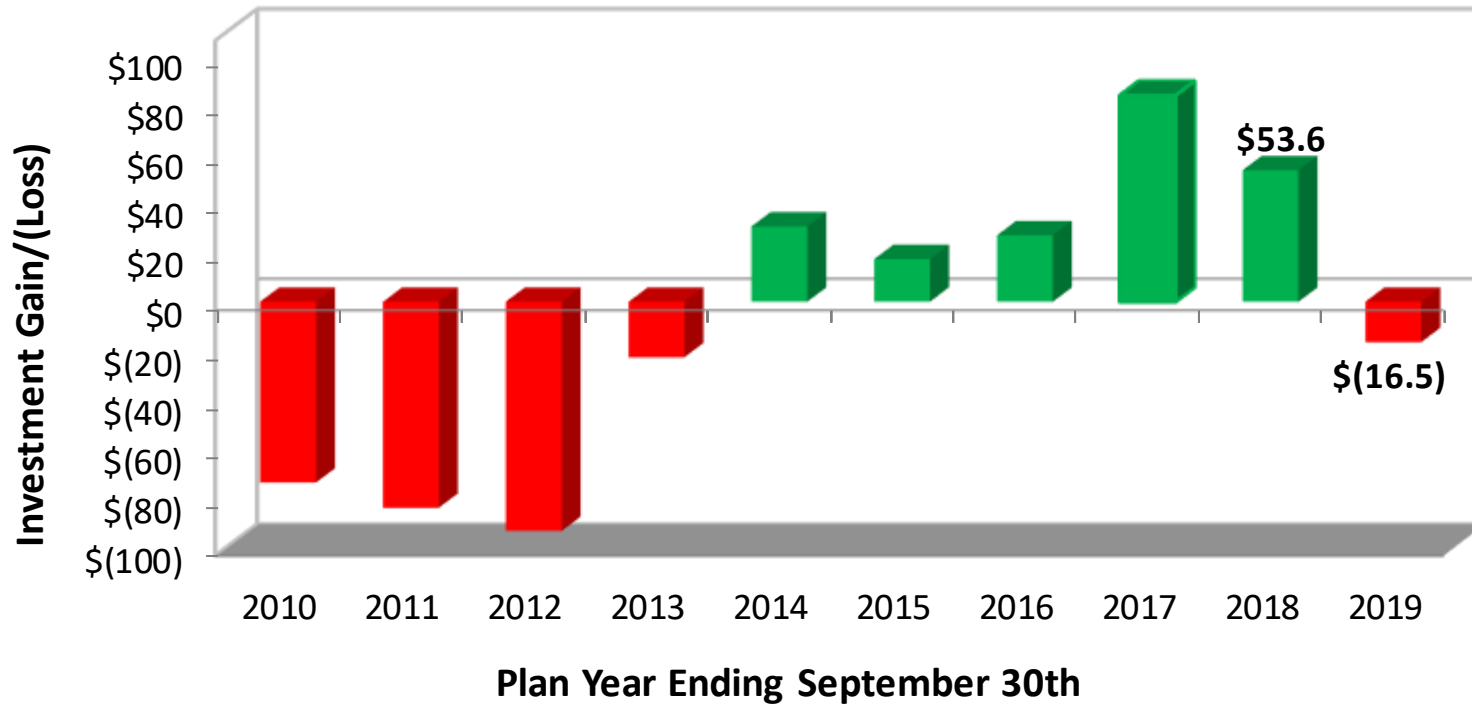
Actuarial & Market Net Rates of Return



Rates of return shown above are for Non-Hybrid assets.

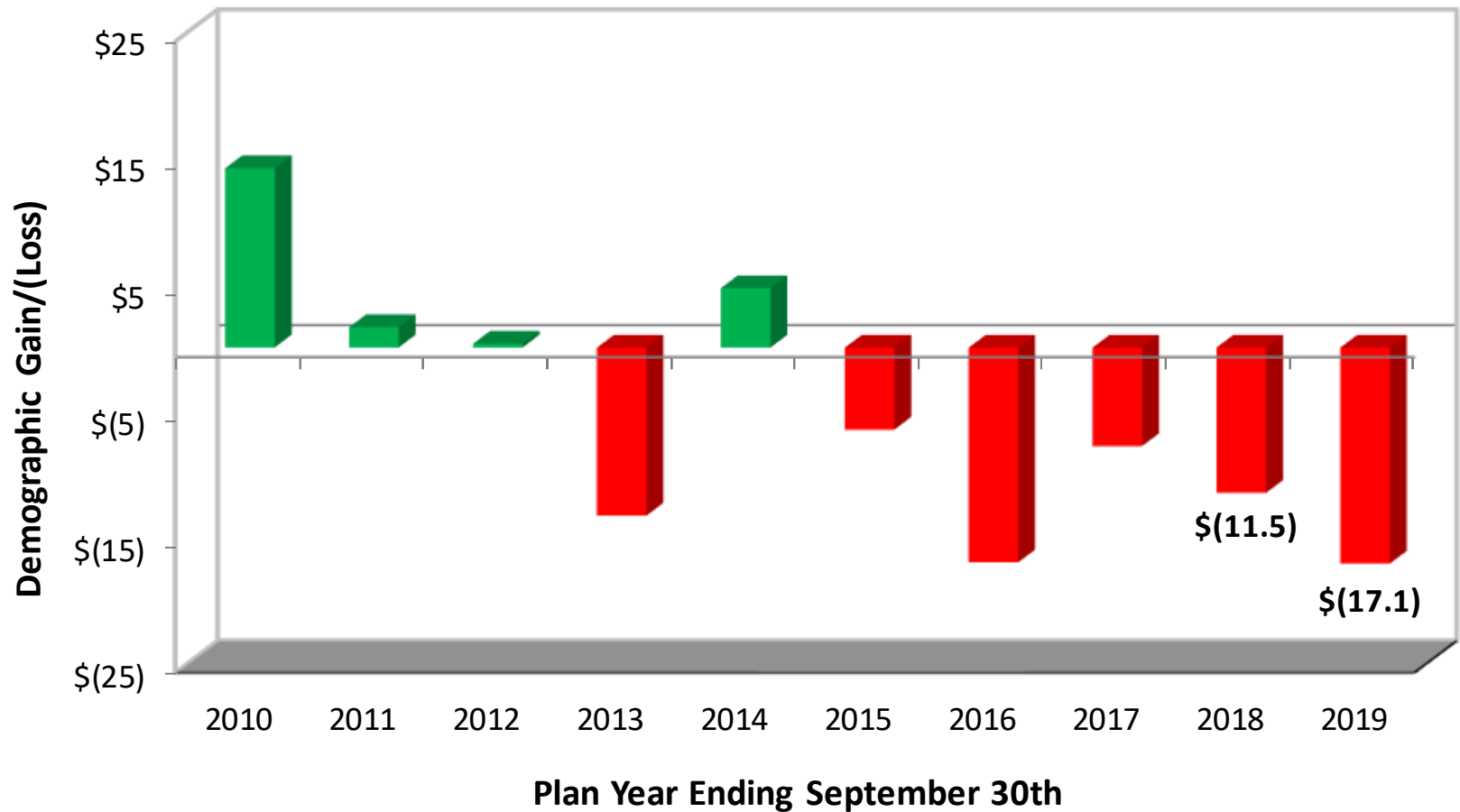
Investment Gain/(Loss)

(Amounts in Millions)



Demographic Gain/(Loss)

(Amounts in Millions)



Gain/(Loss) by Type of Activity

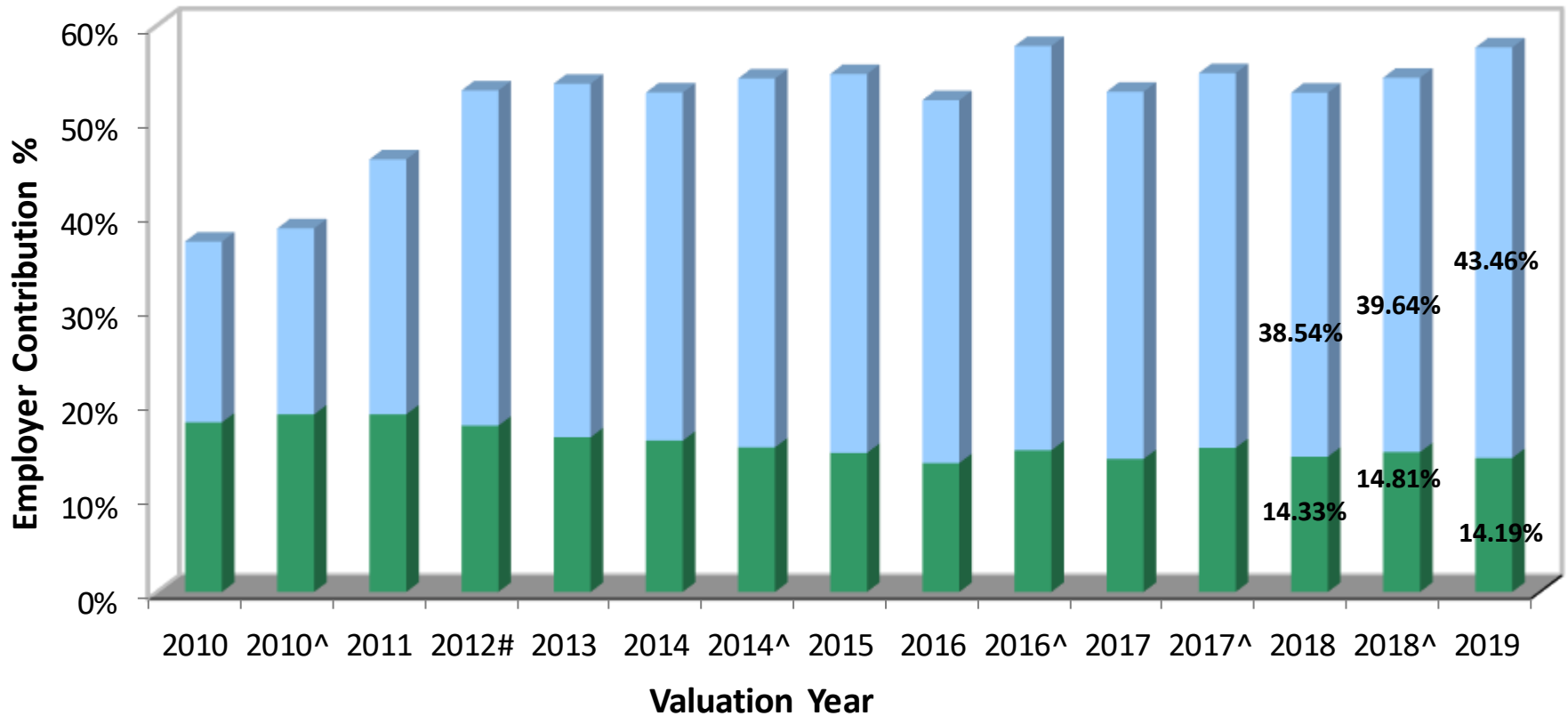
(Amounts in Millions)

Plan Year Ending 9/30	2019	2018	2017	2016	2015	2014
New Entrants *	(0.84)	(0.45)	0.00	0.00	0.00	0.00
Retiree Deaths	(5.30)	(2.42)	(1.83)	(2.84)	(0.71)	(2.78)
Investments	(16.46)	53.59	84.14	27.08	17.43	30.70
Pay Increases	(8.21)	(2.92)	(4.37)	1.14	5.40	8.93
Withdrawal	1.69	(0.37)	0.43	(1.48)	(0.54)	0.42
Retirements	(0.42)	(0.11)	2.47	1.12	(3.03)	(0.75)
Other	(4.02)	(5.23)	(4.46)	(14.98)	(7.62)	(1.11)
Total	(33.56)	42.09	76.38	10.04	10.93	35.41

* New entrants with past service (rehires).



Historical Employer Contribution %'s Valuation as of September 30th

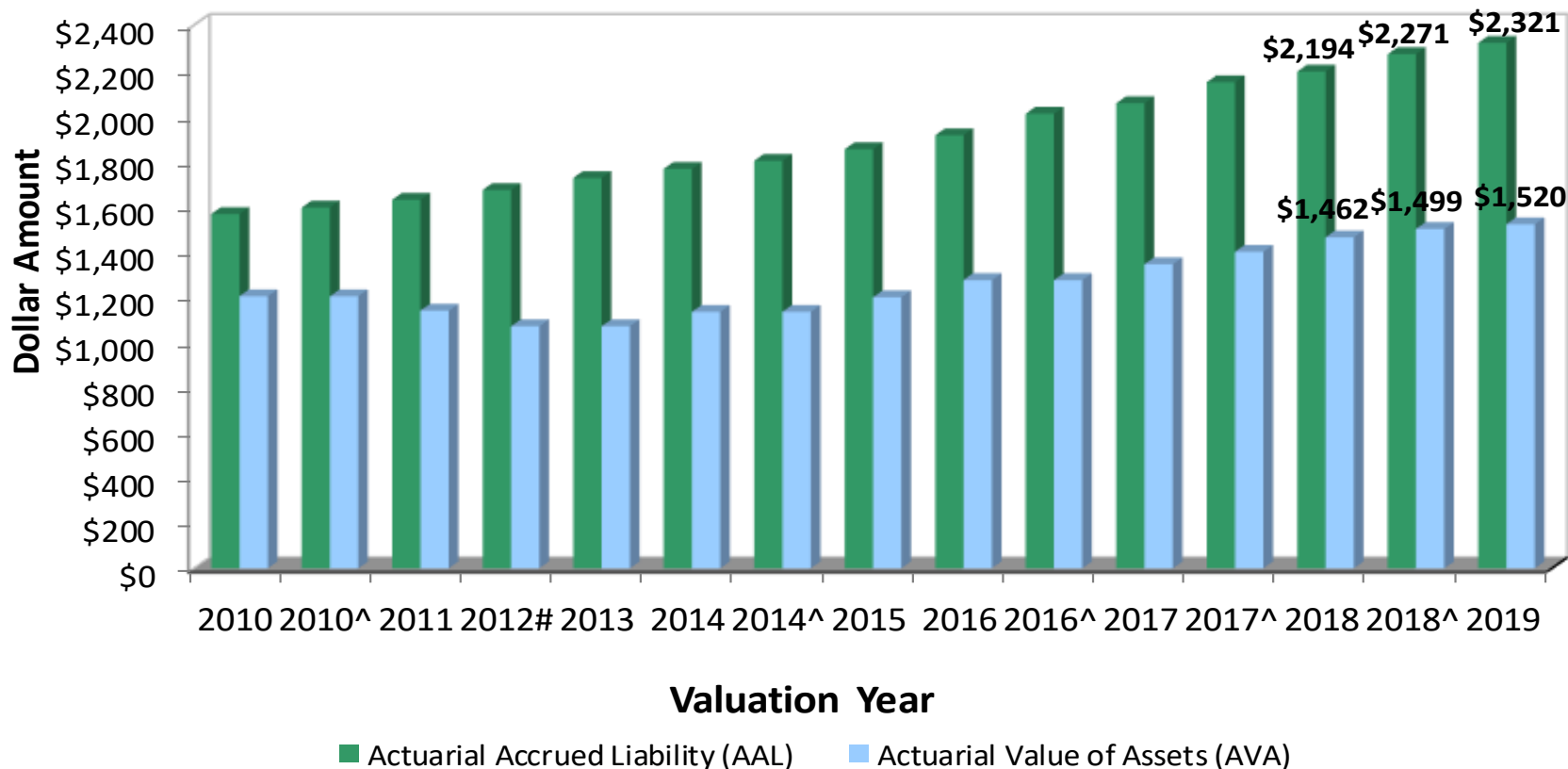


Revised benefit provisions.

^ Revised actuarial assumptions.



Actuarial Accrued Liability Compared to Actuarial Value of Assets (Amounts in Millions)

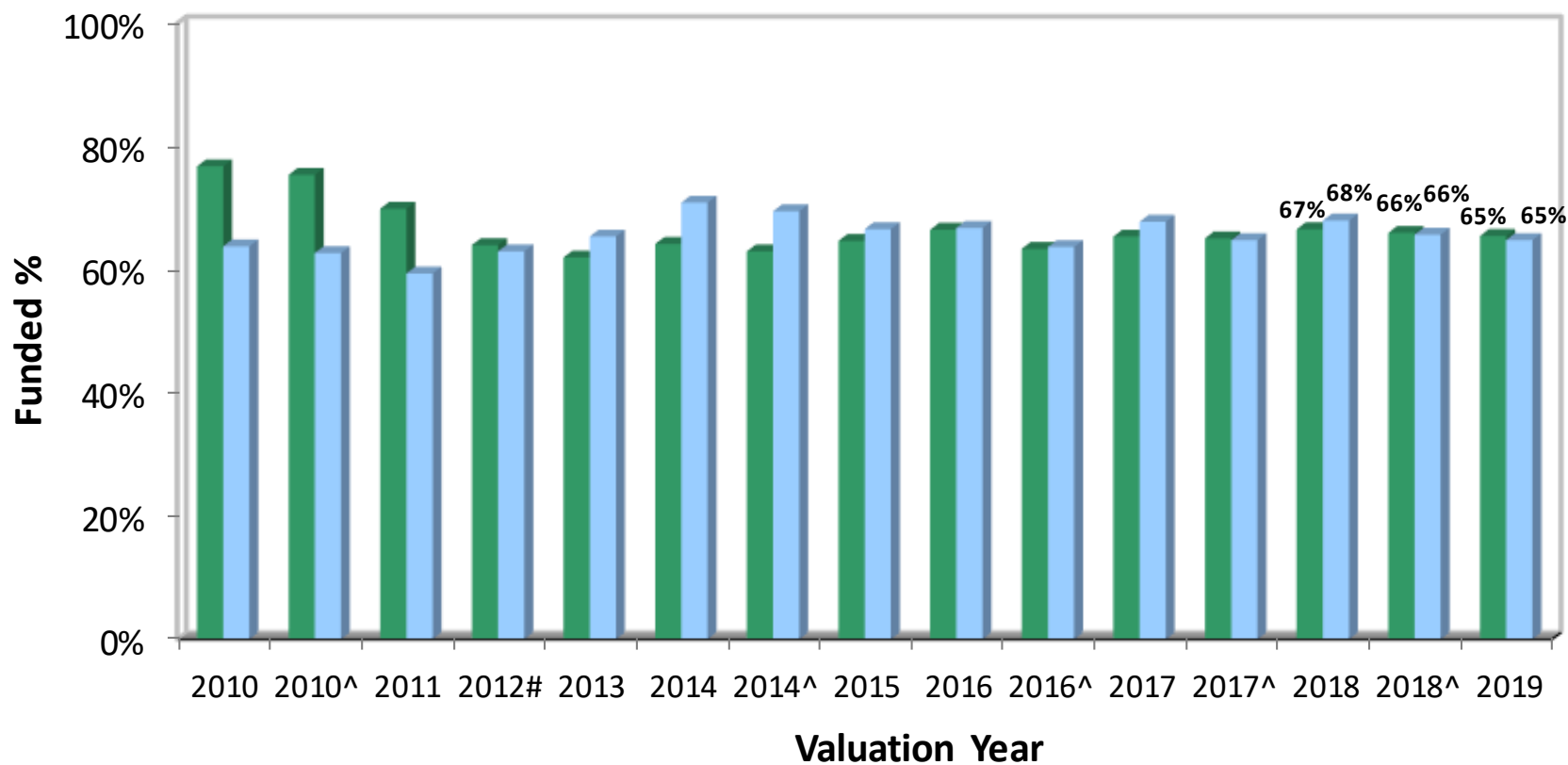


Revised benefit provisions.

^ Revised actuarial assumptions.



Retirement System Funded % Based on Actuarial Value and Market Value of Assets

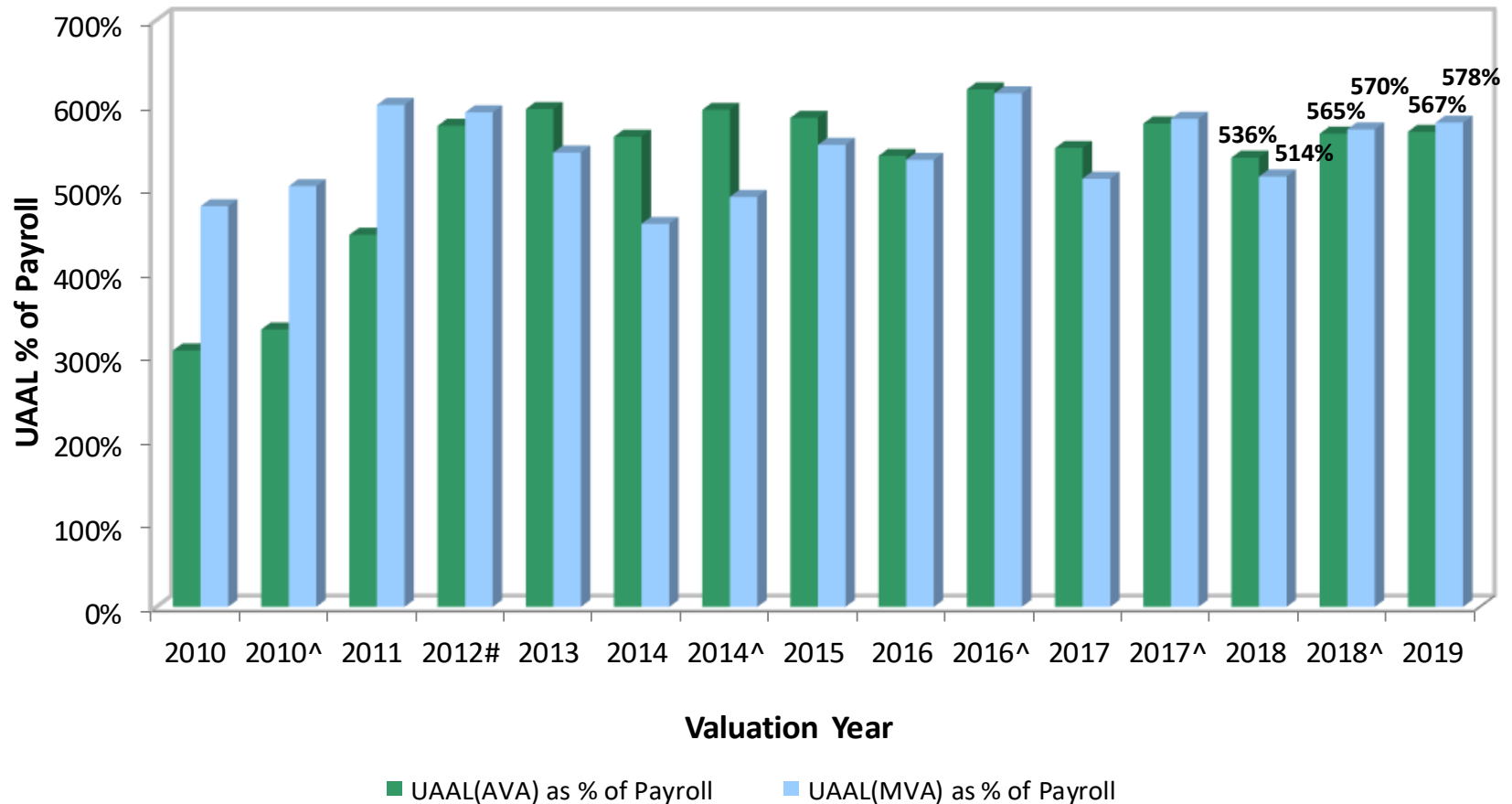


Revised benefit provisions.

^ Revised actuarial assumptions.



Unfunded Actuarial Accrued Liability as a Percentage of Payroll



Revised benefit provisions.

^ Revised actuarial assumptions.



Risk Metrics

- The determination of the actuarial accrued liability and the total computed employer contribution requires the use of assumptions regarding future economic and demographic experience
- Risk measures are intended to aid in the understanding of the effects of future experience differing from the assumptions
- Risk measures may also help with illustrating the potential volatility in the actuarial accrued liability and the total computed employer contribution

Risk Metrics

1. **Funded Ratio (Funding Value of Assets basis)**
 - This is the most widely known measure of a plan's financial strength. The trend in the funded ratio and the actual funded ratio are both important metrics. A trend approaching 100% is desirable.
2. **Funded Ratio (Market Value of Assets basis)**
 - This is similar to the above metric, except that the asset value is the market value.
3. **Unfunded Actuarial Accrued Liability (UAAL) Amortization Period**
 - Periods above about 17 to 23 years generally indicate that the UAAL payment is less than the interest on the UAAL. This situation is referred to as "negative amortization." Negative amortization is increasingly viewed as undesirable.
4. **Total UAAL / Total Payroll**
 - The ratio of UAAL to payroll gives an indication of the plan sponsor's ability to pay off the UAAL. A declining ratio is desirable. A ratio above approximately 3.0 to 4.0 may indicate difficulty in discharging the unfunded liability in some circumstances.

Risk Metrics

5. Total Funding Value of Assets / Total Payroll
 - The ratio of assets to payroll gives an indication of both maturity and volatility. Many systems have ratios between 5.0 and 7.0. Social Security Replacement Plans may fall above that range. A high ratio can indicate volatility of contribution rates.
6. Total Actuarial Accrued Liability (AAL) / Total Payroll
 - This is similar to the above metric. It illustrates the expected ratio of assets to payroll when the plan is fully funded.
7. Standard Deviation of Investment Return / Total Payroll
 - The portfolio standard deviation measures the volatility of investment returns. When divided by payroll, it gives the effect of one standard deviation asset gain or loss as a percent of payroll. This theoretically may happen once every 6 years.

Summary of Risk Metrics

Valuation Date September 30,	Funded Ratio		UAAL Amortization Period	Total UAAL / Total Payroll	Total Funding Value of Assets / Total Payroll	Total AAL / Total Payroll	Standard Deviation of Investment Return / Total Payroll
	Based on AVA	Based on MVA					
2012 ²	64 %	63 %	24	5.7	10.2	15.9	**
2013	62	65	23	5.9	9.7	15.6	**
2014 ¹	63	69	22	5.9	10.1	16.0	**
2015	65	67	21	5.8	10.7	16.5	**
2016 ¹	63	64	18	6.2	10.7	16.9	**
2017 ¹	65	65	17	5.8	10.8	16.5	**
2018 ¹	66	66	18	5.6	11.0	16.6	144 %
2019	65	65	17	5.7	10.8	16.4	140

¹ After changes in actuarial assumptions.

² After changes in plan provisions.

Disclaimers

- This presentation is intended to be used in conjunction with the September 30, 2019 pension actuarial valuation report. This presentation should not be relied on for any purpose other than the purpose described in the valuation report.
- This presentation shall not be construed to provide tax advice, legal advice or investment advice.
- The actuaries submitting this presentation (Mita Drazilov and Louise Gates) are Members of the American Academy of Actuaries and meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein.