



Sacramento County Employees' Retirement System

Risk Assessment

**Including Review of Funded Status of the
Pension Plan as of June 30, 2020**

March 1, 2021

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Section 1: Introduction and Executive Summary

Introduction

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 Sacramento County Employees' Retirement System (SCERS or 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, 2020 funding valuation for SCERS.

The results included in our June 30, 2020 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 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, 2020 valuation), there is a risk that emerging results may differ significantly as actual experience is fluid and will not completely track current assumptions.

It is important to note that this risk assessment is based on plan assets as of June 30, 2020. Due to the COVID-19 pandemic, market conditions have changed significantly since the onset of the Public Health Emergency. The Plan's funded status does not reflect short-term fluctuations of the market, but rather is based on the market values on the last day of the Plan Year. Moreover, this risk assessment does not include any possible short-term or long-term impacts on mortality of the covered population that may emerge after June 30, 2020. While it is impossible to determine how the pandemic will affect market conditions and other demographic experience of the plan in future valuations, the single year investment return scenario test included within this report provides an illustration of the impact of short term market fluctuations on the plan. Additionally, Segal is available to prepare other projections of selected potential outcome scenarios upon request.

Actuarial Standard of Practice on Risk Assessment

Actuarial Standard of Practice No. 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

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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 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 6.75% annual investment return assumption used in the June 30, 2020 valuation. We have also included a projection of future results based on a stochastic modeling of future investment returns for 2020/2021 and thereafter. 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 for the range of potential outcomes.

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	Market Value Basis		Actuarial Value Basis		Aggregate Employer Contribution Rate (% of Payroll)
	Funded Status	UAAL	Funded Status	UAAL	
June 30, 2011	83%	\$1.2 billion	87%	\$1.0 billion	23%
June 30, 2020	79%	\$2.7 billion	81%	\$2.5 billion	31%

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 unfavorable and favorable future market experience so that the impact of market performance can be better understood.

² For example, the UAAL changed by (\$22) million in the June 30, 2011 valuation, \$134 million in the June 30, 2012 valuation, \$16 million in the June 30, 2014 valuation, \$824 million in the June 30, 2017 valuation, and \$216 million in the June 30, 2020 valuation (for a total of \$1.17 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 (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, 7.76% in the June 30, 2017 valuation (before phase-in), and 2.39% in the June 30, 2020 valuation (before phase-in) (for a total of 10.87%), as a result of the experience studies over the last ten years.

The total employer contribution rate is about 31.4% of total payroll in the June 30, 2020 valuation. Using a deterministic projection, this report shows the effect of either unfavorable (0.00%) or favorable (13.50%) hypothetical market returns for 2020/2021 on key valuation results. In particular, the changes (relative to the June 30, 2020 valuation aggregate employer contribution rate of approximately 31.4%) in the total employer contribution rate in the June 30, 2021 valuation and in the June 30, 2027 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:⁴

<u>2020/2021 Single Plan Year Investment Return⁵</u>			
Valuation Date	0.00%	6.75% (baseline)⁶	13.50%
June 30, 2021	+1.2% of payroll	+0.6% of payroll	0.0% of payroll
June 30, 2027	+5.7% of payroll	+0.6% of payroll	-4.6% of payroll

Furthermore, under either the unfavorable or favorable hypothetical market return scenarios for 2020/2021, the System would be expected to reach full funding and the total employer contribution rate would be expected to approach about 11% of payroll at the end of 21 years. That 11% of payroll is the employer normal cost rate after all SCERS' UAAL bases as of June 30, 2020 are paid off over periods ranging from 13 to 20 years and any new UAALs resulting from the hypothetical market experience in 2020/2021 are smoothed and 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.

As part of the triennial experience study reviewing the assumptions for use in the June 30, 2020 valuation, the Board adopted our recommended annual investment return assumption of 6.75%. In that study, we also evaluated an alternative annual investment return of 7.00% that the System could achieve over a 15-year period as measured in that study but with a lower confidence level when compared to the 6.75% adopted assumption. It should be noted that if the System were to actually earn an annual market return of 7.00% over the next 20 years, the System would be expected to achieve full funding about 2 years earlier compared to the results under the baseline scenario.

⁴ Assuming no further assumption changes, method changes or experience that differs significantly from assumptions.

⁵ We assume in all scenarios tested in this report that the amount in the Contingency Reserve as of June 30, 2020 will be utilized in the June 30, 2021 valuation and that the Contingency Reserve will not be restored.

⁶ This differs from our Seven-Year Projection of Employer Contribution Rates dated December 11, 2020 primarily due to: a) assuming that the amount in the Contingency Reserve as of June 30, 2020 will be utilized in the June 30, 2021 valuation which will reduce the employer's contribution rate by about 1.0% of payroll, and b) reflecting the gradual savings in normal cost as active members in the legacy tiers are replaced by new members in the PEPRAs tiers.

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,⁷ there is a 50% chance that the employer contribution rates would be between 12% and 43% of payroll at the end of 10 years and between 11% and 31% of payroll at the end of 20 years. Furthermore, there is a 37% chance SCERS would be fully funded at the end of 10 years and 57% chance SCERS would be fully funded at the end of 20 years.⁸

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.

⁷ For the stochastic modeling, we have used information about SCERS' asset portfolio that we used in developing the 6.75% expected investment return assumption we recommended to the Board for the June 30, 2020 valuation together with updated expected return, standard deviation and other information as outlined in the Appendix. This modeling assumes no further assumption changes, method changes or non-investment experience that differs significantly from assumptions.

⁸ In our June 30, 2019 risk report, the probabilities SCERS would become fully funded were estimated at 39% and 53% at the end of 10 years and 20 years, respectively. There are changes in these probabilities between June 30, 2019 and June 30, 2020 primarily as a result of greater variability (standard deviation) associated with the System's assets allocations as of the two dates and an increase in the UAAL in the June 30, 2020 valuation as a result of the assumption changes and unfavorable actuarial experience during 2019/2020.

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 actuarial⁹ and market value of assets to the actuarial accrued liabilities (AAL)¹⁰ 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 experience studies as part of the June 30, 2017 and 2020 valuations. The unfavorable investment experience also has had an impact. The funded ratios and UAAL¹¹ for the past 10 valuations from June 30, 2011 to 2020 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, 2011 to 2020 are specified in *Chart 2*. The results in *Chart 2* reflect the changes in the investment return assumption from 7.50% to 7.00%¹² in the June 30, 2017 valuation and from 7.00% to 6.75% in the June 30, 2020 valuation and other assumption changes from the two experience studies that together have by far the most impact on the UAAL for SCERS, followed by the unfavorable investment experience during 2011 to 2020.

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 includes the one year scheduled delay in implementing the contribution rates determined in the annual valuation.

⁹ 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.

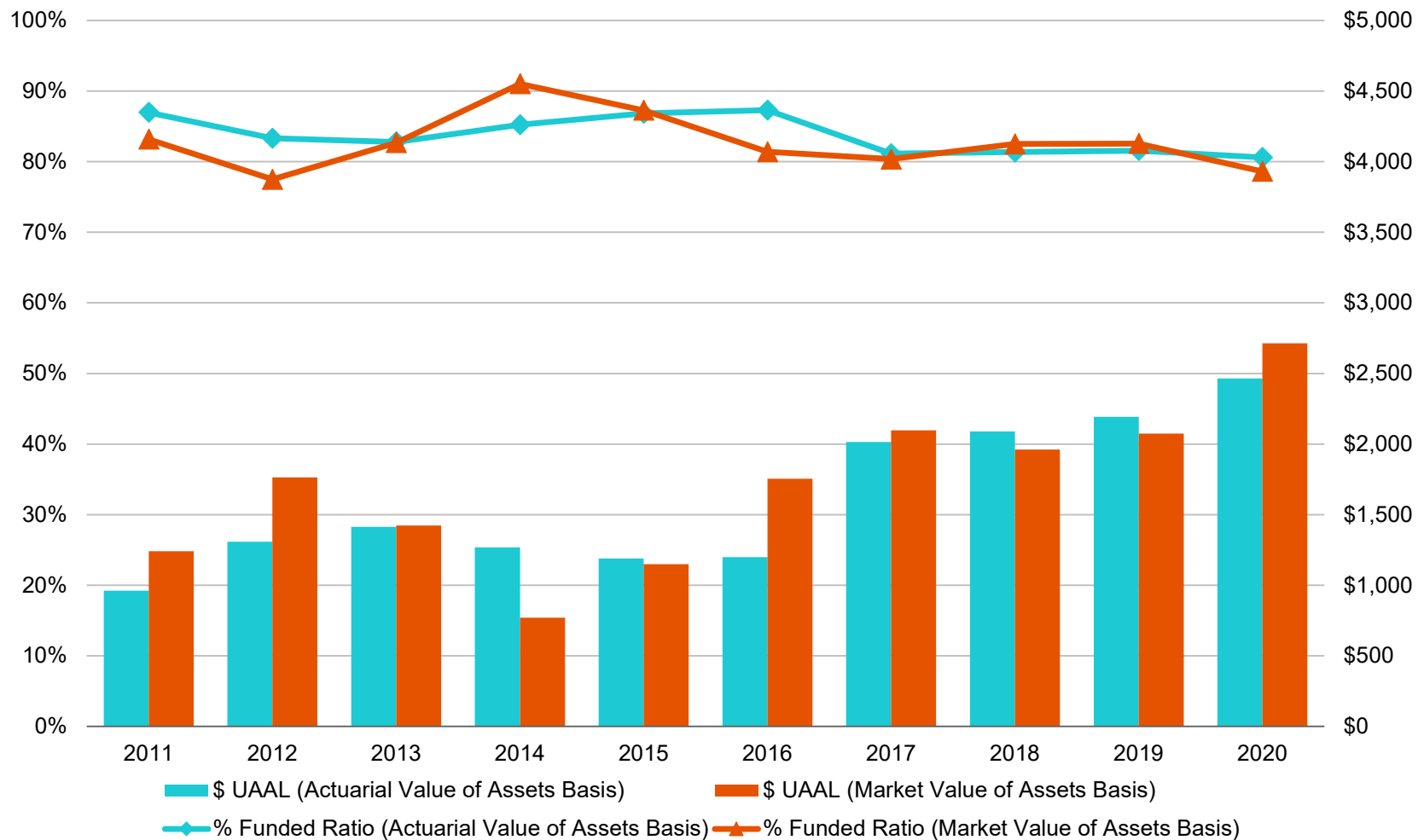
¹⁰ For the actives, the actuarial accrued liability is the value of the accumulated normal costs allocated to the years before the valuation date. For the pensioners, beneficiaries and deferred vested members, the actuarial accrued liability is the single sum present value of the lifetime benefit expected to be paid to those members.

¹¹ The amount by which the actuarial accrued liability of the plan exceeds (or is exceeded by) the assets of the plan.

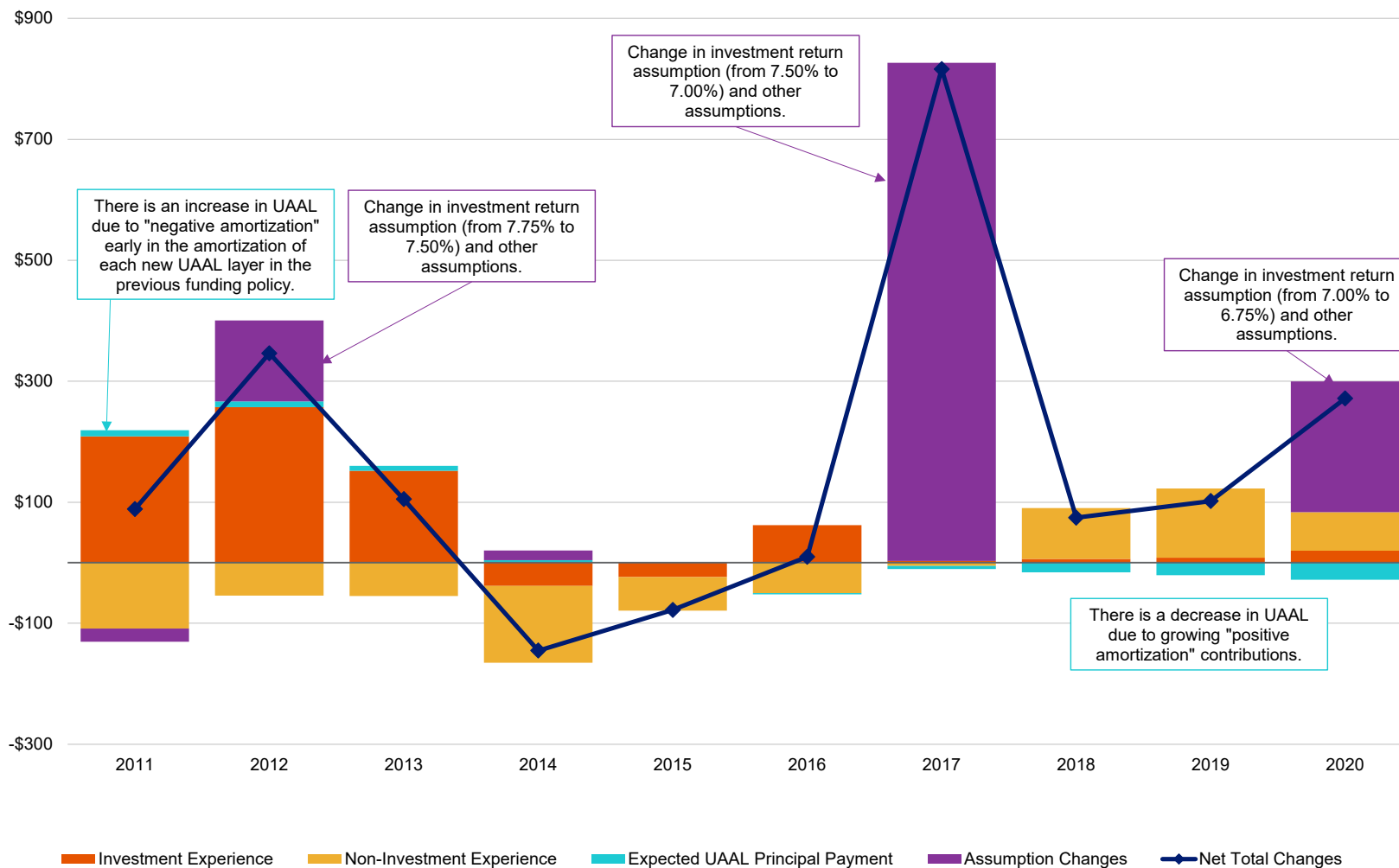
¹² Prior to the experience study as part of the June 30, 2017 valuation, the investment return assumption was lowered from 7.75% to 7.50% in the June 30, 2012 valuation.

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, 2011 to 2020 Valuations



Factors that Changed UAAL in June 30, 2011 to 2020 Valuations (\$ Millions)



Note: The primary source of investment losses starting through the June 30, 2013 valuation is the Great Recession, which was recognized in the actuarial value of assets over several years.

Employer Contribution Rates

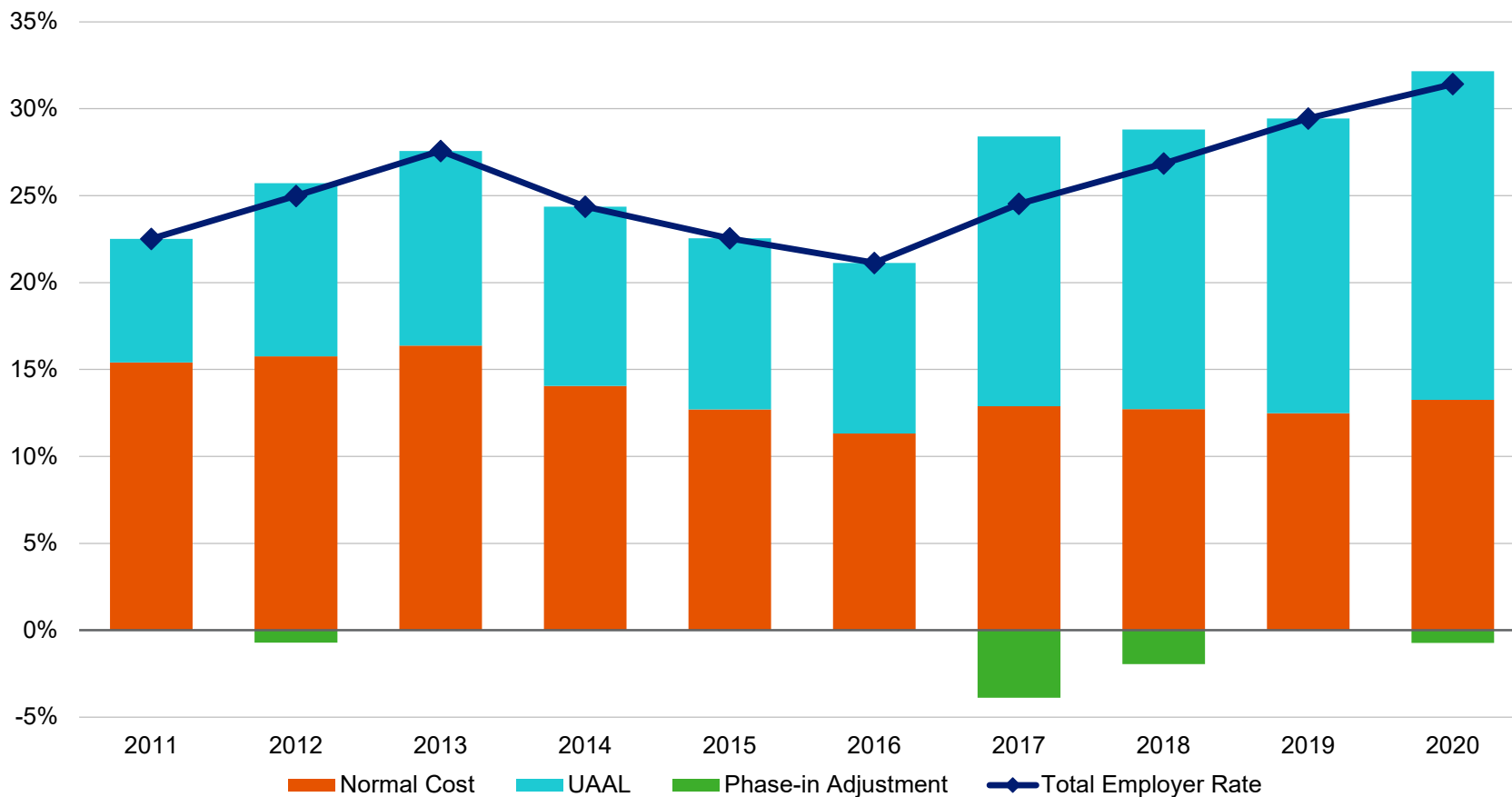
The total (normal cost¹³ plus UAAL payment) employer contribution rates determined in the June 30, 2011 to 2020 valuations are provided in *Chart 3* and the factors that caused the changes in the total employer aggregate rates¹⁴ are provided in *Chart 4*.

The gradual reduction in the aggregate employer normal cost rates as shown in *Chart 3* is 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 are enrolled in the lower cost PEPRA benefit tiers from January 1, 2013 on. *Chart 4* shows that the changes in the investment return from 7.50% to 7.00% in the June 30, 2017 valuation and from 7.00% to 6.75% in the June 30, 2020 valuation and other assumptions from the two experience studies have by far the most impact on increasing the UAAL contribution rates for the employers, followed by the overall unfavorable investment experience during 2011 to 2020. 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) and in the June 30, 2020 valuation (of 2.39% of payroll or \$26 million per year based on an annual payroll of \$1,071 million in the 2020 valuation), the Board decided to phase-in the UAAL contribution rate increase due to the assumption changes over a 3-year period in the 2017 valuation and over a 2-year period in the 2020 valuation.

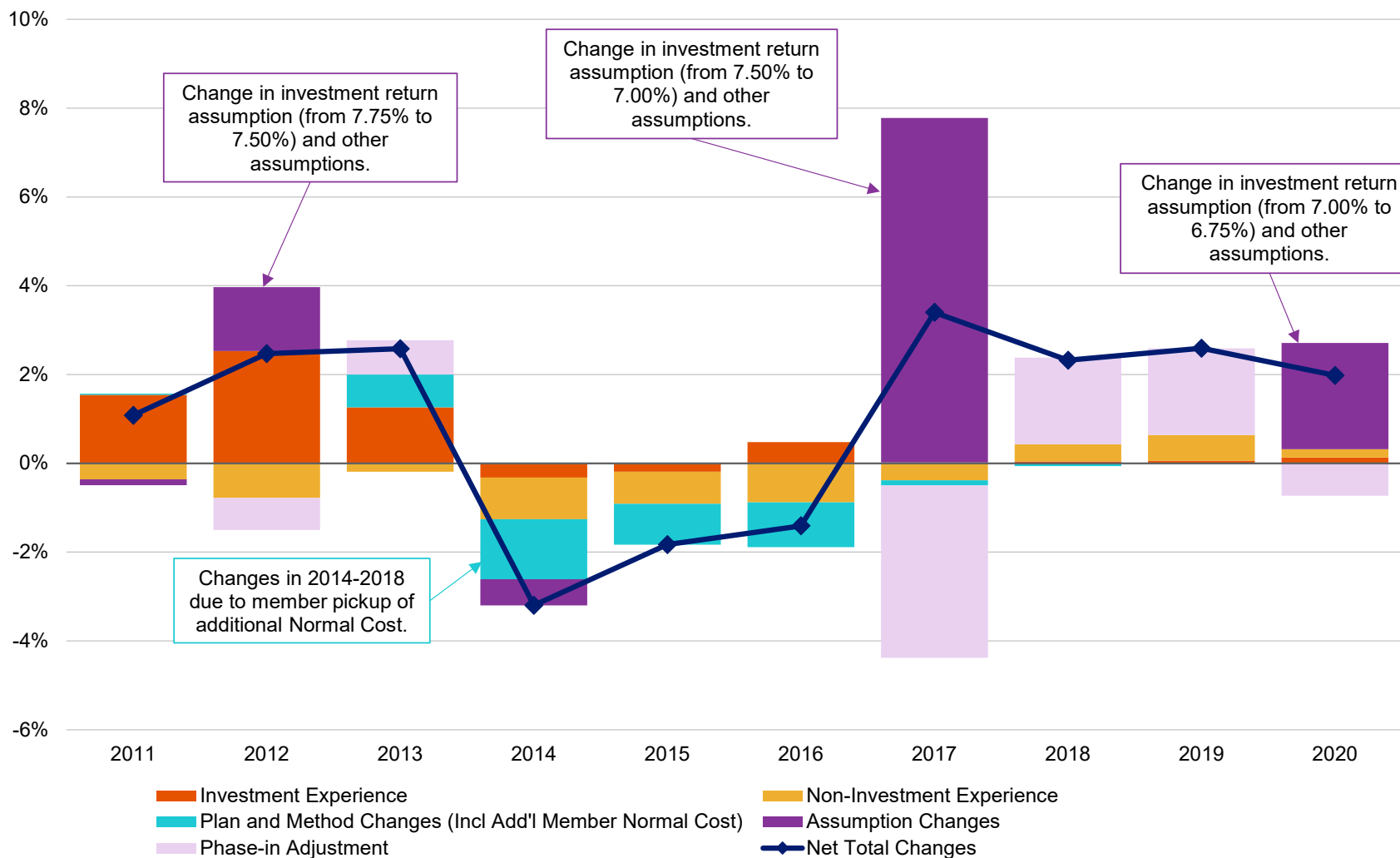
¹³ The normal cost is the amount of contributions required to fund the level cost of the member's projected retirement benefit allocated to the current year of service.

¹⁴ 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.

Employer Contribution Rates in June 30, 2011 to 2020 Valuations (% of Payroll)



Factors that Affected Employer Contribution Rates in June 30, 2011 to 2020 Valuations (% of Payroll)



Note: The primary source of investment losses starting through the June 30, 2013 valuation is the Great Recession, which was recognized in the actuarial value of assets over several years.

Assessment of Primary Risk Factors Going Forward

As discussed in the Evaluation of Historical Trends section, in the 2011 to 2020 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 risk¹⁵ 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 6.75% 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.

¹⁵During 2019/2020, SCERS paid benefits of about \$541 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.

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, 2023 actuarial valuation) scheduled to be performed in 2023.

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

The change to using generational,¹⁶ amount-weighted mortality tables that reflects data from public section retirement plans was 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.

- 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.

There is also some uncertainty about future events for SCERS that we have not attempted to quantify in this risk assessment. In particular, any additional cost impact regarding the exclusion of certain pay items from a legacy member's compensation earnable pertaining to the Supreme Court's Alameda Decision has not been included in the results prepared for the June 30, 2020 valuation.

¹⁶ A generational mortality table provides dynamic projections of mortality experience for each cohort of current and future retirees. For example, the mortality rate for someone who is 65 next year will be slightly less than for someone who is 65 this year. In general, using generational mortality anticipates increases in the cost of the Plan over time as participants' life expectancies are projected to increase. This is in contrast to updating a static mortality assumption with each experience study as was the practice in prior experience studies.

Scenario Test: Deterministic Projections

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 lower or higher than the assumed rate of 6.75% in future valuations using projections under a deterministic approach.

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 lower or higher than 6.75% in the next year following the June 30, 2020 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 2020/2021 will be as follows:

- Scenario 1: 0.00%
- Scenario 2: 6.75% (baseline)
- Scenario 3: 13.50%.

The following table summarizes the resulting contribution rate changes (relative to the June 30, 2020 valuation aggregate employer contribution rate of approximately 31.4%) in the immediate next valuation as well as in the June 30, 2027 valuation where all of the investment gains and losses are fully recognized in the (smoothed) actuarial value of assets.

Valuation Date	<u>2020/2021 Single Plan Year Investment Return</u>¹⁷		
	0.00%	6.75% (baseline)¹⁸	13.50%
June 30, 2021	+1.2% of payroll	+0.6% of payroll	0.0% of payroll
June 30, 2027	+5.7% of payroll	+0.6% of payroll	-4.6% of payroll

Furthermore, under either the unfavorable or favorable hypothetical market return scenarios for 2020/2021, the System would be expected to reach full funding and the total employer contribution rate would be expected to approach about 11% of payroll¹⁹ at the end of 21 years. That 11% of payroll is the employer normal cost rate after SCERS' UAAL layers as of June 30, 2020 are paid off over periods ranging from 13 to 20 years and any new UAALs resulting from the hypothetical market experience in 2020/2021 are paid off over 20 years pursuant to the Board's actuarial funding policy.

¹⁷ We assume in all scenarios tested in this report that the amount in the Contingency Reserve as of June 30, 2020 will be utilized in the June 30, 2021 valuation and that the Contingency Reserve will not be restored.

¹⁸ This differs from our Seven-Year Projection of Employer Contribution Rates dated December 11, 2020 primarily due to: a) assuming that the amount in the Contingency Reserve as of June 30, 2020 will be utilized in the June 30, 2021 valuation which will reduce the employer's contribution rate by about 1.0% of payroll, and b) reflecting the gradual savings in normal cost as active members in the legacy tiers are replaced by new members in the PEPRAs tiers.

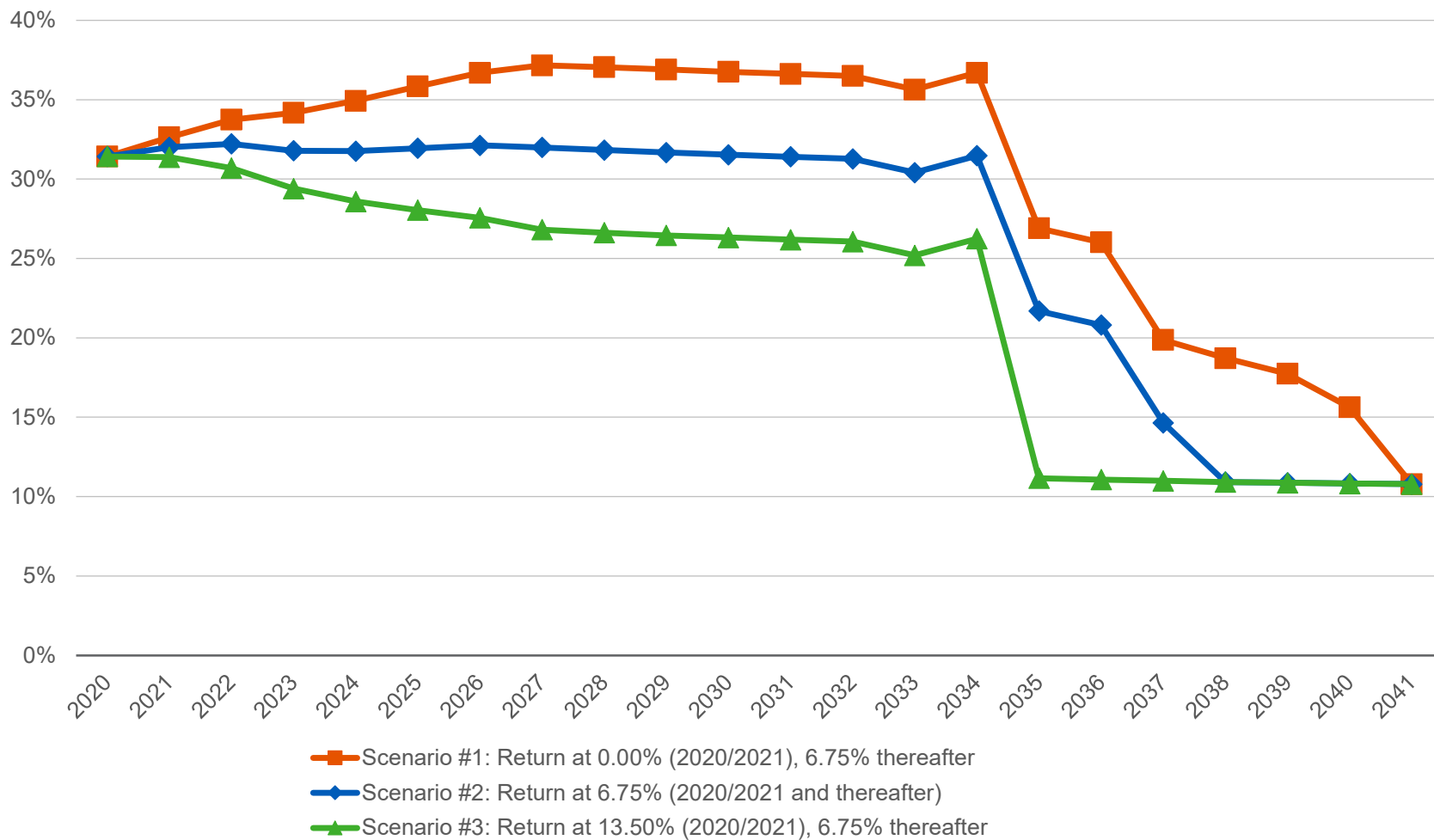
¹⁹ Assuming no further assumption changes, method changes or experience that differs significantly from assumptions.

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.

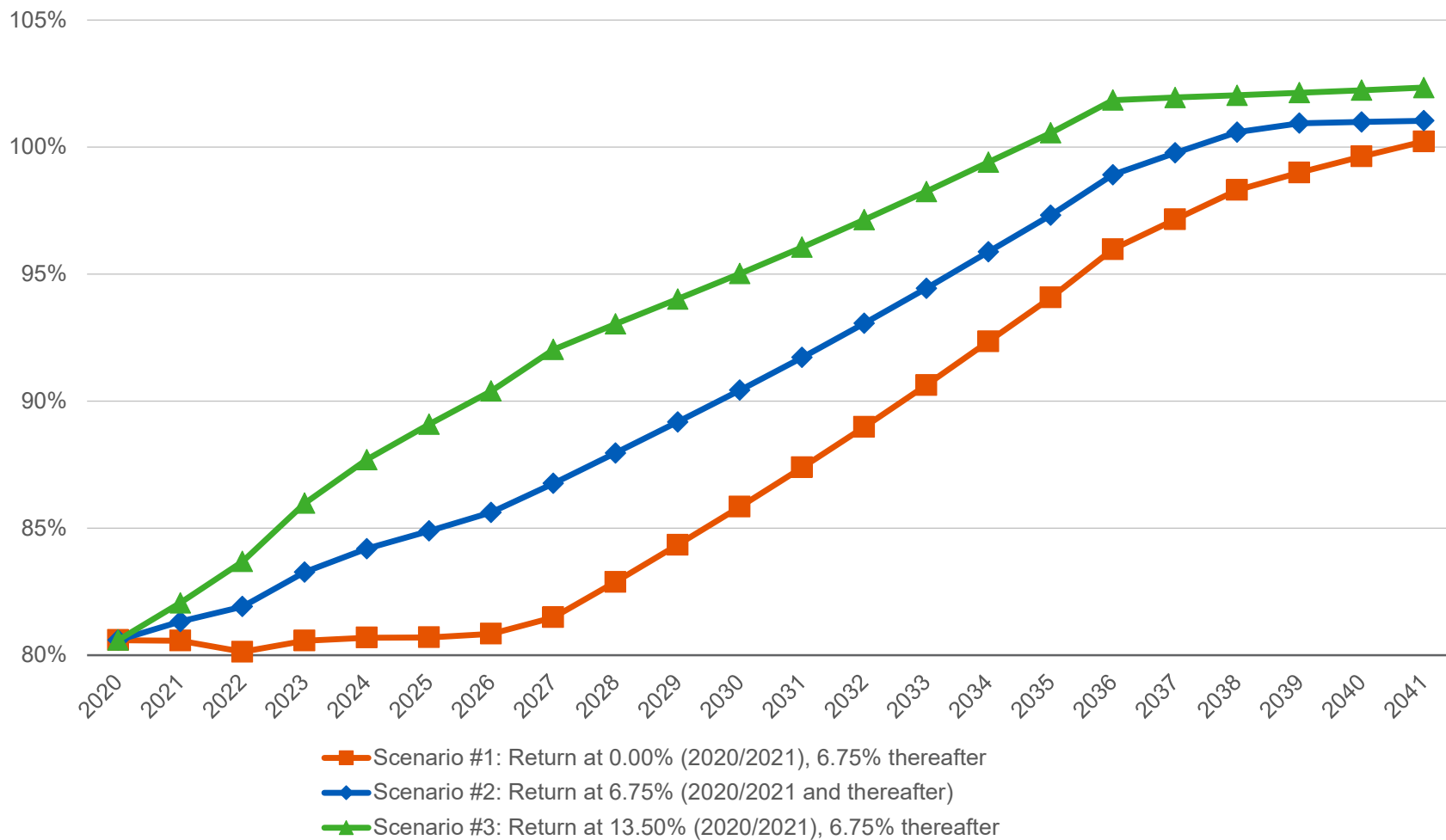
As part of the triennial experience study reviewing the assumptions for use in the June 30, 2020 valuation, the Board adopted our recommended annual investment return assumption of 6.75%. In that study, we also evaluated an alternative annual investment return of 7.00% that the System could achieve over a 15-year period as measured in that study but with a lower confidence level when compared to the 6.75% adopted assumption. It should be noted that if the System were to actually earn an annual market return of 7.00% over the next 20 years, the System would be expected to achieve full funding about 2 years earlier compared to the results under the baseline scenario.

While we have not assigned a probability on the 2020/2021 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, 2021 and next several valuations as the actual investment experience for the 2020/2021 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.

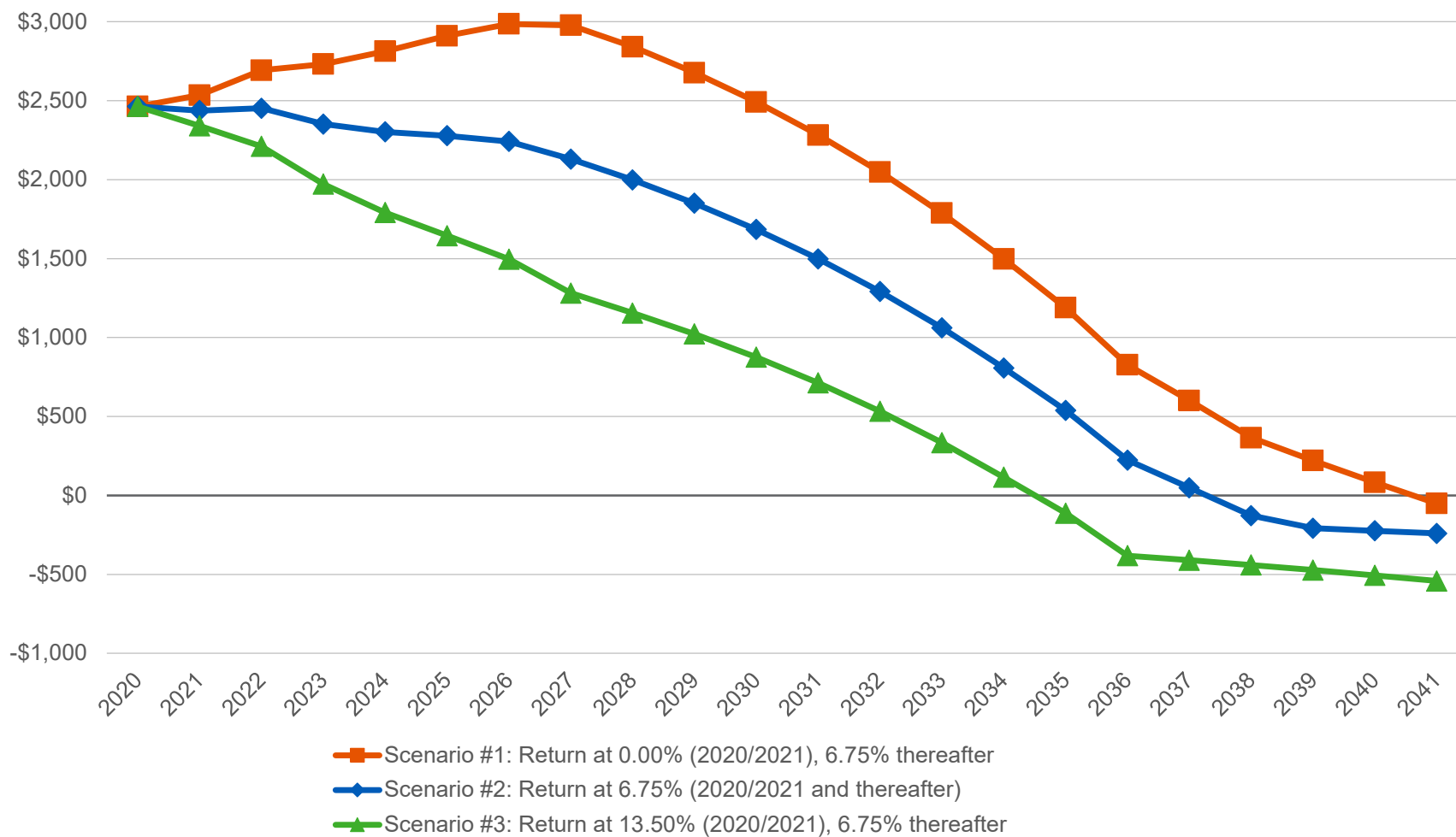
Projected Employer Contribution Rates under Three Hypothetical Market Return Scenarios for 2020/2021 (% of Payroll)



Projected Funded Ratios (on Actuarial Value of Assets Basis) under Three Hypothetical Market Return Scenarios for 2020/2021



Projected UAAL (on Actuarial Value of Assets Basis) under Three Hypothetical Market Return Scenarios for 2020/2021 (\$ Millions)



Stochastic Projection

Based on our discussions with SCERS, we have also been directed to supplement the deterministic scenario tests with a stochastic 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, 2020 valuation. We have performed the stochastic modeling of future market returns using the expected return, standard deviation and other information about SCERS' asset portfolio²⁰ 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% chance²¹ that the annual return of SCERS' investment portfolio would average between 5.4% and 8.7%, the funded ratio would be between 85% and 142% and the corresponding UAAL would be between \$3.4 billion and a surplus (or a negative UAAL) of \$9.4 billion.

On an actuarial (smoothed) value of assets basis, the funded ratio is about 81% at the June 30, 2020 valuation. There is a 37% chance SCERS would be fully funded at the end of 10 years and a 57% chance SCERS would be fully funded at the end of 20 years.²² The probabilities that the funded ratio would fall below 70%, 60% or 50% at any point in the next 20 years are as follows:

	Funded Ratio		
	Below 70%	Below 60%	Below 50%
Probability	25%	9%	2%

²⁰ For the stochastic modeling, we have used information about SCERS' asset portfolio that we used in developing the 6.75% expected investment return assumption we recommended to the Board for the June 30, 2020 valuation together with updated expected return, standard deviation and other information as outlined in the Appendix. This modeling assumes no further assumption changes, method changes or non-investment experience that differs significantly from assumptions.

²¹ This is based on the 25th to the 75th percentile results.

²² In our June 30, 2019 risk report, the probabilities SCERS would become fully funded were estimated at 39% and 53% at the end of 10 years and 20 years, respectively. There are changes in these probabilities between June 30, 2019 and June 30, 2020 primarily as a result of greater variability (standard deviation) associated with the System's assets allocations as of the two dates and an increase in the UAAL in the June 30, 2020 valuation as a result of the assumption changes and unfavorable actuarial experience during 2019/2020.

The total employer contribution rate is about 31% payroll in the June 30, 2020 valuation. Stochastic modeling can help assess the range and relative likelihood of potential future contribution rates. At the end of 10 years (i.e., the June 30, 2030 valuation), there is a 50% chance that the employer contribution rates would be between 12% and 43% of payroll. At the end of 20 years (i.e., the June 30, 2040 valuation), there is a 50% chance that the employer contribution rates would be between 11% and 31% of payroll. 11% 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.²³

The probabilities that the total employer contribution rate would increase from the June 30, 2020 valuation contribution rates by at least 5%, 10% or 15% of payroll at any year during the next 20 years are as follows:²⁴

Total Employer Rate Increases by at least

	5% of Payroll (to 36% of Payroll)	10% of Payroll (to 41% of Payroll)	15% of Payroll (to 46% of Payroll)
Probability	54%	43%	33%

Finally, stochastic modeling can help assess the potential impact of investment experience on contribution volatility in any given year. The probabilities that the total employer contribution rate would spike by 2%, 4% or 6% of payroll in any single year during the next 20 years are as follows:

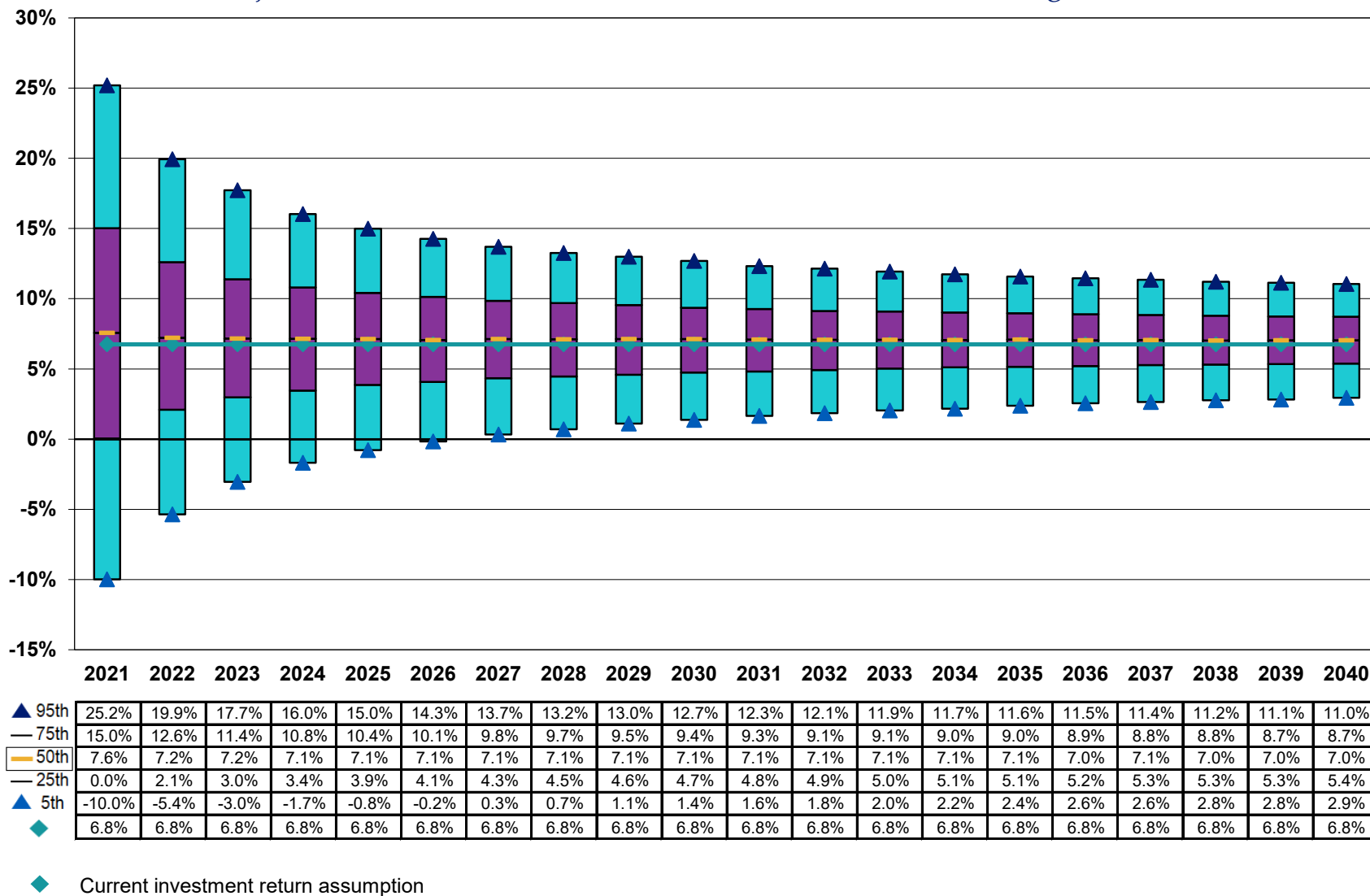
Total Employer Rate Spike in a Single Year by

	2% of Payroll	4% of Payroll	6% of Payroll
Probability	15%	4%	2%

²³Under PEPR, 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.

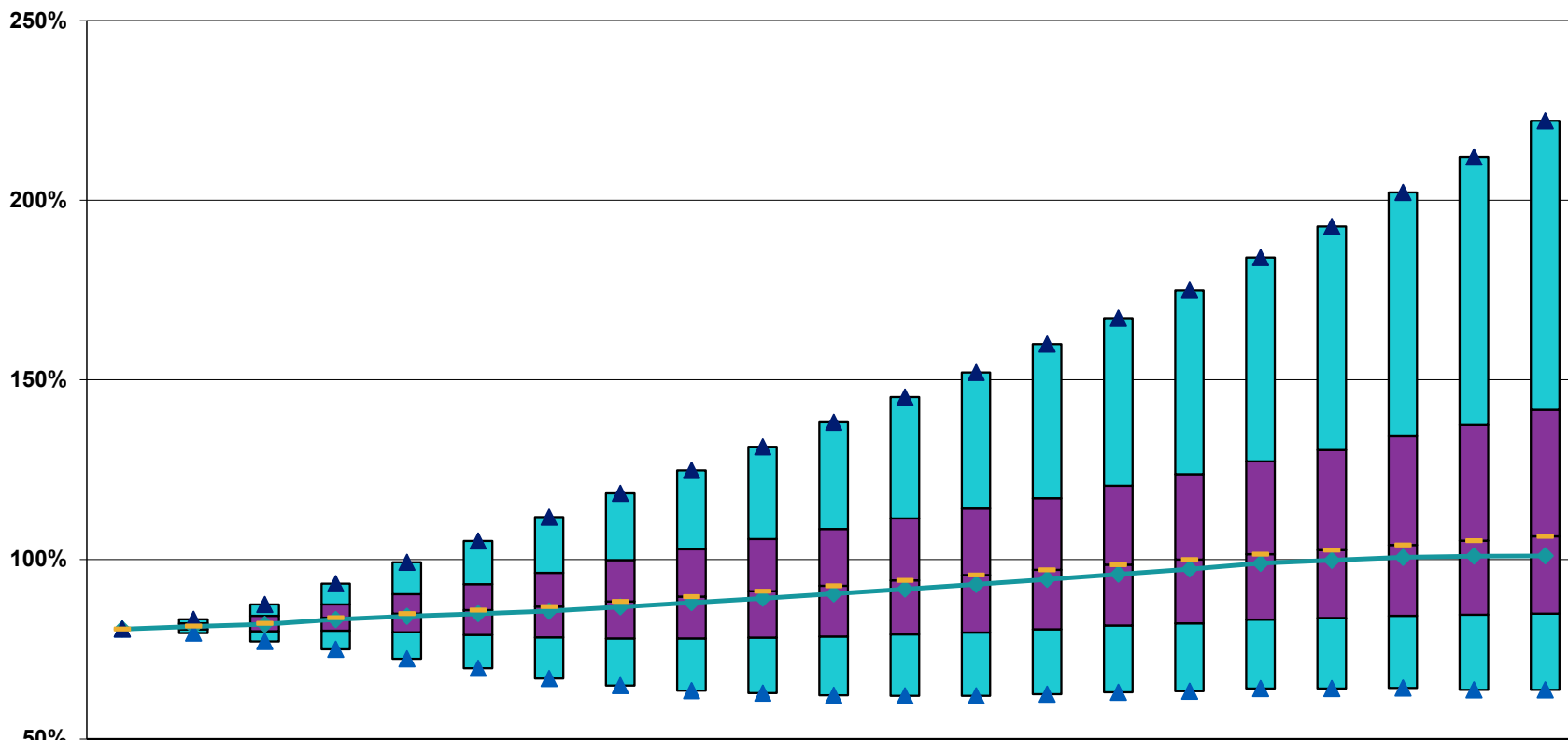
²⁴In our June 30, 2019 risk report, we showed probabilities of the employer contribution rate increasing by 5%, 10% or 15% of payroll during the next 20 years as 26%, 19%, and 14% respectively. Those were the probabilities in any given year over the next 20 years that the contribution rate would be 5%, 10%, or 15% higher than the rate in the June 30, 2019 valuation. The equivalent probabilities for the June 30, 2020 valuation would be 27%, 19%, and 13%, respectively.

Projected Cumulative Investment Return for Plan Years Ending June 30²⁵



²⁵ We observed that in our triennial experience study as of June 30, 2019, we estimated that over a 15-year period, there would be a 58% likelihood that future average geometric return would meet or exceed the 6.75% investment return assumption. Due to updated assumptions in Horizon's 2020 survey, the above results reflect a 55% likelihood that future average geometric return would meet or exceed the 6.75% investment return assumption over a 15-year period.

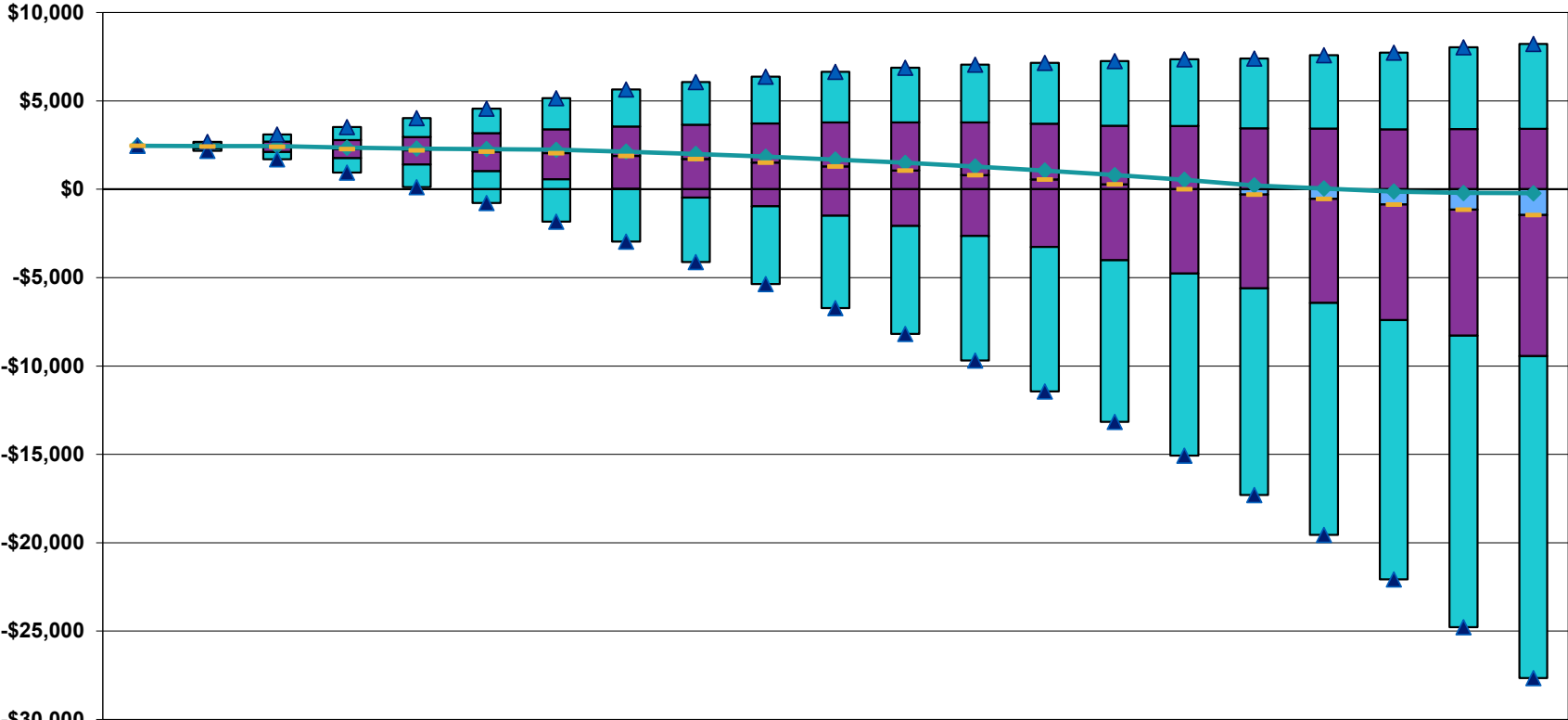
Projected Funded Ratios (on Actuarial Value of Assets Basis)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
▲ 95th	80.6%	83.4%	87.5%	93.3%	99.2%	105.2%	111.8%	118.4%	124.8%	131.4%	138.2%	145.2%	152.1%	160.0%	167.2%	175.0%	184.1%	192.7%	202.2%	212.1%	222.2%
— 75th	80.6%	82.2%	84.3%	87.4%	90.3%	93.1%	96.3%	99.8%	102.8%	105.7%	108.5%	111.4%	114.2%	117.1%	120.5%	123.7%	127.3%	130.5%	134.3%	137.5%	141.7%
— 50th	80.6%	81.4%	82.2%	83.8%	84.9%	85.9%	86.8%	88.3%	89.6%	91.1%	92.7%	94.2%	95.7%	97.1%	98.5%	99.9%	101.5%	102.6%	104.0%	105.2%	106.4%
— 25th	80.6%	80.6%	80.0%	80.2%	79.7%	79.0%	78.3%	78.0%	78.0%	78.2%	78.5%	79.1%	79.7%	80.6%	81.6%	82.2%	83.2%	83.7%	84.3%	84.6%	84.9%
▲ 5th	80.6%	79.5%	77.1%	75.0%	72.4%	69.7%	66.9%	64.9%	63.4%	62.7%	62.2%	62.0%	62.0%	62.5%	63.0%	63.3%	64.0%	64.0%	64.2%	63.7%	63.6%
◆	80.6%	81.3%	81.9%	83.3%	84.2%	84.9%	85.6%	86.8%	88.0%	89.2%	90.4%	91.7%	93.1%	94.4%	95.9%	97.3%	98.9%	99.8%	100.6%	100.9%	101.0%

◆ Baseline deterministic projection with current assumptions

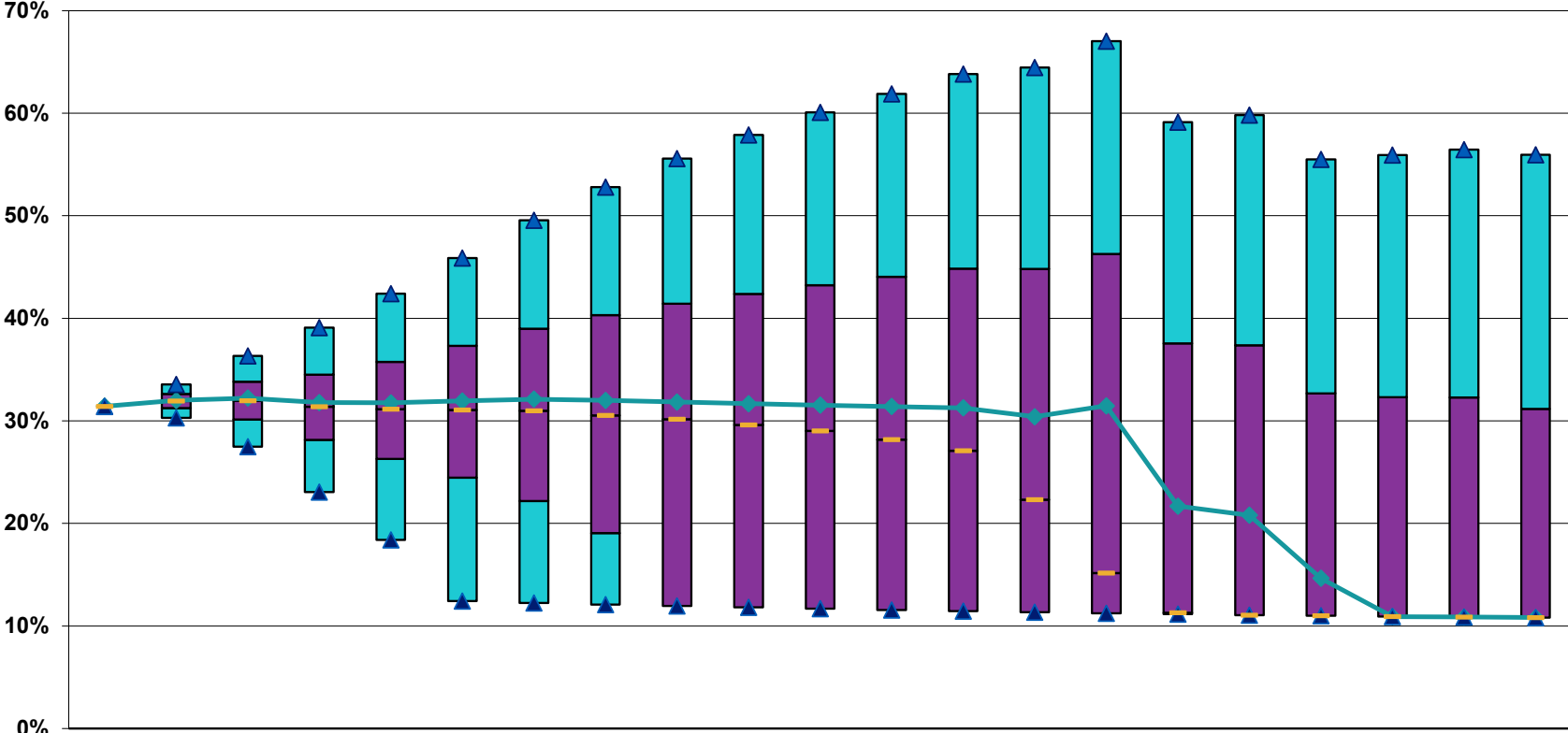
Projected UAAL (on Actuarial Value of Assets Basis)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
▲ 95th	2,464	2,172	1,701	946	117	-778	-1,832	-2,962	-4,120	-5,364	-6,728	-8,183	-9,681	-11,444	-13,159	-15,065	-17,298	-19,550	-22,068	-24,782	-27,660
— 75th	2,464	2,319	2,123	1,765	1,412	1,035	577	35	-472	-967	-1,496	-2,069	-2,634	-3,259	-4,013	-4,768	-5,612	-6,427	-7,408	-8,286	-9,444
— 50th	2,464	2,426	2,413	2,285	2,204	2,131	2,051	1,883	1,719	1,514	1,288	1,058	798	558	287	14	-302	-548	-862	-1,155	-1,460
— 25th	2,464	2,535	2,704	2,789	2,952	3,173	3,390	3,546	3,658	3,721	3,778	3,779	3,780	3,712	3,602	3,581	3,450	3,430	3,393	3,411	3,418
▲ 5th	2,464	2,679	3,101	3,521	4,027	4,570	5,163	5,652	6,066	6,371	6,653	6,880	7,056	7,158	7,254	7,363	7,406	7,585	7,734	8,032	8,232
◆	2,464	2,438	2,452	2,352	2,303	2,278	2,242	2,130	1,999	1,850	1,684	1,498	1,291	1,061	807	539	223	49	-128	-208	-224

◆ Baseline deterministic projection with current assumptions

Projected Employer Contribution Rates



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
▲ 95th	31.4%	30.3%	27.5%	23.1%	18.4%	12.4%	12.3%	12.1%	12.0%	11.8%	11.7%	11.6%	11.4%	11.3%	11.2%	11.2%	11.1%	11.0%	10.9%	10.9%	10.8%
— 75th	31.4%	31.2%	30.1%	28.1%	26.3%	24.5%	22.2%	19.1%	12.0%	11.8%	11.7%	11.6%	11.4%	11.3%	11.2%	11.2%	11.1%	11.0%	10.9%	10.9%	10.8%
— 50th	31.4%	31.9%	32.0%	31.4%	31.1%	31.0%	31.0%	30.5%	30.2%	29.6%	29.0%	28.2%	27.1%	22.3%	15.2%	11.3%	11.1%	11.0%	10.9%	10.9%	10.8%
— 25th	31.4%	32.6%	33.8%	34.5%	35.8%	37.3%	39.0%	40.3%	41.4%	42.4%	43.2%	44.0%	44.9%	44.8%	46.3%	37.6%	37.4%	32.7%	32.3%	32.3%	31.2%
▲ 5th	31.4%	33.6%	36.3%	39.1%	42.4%	45.9%	49.6%	52.8%	55.6%	57.9%	60.1%	61.9%	63.8%	64.5%	67.0%	59.1%	59.8%	55.5%	55.9%	56.4%	55.9%
◆	31.4%	32.0%	32.2%	31.8%	31.8%	31.9%	32.1%	32.0%	31.8%	31.7%	31.5%	31.4%	31.3%	30.4%	31.5%	21.7%	20.8%	14.7%	10.9%	10.9%	10.8%

◆ Baseline deterministic projection with current assumptions

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, 2011 to 2020, 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 9.3 as of June 30, 2020. This means that a 1% asset gain or loss in 2020/2021 (relative to the assumed investment return) would amount to 9.3% of one year's payroll. Similarly, SCERS' LVR was 11.7 as of June 30, 2020, so a 1% liability gain or loss in 2020/2021 would amount to 11.7% of one year's payroll.²⁶ 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.

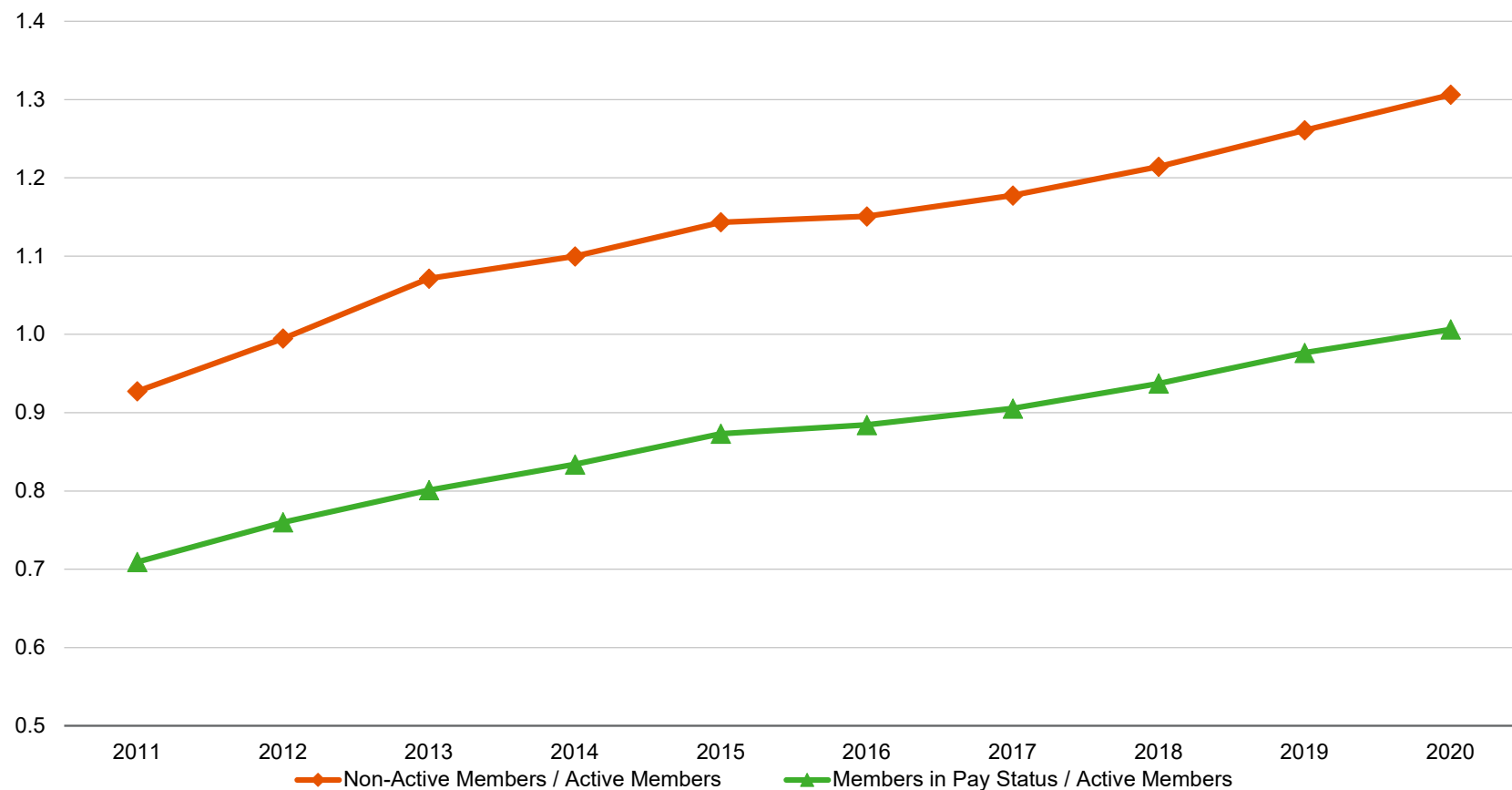
²⁶The 9.3 and 11.7 are the AVR and LVR, respectively, for the entire System. There are considerable differences in those ratios for the Miscellaneous and Safety membership groups.

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

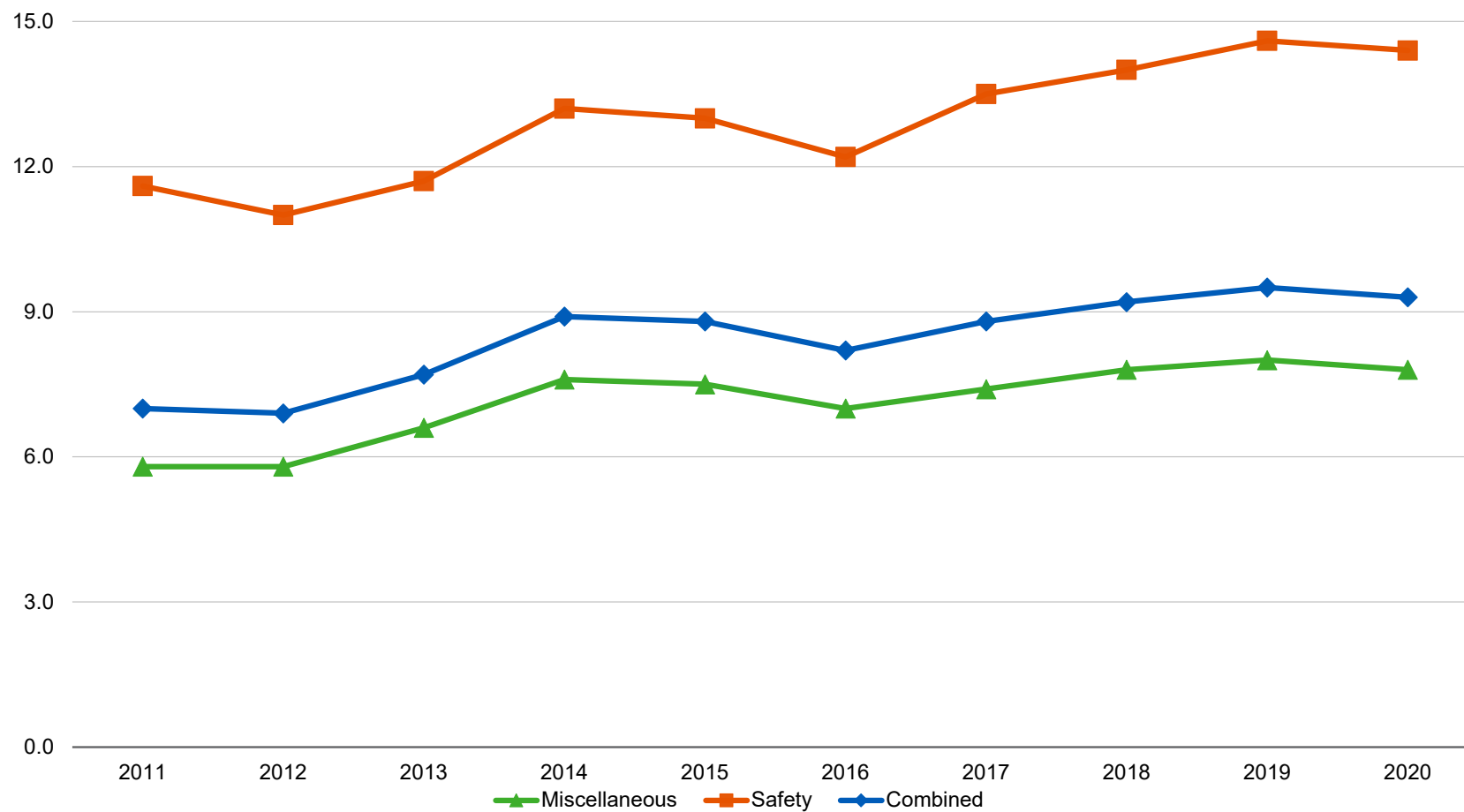
June 30, 2020

Employee Group	AVR	10% Investment Loss Compares to	LVR	10% Liability Change Compares to
Miscellaneous	7.8	78% of payroll	9.6	96% of payroll
Safety	14.4	144% of payroll	18.9	189% of payroll
Combined	9.3	93% of payroll	11.7	117% of payroll

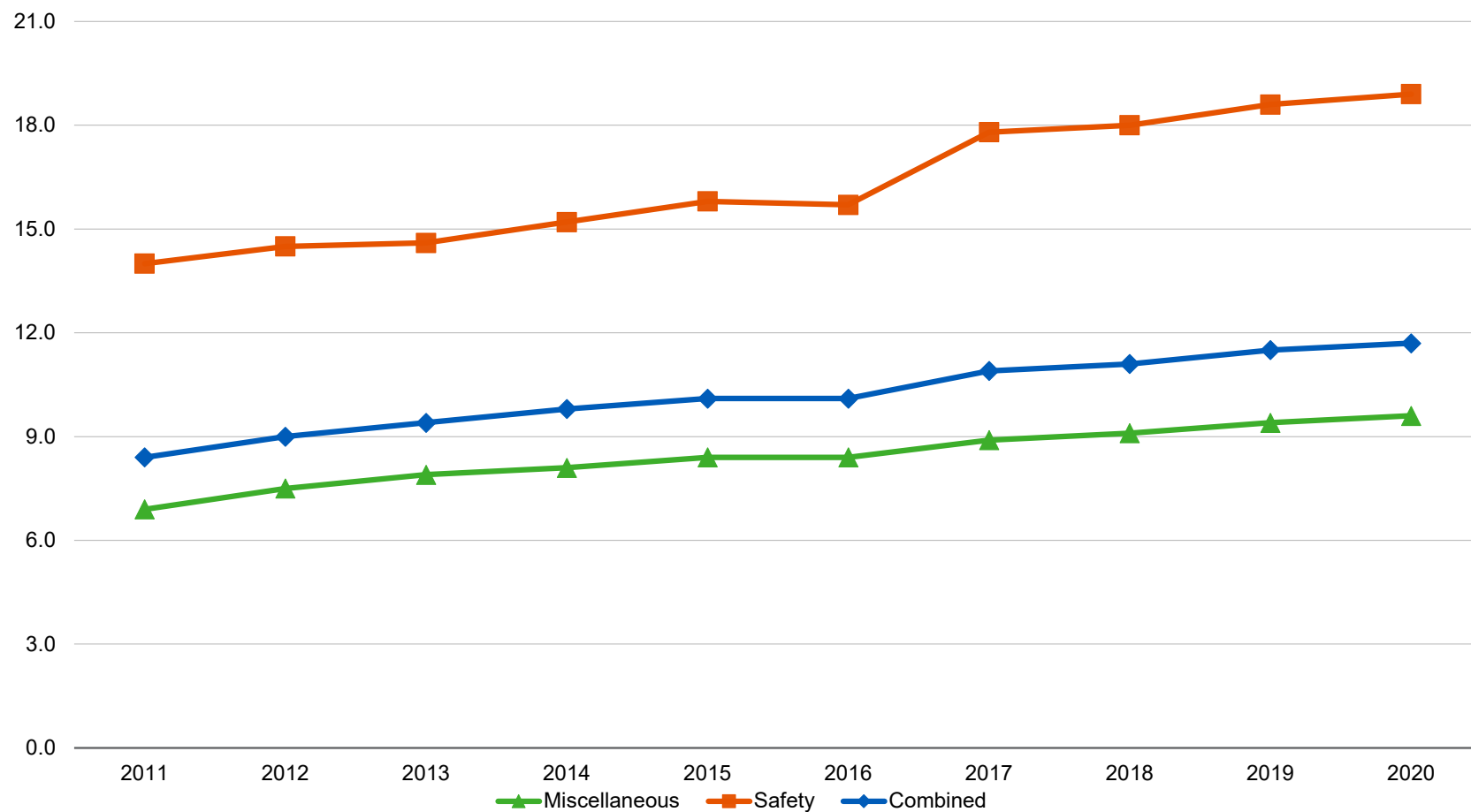
Ratios of Members in Pay-Status (Retirees and Beneficiaries) to Active Members & Non-Active Members (Vested Terminated, Retirees and Beneficiaries) to Active Members in June 30, 2011 to 2020 Valuations



Asset Volatility Ratio in June 30, 2011 to 2020 Valuations



Liability Volatility Ratio in June 30, 2011 to 2020 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, 2020 valuation.

Segal valuation results are based on proprietary actuarial modeling software. The actuarial valuation models generate a comprehensive set of liability and cost calculations that are presented to meet regulatory, legislative and client requirements. Our Actuarial Technology and Systems unit, comprised of both actuaries and programmers, is responsible for the initial development and maintenance of these models. The models have a modular structure that allows for a high degree of accuracy, flexibility and user control. The client team programs the assumptions and the plan provisions, validates the models, and reviews test lives and results, under the supervision of the responsible actuary.

Deterministic Projection

In addition, we have prepared the deterministic projection using the following assumptions and methods applied in the June 30, 2020 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 6.75% investment earnings and 3.00% 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, 2020 will be utilized in the June 30, 2021 valuation and that the Contingency Reserve will not be restored.

- All other actuarial assumptions used in the June 30, 2020 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 6.75% that was applied in the June 30, 2020 valuation. That target asset allocation is as follows:

Asset Class	Target Allocation
U.S. Large Cap Equity	18%
U.S. Small Cap Equity	2%
International Developed Equity	16%
Emerging Markets Equity	4%
Core/Core Plus Bonds	10%
High Yield Bonds	1%
Global Bonds	3%
Bank Loans	1%
U.S. Treasury	5%
Real Estate	5%
Cash	1%
Liquid Real Return	2%
Hedge Fund Growth	3%
Hedge Fund Diversifying	7%
Value Added Real Estate	2%
Private Equity	9%
Private Real Assets	7%
Private Credit/Private Debt	4%
Total	100%

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 2020 survey prepared by Horizon Actuarial Services.²⁷ We used the assumptions that were closest to the asset classes found in SCERS' investment portfolio. Please note that the stochastic simulation in the last triennial experience study dated May 11, 2020 used assumptions in the 2019 survey prepared by Horizon. There have been updated returns and other inputs provided by Horizon in their 2020 survey.

A summary of the 20-year arithmetic returns,^{28,29} 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	8.36%	16.22%	1	1.00														
2 U.S. Small Cap Equity	9.54%	20.22%	2	0.89	1.00													
3 International Developed Equity	9.09%	18.05%	3	0.84	0.76	1.00												
4 Emerging Markets Equity	11.33%	24.23%	4	0.73	0.69	0.80	1.00											
5 Core/Core Plus Bonds	3.74%	5.47%	5	0.15	0.08	0.17	0.16	1.00										
6 High Yield Bonds, Bank Loans	6.14%	9.75%	6	0.63	0.62	0.62	0.62	0.38	1.00									
7 Global Bonds	2.53%	7.02%	7	0.12	0.06	0.28	0.23	0.53	0.24	1.00								
8 U.S. Treasury, Cash	2.28%	1.78%	8	(0.08)	(0.08)	(0.07)	(0.06)	0.23	(0.08)	0.21	1.00							
9 Real Estate, Value Added Real Estate	7.91%	16.84%	9	0.53	0.55	0.49	0.44	0.22	0.46	0.19	(0.01)	1.00						
10 Hedge Fund Growth/Diversifying, Liquid Real Return	6.10%	8.00%	10	0.63	0.61	0.63	0.61	0.15	0.53	0.13	(0.06)	0.37	1.00					
11 Private Real Assets/Infrastructure	8.45%	14.58%	11	0.53	0.50	0.56	0.51	0.25	0.53	0.28	(0.02)	0.40	0.49	1.00				
12 Private Equity	12.54%	21.99%	12	0.73	0.71	0.67	0.59	0.04	0.51	0.07	(0.06)	0.46	0.60	0.51	1.00			
13 Private Credit/Private Debt	8.63%	12.06%	13	0.57	0.57	0.53	0.52	0.11	0.73	0.01	(0.09)	0.39	0.52	0.44	0.56	1.00		

²⁷ That survey included responses from 39 investment advisors, including SCERS' investment advisor at Verus.

²⁸ Note that only 18 investment advisors provided long-term (e.g. 20-year) capital market assumptions in the survey.

²⁹ These returns are gross of inflation and before any adjustment for administrative expenses. The annual inflation assumption based on the Horizon Survey was 2.17%. The annual adjustment for administrative expenses was 0.08%.

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.

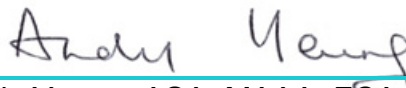
Actuarial Certification

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

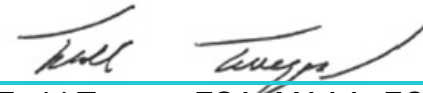
The actuarial opinions expressed in this report were prepared by Paul Angelo, FSA, MAAA, FCA, Enrolled Actuary, Andy Yeung, ASA, MAAA, FCA, Enrolled Actuary and Todd Tauzer, FSA, MAAA, FCA, CERA. They are members of the American Academy of Actuaries and they meet the Qualification Standards of the American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



Paul Angelo, FSA, MAAA, FCA, EA
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