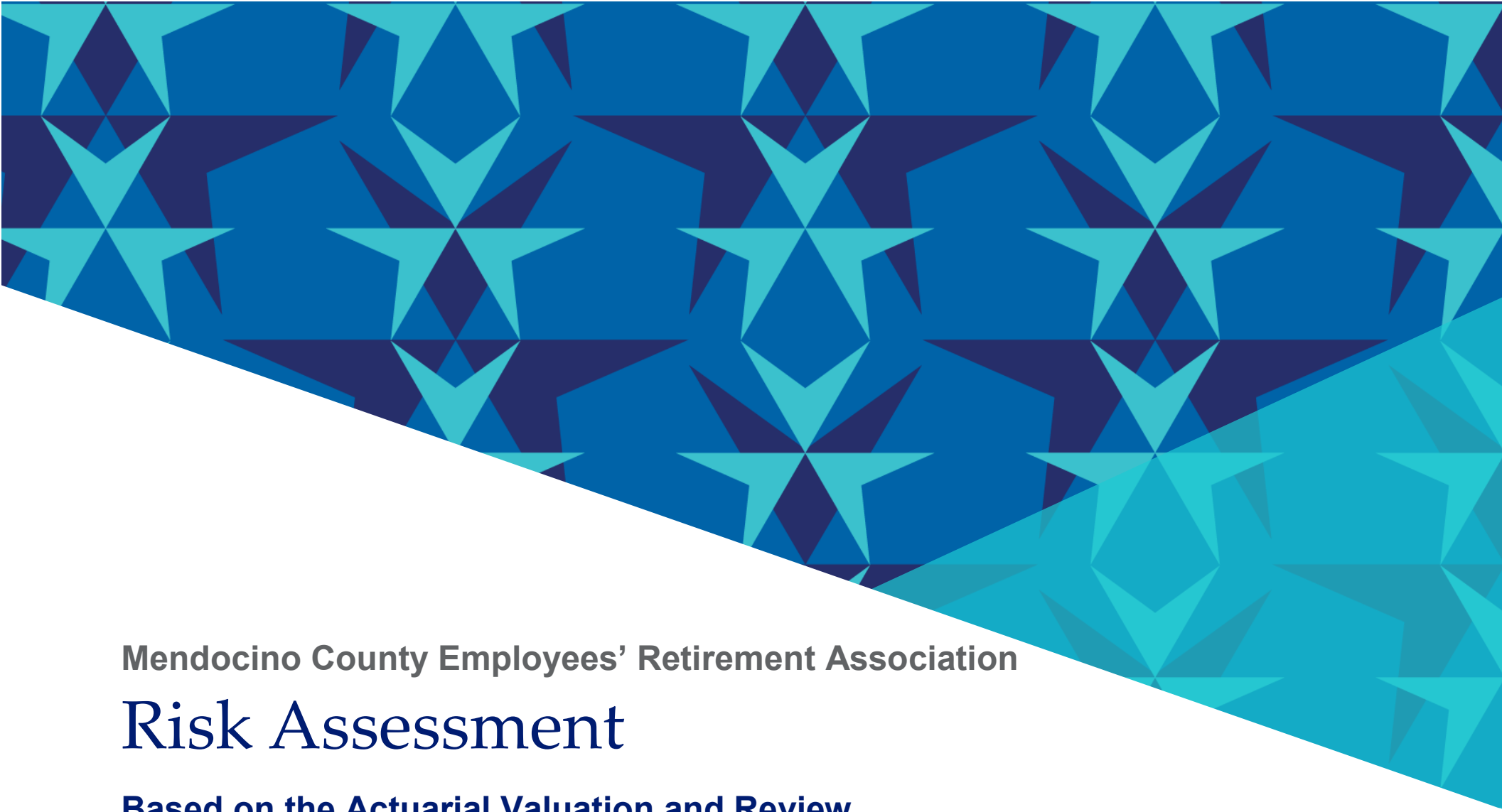




Mendocino County Employees' Retirement Association

Risk Assessment

**Based on the Actuarial Valuation and Review
as of June 30, 2019**

July 7, 2020

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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	12
Plan Maturity Measures that Affect Primary Risks	25
Appendix: Actuarial Assumptions & Methods and Actuarial Certification	30
Actuarial Assumptions & Methods.....	30
Actuarial Certification	33

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 specific set of economic and non-economic actuarial assumptions under the premise that future experience of the Mendocino County Employees' Retirement Association (MCERA or the Association) 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 in June 2020 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.

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 Association, 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 MCERA, after those results have been updated in this Risk Report to reflect the assumptions approved by the Board for the June 30, 2020 valuation.

It is important to note that this risk assessment is based on plan assets as of June 30, 2019. Due to the COVID-19 pandemic, market conditions have changed significantly since the valuation date. The Plan's actuarial 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. While it is impossible to determine how the market will perform over the next several months, and how that will affect the results of next year's valuation, 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.

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 MCERA's June 30, 2019 actuarial valuation for benefits provided by the Pension Plan. ASOP 51 requires actuaries to identify and assess risks that "may reasonably be

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.

anticipated to significantly affect the plan's future financial condition." Examples of key risks listed that are particularly relevant to MCERA 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 MCERA.

Plan Risk Assessment

In Section 2, we start by discussing some of the historical factors that have caused changes in MCERA's 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.

Please note that results herein as of the June 30, 2010 valuation date are from the prior actuary's June 30, 2010 actuarial valuation report.

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 MCERA 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 for only 2019/2020 coming in different from the 7.00% annual investment return assumption that was 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 for 2019/2020 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 to 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	<u>Market Value Basis</u>		<u>Valuation Value Basis</u>		Aggregate Employer Contribution Rate (% of Payroll)
	Funded Status	UAAL	Funded Status	UAAL	
June 30, 2010	69%	\$135 million	79%	\$92 million	19%
June 30, 2019	71%	\$214 million	71%	\$220 million	35%

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. All of these projections reflect the actuarial assumption changes approved by the Board for the June 30, 2020 valuation.

² For example, the UAAL changed by \$24 million in the June 30, 2011 valuation, \$3 million in the June 30, 2012 valuation (with the introduction of an assumption to anticipate conversion of unused sick leave into retirement service credit), \$50 million in the June 30, 2014 valuation, and \$28 million in the June 30, 2017 valuation (for a total of \$105 million), as a result of the experience studies and assumption changes over the last ten years.

³ For example, the change in the employer's total rate (normal cost plus UAAL) was 3.08% in the June 30, 2011 valuation, 0.59% in the June 30, 2012 valuation (with the introduction of an assumption to anticipate conversion of unused sick leave into retirement service credit), 7.05% in the June 30, 2014 valuation, and 4.15% in the June 30, 2017 valuation (for a total of 14.87%), as a result of the experience studies and assumption changes over the last ten years.

The total employer contribution rate is about 34.6% of total payroll in the June 30, 2019 valuation. Using a deterministic projection, this report shows the effect of either unfavorable (0%) or favorable (14%) 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 34.6%) in the total employer contribution rate in the June 30, 2020 valuation and in the June 30, 2024 valuation (when all the investment gains or losses are fully recognized at the end of the 5-year asset smoothing period) are as shown in the following table:

<u>2019/2020 Single Plan Year Investment Return⁴</u>			
Valuation Date	0%	7% (baseline)	14%
June 30, 2020	+2.9% of payroll	+2.2% of payroll	+1.4% of payroll
June 30, 2024	+5.5% of payroll	+1.2% of payroll	-3.1% of payroll

It should be noted that the above changes are after we consider the approximate 2.5% of payroll rate increase due to changes in actuarial assumptions approved by the Board for the June 30, 2020 valuation.⁵ Those changes in actuarial assumptions, including a reduction in the investment return assumption from 7.00% to 6.75% and other assumption changes, would also be expected to increase the UAAL by \$13 million in the June 30, 2020 valuation.

Furthermore, under either the unfavorable or favorable hypothetical market return scenarios for 2019/2020, the Association would be expected to reach full funding and the total employer contribution rate would be expected to approach about 9% of payroll at the end of 20 years. That 9% of payroll is the employer normal cost rate after MCERA's UAAL layers as of June 30, 2019 are paid off over periods ranging from 12 to 20 years and any new UAALs resulting from the hypothetical market experience in 2019/2020 and the impact of the changes in the actuarial assumptions approved by the Board for the June 30, 2020 valuation are paid off over 18 years, all 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 providing for the long-term full funding of the costs of the benefits paid by MCERA.

Using a stochastic projection that models market return over the next 20 years by using expected return, standard deviation and other information about MCERA's asset portfolio,⁶ there is a 50% chance that the employer contribution

⁴ In preparing the projections, we have taken into consideration the decision made by the Board to treat the net deferred investment gain of \$35,392 from the June 30, 2019 valuation as a single four-year smoothing "layer" and recognize that amount in four level amounts over four years.

⁵ The difference between the 2.5% of payroll increase due to changes in actuarial assumptions and the projected total increase of 2.2% of payroll for the June 30, 2020 valuation under the 7% return scenario shown in the table above is due to a reduction in the employer normal cost rate as legacy members are assumed to terminate or retire from the Association during 2019/2020 and are replaced by new members in the lower costing PEPRA tiers.

⁶ For the stochastic modeling, we have used the expected return, standard deviation and other information about MCERA's 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.

rates would be between 21% and 47% of payroll at the end of 10 years and between 9% and 25% of payroll at the end of 20 years. Furthermore, there is a 27% chance MCERA would be fully funded at the end of 10 years and 56% chance MCERA would be fully funded at the end of 20 years.

Lastly, using the results from the June 30, 2019 valuation after those results have been updated in this Risk Report to reflect the assumptions approved by the Board for the June 30, 2020 valuation, we have studied independently the impact of future negotiated salary increases scheduled to take place over three years, starting in fall 2019.⁷ At June 30, 2020, we have estimated that the negotiated salary increases would increase the employer rate by 1.48% of payroll and increase the UAAL by \$12 million. These results include the negotiated salary increases for both 2019/2020 and 2020/2021. Since the June 30, 2020 valuation will be based on projected payroll for fiscal year 2020/2021, we have included the negotiated salary increases for 2020/2021 in that valuation. In addition, since the fiscal year 2019/2020 negotiated salary increases were not included in the data provided for the June 30, 2019 valuation, those increases were also included in the June 30, 2020 valuation results.

At June 30, 2021 the negotiated salary increases would increase the employer rate by an additional 0.67% of payroll (for a total of 2.15% of payroll from both valuations) and increase the UAAL by an additional \$6 million (for a total of \$18 million from both valuations). Note that these salary increases have not been included in any of the other projections included in this Risk Report.

Plan Maturity Measures

During the past 10 valuations, the Association 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 MCERA 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 all active employees as of June 30, 2019, the weighted increases averaged about 4.3% for 2019/2020, 3.2% for 2020/2021, and 3.2% for 2021/2022 over and above a 3% COLA increase.

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 MCERA's financial status is the funded ratio. This ratio compares the actuarial⁸ and market value of assets to the actuarial accrued liabilities (AAL)⁹ of MCERA. The overall level of funding of MCERA has declined on an actuarial basis as a result of unfavorable investment returns and the strengthening of economic and non-economic actuarial assumptions. The funded ratios and UAAL¹⁰ 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 9 valuations from June 30, 2011 to 2019 are specified in *Chart 2*. (This chart shows changes only for the past nine valuations, from June 30, 2011 to 2019, since detailed information regarding the change in UAAL was not provided in the prior actuary's June 30, 2010 valuation report.) The results in *Chart 2* reflect the progression of changes in the investment return assumption from 8.00% to 7.00%¹¹ and other assumption changes from the past three triennial experience studies that have together by far the most impact on the UAAL for MCERA.

Chart 2 also shows that the unfavorable investment experience was offset to some extent by favorable non-investment experience. The non-investment experience includes 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.

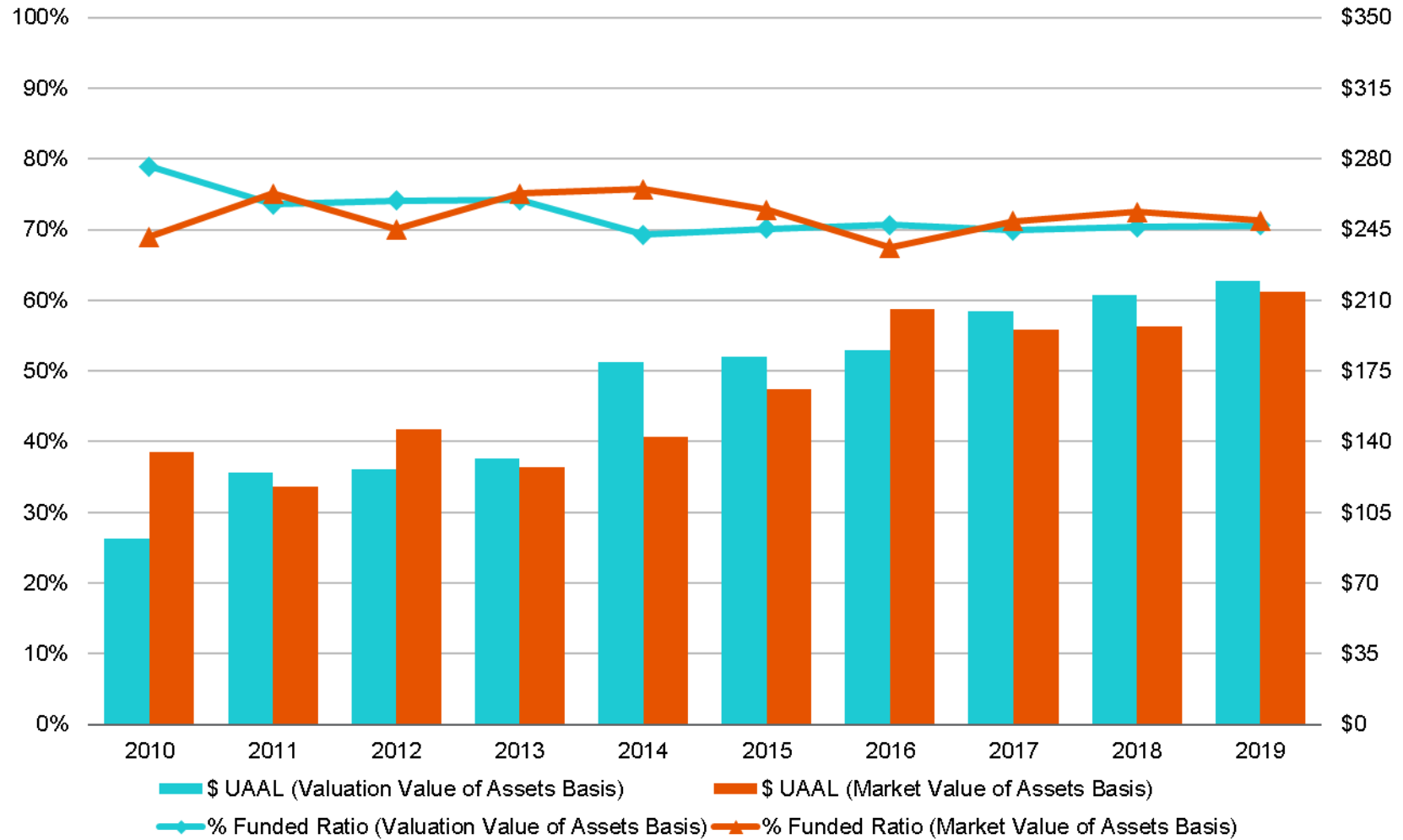
⁸ The actuarial value of assets is equal to the market value of assets excluding unrecognized returns from the last few years. Unrecognized returns are based on the difference between actual and expected returns on a market value basis and are recognized over a five-year period.

⁹ 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.

¹⁰ The amount by which the actuarial accrued liability of the plan exceeds (or is exceeded by) the assets of the plan.

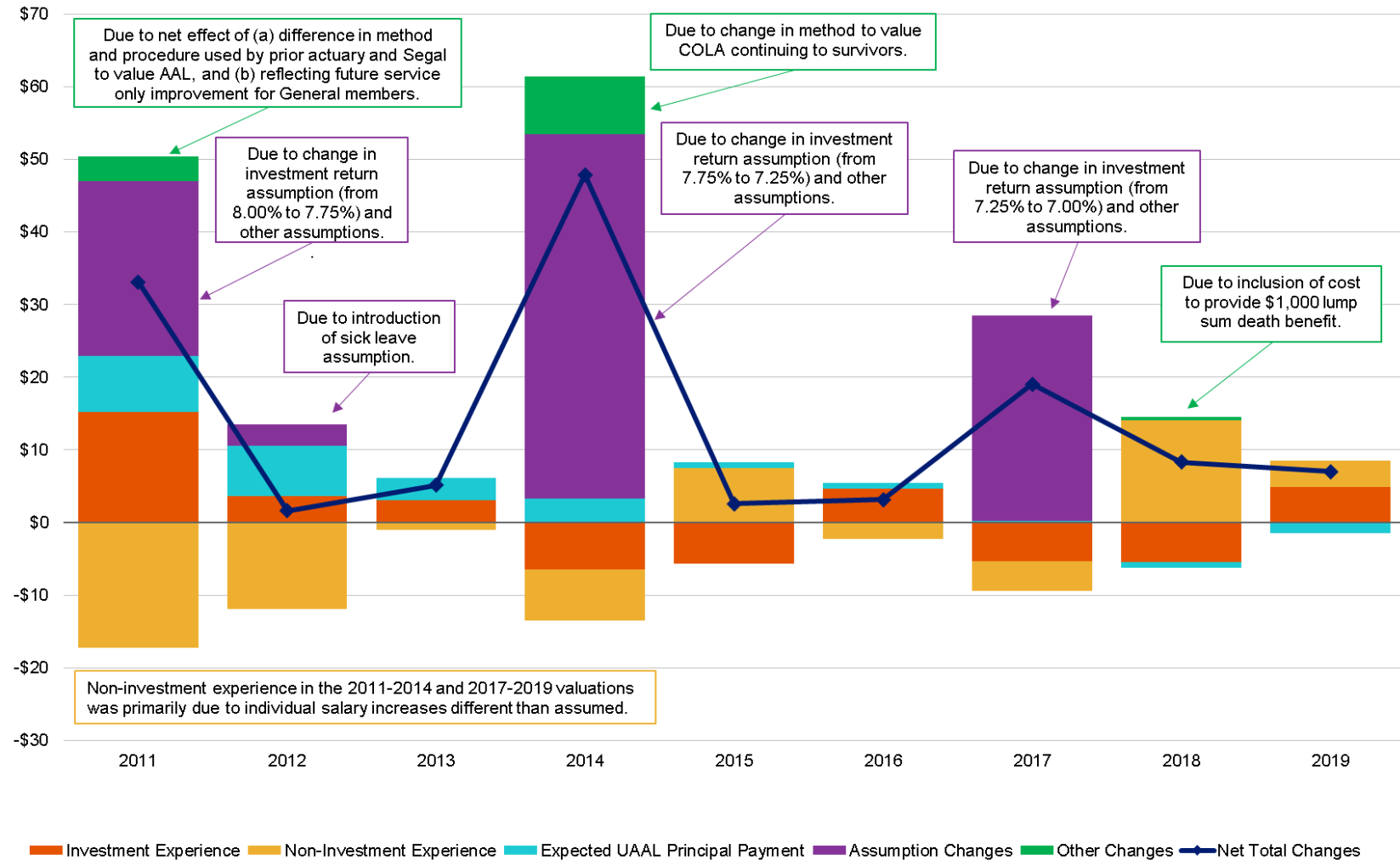
¹¹ The investment return assumption was lowered from 8.00% to 7.75% in the June 30, 2011 valuation, from 7.75% to 7.25% in the June 30, 2014 valuation, and from 7.25% to 7.00% in the June 30, 2017 valuation. In the recent experience study, a 6.75% assumption was approved by the Board for the June 30, 2020 and subsequent valuations.

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



Note: The 2010 results shown above on a market value basis reflect the final audited market value of assets, rather than the preliminary market value used in the prior actuary's June 30, 2010 valuation report.

Factors that Changed UAAL in June 30, 2011 to 2019 Valuations (\$ Millions)



Note: The primary source of investment losses starting in the June 30, 2009 valuation is the Great Recession, which was recognized in the valuation value of assets over several years.

Employer Contribution Rates

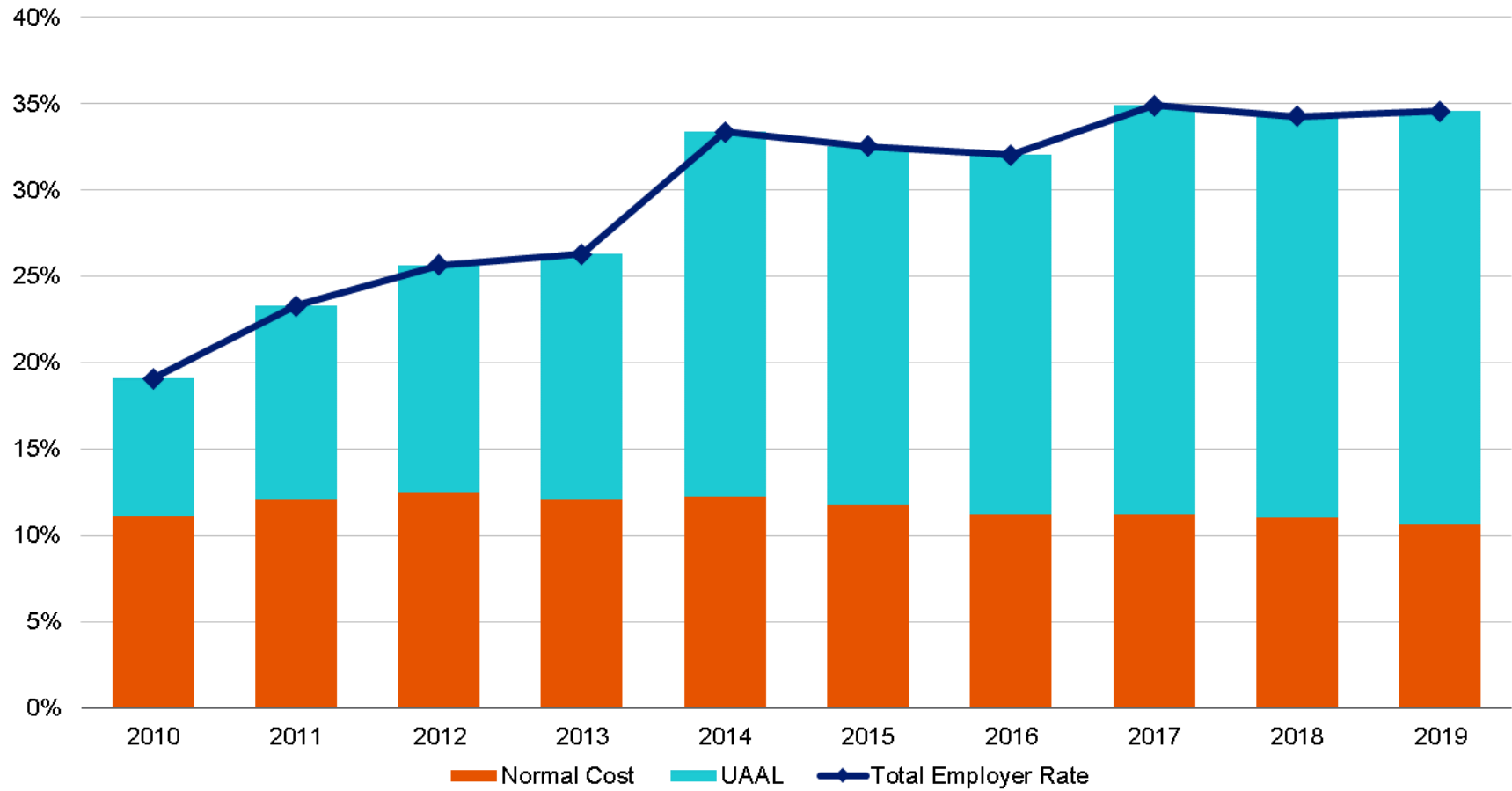
The total (normal cost¹² plus UAAL payment) employer contribution rates determined in the June 30, 2010 to 2019 valuations are provided in *Chart 3* and the factors that caused the changes in the total employer aggregate rates¹³ are provided in *Chart 4*. (Chart 4 shows changes only for the past nine valuations, from June 30, 2011 to 2019, since detailed information regarding the change in total employer aggregate rate was not provided in the prior actuary's June 30, 2010 valuation report.)

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 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 8.00% to 7.00% and other assumptions over the last three triennial experience studies have by far the most impact on increasing the UAAL contribution rates for the employers, followed by the change in method to value COLA continuing to survivors in 2014.

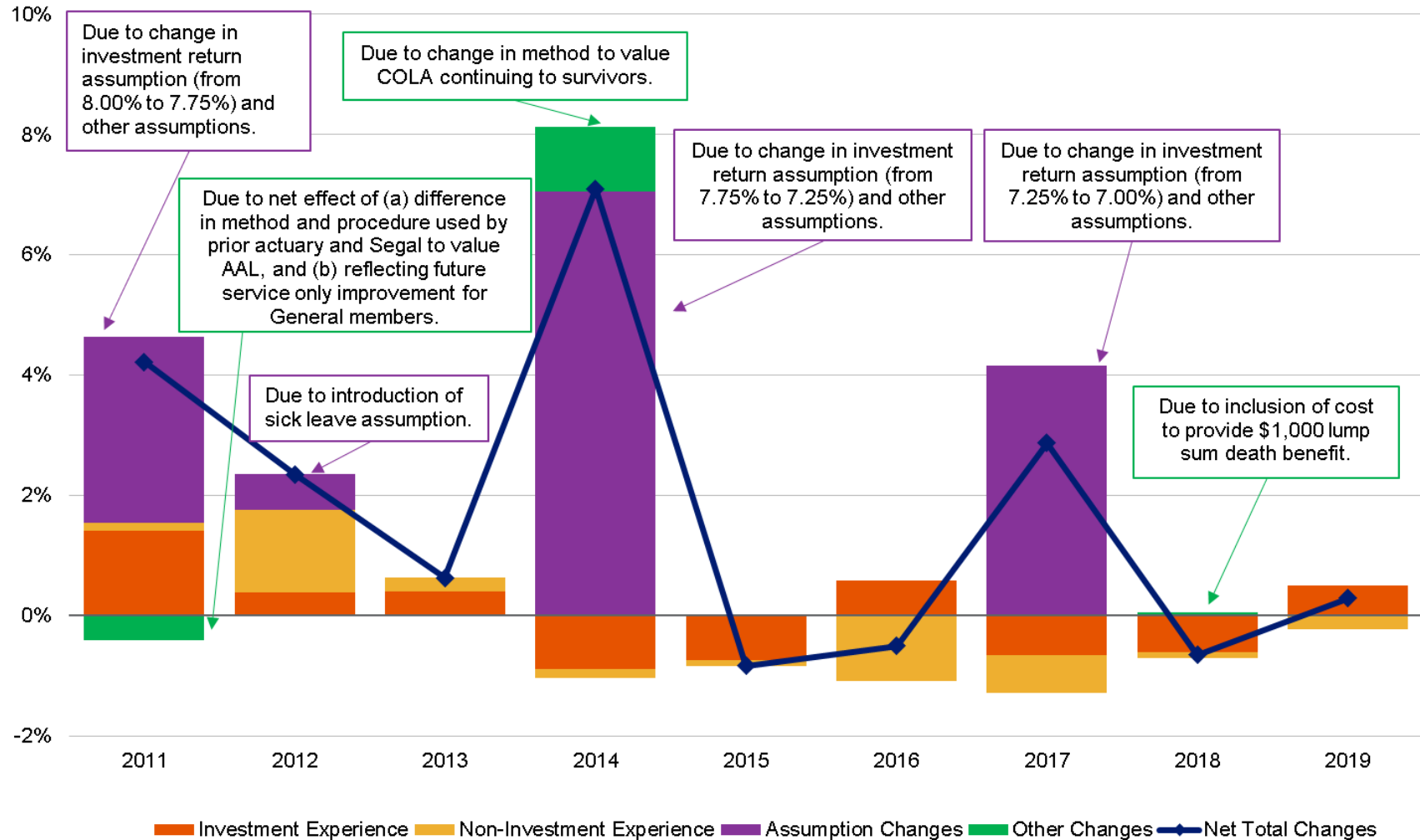
¹² The normal cost is the amount of contributions required to fund the level cost of the member's projected retirement benefit allocated to the current year of service.

¹³ There are separate contribution rates determined in the valuation for the General, Safety, and Probation 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, 2010 to 2019 Valuations (% of Payroll)



Factors that Affected Employer Contribution Rates in June 30, 2011 to 2019 Valuations (% of Payroll)



Note: The primary source of investment losses starting in the June 30, 2009 valuation is the Great Recession, which was recognized in the valuation value of assets over several years.

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 risk to MCERA 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 MCERA.

- Investment risk – the potential that future market returns will be different from the current 7.00% expected annual return assumption used in the June 30, 2019 valuation or the new 6.75% expected annual return assumption to be used in the June 30, 2020 valuation.

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 MCERA can better understand the risk associated with earning either less or more 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, 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.

Changes to the mortality and merit and promotional salary increase assumptions were the most major changes to the non-economic assumptions in the experience study recommending actuarial assumptions for the June 30, 2020 valuation. 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. MCERA's 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 MCERA has essentially no contribution risk.

Furthermore, when ADCs determined in accordance with the MCERA 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 Association would have enough assets to provide all future benefits promised to the current members enrolled in the Association, 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 MCERA associated with earnings either lower or higher than the rate of 7.00% for 2019/2020 assumed in the June 30, 2019 valuation or 6.75% assumed in the June 30, 2020 and future valuations using projections under a deterministic approach and a stochastic approach. All of these projections reflect the actuarial assumption changes approved by the Board for the June 30, 2020 valuation.

Deterministic Projection

To measure such risk, we have included a scenario test to study the change in the UAAL and contribution rates if MCERA were to earn market return lower or higher 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: 0%,
Scenario 2: 7% (baseline)
Scenario 3: 14%

The market return in future years is assumed to equal the 6.75% investment return assumption to be used in the June 30, 2020 valuation. The following table summarizes the resulting contribution rate changes (relative to the June 30, 2019 valuation aggregate employer contribution rate of approximately 34.6%) in the immediate next valuation as well as in the June 30, 2024 valuation where all of the investment gains and losses are fully recognized in the (smoothed) actuarial value of assets.

2019/2020 Single Plan Year Investment Return¹⁴

Valuation Date	0%	7% (baseline)	14%
June 30, 2020	+2.9% of payroll	+2.2% of payroll	+1.4% of payroll
June 30, 2024	+5.5% of payroll	+1.2% of payroll	-3.1% of payroll

It should be noted that the above changes are after we consider the approximate 2.5% of payroll rate increase due to changes in actuarial assumptions approved by the Board for the June 30, 2020 valuation.¹⁵ Those changes in actuarial assumptions, including a reduction in the investment return assumption from 7.00% to 6.75% and other assumption changes, would also be expected to increase the UAAL by \$13 million in the June 30, 2020 valuation.

Furthermore, under either the unfavorable or favorable hypothetical market return scenarios for 2019/2020, the Association would be expected to reach full funding and the total employer contribution rate would be expected to approach about 9% of payroll¹⁶ at the end of 20 years. That 9% of payroll is the employer normal cost rate after MCERA's UAAL layers as of June 30, 2019 are paid off over periods ranging from 12 to 20 years and any new UAALs resulting from the hypothetical market experience in 2019/2020 and the impact of the changes in the actuarial assumptions approved by the Board for the June 30, 2020 valuation are paid off over 18 years, all pursuant to the Board's actuarial funding policy.

¹⁴ In preparing the projections, we have taken into consideration the decision made by the Board to treat the net deferred investment gain of \$35,392 from the June 30, 2019 valuation as a single four-year smoothing "layer" and recognize that amount in four level amounts over four years.

¹⁵ The difference between the 2.5% of payroll increase due to changes in actuarial assumptions and the projected total increase of 2.2% of payroll for the June 30, 2020 valuation under the 7% return scenario shown in the table above is due to a reduction in the employer normal cost rate as legacy members are assumed to terminate or retire from the Association during 2019/2020 and are replaced by new members in the lower costing PEPRAs tiers.

¹⁶ 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 providing for the long-term full funding of the costs of the benefits paid by MCERA.

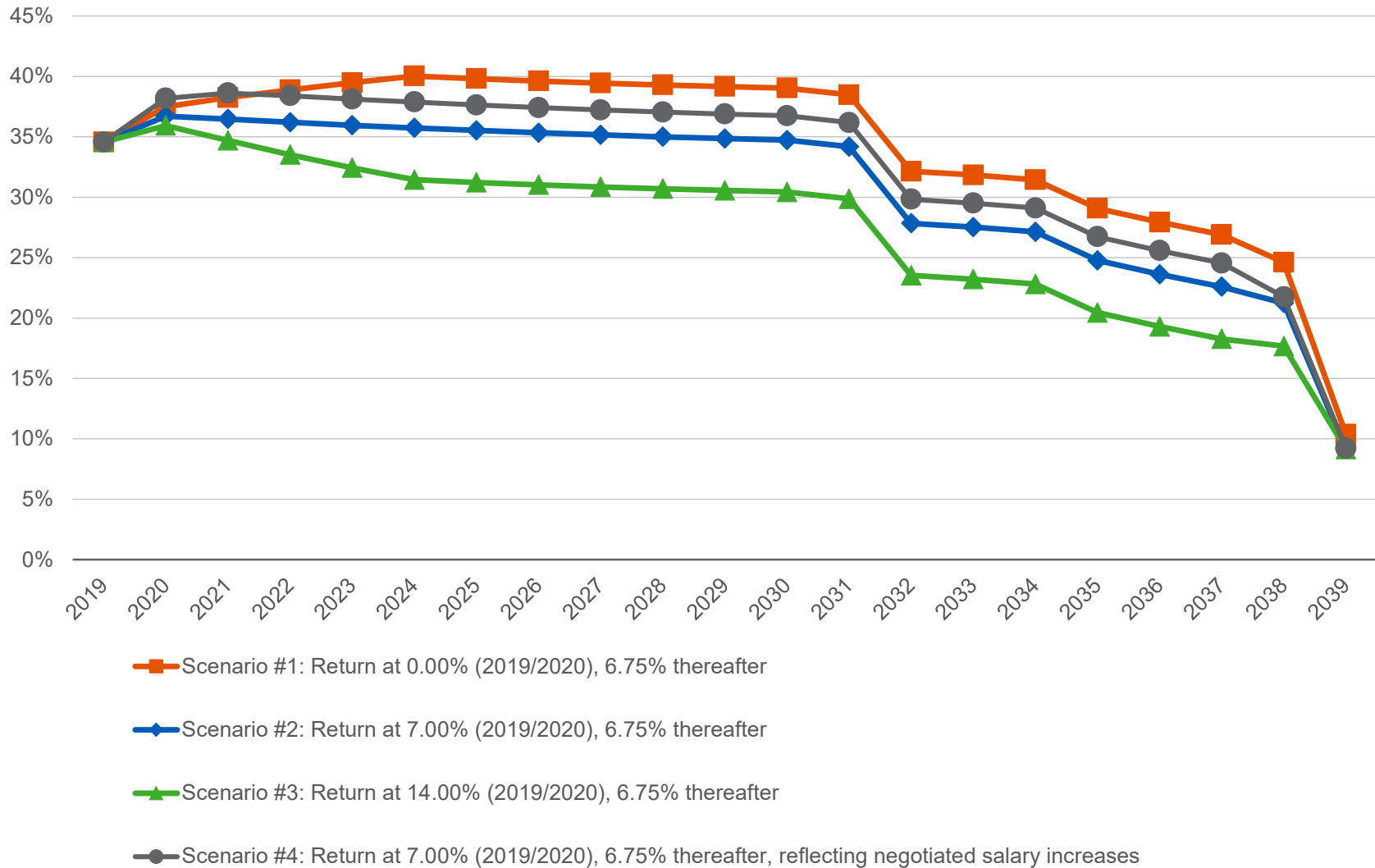
While we have not assigned a probability on the 2019/2020 market return coming in at these rates, the Board and other stakeholders monitoring MCERA should still be able to prorate and estimate the funded status and employer contribution rates for the June 30, 2020 and next several valuations as the actual 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 Association absent any significant plan or assumption changes.

We have also included a Scenario 4 in the charts, which is the same as the Baseline Scenario 2 but includes the cost impact of future negotiated salary increases that are scheduled to take place over three years, starting in fall 2019.¹⁷ At June 30, 2020, we have estimated that the negotiated salary increases would increase the employer rate by 1.48% of payroll and increase the UAAL by \$12 million. These results include the negotiated salary increases for both 2019/2020 and 2020/2021. Since the June 30, 2020 valuation will be based on projected payroll for fiscal year 2020/2021, we have included the negotiated salary increases for 2020/2021 in that valuation. In addition, since the fiscal year 2019/2020 negotiated salary increases were not included in the data provided for the June 30, 2019 valuation, those increases were also included in the June 30, 2020 valuation results.

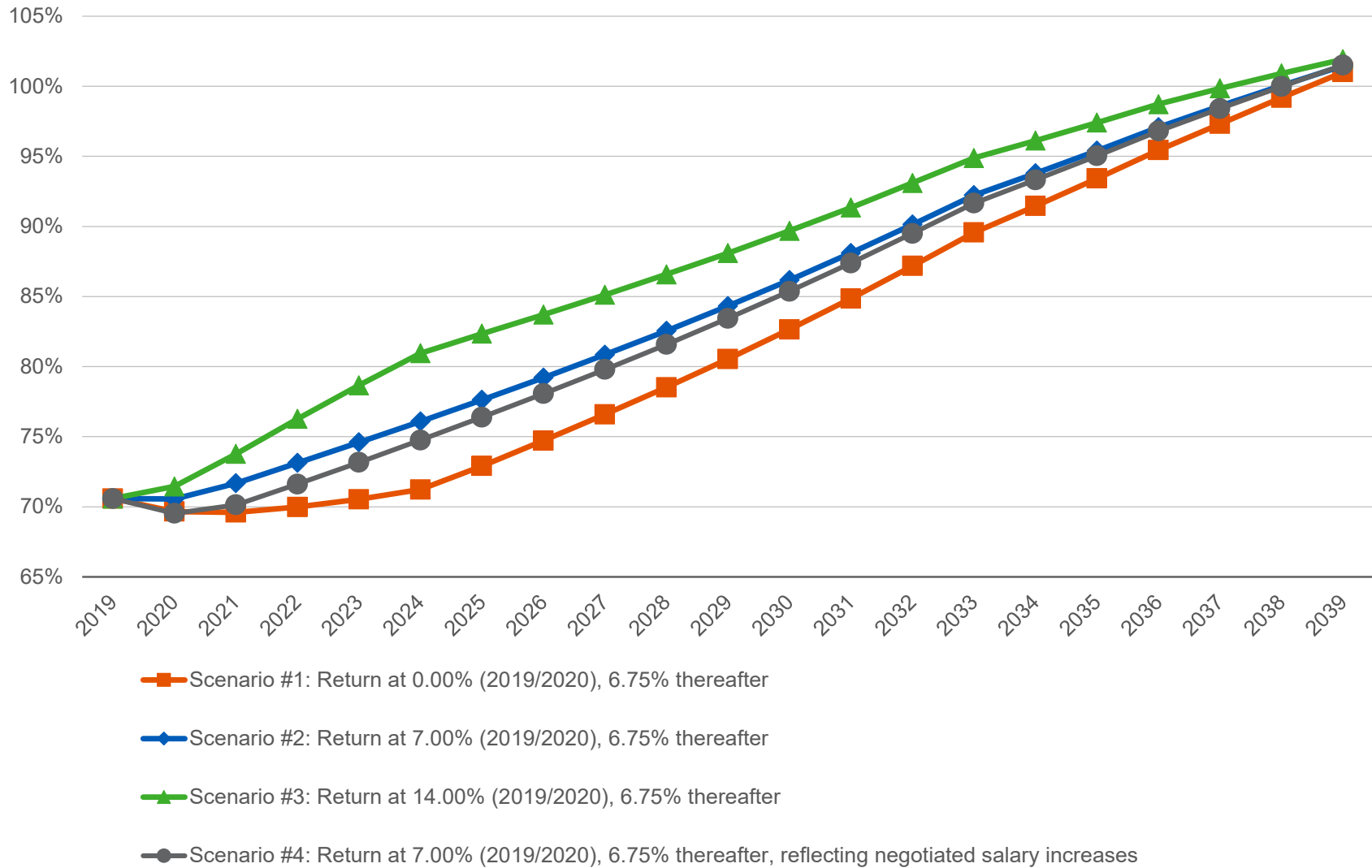
At June 30, 2021 the negotiated salary increases would increase the employer rate by an additional 0.67% of payroll (for a total of 2.15% of payroll from both valuations) and increase the UAAL by an additional \$6 million (for a total of \$18 million from both valuations). Note that these salary increases have not been included in any of the other projections included in this Risk Report.

¹⁷ For all active employees as of June 30, 2019, the weighted increases averaged about 4.3% for 2019/2020, 3.2% for 2020/2021, and 3.2% for 2021/2022, over and above a 3% COLA increase.

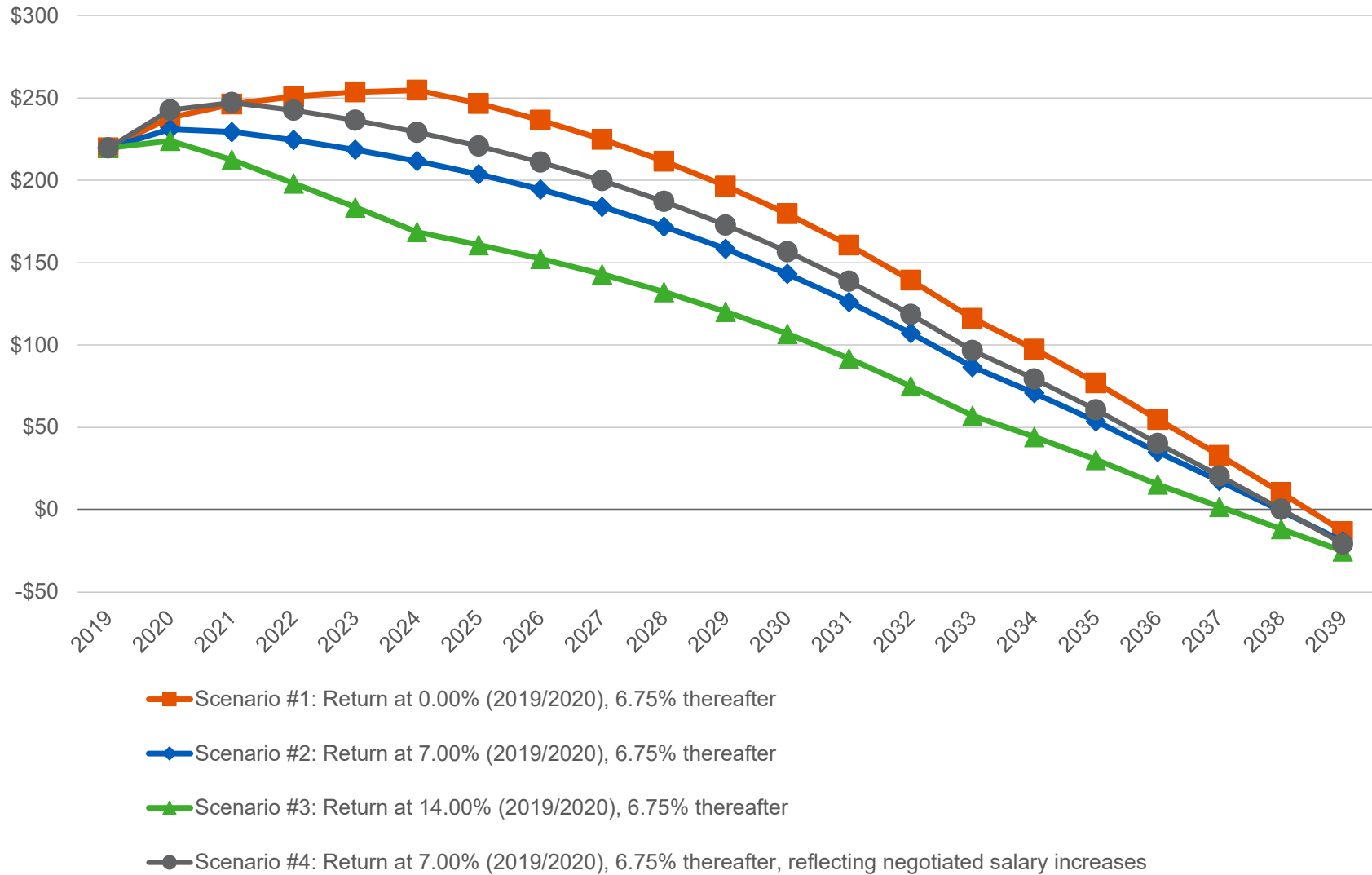
Projected Employer Contribution Rates under Three Hypothetical Market Return Scenarios for 2019/2020 (% of Payroll)



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 MCERA, 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 MCERA's asset portfolio¹⁸ as provided in the Appendix of this report, assuming no future assumption or method changes to the plan. These projections reflect the actuarial assumption changes approved by the Board for the June 30, 2020 valuation. However, they do not reflect the future negotiated salary increases included in Scenario #4 of the deterministic projections, as the purpose of the stochastic projections is specifically to show the effect of potential variations in market returns on various valuation results.

In *Chart 8*, we summarize the cumulative compounded rate of return of MCERA's 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% chance¹⁹ that the annual return of MCERA's investment portfolio would average between 5.0% and 8.6%, the funded ratio would be between 85% and 138% and the corresponding UAAL would be between \$195 million and a surplus (or a negative UAAL) of \$506 million.

The funded ratio is about 71% the June 30, 2019 valuation. There is a 27% chance MCERA would be fully funded at the end of 10 years and a 56% chance MCERA 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:

<u>Funded Ratio</u>			
	Below 50%	Below 60%	Below 70%
Probability	5%	21%	58%

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 21% and 47% of payroll. At the end of 20 years (i.e., the June 30, 2039 valuation), there is a 50%

¹⁸ For the stochastic modeling, we have used the expected return, standard deviation and other information about MCERA's asset portfolio that we applied in developing the 6.75% expected investment return assumption we recommended to the Board for the June 30, 2020 valuation.

¹⁹ This is based on the 25th to the 75th percentile results.

chance that the employer contribution rates would be between 9% and 25% of payroll. 9% 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.²⁰

The total employer contribution rate is about 35% payroll in the June 30, 2019 valuation. (That contribution rate is expected to increase by about 2.5% of payroll as a result of the assumption changes adopted by the Board for the June 30, 2020 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:

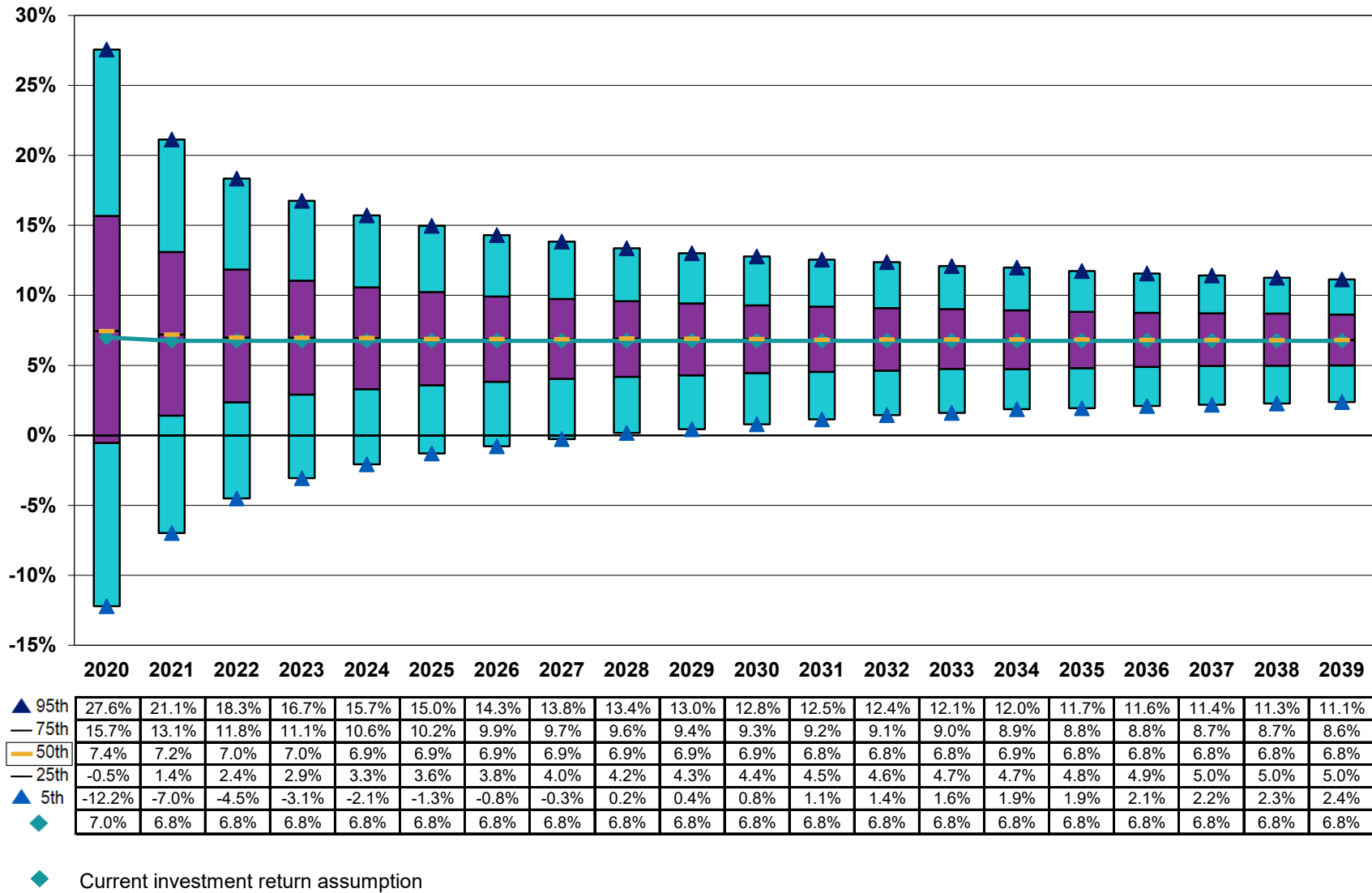
<u>Total Employer Rate Increases by at least</u>			
	5% of Payroll (to 40% of Payroll)	10% of Payroll (to 45% of Payroll)	15% of Payroll (to 50% of Payroll)
Probability	57%	44%	32%

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:

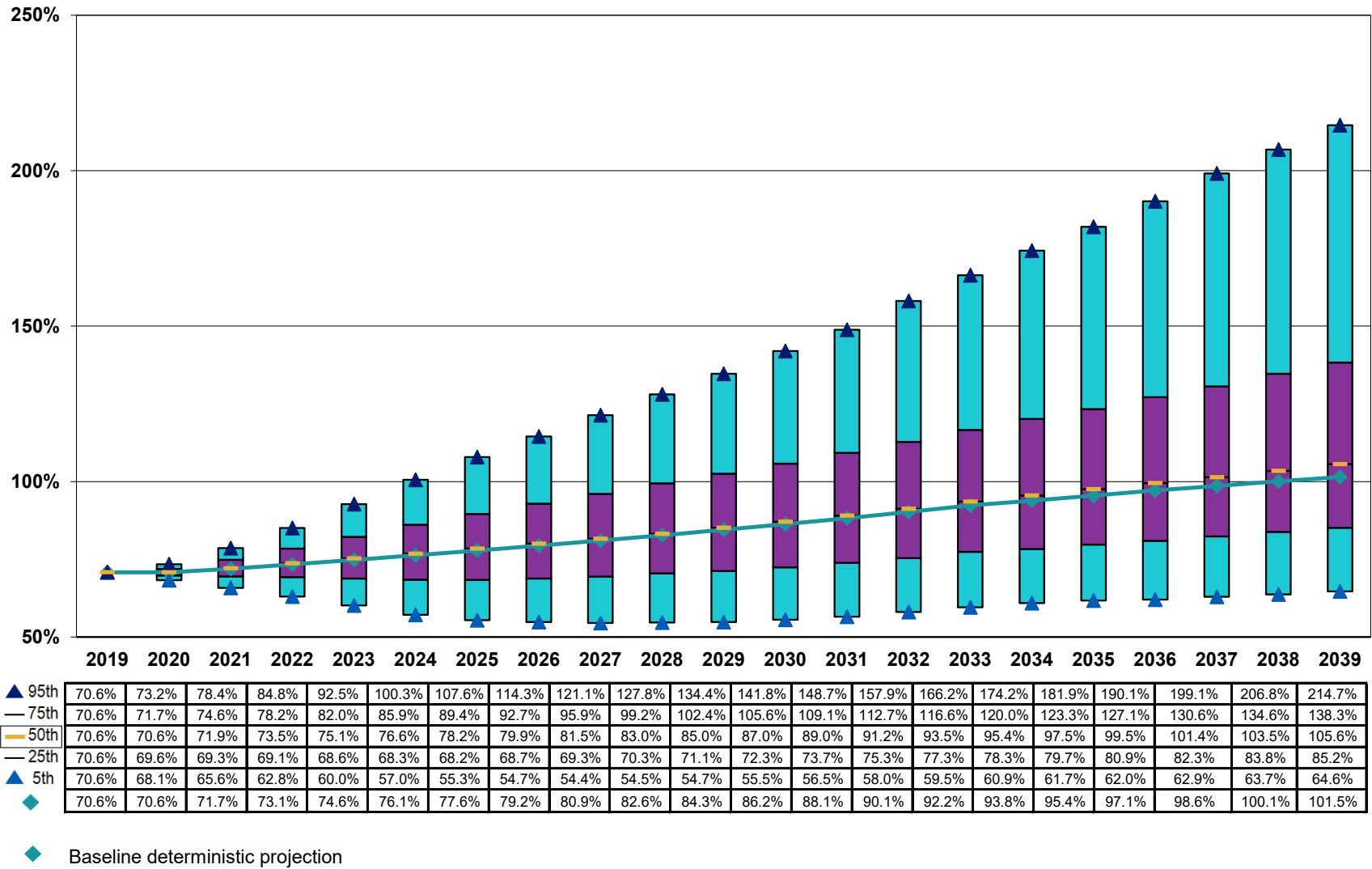
<u>Total Employer Rate Spike in a Single Year by</u>			
	3% of Payroll	5% of Payroll	7% of Payroll
Probability	11%	3%	1%

²⁰Under PEPPRA, the Association 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.

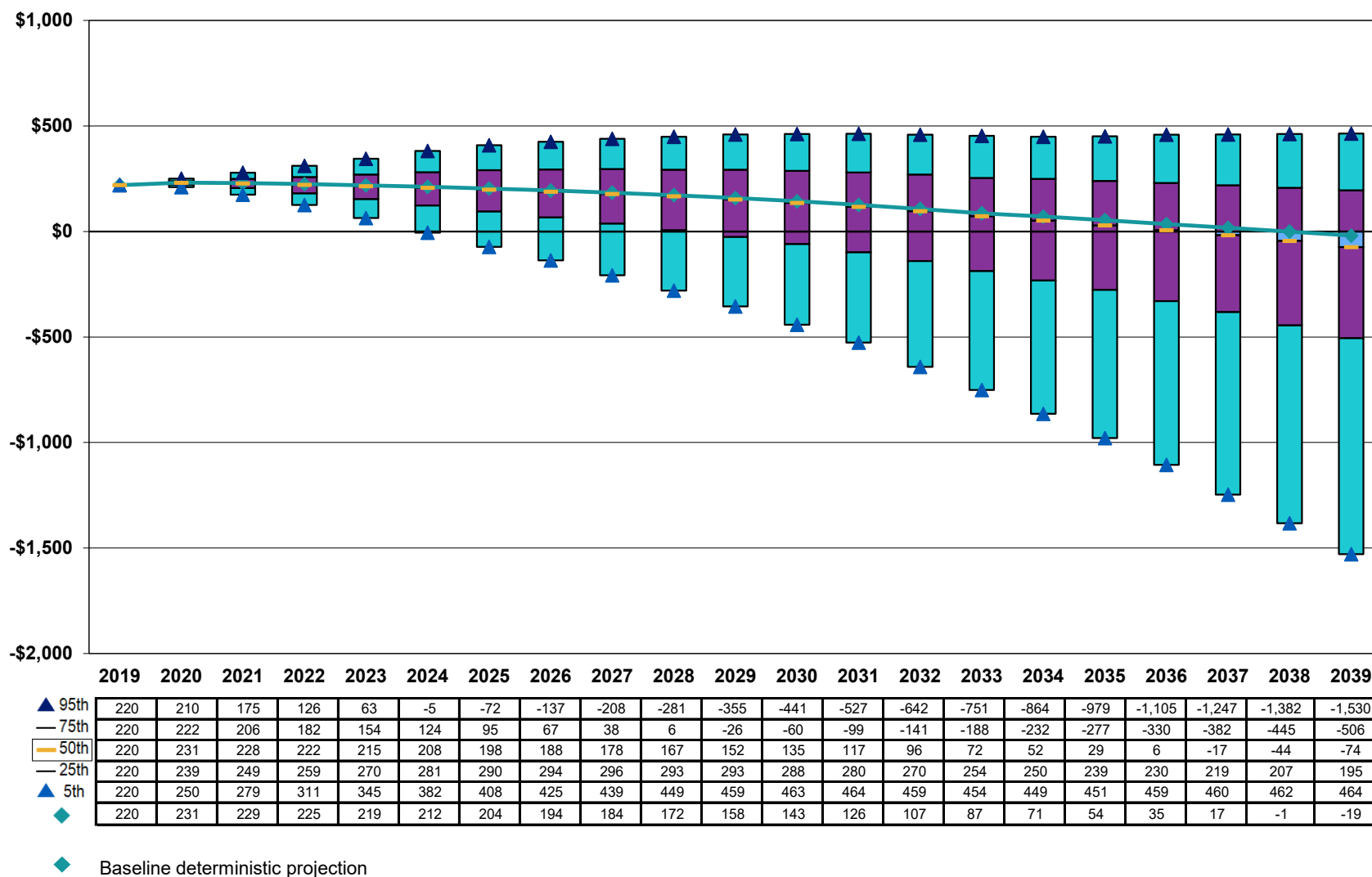
Projected Cumulative Investment Return for Plan Years Ending June 30



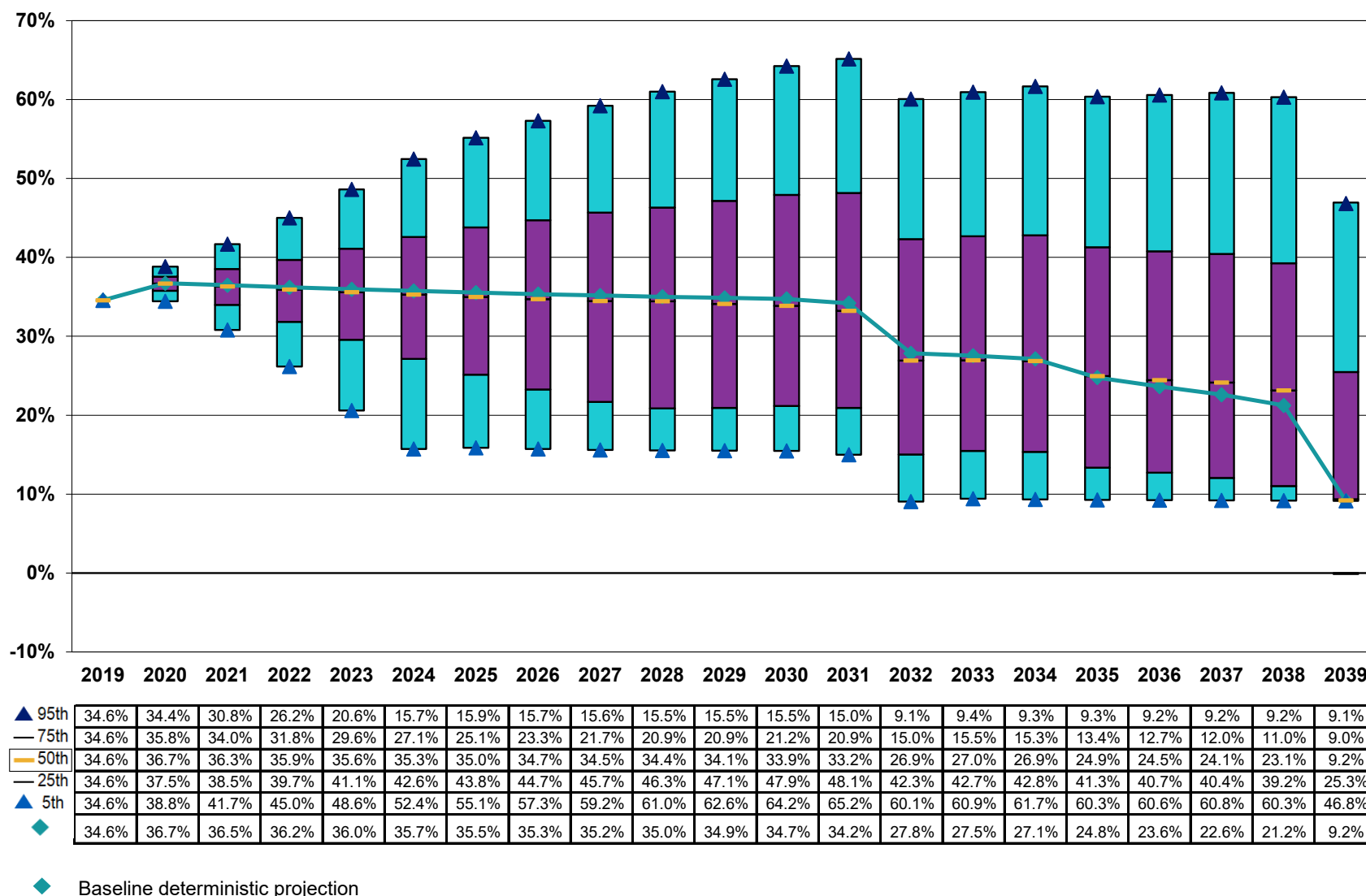
Projected Funded Ratios (on Actuarial Value of Assets Basis)



Projected UAAL (on Actuarial Value of Assets Basis)



Projected Employer Contribution Rates



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, MCERA has become more mature, indicated by the continued increase in the ratio of non-active to active members covered by the Association 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 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, MCERA's AVR was 7.5 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 7.5% of one year's payroll. Similarly, MCERA's LVR was 10.5 as of June 30, 2019, so a 1% liability gain or loss in 2019/2020 would amount to 10.5% of one year's payroll.²¹ Based on MCERA's policy to amortize actuarial experience over a period of 18 years, there would be a 0.6% 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.

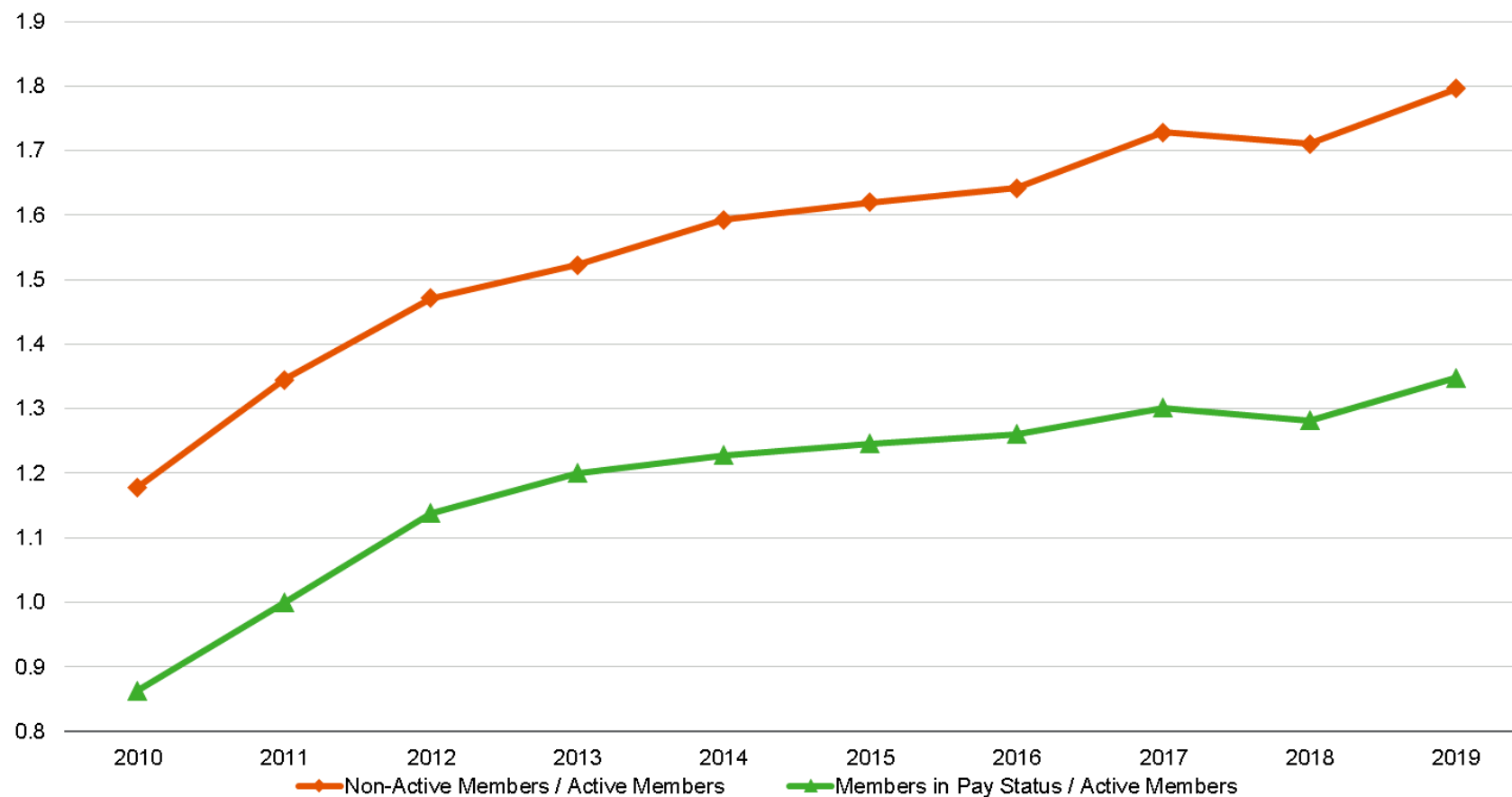
²¹ The 7.5 and 10.5 are the AVR and LVR, respectively, for the entire Association. There are considerable differences in those ratios for the General, Safety, and Probation membership groups.

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

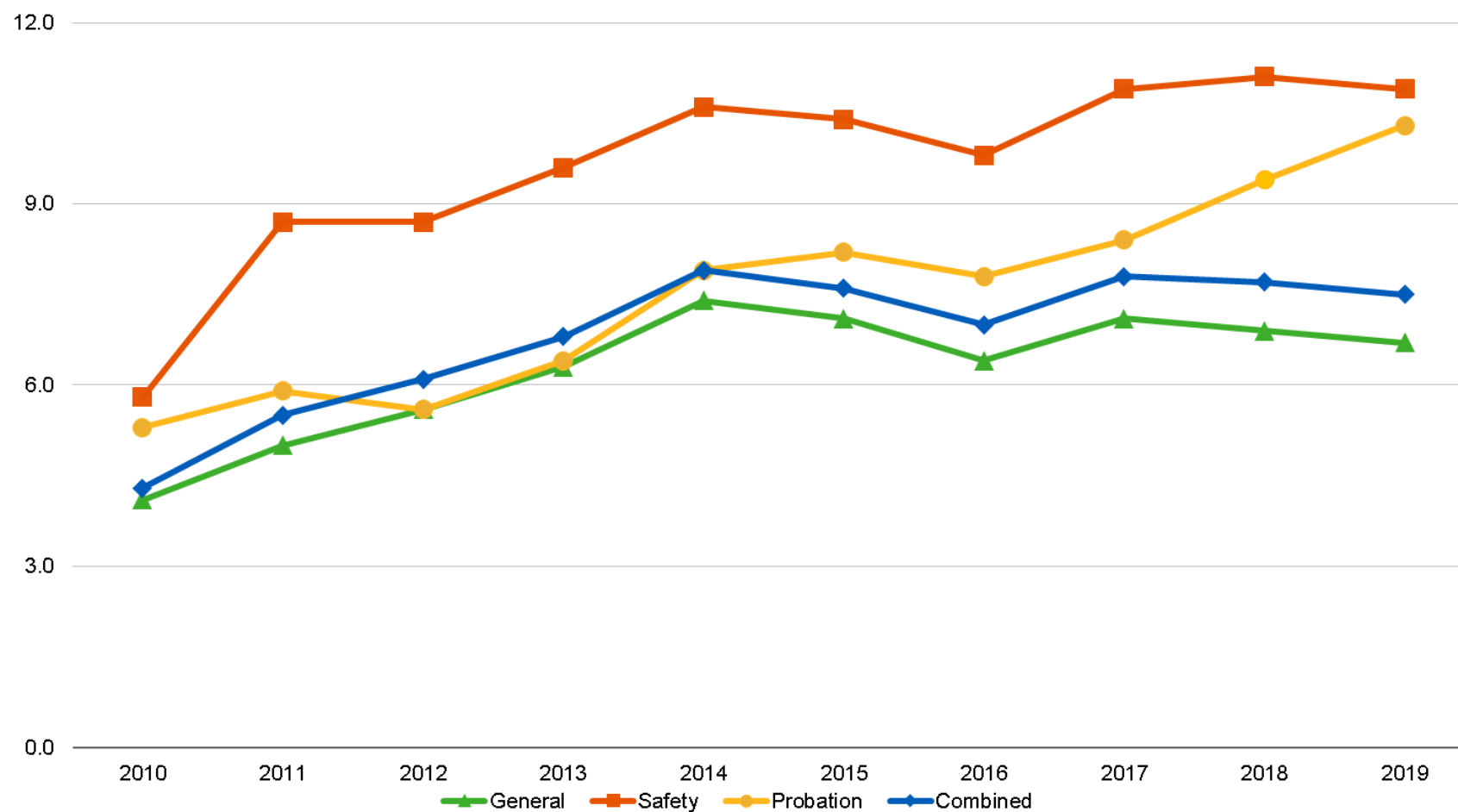
June 30, 2019

Employee Group	AVR	10% Loss Compares to	LVR	10% Loss Compares to
General	6.7	67% of payroll	9.4	94% of payroll
Safety	10.9	109% of payroll	15.6	156% of payroll
Probation	10.3	103% of payroll	13.0	130% of payroll
Combined	7.5	75% of payroll	10.5	105% of payroll

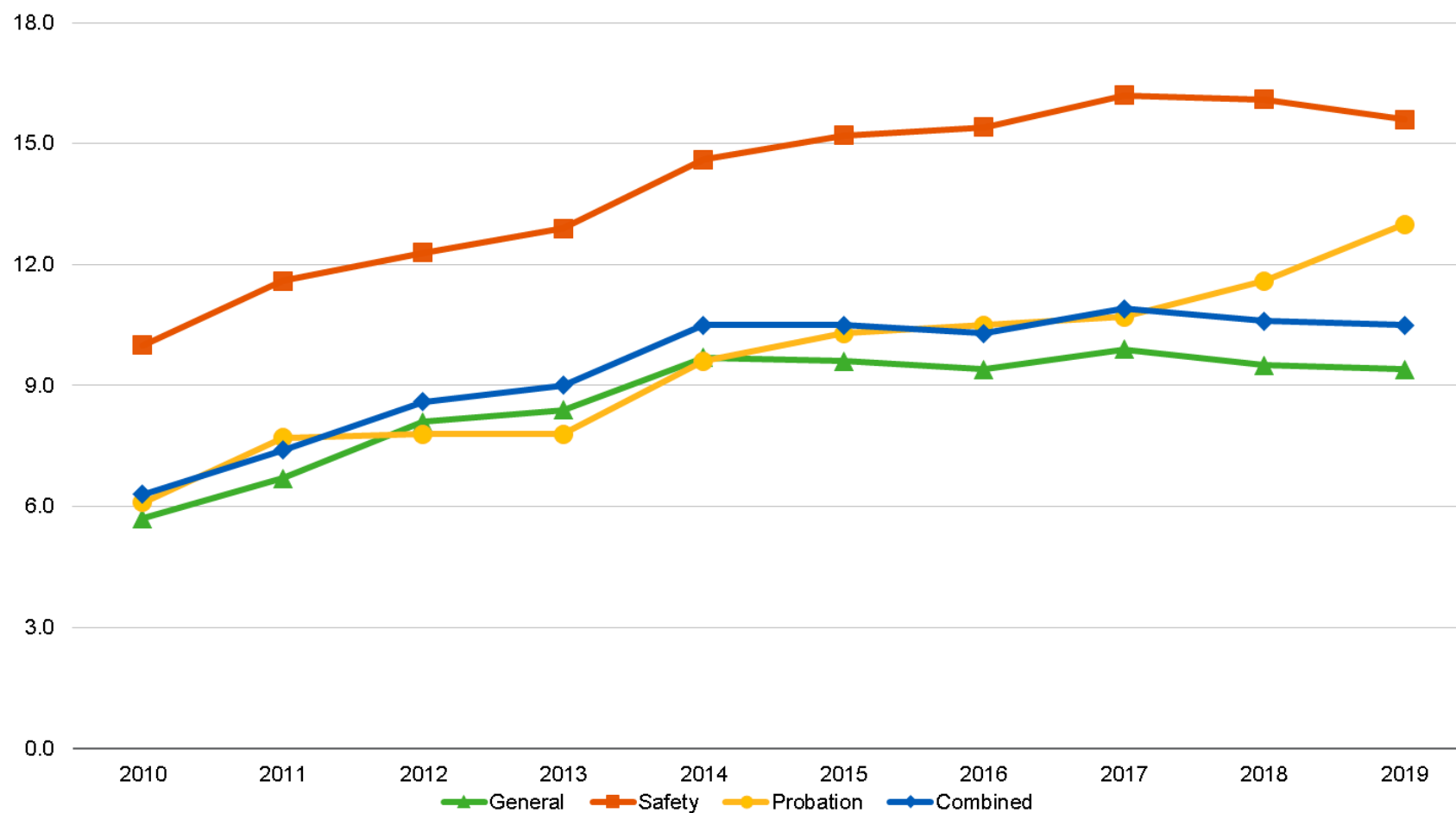
Ratios of Members in Pay-Status (Retirees and Beneficiaries) to Active Members &
Non-Active Members (Vested Terminated, Retirees and Beneficiaries) to Active Members
in June 30, 2010 to 2019 Valuations



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 & 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:

- The Board adopted the assumption changes recommended in our Actuarial Experience Study recommending assumptions for the June 30, 2020 valuation, including the annual 6.75% investment earnings and 3.25% active payroll growth assumptions. We have reflected those new assumptions in all of the projections.
- Retirement benefit formulas will remain unchanged.
- 1937 Act and PEPRA statutes will remain unchanged.
- UAAL amortization method will remain unchanged (i.e., 18-year layers and level percent of pay).
- Deferred investment gains and losses will be recognized over a 5-year period.
- Future experience at June 30, 2020 and thereafter will follow the recommended assumptions in our Actuarial Experience Study recommending assumptions for the June 30, 2020 valuation.
- For Scenario 4, the cost impact of the 2019 and 2020 negotiated salary increases will be recognized in the June 30, 2020 valuation. The cost impact of the 2021 negotiated salary increases will be recognized in the June 30, 2021 valuation.

Stochastic Projection

Besides the assumptions and methods discussed above for the deterministic projection, the following additional assumptions or parameters are used in projecting MCERA's 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 MCERA at the last triennial experience study and used by Segal to set the investment return assumption of 6.75% that will be applied in the June 30, 2020 valuation. That target asset allocation is as follows:

Asset Class	Target Allocation
U.S. Large Cap Equity	24.67%
U.S. Small Cap Equity	12.33%
Global ex-US Equity	25.00%
Core Bonds	21.00%
Real Estate	11.00%
Infrastructure	<u>6.00%</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 MCERA's investment portfolio.

²² That survey included responses from 34 investment advisors, including MCERA's investment advisor at Callan.

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
1 U.S. Large Cap Equity	7.94%	16.17%	1	0.86	0.83	0.15	0.48	0.50
2 U.S. Small Cap Equity	9.12%	20.15%	0.86	1	0.74	0.07	0.49	0.46
3 Global ex-US Equity	8.90%	18.23%	0.83	0.74	1	0.17	0.46	0.52
4 Core Bonds	4.06%	5.47%	0.15	0.07	0.17	1	0.16	0.21
5 Real Estate	7.54%	15.03%	0.48	0.49	0.46	0.16	1	0.41
6 Infrastructure	8.06%	14.39%	0.50	0.46	0.52	0.21	0.41	1

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.

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

²⁴These 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 investment expenses was 0.40%.

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 and Andy Yeung, ASA, MAAA, FCA, Enrolled Actuary. 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.



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Senior Vice President and Actuary



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Vice President and Actuary

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