



Board of Retirement Regular Meeting

Sacramento County Employees' Retirement System

Agenda Item 17

MEETING DATE: February 19, 2020

SUBJECT: Actuarial Funding Risk Assessment Report

SUBMITTED FOR: Consent **Deliberation and Action** **Receive and File**

RECOMMENDATION

Staff recommends the Board receive and file the Risk Assessment Report as prepared by Segal.

PURPOSE

This item supports the 2019-20 Strategic Management Plan by maintaining prudent and effective funding policies and practices that assist in producing low contribution rate volatility and plan sustainability.

DISCUSSION

The Risk Assessment Report is required under the Actuarial Standard of Practice No. 51 (ASOP 51), *Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions*, issued by the Actuarial Standards Board.

The Risk Assessment Report as of June 30, 2019 prepared by Segal is attached, which includes the following information:

- Factors that have historically impacted SCERS' funded status, UAAL, and employer contribution rates.
- Factors that may impact future funded status, UAAL, and employer contribution rates.
- Impact on the funded status, UAAL, and employer and member contribution rates based on changes in inflation or investment return assumptions.

Segal will attend the Board Meeting to present the report and answer any questions.

ATTACHMENT

- Risk Assessment Including Review of Funded Status as of June 30, 2019

/S/

Debbie Chan
Senior Accounting Manager

/S/

Eric Stern
Chief Executive Officer



Sacramento County Employees' Retirement System

Risk Assessment

**Including Review of Funded Status of the
Pension Plan as of June 30, 2019**

February 12, 2020

Paul Angelo, FSA, MAAA, FCA, EA

Andy Yeung, ASA, MAAA, FCA, EA

Todd Tauzer, FSA, MAAA, FCA, CERA

Table of Contents

Section 1: Introduction and Executive Summary	1
Introduction	1
Executive Summary	3
Section 2: Key Plan Risks on Funded Status, Unfunded Actuarial Accrued Liabilities, and Employer Contribution Rates	6
Evaluation of Historical Trends.....	6
Assessment of Primary Risk Factors Going Forward	13
Plan Maturity Measures that Affect Primary Risks	27
Appendix: Actuarial Assumptions, Methods and Actuarial Certification.....	32
Actuarial Assumptions and Methods	32
Actuarial Certification	35

Section 1: Introduction and Executive Summary

Introduction

The results included in our June 30, 2019 funding valuation report for the Pension Plan were prepared based on a fixed set of economic and non-economic actuarial assumptions under the premise that future experience of the Sacramento County Employees' Retirement System (SCERS or the System) would be consistent with those assumptions. While those assumptions are reviewed every three years (with the assumptions from the last triennial experience study adopted by the Board of Retirement for use starting with the June 30, 2017 valuation), there is a risk that emerging results may differ significantly as actual experience is fluid and will not completely track current assumptions.

The purpose of this report is to assist the Board of Retirement,¹ participating employers and members and other stakeholders to better understand and assess the risk profile of the System, as well as the particular risks inherent in using a fixed set of actuarial assumptions in preparing the results in our June 30, 2019 funding valuation for SCERS.

New Actuarial Standard of Practice on Risk Assessment

The Actuarial Standards Board approved the new Actuarial Standard of Practice No. 51 (ASOP 51) regarding risk assessment when performing a funding valuation and it is effective with SCERS' June 30, 2019 actuarial valuation for benefits provided by the Pension Plan. It should be noted that SCERS chose early adoption of ASOP 51 effective with SCERS' June 30, 2018 valuation, so this is the second report prepared under ASOP 51. ASOP 51 requires actuaries to identify and assess risks that "may reasonably be anticipated to significantly affect the plan's future financial condition." Examples of key risks listed that are particularly relevant to SCERS are asset/liability mismatch risk, investment risk, and longevity and other demographic risks. The Standard also requires an actuary to consider if there is any ongoing contribution risk to the plan; however, it does not require the actuary to evaluate the particular ability or willingness 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 initial assessment can be strictly a qualitative discussion about potential adverse experience and the possible effect on future results, but it may also include quantitative numerical demonstrations where informative. The

¹ This risk report has been prepared at the request of the Board of Retirement to assist in administering the Fund. This risk report may not be otherwise copied or reproduced in any form without the consent of the Board of Retirement and may only be provided to other parties in its entirety, unless expressly authorized by Segal. The measurements shown in this risk report may not be applicable for other purposes.

actuary is also encouraged to consider a recommendation as to whether a more detailed risk assessment would be significantly beneficial for the intended user in order to examine particular financial risks. When making that recommendation, the actuary will take into account such factors as the plan's design, risk profile, maturity, size, funded status, asset allocation, cash flow, possible insolvency and current market conditions. This report incorporates a more detailed risk assessment as agreed upon with SCERS.

Plan Risk Assessment

In Section 2, we start by discussing some of the historical factors that have caused changes in SCERS' funded status and employer contribution rates. It is important to understand how the combination of decisions and experience have led to the current financial status of the plan.

We follow this with a discussion of the most significant risk factors going forward. Even though we have not included a numerical analysis of all the risk factors, we have been directed by SCERS to illustrate the impact on the funded status and employer contribution rates using relevant economic scenario tests. These tests illustrate the effect of future investment returns on the portfolio coming in different from the current 7.00% annual investment return assumption used in the June 30, 2019 valuation. We have also included a projection of future results based on a stochastic modeling of future investment returns. The stochastic modeling is useful for assessing the distribution of future results based on random variations in actual investment returns each year, and introduces a relative likelihood to the range of potential outcomes. As Segal will be conducting a triennial experience study of the economic and non-economic actuarial assumptions before the next valuation as of June 30, 2020, we have been directed by SCERS to illustrate the impact on the funded status and the employer and employee contribution rates if the Board were to lower either the 3.00% inflation assumption or the 7.00% investment return assumption, as well as lowering both the inflation and investment return assumptions, in our sensitivity tests of the two most important economic assumptions.

The Standard also requires disclosure of plan maturity measures and other historical information that are significant to understanding the risks associated with the Pension Plan and this information is included in this report.

Executive Summary

Historical Funded Status and Employer Contribution Rates

The following table provides a summary of financial changes to the plan over the last 10 valuations. The unfunded actuarial accrued liability (UAAL)² and contribution rates³ increased primarily as a result of the strengthening of the actuarial assumptions used in preparing the valuations and unfavorable investment experience.

Valuation Date	<u>Market Value Basis</u>		<u>Actuarial Value Basis</u>		<u>Aggregate Employer Contribution Rate (% of Payroll)</u>
	Funded Status	UAAL	Funded Status	UAAL	
June 30, 2010	70%	\$2,100 million	88%	\$900 million	21%
June 30, 2019	83%	\$2,100 million	82%	\$2,200 million	29%

Future Funded Status and Employer Contribution Rates

In this report, we highlight other key factors besides assumption changes that may affect the financial profile of the plan going forward. As investment experience in the past 10 years has had a significant impact on the funded status and employer contribution rates, we have also provided deterministic projections (using select scenarios for illustration) under hypothetical favorable and unfavorable future market experience so that the impact of market performance can be better understood.

² For example, the UAAL changed by \$108 million in the June 30, 2010 valuation, (\$22) million in the June 30, 2011 valuation, \$134 million in the June 30, 2012 valuation, \$16 million in the June 30, 2014 valuation, and \$824 million in the June 30, 2017 valuation (for a total of \$1.06 billion), as a result of the experience studies over the last ten years.

³ For example, the change in the employer's total rate (normal cost plus UAAL) was 1.20% in the June 30, 2010 valuation, (0.13%) in the June 30, 2011 valuation, 1.44% in the June 30, 2012 valuation (before phase-in), (0.59%) in the June 30, 2014 valuation, and 7.76% in the June 30, 2017 valuation (before phase-in) (for a total of 9.68%), as a result of the experience studies over the last ten years.

The total employer contribution rate is about 29.4% of total payroll in the June 30, 2019 valuation. Using a deterministic projection, this report shows the effect of either favorable (14%) or unfavorable (0%) hypothetical market returns for 2019/2020 on key valuation results. In particular, the changes (relative to the June 30, 2019 valuation aggregate employer contribution rate of approximately 29.4%) in the total employer contribution rate in the June 30, 2020 valuation and in the June 30, 2026 valuation (when all the investment gains or losses are fully recognized at the end of the 7-year asset smoothing period) are as shown in the following table:

2019/2020 Single Plan Year Investment Return⁴			
Valuation Date	14%	7% (baseline)⁵	0%
June 30, 2020	-2.0% of payroll	-1.3% of payroll	-0.6% of payroll
June 30, 2026	-8.6% of payroll	-3.2% of payroll	+2.3% of payroll

Furthermore, under either the favorable or unfavorable hypothetical market return scenarios for 2019/2020, the System would be expected to reach full funding and the total employer contribution rate would be expected to approach about 10% of payroll at the end of 20 years. That 10% of payroll is the employer normal cost rate after SCERS' UAAL layers as of June 30, 2019 are paid off over periods ranging from 1 to 20 years and any new UAALs resulting from the hypothetical market experience in 2019/2020 are paid off over 20 years pursuant to the Board's actuarial funding policy. This means that the Board's funding policy is very effective in achieving the general policy goal of achieving the long-term full funding of the costs of the benefits paid by SCERS.

Using a stochastic projection that models market return over the next 20 years by using expected return, standard deviation and other information about SCERS' asset portfolio, there is a 50% chance that the employer contribution rates would be between 11% and 40% of payroll at the end of 10 years and between 10% and 33% of payroll at the end of 20 years. Furthermore, there is a 39% chance SCERS would be fully funded at the end of 10 years and 53% chance SCERS would be fully funded at the end of 20 years.

Using the results from the June 30, 2019 valuation, we have studied independently the impact of a 0.25% reduction in either the 3.00% inflation assumption or the 7.00% investment return assumption that were used in that valuation, as well as the impact of a 0.25% reduction in both the inflation and the investment return assumptions.

⁴ We assume in all scenarios tested in this report that the amount in the Contingency Reserve as of June 30, 2019 will be utilized in the June 30, 2020 valuation and that the Contingency Reserve will not be restored.

⁵ This differs from our Seven-Year Projection of Employer Contribution Rates primarily due to: a) assuming that the amount in the Contingency Reserve as of June 30, 2019 will be utilized in the June 30, 2020 valuation and b) reflecting the gradual savings in normal cost as active members in the legacy tiers are replaced by new members in the PEPRA tiers.

- A 0.25% reduction in the inflation assumption to 2.75% (which impacts the active salary increase assumption, retiree COLAs for members in Tier 1, and growth in the System's payroll used to develop the UAAL rate), with no change to the 7.00% investment return assumption, would decrease the employer and employee rates by 1.2% and 0.3% of payroll, respectively, and decrease the UAAL by \$167 million.
- A 0.25% reduction in the investment return assumption to 6.75%, with no change to the 3.00% inflation assumption, would increase the employer and employee contribution rates by 2.9% and 0.6% of payroll, respectively, and increase the UAAL by \$378 million.
- A 0.25% reduction in both the inflation assumption to 2.75% and the investment return assumption to 6.75% would increase the employer and employee rates by 1.7% and 0.3% of payroll, respectively, and increase the UAAL by \$205 million.

Plan Maturity Measures

During the past 10 valuations, the System has become more mature as evidenced by an increase in the ratio of members in pay status (retirees and beneficiaries) to active members and by an increase in the ratios of plan assets and liabilities to active member payroll. We expect these trends to continue going forward. This is significant for understanding the volatility of both historical and future employer contribution rates because any increase in UAAL due to unfavorable investment and non-investment experience for the relatively larger group of non-active and active members would have to be amortized and funded over the payroll of the relatively smaller group of only active members. Put another way, as a plan grows more mature, its contribution rate becomes more sensitive to investment volatility and liability changes. As SCERS continues to mature with time, its risk profile will continue to evolve in this way and contributions will grow more sensitive to plan experience.

Section 2: Key Plan Risks on Funded Status, Unfunded Actuarial Accrued Liabilities, and Employer Contribution Rates

Evaluation of Historical Trends

Funded Status and Change in Unfunded Actuarial Accrued Liabilities

One common measure of SCERS' financial status is the funded ratio. This ratio compares the actuarial⁶ and market value of assets to the actuarial accrued liabilities (AAL)⁷ of SCERS. The overall level of funding of SCERS has declined on an actuarial basis as a result of unfavorable investment returns and the strengthening of economic and non-economic actuarial assumptions, especially in the last triennial experience study. Those new actuarial assumptions were used in the June 30, 2017, 2018 and 2019 valuations. The unfavorable investment experience also has an impact. The funded ratios and UAAL⁸ for the past 10 valuations from June 30, 2010 to 2019 measured using both actuarial and market value of assets bases are provided in *Chart 1*.

The factors that caused the changes in the UAAL for the past 10 valuations from June 30, 2010 to 2019 are specified in *Chart 2*. The results in *Chart 2* reflect the changes in the investment return assumption from 7.50% to 7.00%⁹ and other assumption changes from the last triennial experience study as part of the June 30, 2017 valuation that have together by far the most impact on the UAAL for SCERS, followed by the unfavorable investment experience during 2010 to 2019.

Chart 2 also shows that the unfavorable investment experience was offset to some extent by favorable non-investment experience. The non-investment experience included smaller salary increases received by active members and smaller cost-of-living-adjustment (COLA) increases received by retirees and beneficiaries than expected under the actuarial assumptions. The non-investment experience also included the one year scheduled delay in implementing the contribution rates determined in the annual valuation.

⁶ The actuarial value of assets is equal to the market value of assets excluding unrecognized returns from the last few years. Unrecognized returns are based on the difference between actual and expected returns on a market value basis and are recognized over a seven-year period.

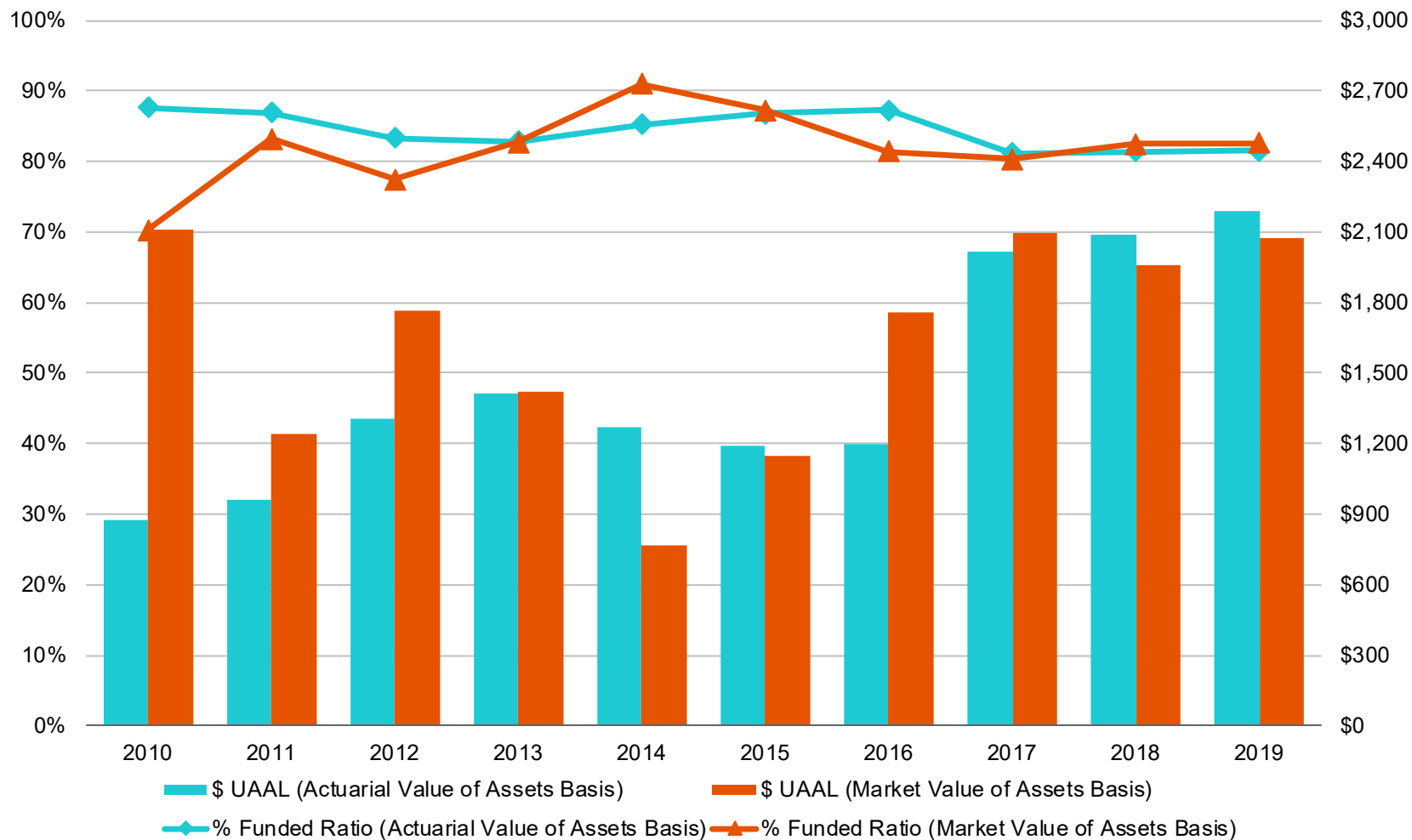
⁷ For the actives, the actuarial accrued liability is the value of the accumulated normal costs allocated to the years before the valuation date. For the pensioners, beneficiaries and deferred vested members, the actuarial accrued liability is the single sum present value of the lifetime benefit expected to be paid to those members.

⁸ The amount by which the actuarial accrued liability of the plan exceeds (or is exceeded by) the assets of the plan.

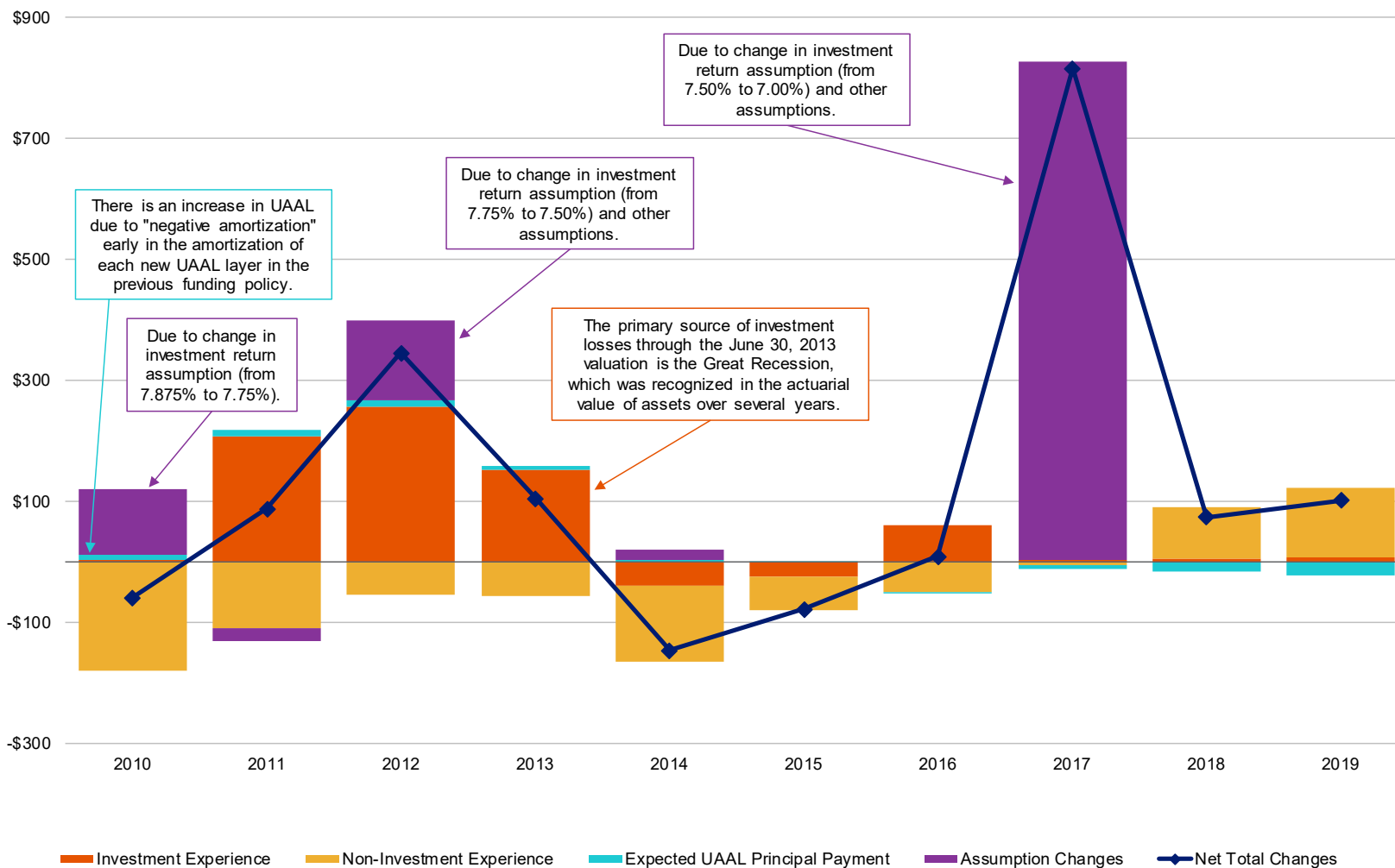
⁹ Prior to the experience study as part of the June 30, 2017 valuation, the investment return assumption was lowered from 7.875% to 7.75% in the June 30, 2010 valuation and from 7.75% to 7.50% in the June 30, 2012 valuation.

Finally, prior to 2016 *Chart 2* shows some “negative amortization” under the longer amortization periods used in these years. Current amortization policy generally will not entail negative amortization in the future.

Funded Ratio (Percentages) and Dollar UAAL (\$ Millions)
in June 30, 2010 to 2019 Valuations



Factors that Changed UAAL in June 30, 2010 to 2019 Valuations (\$ Millions)



Employer Contribution Rates

The total (normal cost¹⁰ plus UAAL payment) employer contribution rates determined in the June 30, 2010 to 2019 valuations are provided in *Chart 3* and the factors that caused the changes in the total employer aggregate rates¹¹ are provided in *Chart 4*.

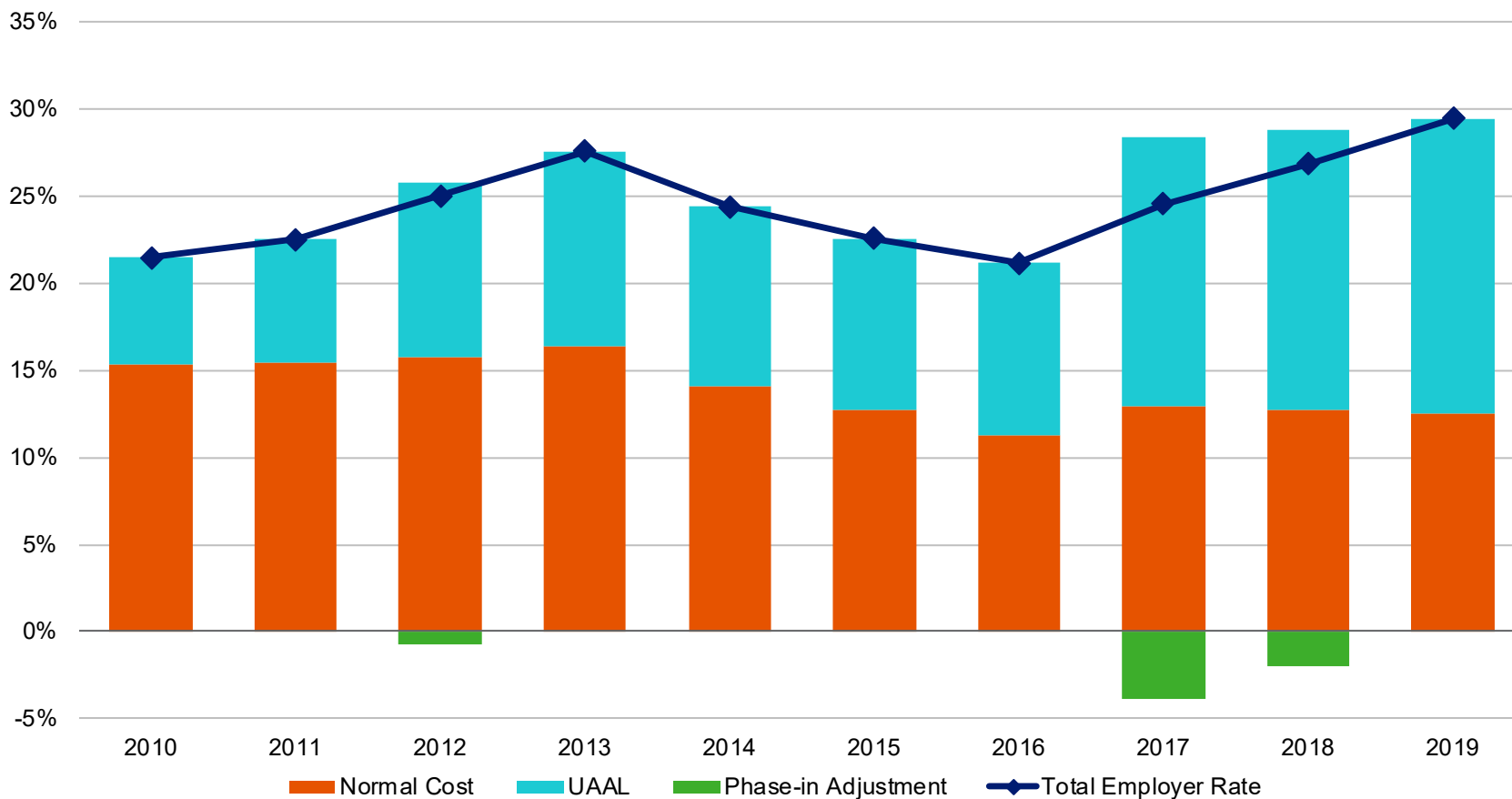
The gradual reduction in the aggregate employer normal cost rates as shown in *Chart 3* was primarily due to plan changes under the Public Employees' Pension Reform Act of 2013 (PEPRA) as County legacy members agreed to pay additional normal cost contributions and County and District new members were enrolled in the lower cost PEPRA benefit tiers starting on January 1, 2013. *Chart 4* shows that the changes in the investment return from 7.50% to 7.00% and other assumptions from the last triennial experience study as part of the June 30, 2017 valuation have by far the most impact on increasing the UAAL contribution rates for the employers, followed by the overall unfavorable investment experience during 2010 to 2019. Based on the significant increase in the employer contribution rates in the June 30, 2017 valuation (of 7.76% of payroll or \$76 million per year based on an annual payroll of \$980 million in the 2017 valuation), the Board decided to phase-in the UAAL contribution rate increase due to the assumption changes over a 3-year period.¹²

¹⁰ The normal cost is the amount of contributions required to fund the level cost of the member's projected retirement benefit allocated to the current year of service.

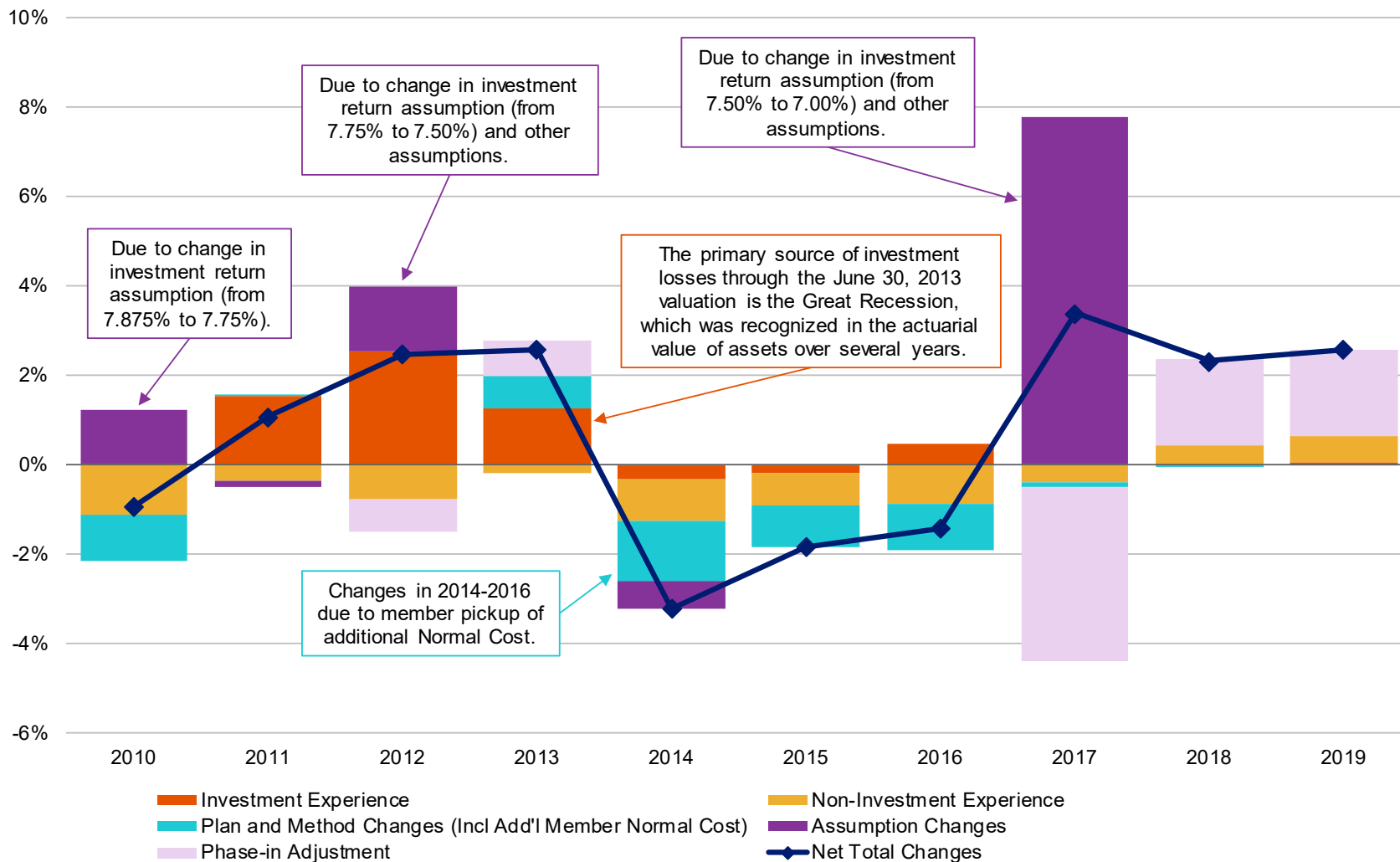
¹¹ There are separate contribution rates determined in the valuation for the Miscellaneous and Safety membership groups and for the different benefit tiers. The aggregate rates have been calculated based on an average of those rates weighted by the payrolls of the active members reported in those valuations.

¹² As of the June 30, 2019 valuation, the entire 5.8% UAAL contribution rate increase has been phased in.

Employer Contribution Rates in June 30, 2010 to 2019 Valuations (% of Payroll)



Factors that Affected Employer Contribution Rates in June 30, 2010 to 2019 Valuations (% of Payroll)



Assessment of Primary Risk Factors Going Forward

As discussed in the Evaluation of Historical Trends section, in the 2010 to 2019 valuations the funded ratios and the employer contribution rates have changed mainly as a result of changes in actuarial assumptions and investment experience.

In general, we anticipate the following risk factors to have an ongoing influence on those financial metrics in our future valuations:

- Asset/liability mismatch risk – the potential that future plan experience does not affect asset and liability values in the same way, causing them to diverge.

The most significant asset/liability mismatch risk¹³ to SCERS is investment risk, as defined below. In fact, investment risk has the potential to impact asset/liability mismatch in two ways. The first mismatch is evident in annual valuations: when asset values deviate from assumptions, those changes are essentially independent from liability changes. The second mismatch can be caused when systemic asset deviations from assumptions may signal the need for an assumption change, which causes liability values and contribution rates to move in the opposite direction from the experience of the asset values.

Asset/liability mismatch can also be caused by longevity and other demographic assumption risks, which affect liabilities but have no impact on asset levels. These risks are also discussed below.

It may be informative to use the Asset Volatility and Liability Volatility Ratios and associated contribution rate impacts provided in the following Plan Maturity Measures section when discussing with the employers the effect of unfavorable or favorable actuarial experience on the assets and the liabilities of SCERS.

- Investment risk – the potential that future market returns will be different from the current expected 7.00% annual return assumption.

The investment return assumption is a long-term, deterministic assumption for valuation purposes even though in reality market experience can be quite volatile in any given year. We have included deterministic scenario tests later in this section so that SCERS can better understand the risk associated with earning either more or less than the assumed rate.

Also, the Board has a policy of reviewing the investment return and the other actuarial assumptions every three years, with the next triennial experience study (recommending assumptions for the June 30, 2020 actuarial valuation)

¹³During 2018/2019, SCERS paid benefits of about \$506 million. Out of that total amount, only about \$3 million was made in refund of employee contributions where the liabilities associated with the growth in the members' employee contribution account bear some relationship to the rate of return on short term US Treasury Securities in SCERS' investment portfolio.

scheduled to be performed in 2020. We have included sensitivity tests later in this section that show the impact of changes in the investment return and inflation economic assumptions.

- Longevity and other demographic risks – the potential that mortality or other demographic experience will be different than expected.

Changes to the mortality tables were the most major change to the non-economic assumptions in the last experience study. As can be observed from *Charts 2 and 4*, there had been relatively small impact on the UAAL and employer contribution rates due to non-investment related experience relative to the assumptions used in the last 10 valuations. However, in the last triennial experience study recommending assumptions for the June 30, 2017 valuation, we alerted the Board that it should consider a new benefit weighted mortality basis when choosing the next mortality table, pending the availability of mortality experience from the Society of Actuaries (SOA) that includes data from public sector retirement plans. In January 2019, the SOA published the public sector mortality tables. While it is premature to estimate the impact of applying those new mortality tables on employer and employee contribution rates until we perform the next triennial experience study recommending assumptions for the June 30, 2020 valuation, the Board should still be aware that there may be some increase in liabilities and contribution rates.

- Contribution risk – The potential that actual future contributions will be different from expected future contributions.

ASOP 51 does not require the actuary to evaluate the particular ability or willingness of the plan sponsor or other contributing entity to make contributions to the plan when due. However, it does require the actuary to consider the potential for and impact of actual contributions deviating from expected in the future. SCERS' employers have a well-established practice of making the Actuarially Determined Contributions (ADC) determined in the annual actuarial valuation, based on the Board of Retirement's Actuarial Funding Policy. As a result, in practice SCERS has essentially no contribution risk.

Furthermore, when ADCs determined in accordance with the SCERS Actuarial Funding Policy are made in the future by the employers (and contributions required by the statute are made by the employees), it is anticipated that the System would have enough assets to provide all future benefits promised to the current members enrolled in the System, if all of the actuarial assumptions used in the valuation are met.

The ASOP also lists interest rate risk as an example of a potential risk to consider. However, the valuation of your plan's liabilities is not linked directly to market interest rates so the resulting interest rate risk exposure is minimal.

Scenario Tests

Since the funded ratio, UAAL and the employer contribution rates have fluctuated as a result of deviation in investment experience in the last 10 valuations, we have examined the risk for SCERS associated with earnings either higher or

lower than the assumed rate of 7.00% in future valuations using projections under a deterministic approach and a stochastic approach.

Deterministic Projection

To measure such risk, we have included a scenario test to study the change in the UAAL and contribution rates if SCERS were to earn market return higher or lower than 7.00% in the next year following the June 30, 2019 valuation. In *Charts 5, 6 and 7*, we show the aggregate employer contribution rates, funded ratios, and UAAL respectively assuming that the portfolio’s market return in 2019/2020 will be as follows: Scenario 1: 14.00%, Scenario 2: 7.00% (baseline) or Scenario 3: 0.00%. The following table summarizes the resulting contribution rate changes (relative to the June 30, 2019 valuation aggregate employer contribution rate of approximately 29.4%) in the immediate next valuation as well as in the June 30, 2026 valuation where all of the investment gains and losses are fully recognized in the (smoothed) actuarial value of assets.

<u>2019/2020 Single Plan Year Investment Return¹⁴</u>			
Valuation Date	14%	7% (baseline)¹⁵	0%
June 30, 2020	-2.0% of payroll	-1.3% of payroll	-0.6% of payroll
June 30, 2026	-8.6% of payroll	-3.2% of payroll	+2.3% of payroll

Furthermore, under either the favorable or unfavorable hypothetical market return scenarios for 2019/2020, the System would be expected to reach full funding and the total employer contribution rate would be expected to approach about 10% of payroll¹⁶ at the end of 20 years. That 10%¹⁷ of payroll is the employer normal cost rate after SCERS’ UAAL layers as of June 30, 2019 are paid off over periods ranging from 1 to 20 years and any new UAALs resulting from the hypothetical market experience in 2019/2020 are paid off over 20 years pursuant to the Board’s actuarial funding policy. This means that the Board’s funding policy is very effective in achieving the general policy goal of achieving the long-term full funding of the costs of the benefits paid by SCERS.

¹⁴ We assume in all scenarios tested in this report that the amount in the Contingency Reserve as of June 30, 2019 will be utilized in the June 30, 2020 valuation and that the Contingency Reserve will not be restored.

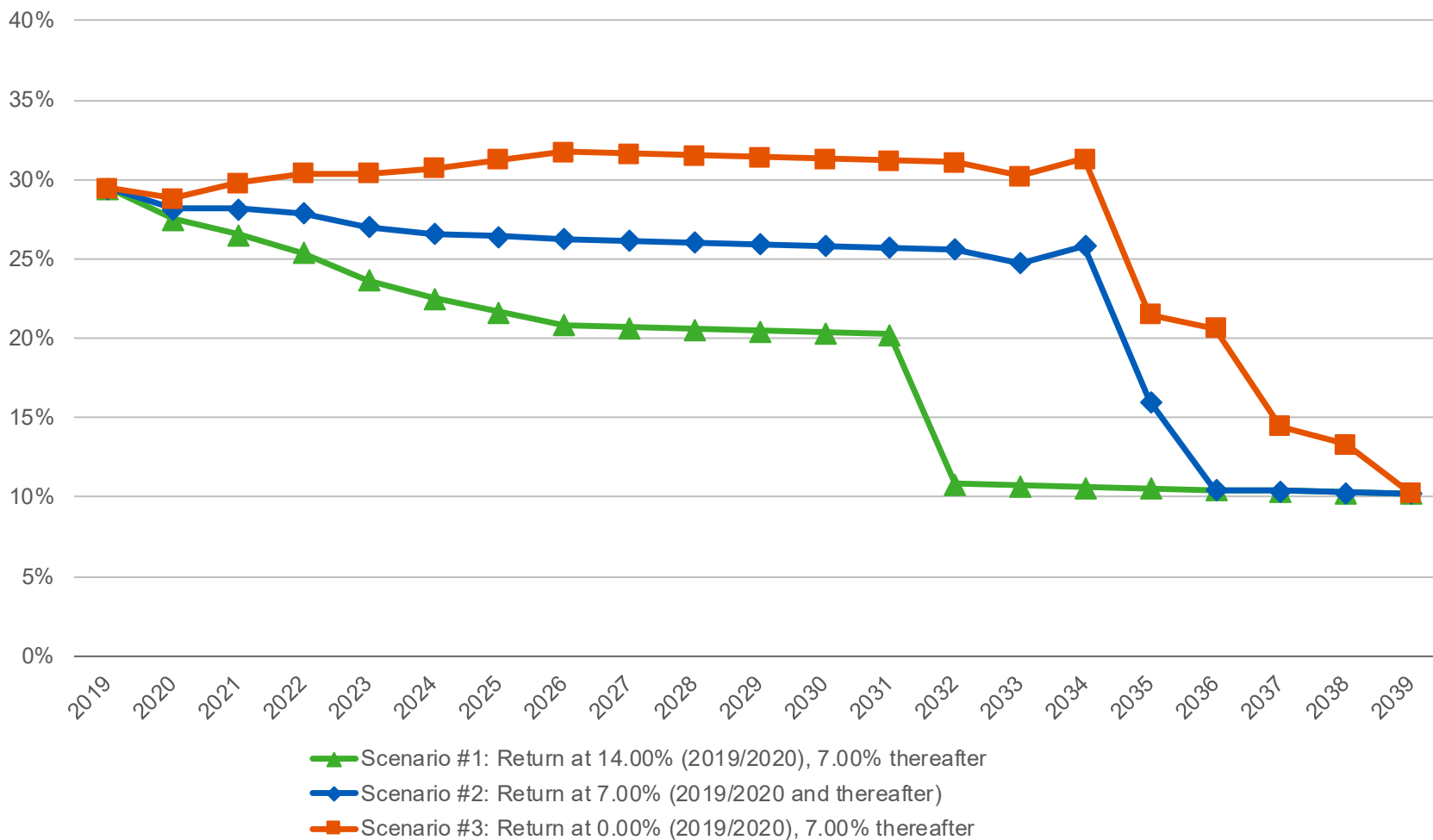
¹⁵ This differs from our Seven-Year Projection of Employer Contribution Rates primarily due to: a) assuming that the amount in the Contingency Reserve as of June 30, 2019 will be utilized in the June 30, 2020 valuation and b) reflecting the gradual savings in normal cost as active members in the legacy tiers are replaced by new members in the PEPRA tiers.

¹⁶ Assuming no further assumption changes, method changes or experience that differs significantly from assumptions.

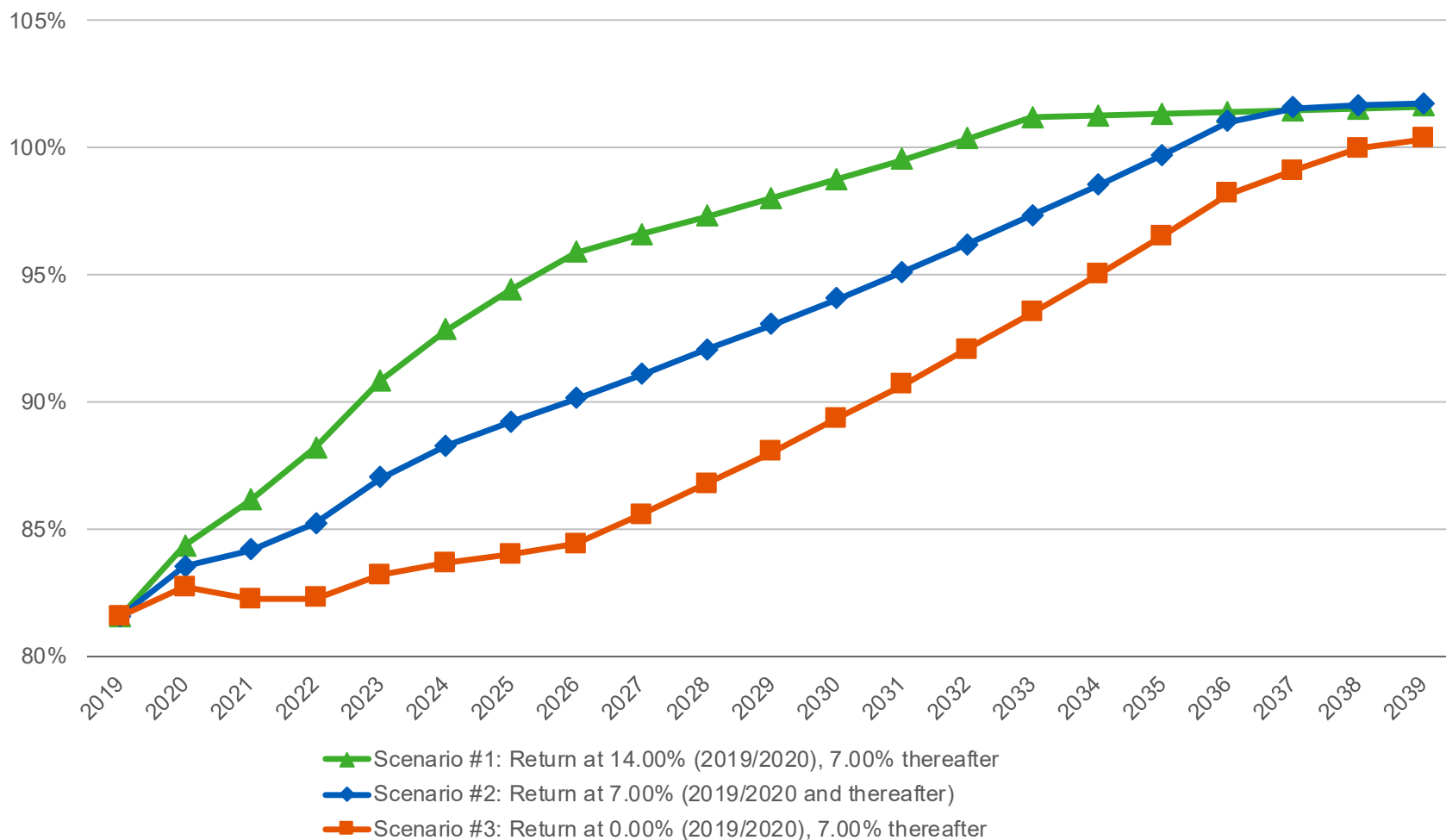
¹⁷ In the risk report as of June 30, 2018, the contribution rate after 20 years was 10.59%, which rounded up to 11%. The contribution rate after 20 years calculated for the risk report as of June 30, 2019 is 10.25%, which rounds down to 10%.

While we have not assigned a probability on the 2019/2020 market return coming in at these rates, the Board and other stakeholders monitoring SCERS should still be able to prorate and estimate the funded status and employer contribution rates for the June 30, 2020 and next several valuations as the actual investment experience for the 2019/2020 year becomes available throughout the year. Additionally, comparable experience in upcoming future years is likely to have a similar impact on the System absent any significant plan or assumption changes.

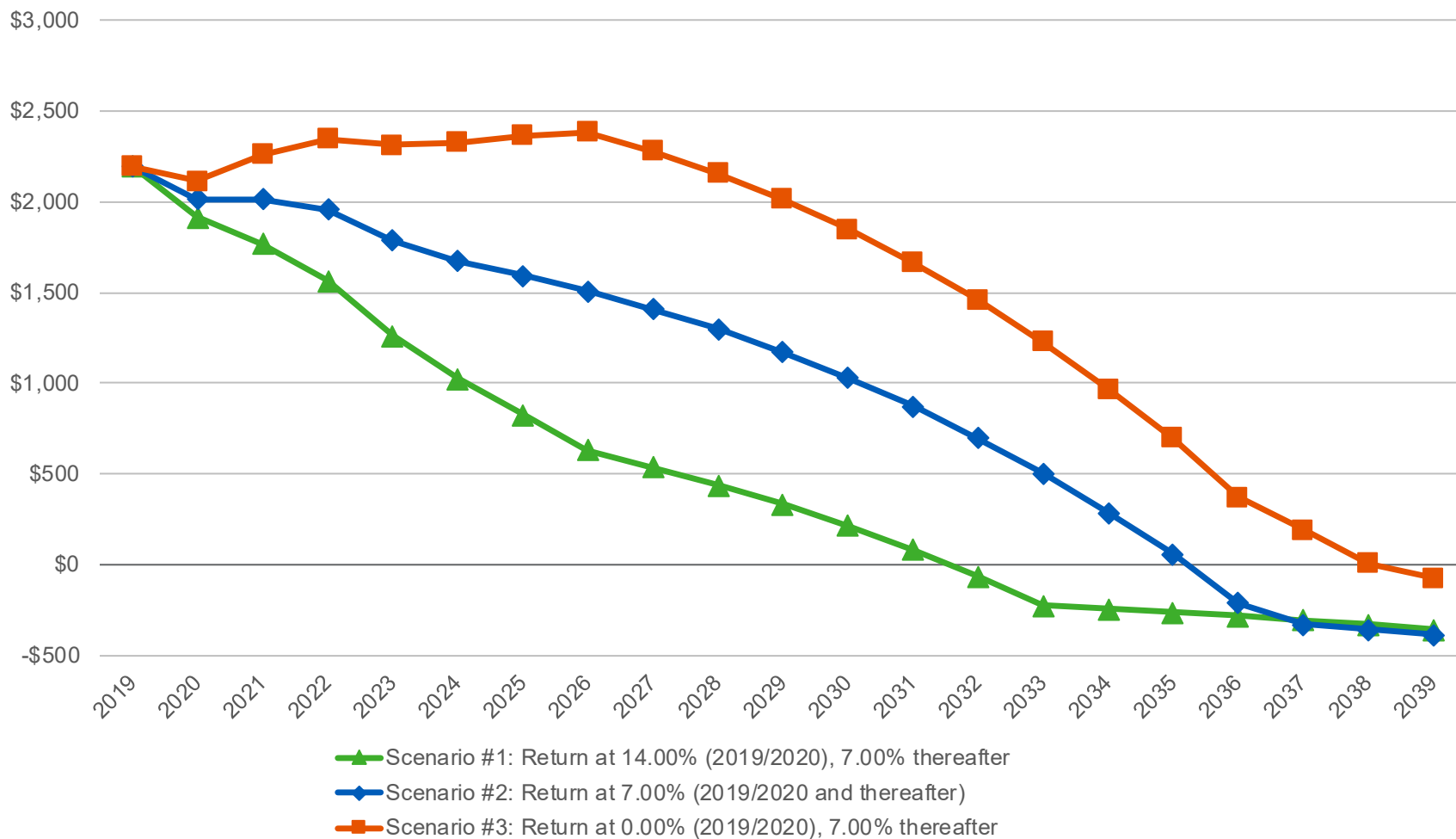
Projected Employer Contribution Rates under Three Hypothetical Market Return Scenarios for 2019/2020 (% of Payroll)



Projected Funded Ratios (on Actuarial Value of Assets Basis) under Three Hypothetical Market Return Scenarios for 2019/2020



Projected UAAL (on Actuarial Value of Assets Basis) under Three Hypothetical Market Return Scenarios for 2019/2020 (\$ Millions)



Stochastic Projection

Based on our discussions with SCERS, we have also been directed to supplement the deterministic Scenario Tests by another analysis that shows the range of possible changes in funded status and contribution rates under a statistical distribution of potential market returns for 20 years following the June 30, 2019 valuation. We have accomplished the stochastic modeling of future market returns by using the expected return, standard deviation and other information about SCERS' asset portfolio as provided in the Appendix of this report, assuming no future assumption or method changes to the plan.

In *Chart 8*, we summarize the cumulative compounded rate of return of SCERS' investment portfolio over the next 20 years based on performing 10,000 trial outcomes of future market returns. The projected funded ratios for those trials are provided in *Chart 9*. The UAAL and the resultant employer contribution rates are provided in *Charts 10* and *11*, respectively.

At the end of 20 years, there is a 50% chance¹⁸ that the annual return of SCERS' investment portfolio would average between 5.2% and 8.7%, the funded ratio would be between 82% and 141% and the corresponding UAAL would be between \$4.1 billion and a surplus (or a negative UAAL) of \$9.1 billion.

The funded ratio is about 82% the June 30, 2019 valuation. There is a 39% chance SCERS would be fully funded at the end of 10 years and a 53% chance SCERS would be fully funded at the end of 20 years. The probabilities that the funded ratio would fall below 50%, 60% or 70% at any point in the next 20 years are as follows:

	Funded Ratio		
	Below 50%	Below 60%	Below 70%
Probability	1%	3%	10%

At the end of 10 years (i.e., the June 30, 2029 valuation), there is a 50% chance that the employer contribution rates would be between 11% and 40% of payroll. At the end of 20 years (i.e., the June 30, 2039 valuation), there is a 50% chance that the employer contribution rates would be between 10% and 33% of payroll. 10% of payroll is about the level of the employer normal cost rate. Note that we have not offset the normal cost by any available actuarial surplus.¹⁹

¹⁸ This is based on the 25th to the 75th percentile results.

¹⁹ Under PEPRA, the System has an actuarial surplus when the funded ratio is at or over 120% and certain other conditions are met. For the purposes of these projections, we have assumed that those other conditions have not been met and therefore we did not amortize such actuarial surplus over a rolling (non-decreasing) 30-year period as described under the Board's funding policy.

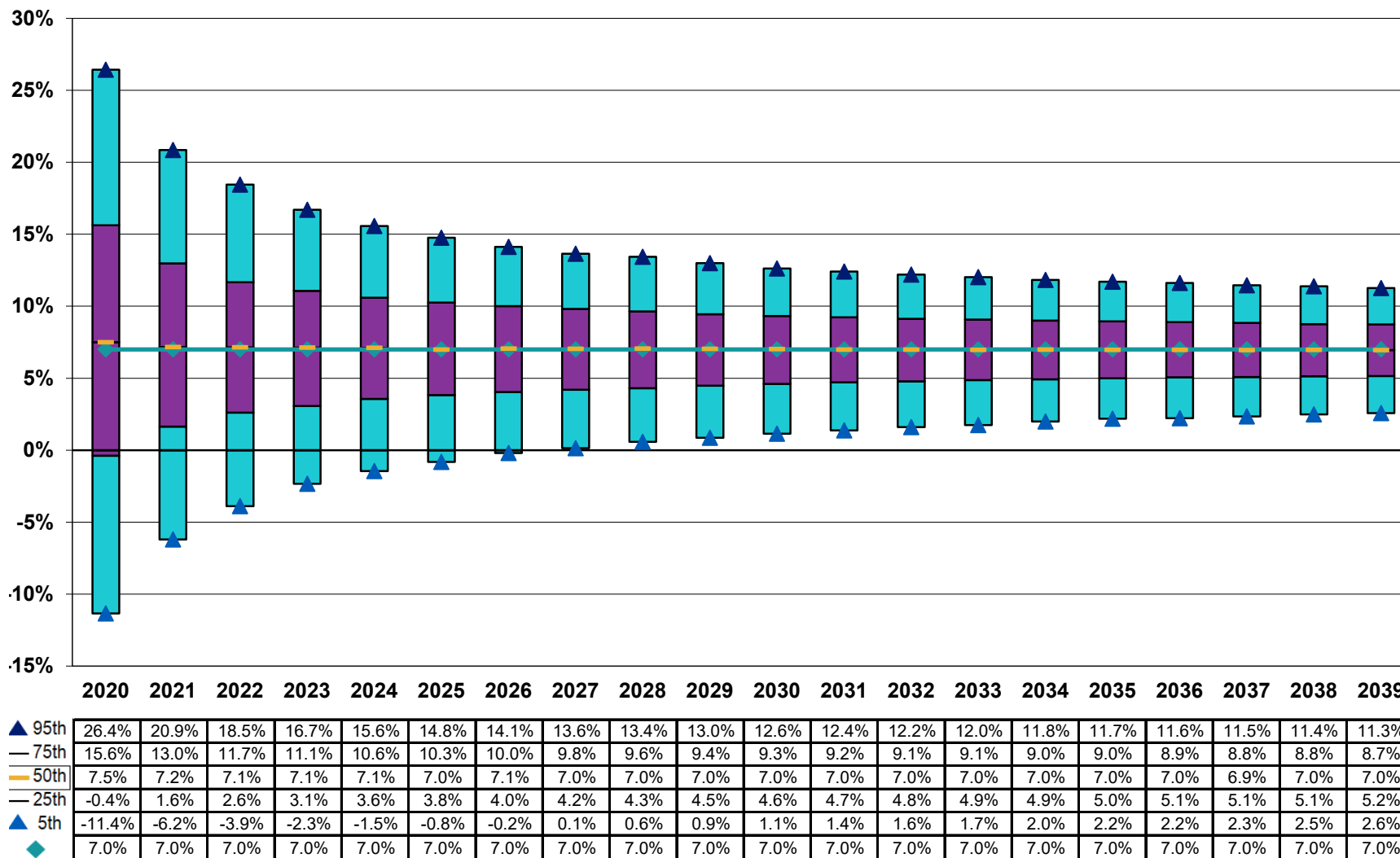
The total employer contribution rate is about 29% payroll in the June 30, 2019 valuation. The probabilities that the total employer contribution rate would increase at least by 5%, 10% or 15% of payroll at any point in the next 20 years are as follows:

<u>Total Employer Rate Increases by at least</u>			
	5% of Payroll (to 34% of Payroll)	10% of Payroll (to 39% of Payroll)	15% of Payroll (to 44% of Payroll)
Probability	26%	19%	14%

Finally, the probabilities that the total employer contribution rate would spike by 3%, 5% or 7% of payroll in any single year during the next 20 years are as follows:

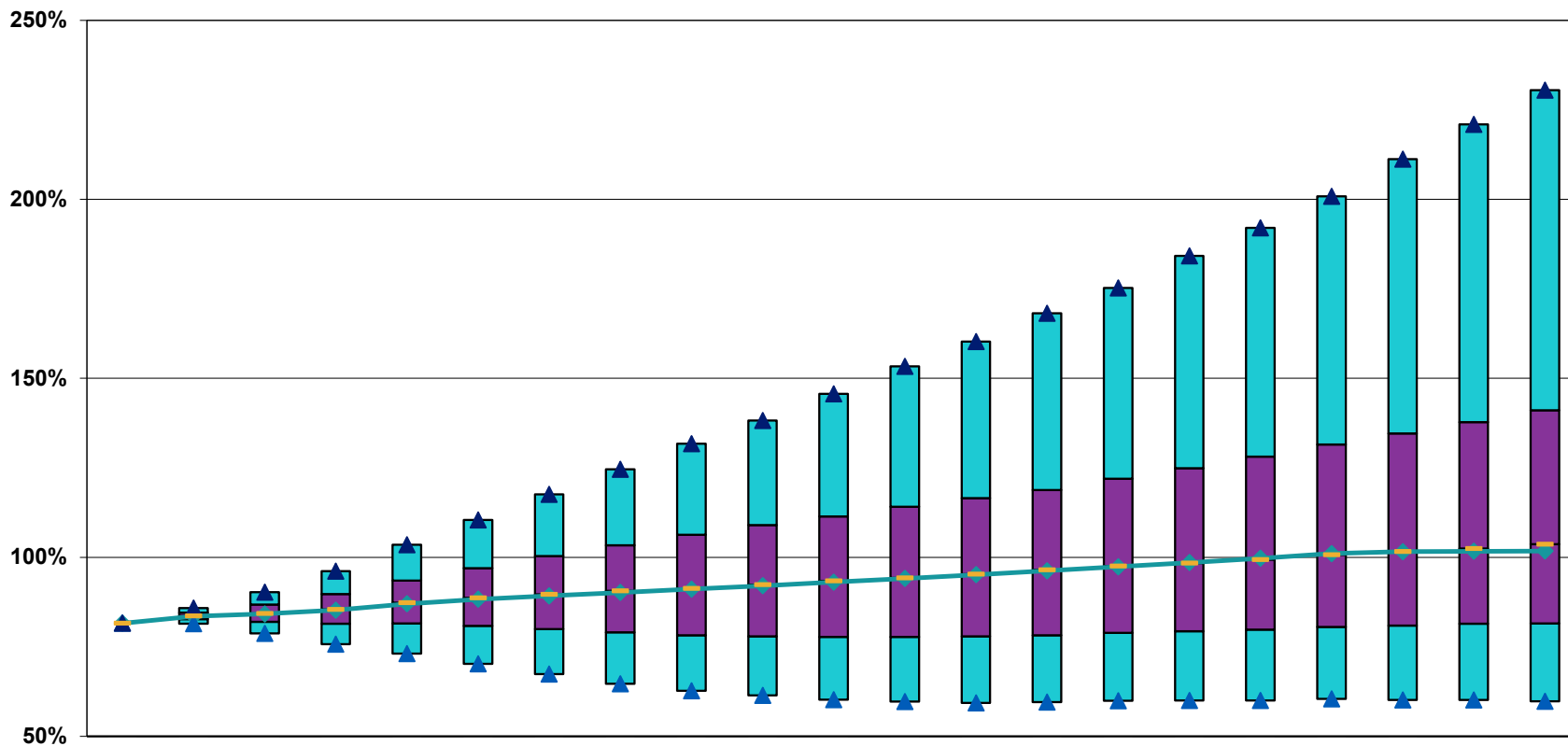
<u>Total Employer Rate Spike in a Single Year by</u>			
	3% of Payroll	5% of Payroll	7% of Payroll
Probability	10%	3%	2%

Projected Cumulative Investment Return for Plan Years Ending June 30



◆ Current investment return assumption

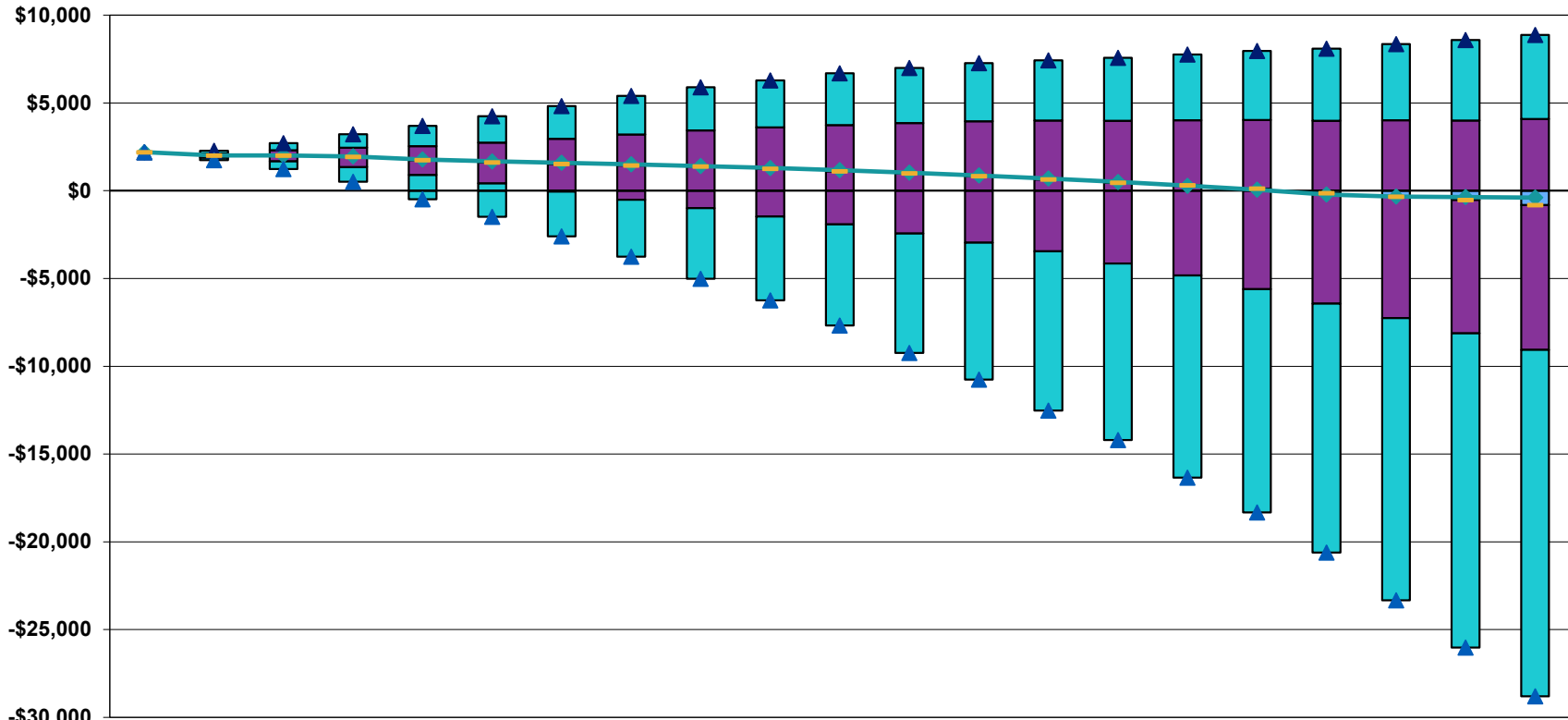
Projected Funded Ratios (on Actuarial Value of Assets Basis)



	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
▲ 95th	81.6%	85.8%	90.3%	96.2%	103.5%	110.4%	117.6%	124.6%	131.7%	138.2%	145.7%	153.3%	160.3%	168.2%	175.2%	184.2%	192.0%	200.8%	211.3%	220.9%	230.5%
— 75th	81.6%	84.5%	86.8%	89.7%	93.5%	97.0%	100.4%	103.4%	106.3%	109.0%	111.4%	114.1%	116.6%	118.8%	122.0%	124.9%	128.2%	131.5%	134.6%	137.8%	141.1%
— 50th	81.6%	83.6%	84.3%	85.5%	87.3%	88.7%	89.7%	90.6%	91.3%	92.3%	93.4%	94.3%	95.3%	96.5%	97.6%	98.4%	99.4%	100.7%	101.6%	102.5%	103.7%
— 25th	81.6%	82.7%	81.9%	81.4%	81.5%	80.8%	80.0%	79.0%	78.2%	77.9%	77.8%	77.7%	77.9%	78.2%	78.9%	79.3%	79.8%	80.5%	80.9%	81.4%	81.5%
▲ 5th	81.6%	81.4%	78.7%	75.7%	73.1%	70.2%	67.3%	64.7%	62.7%	61.4%	60.2%	59.7%	59.3%	59.5%	59.9%	60.0%	60.0%	60.4%	60.2%	60.1%	59.7%
◆	81.6%	83.6%	84.2%	85.2%	87.0%	88.3%	89.2%	90.1%	91.1%	92.1%	93.0%	94.1%	95.1%	96.2%	97.3%	98.5%	99.7%	101.0%	101.6%	101.7%	101.8%

◆ Baseline deterministic projection with current assumptions

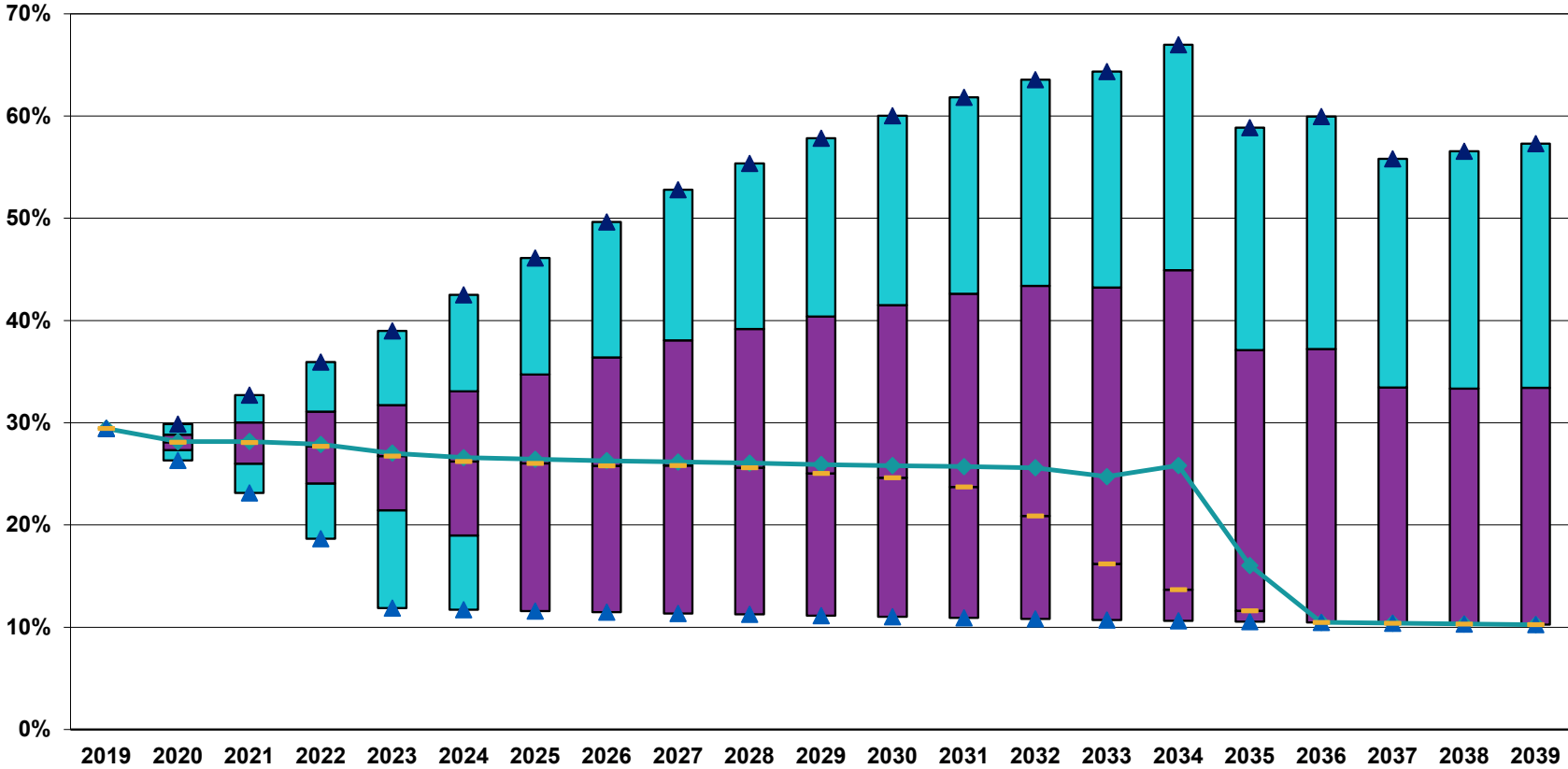
Projected UAAL (on Actuarial Value of Assets Basis)



	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
▲ 95th	2,192	1,741	1,242	509	-483	-1,485	-2,601	-3,759	-5,010	-6,237	-7,682	-9,245	-10,761	-12,520	-14,207	-16,336	-18,329	-20,613	-23,338	-26,016	-28,793
— 75th	2,192	1,894	1,680	1,359	898	432	-52	-515	-988	-1,468	-1,922	-2,445	-2,957	-3,448	-4,149	-4,832	-5,608	-6,435	-7,262	-8,123	-9,068
— 50th	2,192	2,009	1,998	1,927	1,740	1,610	1,526	1,434	1,377	1,251	1,111	994	833	642	455	312	121	-143	-344	-534	-812
— 25th	2,192	2,121	2,301	2,459	2,539	2,734	2,959	3,207	3,439	3,608	3,738	3,857	3,951	4,000	3,986	4,016	4,033	3,979	4,009	3,999	4,081
▲ 5th	2,192	2,276	2,714	3,217	3,698	4,250	4,825	5,400	5,898	6,289	6,688	6,993	7,265	7,430	7,569	7,759	7,963	8,091	8,358	8,584	8,882
◆	2,192	2,016	2,015	1,955	1,786	1,674	1,593	1,507	1,409	1,297	1,172	1,031	873	697	501	285	58	-213	-332	-358	-385

◆ Baseline deterministic projection with current assumptions

Projected Employer Contribution Rates



	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039
▲ 95th	29.4%	26.3%	23.1%	18.7%	11.9%	11.7%	11.6%	11.5%	11.3%	11.3%	11.1%	11.0%	10.9%	10.8%	10.7%	10.6%	10.6%	10.5%	10.4%	10.3%	10.3%
— 75th	29.4%	27.3%	26.0%	24.1%	21.4%	19.0%	11.6%	11.5%	11.3%	11.3%	11.1%	11.0%	10.9%	10.8%	10.7%	10.6%	10.6%	10.5%	10.4%	10.3%	10.3%
— 50th	29.4%	28.1%	28.1%	27.7%	26.7%	26.2%	26.0%	25.8%	25.8%	25.6%	25.0%	24.6%	23.7%	20.9%	16.2%	13.7%	11.6%	10.5%	10.4%	10.3%	10.3%
— 25th	29.4%	28.8%	30.0%	31.1%	31.7%	33.1%	34.7%	36.4%	38.1%	39.2%	40.4%	41.5%	42.6%	43.4%	43.2%	44.9%	37.1%	37.2%	33.4%	33.3%	33.4%
▲ 5th	29.4%	29.9%	32.7%	35.9%	39.0%	42.5%	46.1%	49.6%	52.8%	55.4%	57.8%	60.0%	61.8%	63.5%	64.3%	67.0%	58.9%	59.9%	55.8%	56.5%	57.3%
◆	29.4%	28.2%	28.2%	27.9%	27.0%	26.6%	26.4%	26.3%	26.2%	26.1%	25.9%	25.8%	25.7%	25.6%	24.7%	25.8%	16.0%	10.5%	10.4%	10.3%	10.3%

◆ Baseline deterministic projection with current assumptions

Sensitivity Tests

The Board has a policy of reviewing the investment return and the other actuarial assumptions every three years, with the next triennial experience study (recommending assumptions for the June 30, 2020 actuarial valuation) scheduled to be performed in 2020. Even though the economic assumptions included in our sensitivity analysis might not correspond to the final investment return and inflation assumptions²⁰ we would recommend to the Board at the next triennial experience study, the results from this analysis could still provide the stakeholders the approximate financial impact of such changes in assumptions.

The following table summarizes the resulting impact of:

- a 0.25% reduction in the inflation assumption with an offsetting 0.25% increase in real return,
- a 0.25% reduction in only the investment real return assumption, or
- a 0.25% reduction in the inflation assumption with no offsetting 0.25% increase in real return.

Increase/Decrease from Baseline Results in the June 30, 2019 Valuation due to Change in Inflation or Investment Return Assumption

Inflation/Investment Assumptions	Employee Contribution Rate	Employer Contribution Rate	UAAL	Funded Ratio
3.00% / 7.00% (baseline)	+0.0% of payroll	+0.0% of payroll	+\$0 million	+0%
2.75% / 7.00%	-0.3% of payroll	-1.2% of payroll	-\$167 million	+1.2%
3.00% / 6.75%	+0.6% of payroll	+2.9% of payroll	+\$378 million	-2.5%
2.75% / 6.75%	+0.3% of payroll	+1.7% of payroll	+\$205 million	-1.4%

²⁰The inflation assumption impacts the active salary increase assumption, retiree COLAs for members in Tier 1, and growth in the System's future payroll used to develop the UAAL rate.

Plan Maturity Measures that Affect Primary Risks

The annual actuarial valuation considers the number and demographic characteristics of covered members, including active members and non-active members (vested terminated, retirees and beneficiaries). In the past 10 valuations from June 30, 2010 to 2019, SCERS has become more mature, indicated by the continued increase in the ratio of non-active to active members covered by the System as shown in *Chart 12*. The Chart also shows the ratio of members in pay status (retirees and beneficiaries) to active members. This ratio excludes the vested terminated members who have relatively smaller liabilities. The increase in the ratios is significant because any increase in UAAL due to unfavorable future investment and non-investment experience for a relatively larger group of non-active or members would have to be amortized and funded using the payroll of a relatively smaller group of active members.

Besides the ratio of members in pay status to active members, another indicator of a more mature retirement plan is relatively large amounts of assets and/or liabilities compared to active member payroll, which leads to increasing volatility in the level of required contributions. The **Asset Volatility Ratio (AVR)**, which is equal to the market value of assets divided by total payroll, provides an indication of contribution sensitivity to changes in the current level of assets and is detailed in *Chart 13*. The **Liability Volatility Ratio (LVR)**, which is equal to the actuarial accrued liability divided by payroll, provides an indication of the contribution sensitivity to changes in the current level of liability and is detailed in *Chart 14*. Over time, the AVR should approach the LVR because when a plan is fully funded the assets will equal the liabilities. As such, the LVR also indicates the long-term contribution sensitivity to the asset volatility, as the plan approaches full funding.

In particular, SCERS' AVR was 9.5 as of June 30, 2019. This means that a 1% asset gain or loss in 2019/2020 (relative to the assumed investment return) would amount to 9.5% of one year's payroll. Similarly, SCERS' LVR was 11.5 as of June 30, 2019, so a 1% liability gain or loss in 2019/2020 would amount to 11.5% of one year's payroll.²¹ Based on SCERS' policy to amortize actuarial experience over a period of 20 years, there would be a 0.7% of payroll decrease or increase in the required contribution rate for each 1% asset gain or loss respectively and a 0.8% of payroll decrease or increase in the required contribution rate for each 1% liability gain or loss respectively.

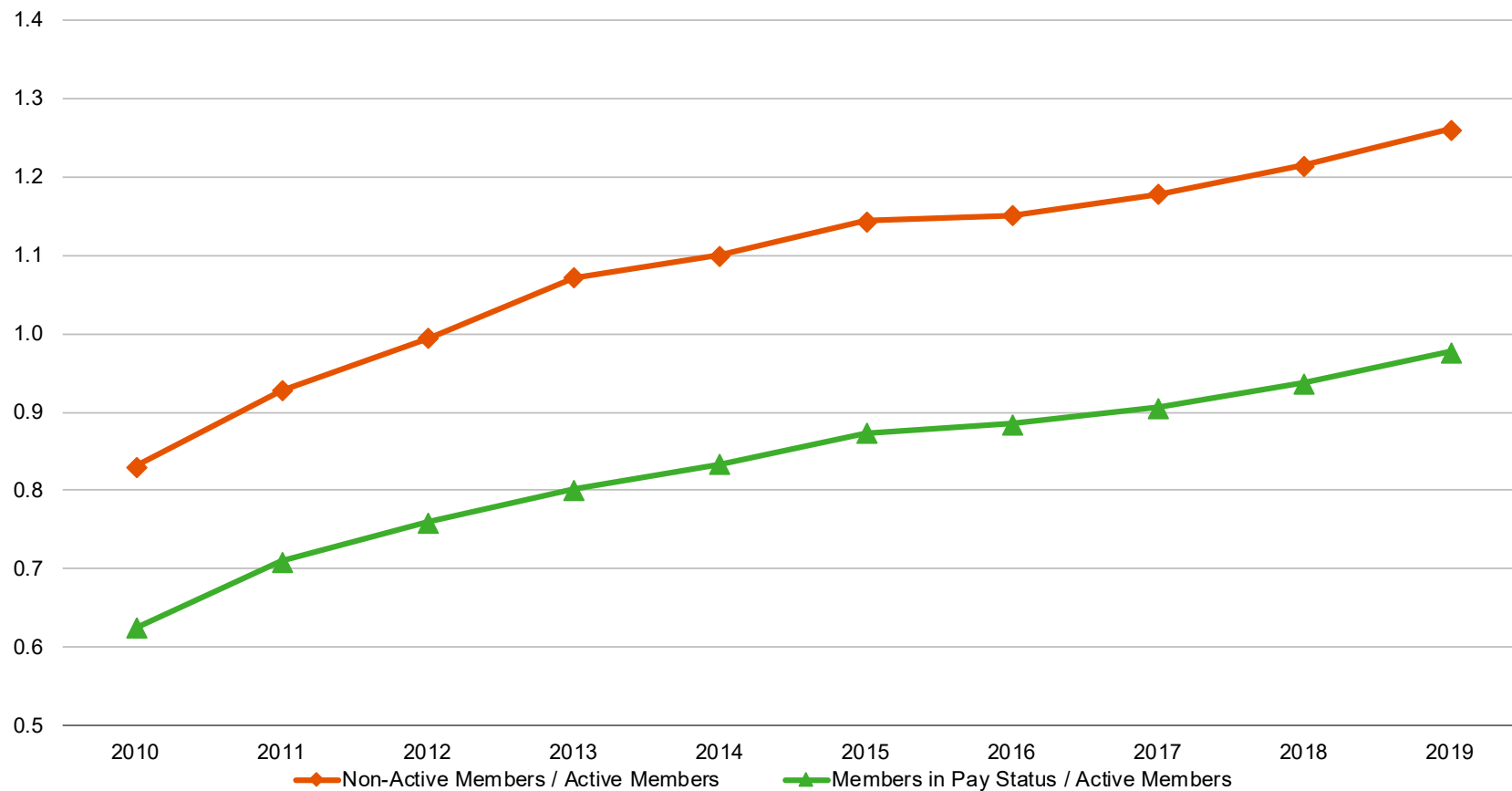
²¹ The 9.5 and 11.5 are the AVR and LVR, respectively, for the entire System. There are considerable differences in those ratios for the Miscellaneous and Safety membership groups.

It is also informative to note that the AVR and LVR ratios for SCERS' Safety groups are significantly higher than for Miscellaneous groups. This means that both investment volatility and assumption changes will have a greater impact on the contribution rates of Safety groups than Miscellaneous groups. This is illustrated in the following table:

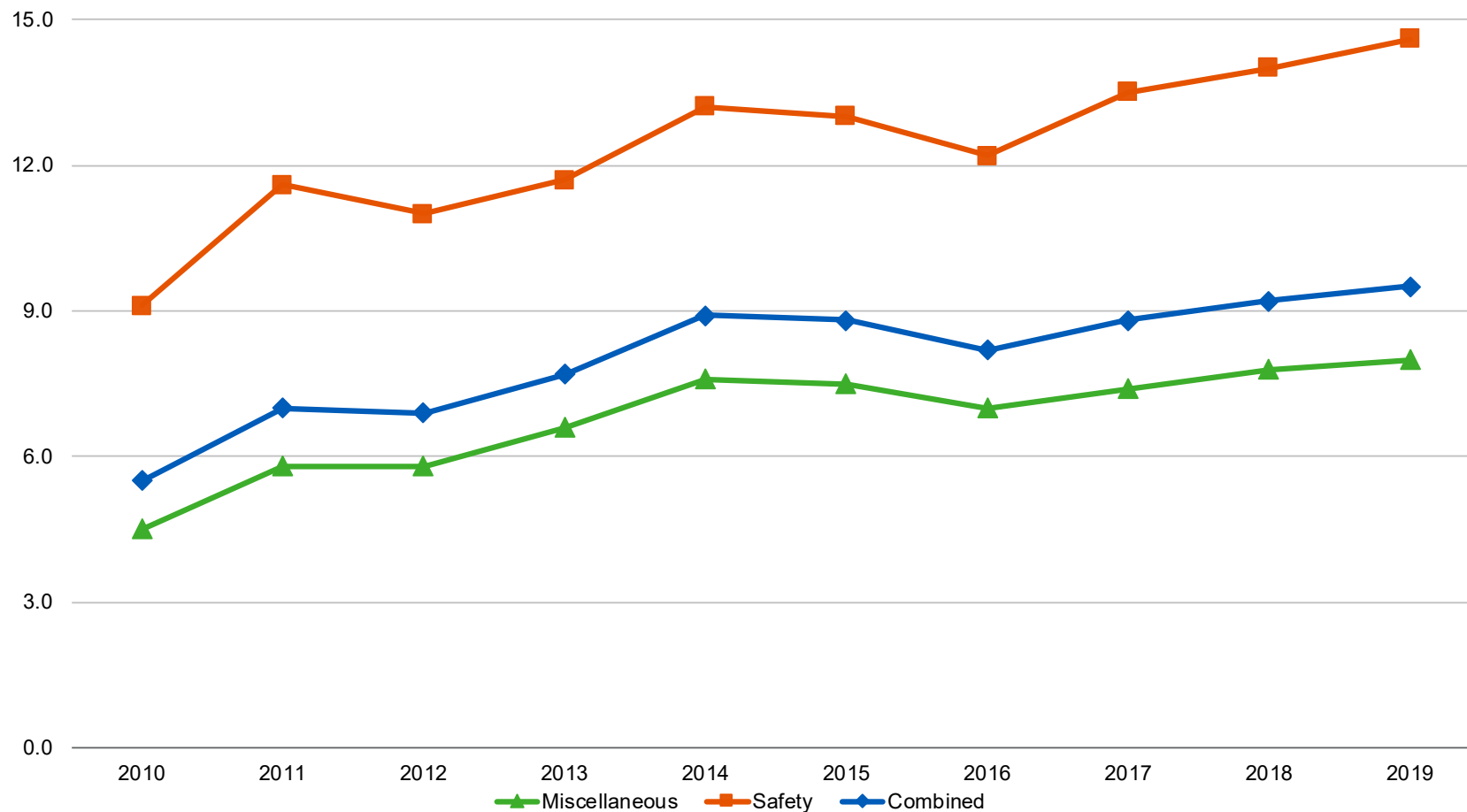
June 30, 2019

Employee Group	AVR	10% Loss Compares to	LVR	10% Loss Compares to
Miscellaneous	8.0	80% of payroll	9.4	94% of payroll
Safety	14.6	146% of payroll	18.6	186% of payroll
Combined	9.5	95% of payroll	11.5	115% of payroll

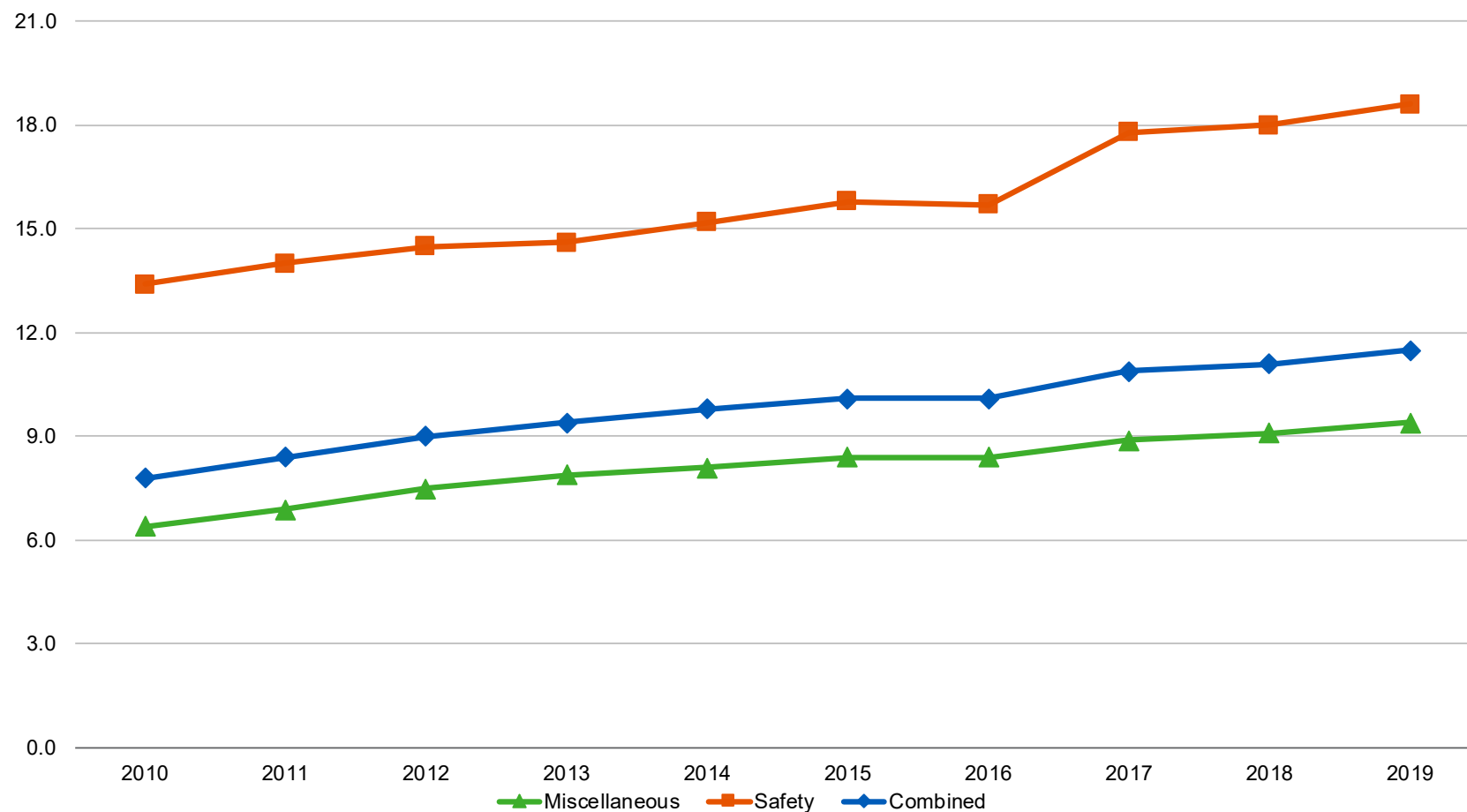
Ratios of Members in Pay-Status (Retirees and Beneficiaries) to Active Members & Non-Active Members (Vested Terminated, Retirees and Beneficiaries) to Active Members in June 30, 2010 to 2019 Valuations



Asset Volatility Ratio in June 30, 2010 to 2019 Valuations



Liability Volatility Ratio in June 30, 2010 to 2019 Valuations



Appendix: Actuarial Assumptions, Methods and Actuarial Certification

Actuarial Assumptions and Methods

Unless otherwise noted, the results included in this report have been prepared based on the assumptions and methods used in preparing the June 30, 2019 valuation.

Deterministic Projection

In addition, we have prepared the deterministic projection using the following assumptions and methods applied in the June 30, 2019 actuarial valuation:

- Non-economic assumptions will remain unchanged.
- Retirement benefit formulas will remain unchanged.
- 1937 Act and PEPRA statutes will remain unchanged.
- UAAL amortization method will remain unchanged (i.e., 20-year layers and level percent of pay).
- Economic assumptions will remain unchanged, including the annual 7.00% investment earnings and 3.25% active payroll growth assumptions.
- Deferred investment gains and losses will be recognized over a 7-year period.
- Using a simplifying assumption, we assume in all scenarios tested in this report that the amount in the Contingency Reserve as of June 30, 2019 will be utilized in the June 30, 2020 valuation and that the Contingency Reserve will not be restored.
- All other actuarial assumptions used in the June 30, 2019 actuarial valuation will be realized.

Stochastic Projection

Besides the assumptions and methods discussed above for the deterministic projection, the following additional assumptions or parameters are used in projecting SCERS' investment portfolio over the next 20 years based on performing 10,000 trial outcomes of future market returns.

Target Asset Allocation

The target asset allocation is based on that provided by SCERS at the last triennial experience study and used by Segal to set the investment return assumption of 7.00% that was applied in the June 30, 2017, 2018 and 2019 valuations. That target asset allocation is as follows:

Asset Class	Target Allocation
U.S. Large Cap Equity	17.00%
U.S. Small Cap Equity	4.00%
International Developed Equity	16.00%
Emerging Markets Equity	4.00%
High Yield Bonds	1.00%
Bank Loans	1.00%
Growth Oriented Absolute Return	3.00%
Private Equity	9.00%
Private Credit/Private Debt	4.00%
Core/Core Plus Bonds	10.00%
Global Bonds	3.00%
U.S. Treasury	5.00%
Diversifying Absolute Return	7.00%
Private Real Estate	7.00%
Private Real Assets	7.00%
Commodities	<u>2.00%</u>
Total	100.00%

Simulation of Future Returns

In preparing the 10,000 trial outcomes of future market returns, we performed simulations using assumptions regarding the 20-year arithmetic returns, standard deviations and correlation matrix that were found in the 2019 survey prepared by Horizon Actuarial Services.²² We used the assumptions that were closest to the asset classes found in SCERS' investment portfolio.

A summary of the 20-year arithmetic returns,^{23,24} standard deviations and correlation matrix for each of the different asset classes used in the modeling is as follows:

Asset Class	20-Year Arithmetic Return	Standard Deviation	Correlation Matrix															
			1	2	3	4	5	6	7	8	9	10	11	12	13			
1 U.S. Large Cap Equity	8.34%	16.17%	1	1.00														
2 U.S. Small Cap Equity	9.52%	20.15%	2	0.86	1.00													
3 International Developed Equity	9.30%	18.23%	3	0.83	0.74	1.00												
4 Emerging Markets Equity	11.67%	24.73%	4	0.72	0.67	0.78	1.00											
5 Core/Core Plus Bonds	4.46%	5.47%	5	0.15	0.07	0.17	0.17	1.00										
6 Bank Loans	4.97%	10.50%	6	0.13	0.07	0.14	0.13	0.84	1.00									
7 High Yield Bonds, Private Credit/Private Debt	6.38%	10.06%	7	0.60	0.58	0.61	0.61	0.41	0.33	1.00								
8 Global Bonds	3.81%	7.61%	8	0.20	0.12	0.32	0.29	0.53	0.50	0.23	1.00							
9 U.S. Treasury	3.07%	2.31%	9	(0.06)	(0.07)	(0.05)	(0.03)	0.23	0.17	(0.01)	0.20	1.00						
10 Private Real Estate	7.94%	15.03%	10	0.48	0.49	0.46	0.41	0.16	0.15	0.42	0.15	0.03	1.00					
11 Growth Oriented Abs. Return, Diversifying Abs. Return	6.61%	8.38%	11	0.64	0.62	0.64	0.62	0.18	0.11	0.53	0.19	(0.02)	0.36	1.00				
12 Commodities	6.29%	17.66%	12	0.31	0.30	0.38	0.42	0.10	0.04	0.32	0.22	0.02	0.27	0.38	1.00			
13 Private Equity, Private Real Assets	12.82%	22.05%	13	0.75	0.70	0.70	0.63	0.05	0.07	0.50	0.11	(0.06)	0.43	0.58	0.32	1.00		

Other Considerations

The results presented in this report are intended to provide insight into key plan risks that can inform financial preparation and future decision making. However, we emphasize that deterministic and stochastic projections, by their nature, are not a guarantee of future results. The modeling projections are intended to serve as illustrations of future financial outcomes that are based on the information available to us at the time the modeling is undertaken and completed, and the agreed-upon assumptions and methodologies described herein. Emerging results may differ significantly if the actual experience proves to be different from these assumptions or if alternative methodologies are used. Actual experience may differ due to such variables as demographic experience, the economy, stock market performance and the regulatory environment.

²² That survey included responses from 34 investment advisors, including SCERS' investment advisor at Verus.

²³ Note that only 16 investment advisors provided long-term (e.g. 20-year) capital market assumptions in the survey.

²⁴ These returns are gross of inflation and before any adjustment for administrative and investment expenses. The annual inflation assumption based on the Horizon Survey was 2.29%. The annual adjustment for administrative and investment expenses was 0.65%.

Actuarial Certification

The actuarial calculations in this report were completed under the supervision of Andy Yeung, ASA, MAAA, FCA, Enrolled Actuary.

The actuarial opinions expressed in this report were prepared by Paul Angelo, FSA, MAAA, FCA, Enrolled Actuary, Andy Yeung, ASA, MAAA, FCA, Enrolled Actuary and Todd Tauzer, FSA, MAAA, FCA, CERA. They are members of the American Academy of Actuaries and they meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion herein.



Paul Angelo, FSA, MAAA, FCA, EA
Senior Vice President and Actuary



Andy Yeung, ASA, MAAA, FCA, EA
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