Los Angeles City Employees' Retirement System

Risk Assessment

Including Review of Funded Status of the Retirement and Health Plans as of June 30, 2021

March 3, 2022

Paul Angelo, FSA, MAAA, FCA, EA
Andy Yeung, ASA, MAAA, FCA, EA
Todd Tauzer, FSA, MAAA, FCA, CERA

Segal

Table of Contents

Section 1: Introduction and Executive Summary

Introduction

The purpose of this report is to assist the Board of Administration,[1] participating employers and members and other stakeholders to better understand and assess the risk profile of the Los Angeles City Employees' Retirement System (LACERS), as well as the particular risks inherent in using a fixed set of actuarial assumptions in preparing the results in our June 30, 2021 funding valuations for LACERS.

The results included in our June 30, 2021 funding valuation reports for the Retirement and Health Plans were prepared based on a fixed set of economic and non-economic actuarial assumptions under the premise that future experience of LACERS would be consistent with those assumptions. While those assumptions are generally reviewed every three years (with the assumptions from the last triennial experience study adopted by the Board of Administration 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, 2021. 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, 2021. 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. In addition to the stochastic projections prepared for the next 20 years, Segal is available to prepare other projections of selected potential outcome scenarios upon request.

Actuarial Standard of Practice on Risk Assessment

The Actuarial Standards Board approved the Actuarial Standard of Practice No. 51 (ASOP 51) regarding risk assessment when performing a funding valuation and it was effective with LACERS' June 30, 2019 actuarial valuation for benefits

[1] This risk report has been prepared at the request of the Board of Administration to assist in administering the Fund. This risk report may not otherwise be copied or reproduced in any form without the consent of the Board of Administration 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.

provided by the Retirement Plan.[2] ASOP 51 requires actuaries to identify and assess risks that "may reasonably be anticipated to significantly affect the plan's future financial condition." Examples of key risks listed that are particularly relevant to LACERS 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 LACERS.

Plan Risk Assessment

In Section 2, we start by discussing some of the historical factors that have caused changes in LACERS' funded status and employer contribution rates. It is important to understand how the combination of decisions and experience has 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, based on our discussions with LACERS we have illustrated 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 System's portfolio coming in differently from the current 7.00% annual investment return assumption used in the June 30, 2021 valuations. We have also included a projection of future results based on a stochastic modeling of future investment returns for 2021/2022 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 Retirement and Health Plans and this information is included in this report.

[2] ASOP 51 does not actually apply to actuaries performing services related to other post-employment benefits; however, as the same kind of information is useful for the administration of the Health Plan, after discussions with LACERS the System has requested Segal to include information on the Health Plan in this risk report.

Executive Summary

Historical Funded Status and Employer Contribution Rates

The following table provides a summary of financial changes to the Retirement and Health Plans over the last 10 valuations by showing the beginning and ending year results over that period. The full set of results for each of the 10 years is provided in *Appendix D*.

The unfunded actuarial accrued liability (UAAL)[3] and contribution rates[4] increased primarily as a result of the strengthening of the actuarial assumptions used in preparing the valuations and unfavorable investment experience that were offset to some degree by favorable non-investment experience.

	Market Value Basis		Valuation Value Basis		Total (Aggregate) Employer Contribution Rate (% of Payroll – Contributions Received on July 15)
Valuation Date	Funded Status	UAAL	Funded Status	UAAL	
June 30, 2012	63.3%	$6.1B	69.4%	$5.1B	25.33%
June 30, 2021	84.7%	$4.1B	74.6%	$6.8B	33.31%

Future Funded Status and Employer Contribution Rates

In this report, we highlight key factors that may affect the financial profile of the Plans 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.

The total (aggregate) employer contribution rate is 33.31% of total payroll in the June 30, 2021 valuations. Using a deterministic projection, this report shows the effect of either unfavorable (0.00%) or favorable (14.00%) hypothetical market returns for 2021/2022 on key valuation results. In particular, the changes in the total employer contribution rate (relative to the June 30, 2021 valuation aggregate employer contribution rate of 33.31%) in the June 30, 2022 valuation

[3] For example, the UAAL increased by $920.7 million in the June 30, 2014 valuations, $461.9 million in the June 30, 2017 valuations, $593.6 million in the June 30, 2018 valuations, and $626.6 million in the June 30, 2020 valuations (for a total of $2.6B), as a result of the assumptions adopted by the Board following the economic assumptions study and the experience studies over the last ten years.

[4] For example, the increase in the employer's total rate (normal cost plus UAAL) was 3.20% in the June 30, 2014 valuations, 2.03% in the June 30, 2017 valuations, 2.09% in the June 30, 2018 valuations, and 3.94% in the June 30, 2020 valuations (for a total of 11.26%), as a result of the assumptions adopted by the Board following the economic assumptions study and the experience studies over the last ten years.

and in the June 30, 2028 valuation (when all the investment gains or losses are fully recognized at the end of the seven-year asset smoothing period) are as shown in the following table:[5]

	2021/2022 Single Plan-Year Investment Return		
Contribution Rate Change	**0.00%**	**7.00% (Baseline)**	**14.00%**
June 30, 2022	-1.2% of payroll	-2.0% of payroll	-2.9% of payroll
June 30, 2028	-7.9% of payroll	-14.4% of payroll	-20.9% of payroll

Under the hypothetical market return scenarios we have studied, the Retirement Plan is projected to reach full funding by around 2042 or 2043, and the Health Plan is projected to reach full funding before the Retirement Plan Note that under each of the hypothetical market return scenarios for 2021/2022, the total employer normal cost contribution rate would be expected to approach about 9.50% of payroll when both of the Retirement and Health Plans reach full funding.

Using a stochastic projection that models market return over the next 20 years by using expected return, standard deviation and other information about LACERS' asset portfolio,[6] there is a 50% chance that the employer contribution rates would be between 0% and 38% of payroll at the end of 10 years and between 0% and 39% of payroll at the end of 20 years. Furthermore, there is a 46% chance LACERS would be fully funded at the end of 10 years and 60% chance LACERS would be fully funded at the end of 20 years.

Plan Maturity Measures

During the past 10 valuations, the Plans have become more mature as evidenced by an increase in the ratio of members in pay status (retirees and beneficiaries) to active members (as shown in *Section 2, Charts 12a and 12b* on pages 31 and 32) and by an increase in the ratios of plan assets and liabilities to active member payroll (as shown in *Section 2, Charts 13a and 13b* on pages 33 and 34). 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 the Plans continue to mature with time, its risk profile will continue to evolve in this way and contributions will grow more sensitive to plan experience.

---

[5] Assuming no further assumption changes, method changes or experience that differs significantly from assumptions.

[6] For the stochastic modeling, we have used LACERS' target asset allocation that we used in developing the 7.00% expected investment return assumption we recommended to the Board for the June 30, 2020 valuations 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. For a detailed discussion regarding the target asset allocation used in the stochastic projections, see Appendix A, pages 37-38

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

Evaluation of Historical Trends – Retirement and Health Plans

Funded Status and UAAL

One common measure of LACERS' financial status is the funded ratio. This ratio compares the valuation[7] and market value of assets to the actuarial accrued liabilities (AAL)[8] of LACERS. After accounting for contributions made at the Actuarially Determined Contribution (ADC) amount, the overall level of funding of LACERS has remained relatively level as a result of favorable non-investment experience, offset by the change in actuarial funding method, the strengthening of the actuarial assumptions, and unfavorable investment experience. The funded ratios and UAAL are provided separately for the Retirement and Health Plans for the past 10 valuations from June 30, 2012 to 2021 measured using both valuation and market value of assets in *Charts 1a* and *1b*, respectively.

The factors that caused the changes in the UAAL for the past 10 valuations from June 30, 2012 to 2021 are provided separately for the Retirement and Health Plans in *Charts 2a* and *2b,* respectively.[9] The results in *Charts 2a* and *2b* show that the reductions in the investment return assumption in the June 30, 2014, 2017, and 2020[10] valuations, together with the changes in the mortality tables and other assumptions from the three triennial experience studies recommending assumptions used in the June 30, 2014, 2018, and 2020[10] valuations, have had the most impact on the UAAL for LACERS,[11] followed by the investment experience, especially during 2009 to 2013.

---

[7] The valuation value of assets is the portion of the total actuarial value of assets allocated for the Retirement and Health Plans. The actuarial value of assets is equal to the market value of assets less unrecognized returns in each of the last seven years. Unrecognized return is equal to the difference between the actual market return and the expected return on the market value, and is recognized over a seven-year period.

[8] 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 inactive vested members, the actuarial accrued liability is the single-sum present value of the lifetime benefit expected to be paid to those members.

[9] For the Health Plan, *Chart 2b* shows changes only for the past eight valuations, from June 30, 2014 to 2021, because detailed information regarding the change in UAAL is not readily available in Segal's valuation reports for June 30, 2012 and 2013.

[10] The Board has a practice of reviewing the investment return and other actuarial assumptions at the same time in the triennial experience study. However, the full (economic and demographic) 2017 experience study was delayed one year to 2018 to allow more time for Segal to study and the Board to discuss and approve the assumptions, and a 2017 study of only the economic assumptions was completed as part of the June 30, 2017 valuations.

[11] For example, for the Retirement and Health Plans combined, the UAAL increased $920.7 million in the June 30, 2014 valuations, $461.9 million in the June 30, 2017 valuations, $593.6 million in the June 30, 2018 valuations, and $626.6 million in the June 30, 2020 valuations (for a total of $2.6B), as a result of the assumptions adopted by the Board following the economic assumptions study and the experience studies over the last ten years.

Charts 2a and *2b* also show that the unfavorable investment experience was offset to some extent by favorable non-investment experience. The non-investment experience included lower than expected COLAs granted to retirees and beneficiaries, and lower than expected salary increases for continuing actives. The non-investment experience also included the scheduled 12-month delay in implementing the contribution rates determined in the annual valuation.

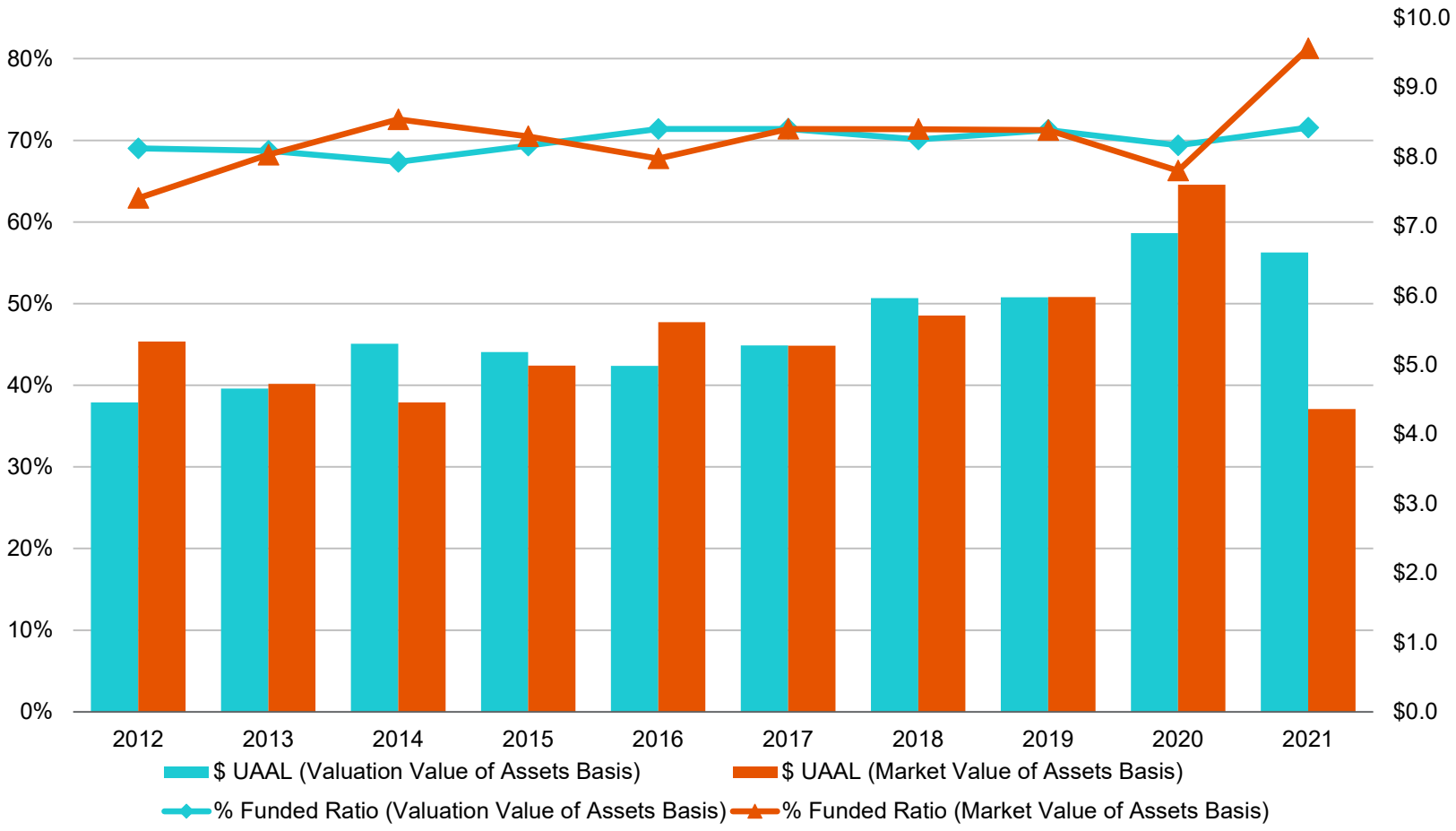
Finally, *Charts 2a and 2b* show some "negative amortization" due to the initial 30-year amortization of the combined base established June 30, 2012. The negative amortization from the combined base for the Pension Plan is not expected to continue after June 30, 2021. The negative amortization for the Health Plan will cease to appear in any year where that Plan is projected to become fully funded. (For instance, assuming a 7.00% market return for 2021/2022, the Health Plan is projected to become fully funded in the June 30, 2023 valuation.) Current assumptions and amortization policy generally will not entail negative amortization for any new UAAL identified in the future.

It is important to note that LACERS has strengthened the assumptions over time, particularly lowering the expected investment rate of return, utilizing a generational mortality assumption, and adopting a funding policy that controls future negative amortization. These changes may result in higher contributions in the short term, but in the medium to longer term avoid both deferring contributions and allowing unmanaged growth in the UAAL. We believe these actions are essential for LACERS' fiscal health going forward.

Chart 1a

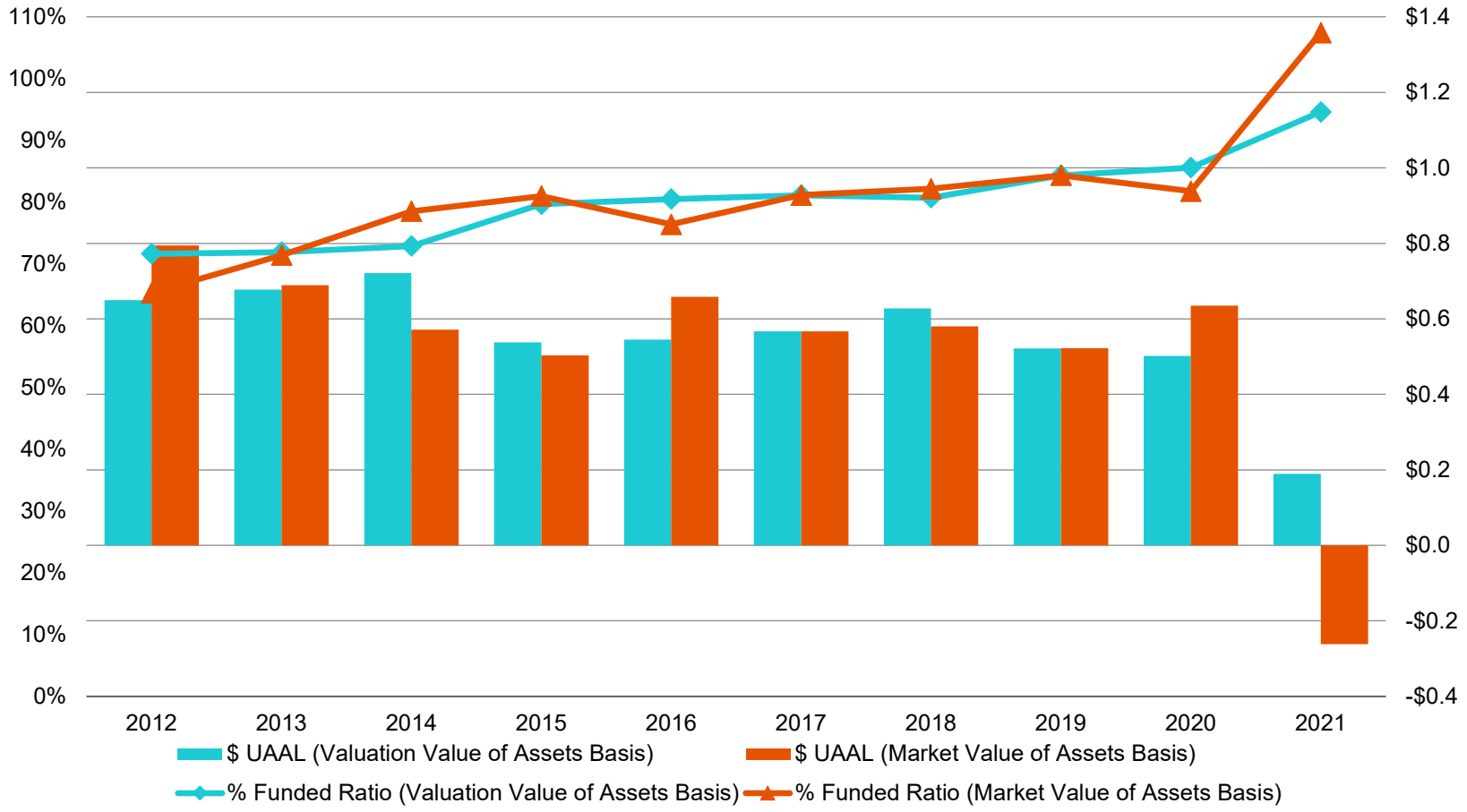
RETIREMENT PLAN

Funded Ratio (Percentages) and Dollar UAAL ($ Billions) in June 30, 2012 to 2021 Valuations



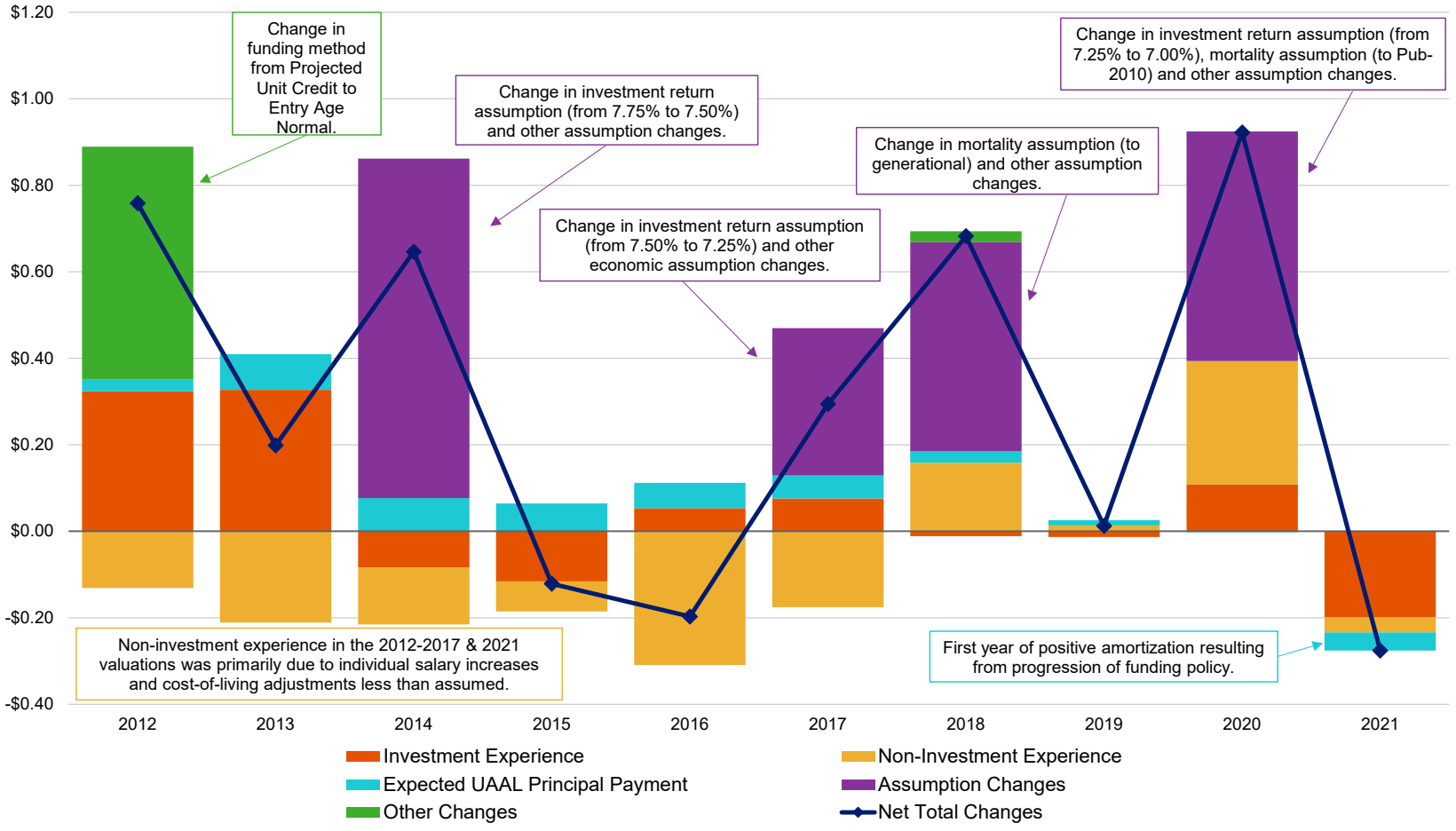
HEALTH PLAN

Funded Ratio (Percentages) and Dollar UAAL ($ Billions) in June 30, 2012 to 2021 Valuations



RETIREMENT PLAN

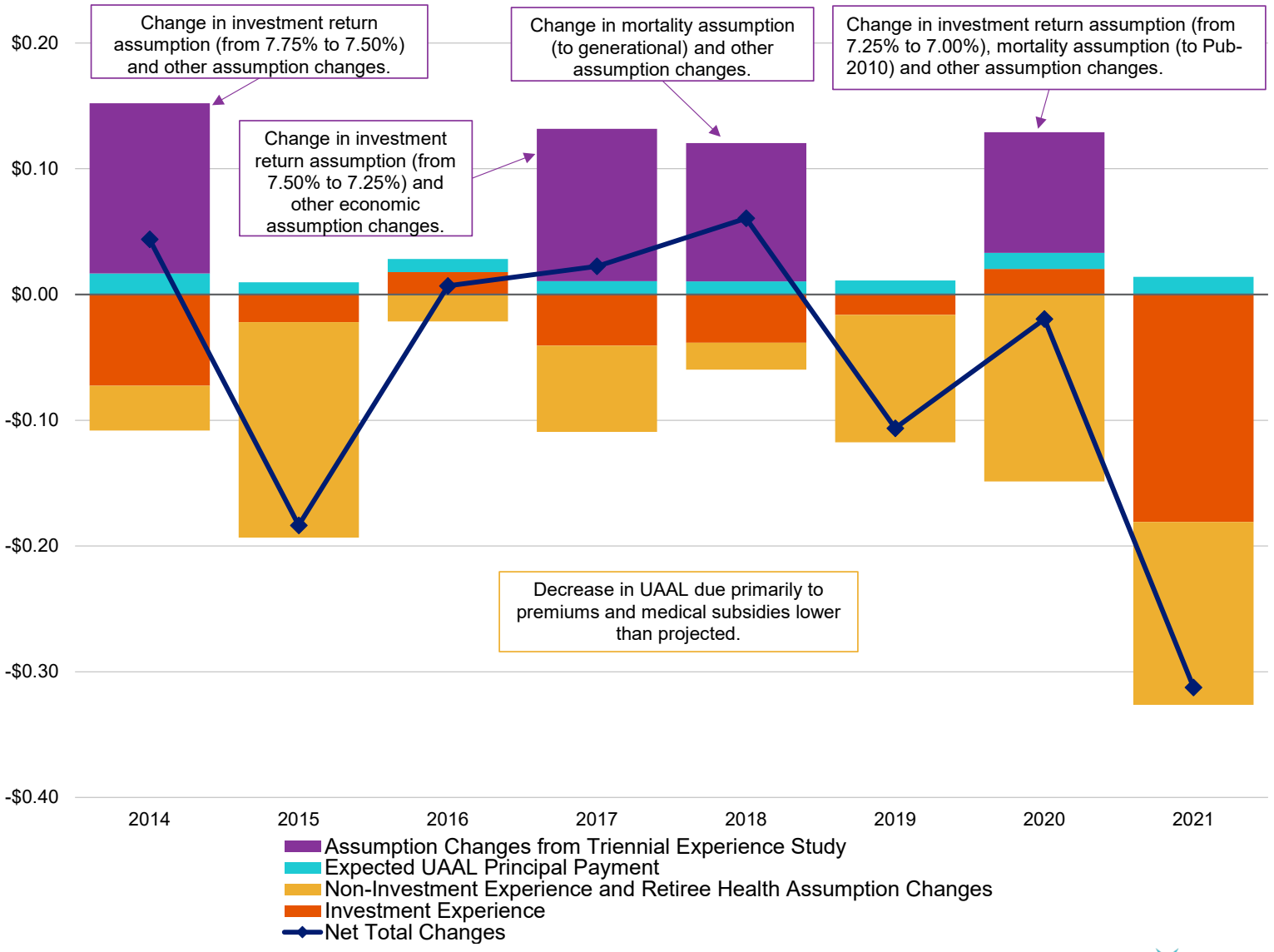
Factors that Changed UAAL in June 30, 2012 to 2021 Valuations ($ Billions)



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.

HEALTH PLAN

Factors that Changed UAAL in June 30, 2014 to 2021 Valuations ($ Billions)



Employer Contribution Rates

The total (normal cost[12] plus UAAL payment) employer contribution rates determined in the June 30, 2012 to 2021 valuations for the Retirement and Health Plans are provided in *Charts 3a* and *3b*, respectively, and the factors that caused the changes in the total aggregate employer rates[13] for the Retirement and Health Plans are provided in *Charts 4a and 4b*, respectively.

The aggregate employer normal cost rates for the Retirement and Health Plans as shown in *Charts 3a* and *3b* have stayed relatively flat since the June 30, 2012 valuation. For the Retirement Plan, the UAAL rate generally increased between the June 30, 2012 and the June 30, 2021 valuations primarily due to unfavorable investment experience and changes in actuarial assumptions. While there have also been increases in the normal cost rates due to the changes in the actuarial assumptions, those increases were offset to some degree by the plan changes – with the introduction of Tier 3 – as new members have been enrolled in the lower cost benefit tier since February 21, 2016. Furthermore, beginning with the June 30, 2012 valuation, an additional employee contribution (either 2% or 4%, becoming 4% for all affected employees effective January 1, 2013) was implemented by the City for certain bargaining groups and for all non-represented employees.[14] For the Health Plan, the UAAL rate generally decreased between the June 30, 2012 and the June 30, 2021 valuations. The primary sources of the decrease include health related assumption changes and other actuarial experience (primarily medical premiums and subsidies lower than projected).

For the Retirement Plan, *Chart 4a* shows that the changes in the investment return, mortality table and other assumptions have had the most impact on increasing the UAAL contribution rates[15] for the City. The next greatest impact was from the investment experience during 2012 to 2021. Favorable non-investment experience and additional required member contributions have partially offset the contribution rate increases during 2012 to 2020.

For the Health Plan, *Chart 4b* shows that the non-investment experience[16] (primarily medical premiums and subsidies lower than projected) has had the most impact on decreasing the UAAL contribution rates[15] for the City, offset somewhat from changes in the investment return, mortality tables and other assumptions.

---

[12] The normal cost is the amount of contributions required to fund the portion of the level cost of the member's projected retirement and health benefits that is allocated to the current year of service.

[13] There are separate contribution rates determined in the valuation for Tier 1 and Tier 3 (previously Tier 2, through the June 30, 2015 valuation). The aggregate contribution rates have been calculated based on an average of those rates weighted by the payrolls of the active members reported in those valuations.

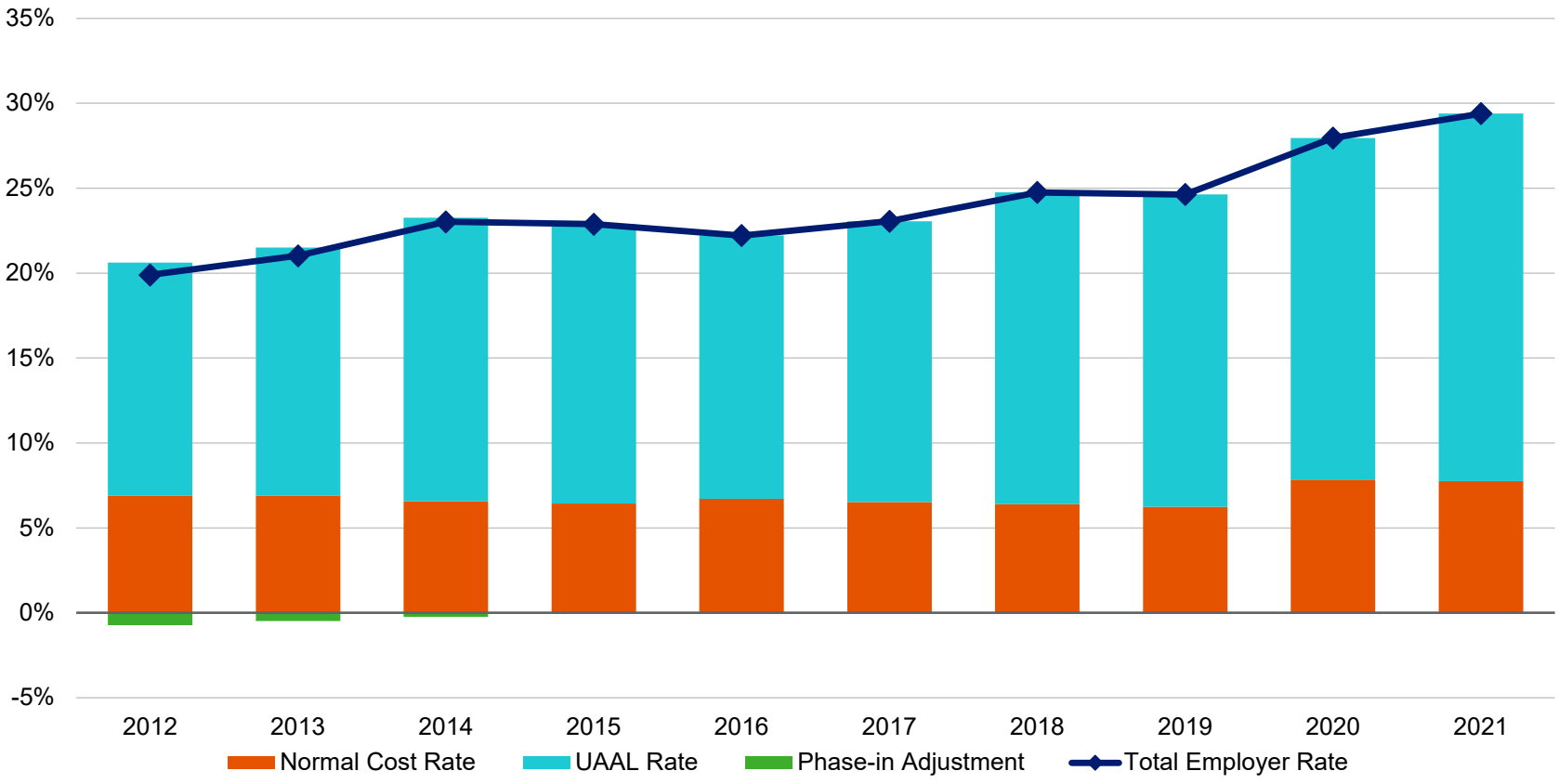
[14] As of the June 30, 2012 valuation, roughly 95% of active members were required to pay an additional member contribution rate. By the June 30, 2020 valuation, all active members were paying an additional member contribution rate (which was increased to 4.5% for less than 1% of active members).

[15] For example, for the Retirement and Health Plans combined, the increase in the employer's total rate (normal cost plus UAAL) was 3.20% in the June 30, 2014 valuations, 2.03% in the June 30, 2017 valuations, 2.09% in the June 30, 2018 valuations, and 3.94% in the June 30, 2020 valuations (for a total of 11.26%), as a result of the assumptions adopted by the Board following the economic assumptions study and the experience studies over the last ten years.

[16] Includes the impact of the annual review and adjustment of the medical trend assumptions.

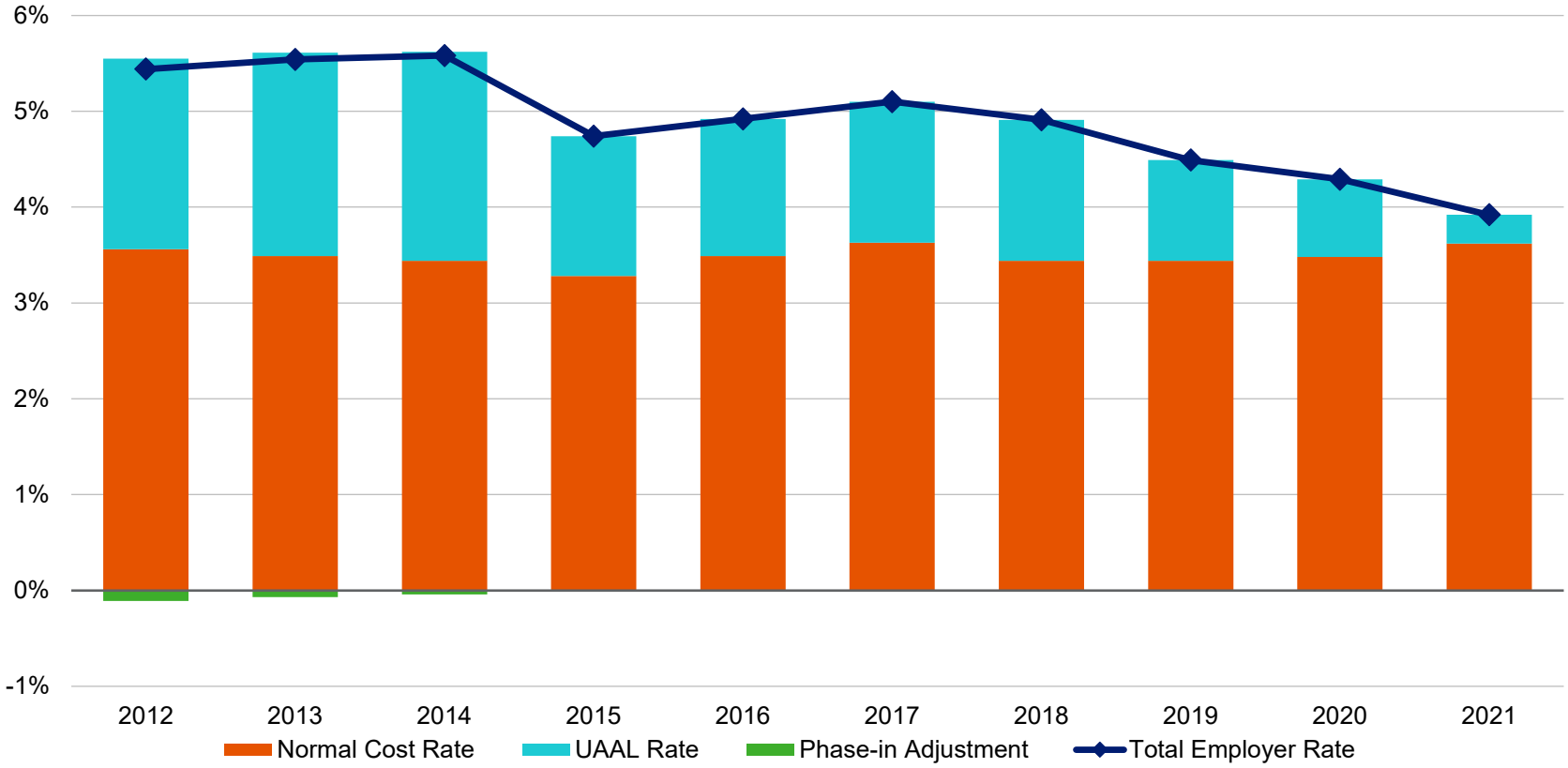
RETIREMENT PLAN

Employer Contribution Rates in June 30, 2012 to 2021 Valuations
(% of Payroll – Contributions Received on July 15)



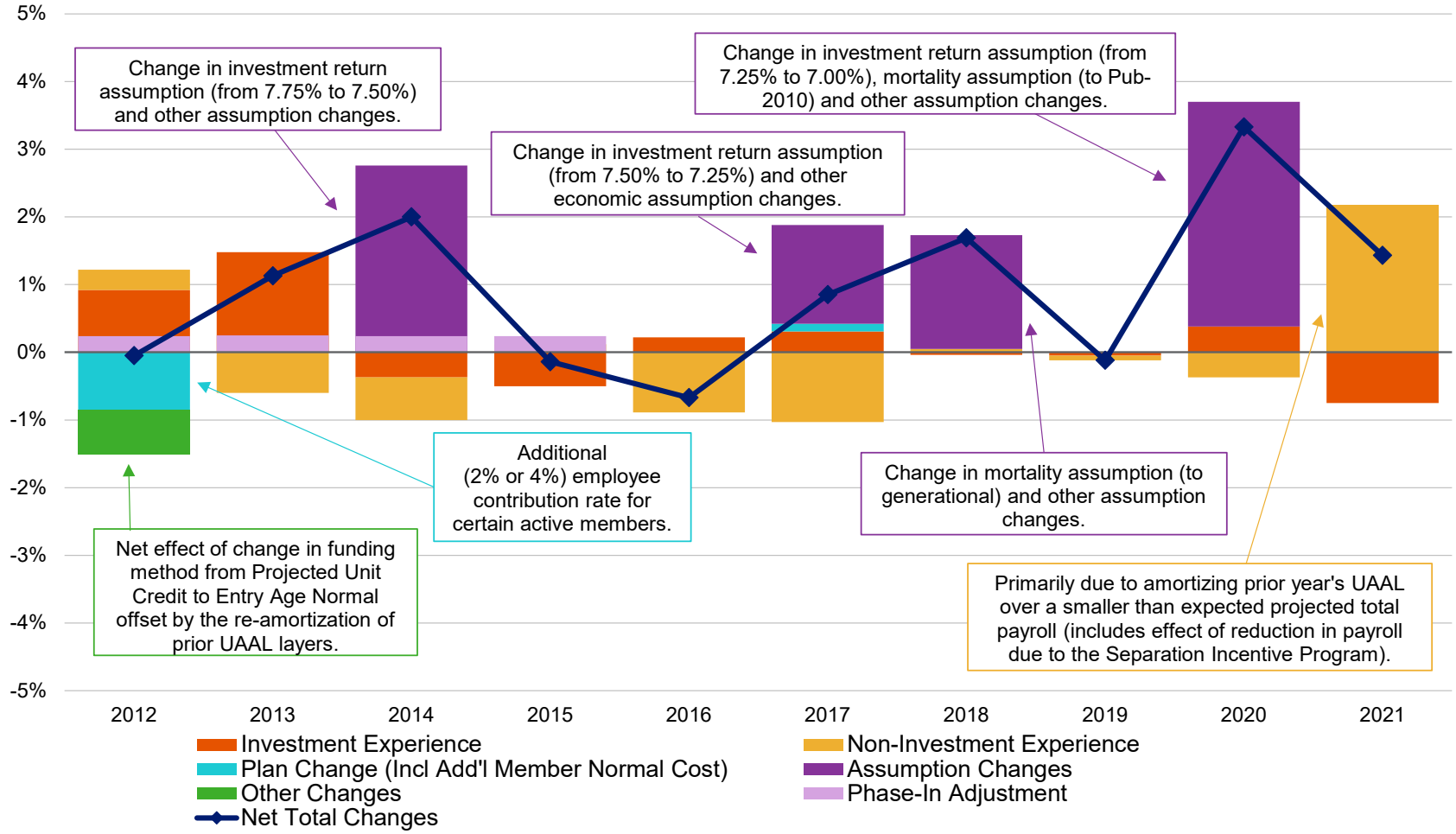
HEALTH PLAN

Employer Contribution Rates in June 30, 2012 to 2021 Valuations
(% of Payroll – Contributions Received on July 15)



RETIREMENT PLAN

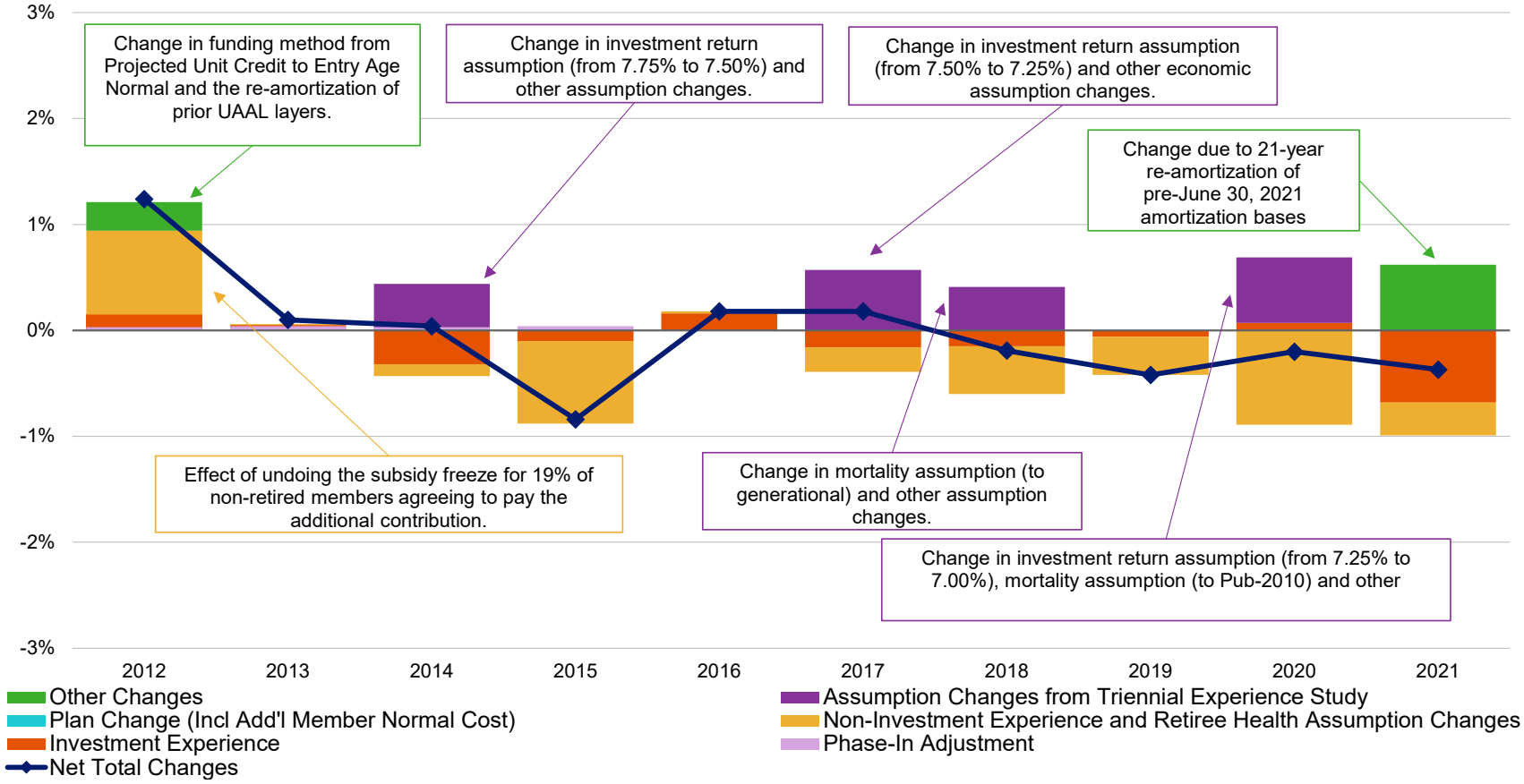
Factors that Affected Employer Contribution Rates in June 30, 2012 to 2021 Valuations (% of Payroll – Contributions Received on July 15)



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.

HEALTH PLAN

Factors that Affected Employer Contribution Rates in June 30, 2012 to 2021 Valuations (% of Payroll – Contributions Received on July 15)



Assessment of Primary Risk Factors Going Forward

As discussed in the Evaluation of Historical Trends section, in the 2012 to 2021 valuations the funded ratios and the employer contribution rates have changed mainly as a result of changes in actuarial assumptions, investment experience, and non-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 LACERS 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 City the effect of unfavorable or favorable actuarial experience on the assets and the liabilities of LACERS.

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

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

  The Board has a policy of reviewing the investment return and the other actuarial assumptions generally every three years, the next triennial experience study (recommending assumptions for the June 30, 2023 actuarial valuations) is scheduled to be performed in 2023.

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

  For the Retirement Plan, the change in the merit and promotion salary increase assumption was the most significant change to the non-economic assumptions in the last experience study conducted before the June 30, 2020 valuation. As can be observed from *Charts 2a, 2b, 4a,* and *4b*, there had been relatively small unfavorable 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. The City has a well-established practice of making the ADC determined in the annual actuarial valuations, based on the Board of Administration's Actuarial Funding Policy. As a result, in practice LACERS has essentially no contribution risk.

  Furthermore, when ADCs determined in accordance with the LACERS Actuarial Funding Policy are made in the future by the City (and contributions required by the Administrative Code 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 valuations of your Plans' liabilities are not linked directly to market interest rates so the resulting interest rate risk exposure is minimal.

Note that other events that could affect costs going forward, such as future plan changes, are not included herein.

Scenario Tests: Deterministic Projections

Because 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 LACERS associated with earning either lower or higher than the assumed rate of 7.00% in future valuations using projections under a deterministic approach.

To measure such risk, we have included scenario tests to study the change in the UAAL and contribution rates if LACERS were to earn a market return lower or higher than 7.00% in the next year following the June 30, 2021 valuations. In *Charts 5, 6* and *7*, we show the aggregate employer contribution rates, funded ratios, and UAAL respectively assuming that the System's portfolio market return in 2021/2022 will be as follows:

Scenario 1: 0.00%
Scenario 2: 7.00% (baseline)
Scenario 3: 14.00%.

In the past, LACERS allowed us to assist the City in their budgeting process by providing a 6-year illustration of the financial position of LACERS assuming the System was to earn the assumed rate of investment return in all future years. The detailed employer contribution rates, funded ratios and UAAL developed for each of the Retirement and Health Plans, and in total, under the baseline Scenario 2, are provided in *Appendix C* of this report for this reason. We note that for the Health Plan, the UAAL contribution rate is expected to be negative (a credit) in the 2022 valuation even though there would still be a positive UAAL amount in that year. This is primarily due to the pre-June 30, 2021 UAAL in the June 30, 2021 valuation being amortized over a period that is longer (i.e., 21 years) than the experience gains from June 30, 2021 and June 30, 2022.[17] For purposes of these projections, and consistent with the Plan's funding policy, we have amortized the entire UAAL as of June 30, 2022 over a 20-year period[18]. The Board could make an adjustment to its funding policy so that the amortization period for experience gains and losses is the greater of 15 years or the remaining period of the pre-6/30/2021 combined base from the June 30, 2021 valuation. We will bring this topic back for further discussion with the Board before the June 30, 2022 valuations once the market return for 2021/2022 becomes available.

The following table summarizes for the Retirement and Health Plans the resulting aggregate contribution changes (relative to the June 30, 2021 valuation aggregate employer contribution rate of 33.31%) in the immediately next valuation as well as in the June 30, 2028 valuations when all of the investment gains and losses are fully recognized in the (smoothed) actuarial value of assets.

[17] This anomaly is also expected for the OPEB Plan Scenario 1 with a 0.00% return for 2021/2022 and we have amortized the entire UAAL over the remaining period of the combined pre-June 30, 2021 base (i.e., 20 years as of June 30, 2022) for the valuation years when the total UAAL contribution rate would have become negative (credit).

[18] 20 years matches the remaining duration of the "Total Pre-June 30, 2021 bases" as of June 30, 2022.

	2021/2022 Single Plan-Year Investment Return		
Contribution Rate Change	**0.00%**	**7.00% (Baseline)**	**14.00%**
June 30, 2022	-1.2% of payroll	-2.0% of payroll	-2.9% of payroll
June 30, 2028	-7.9% of payroll	-14.4% of payroll	-20.9% of payroll

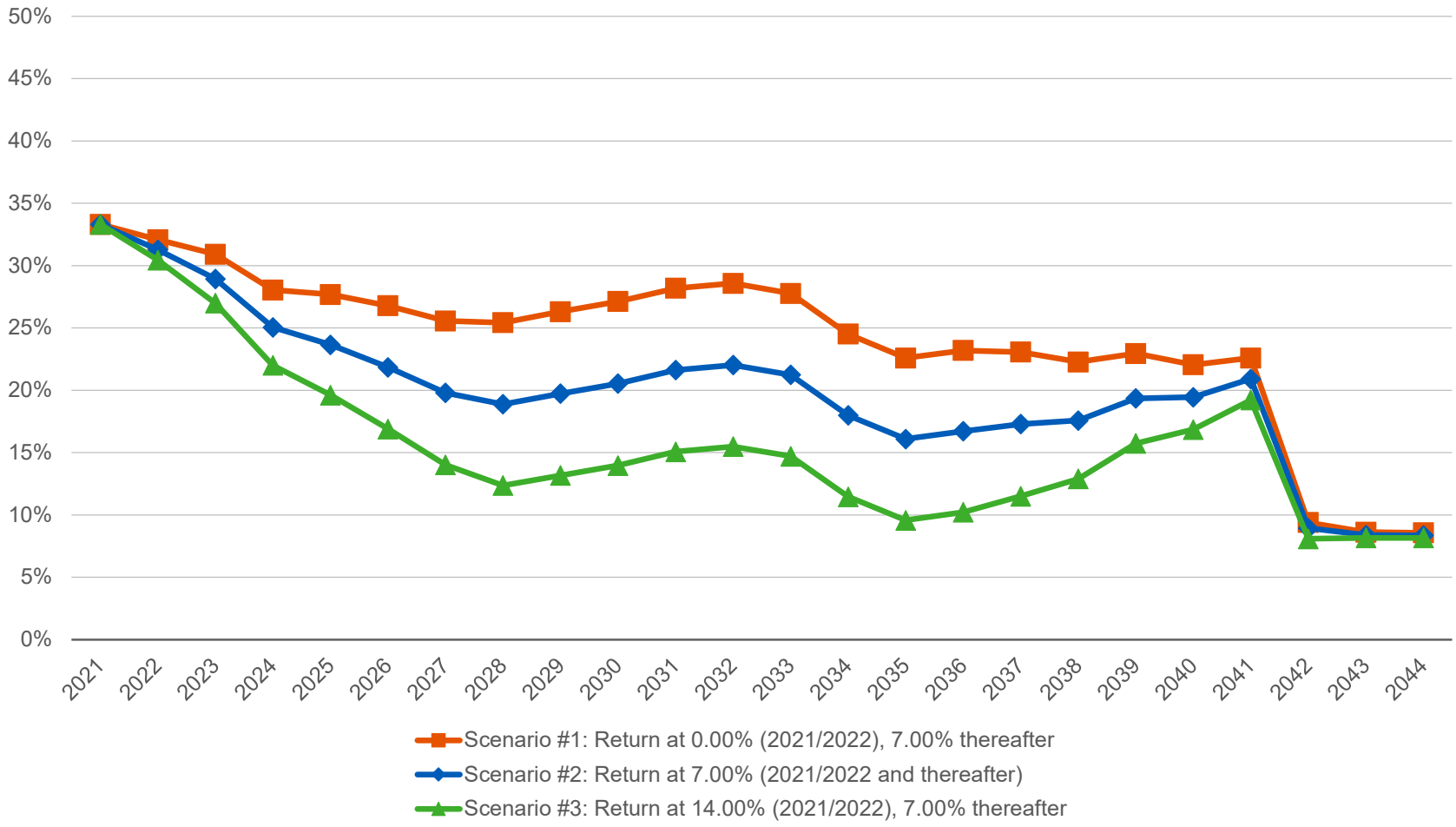
Under the hypothetical market return scenarios we have studied, the Retirement Plan is projected to reach full funding by around 2042 or 2043, and the Health Plan is projected to reach full funding before the Retirement Plan. Note that under each of the hypothetical market return scenarios for 2021/2022, the total employer normal cost contribution rate would be expected to approach about 9.50% of payroll when both of the Retirement and Health Plans reach full funding.

While we have not assigned a probability on the 2021/2022 market return coming in at these rates, the Board and other stakeholders monitoring LACERS can interpolate between these scenarios to estimate the funded status and employer contribution rates for the June 30, 2022 and next several valuations as the actual investment experience for the 2021/2022 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.

Chart 5

RETIREMENT AND HEALTH PLANS

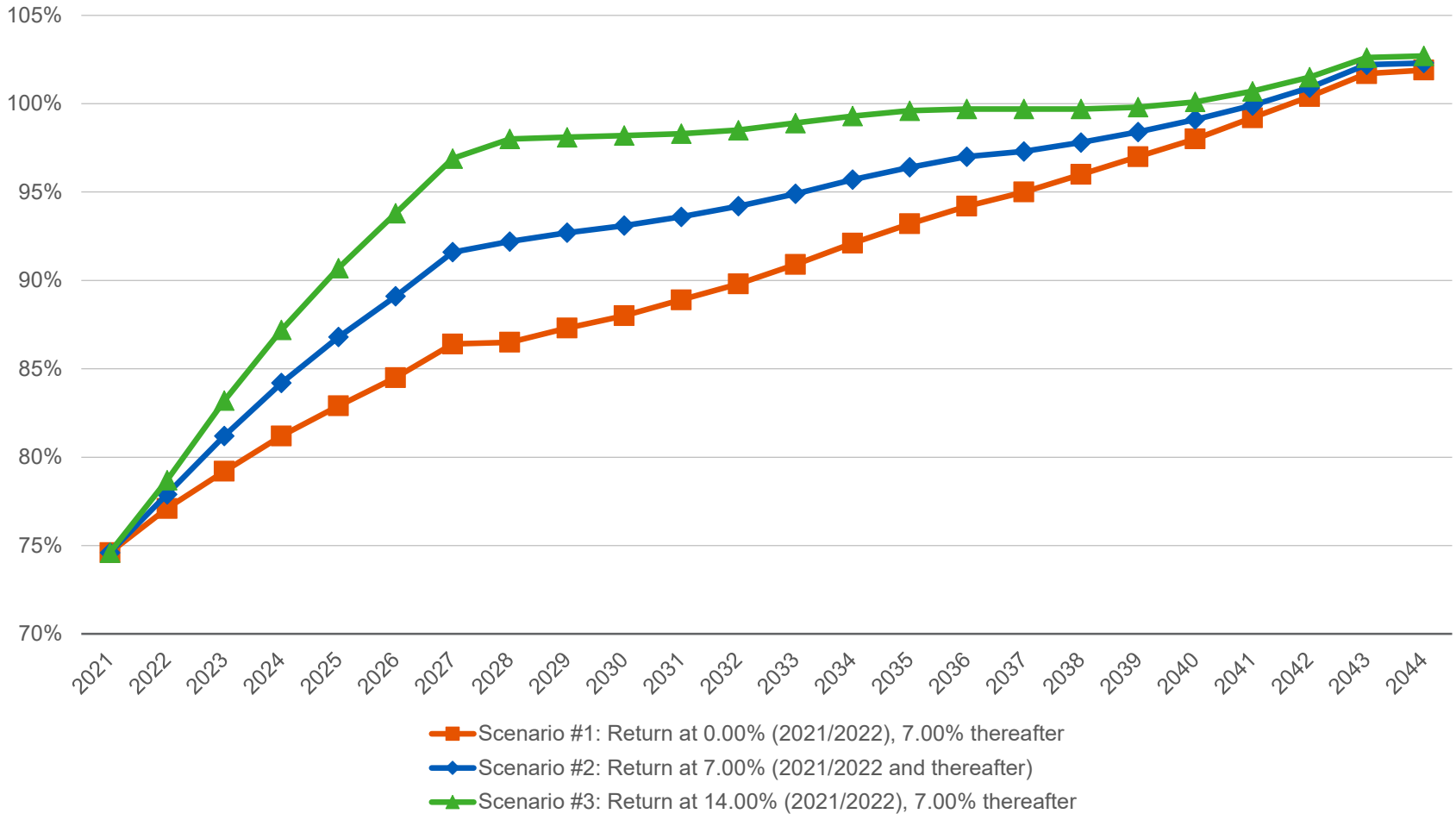
Projected Employer Contribution Rates
Under Three Hypothetical Market Return Scenarios for 2021/2022
for the June 30, 2021 to 2044 Valuations (% of Payroll – Contributions Received on July 15)



Note: The total employer normal cost contribution rate would be expected to approach about 9.50% of payroll when both of the Retirement and Health Plans reach full funding.

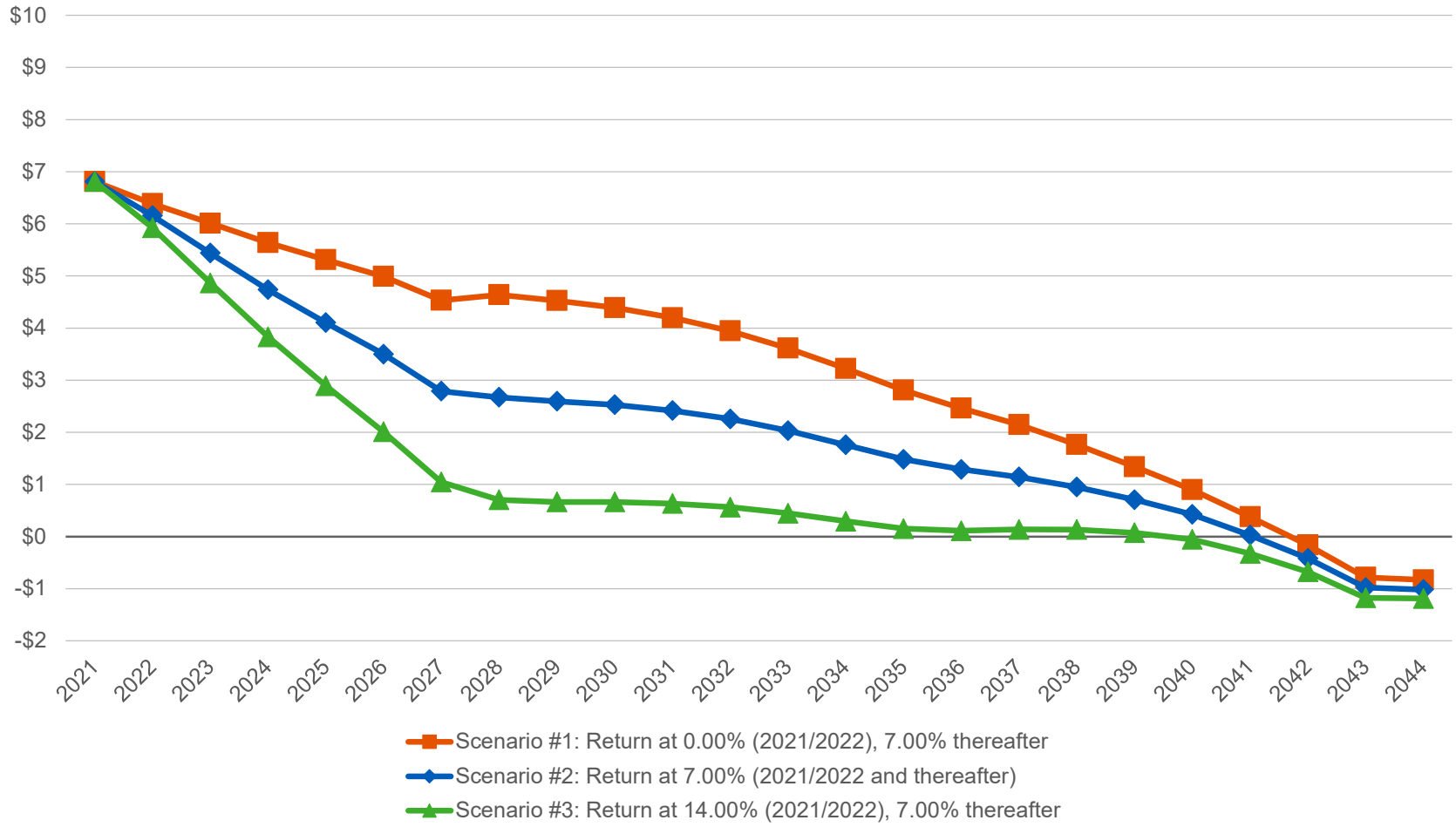
RETIREMENT AND HEALTH PLANS

Projected Funded Ratios (on Valuation Value of Assets) Under Three Hypothetical Market Return Scenarios for 2021/2022 for the June 30, 2021 to 2044 Valuations



RETIREMENT AND HEALTH PLANS

Projected UAAL (on Valuation Value of Assets)
Under Three Hypothetical Market Return Scenarios for 2021/2022
for the June 30, 2021 to 2044 Valuations ($ Billions)



Stochastic Projection

Based on our discussions with LACERS, 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, 2021 valuations. We have performed the stochastic modeling of future market returns using the expected return, standard deviation and other information about LACERS' asset portfolio[19] 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 LACERS' 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. The results in *Charts 9 – 11* are for the Retirement and Health Plans combined.

At the end of 20 years, there is a 50% chance[20] that the annual return of LACERS' investment portfolio would average between 5.5% and 9.4%, the funded ratio would be between 86% and 151% and the corresponding UAAL would be between $6.5 billion and a surplus (or a negative UAAL) of $22.9 billion.

On an Actuarial (smoothed) Value of Assets basis, the funded ratio for the Retirement and Health Plans combined is about 74.6% as of the June 30, 2021 valuation. There is a 46% chance LACERS would be fully funded at the end of 10 years and a 60% chance LACERS would be fully funded at the end of 20 years. 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	27%	12%	3%

The total employer contribution rate is about 33% of payroll based on the June 30, 2021 valuations. 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, 2031 valuation), there is a 50% chance that the employer contribution rates would be between 0% and 38% of payroll. At the end of 20 years (i.e., the June 30, 2041 valuation), there is a 50% chance that the employer contribution

[19] For the stochastic modeling, we have used LACERS' target asset allocation that we used in developing the 7.00% expected investment return assumption we recommended to the Board for the June 30, 2020 valuations 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. For a detailed discussion regarding the target asset allocation used in the stochastic projections, see Appendix A, pages 37-38.

[20] This is based on the 25th to the 75th percentile results.

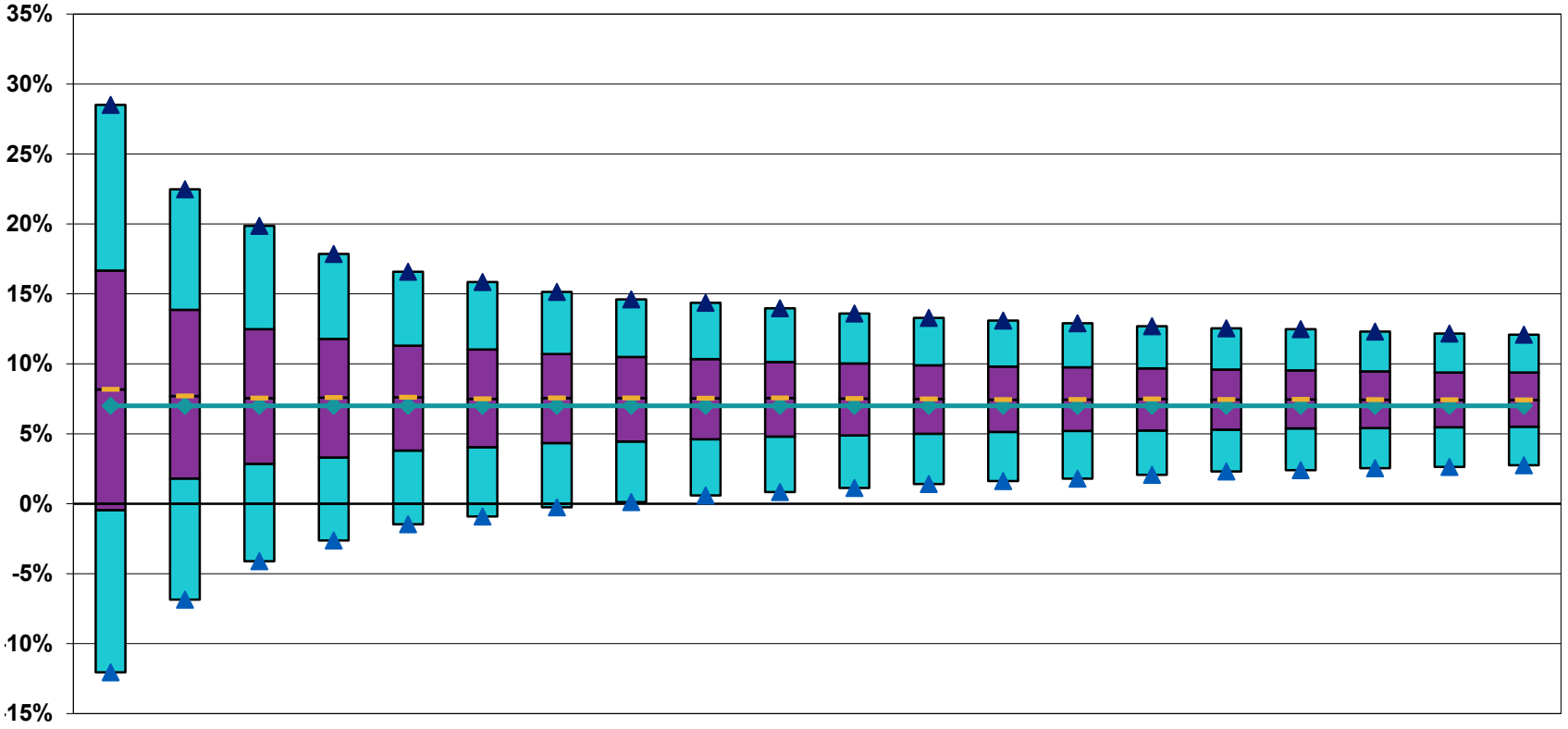
rates would be between 0% and 39% of payroll. The probabilities that the total employer contribution rate would increase at least by 5%, 10% or 15% of payroll at any point in the next 20 years are as follows:

	Total Employer Rate Increases by at least		
	5% of Payroll (to 38% of Payroll)	**10% of Payroll (to 43% of Payroll)**	**15% of Payroll (to 48% of Payroll)**
Probability	41%	35%	30%

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 Spikes in a Single Year by		
	2% of Payroll	**4% of Payroll**	**6% of Payroll**
Probability	22%	11%	5%

Projected Cumulative Investment Return for Plan Years Ending June 30

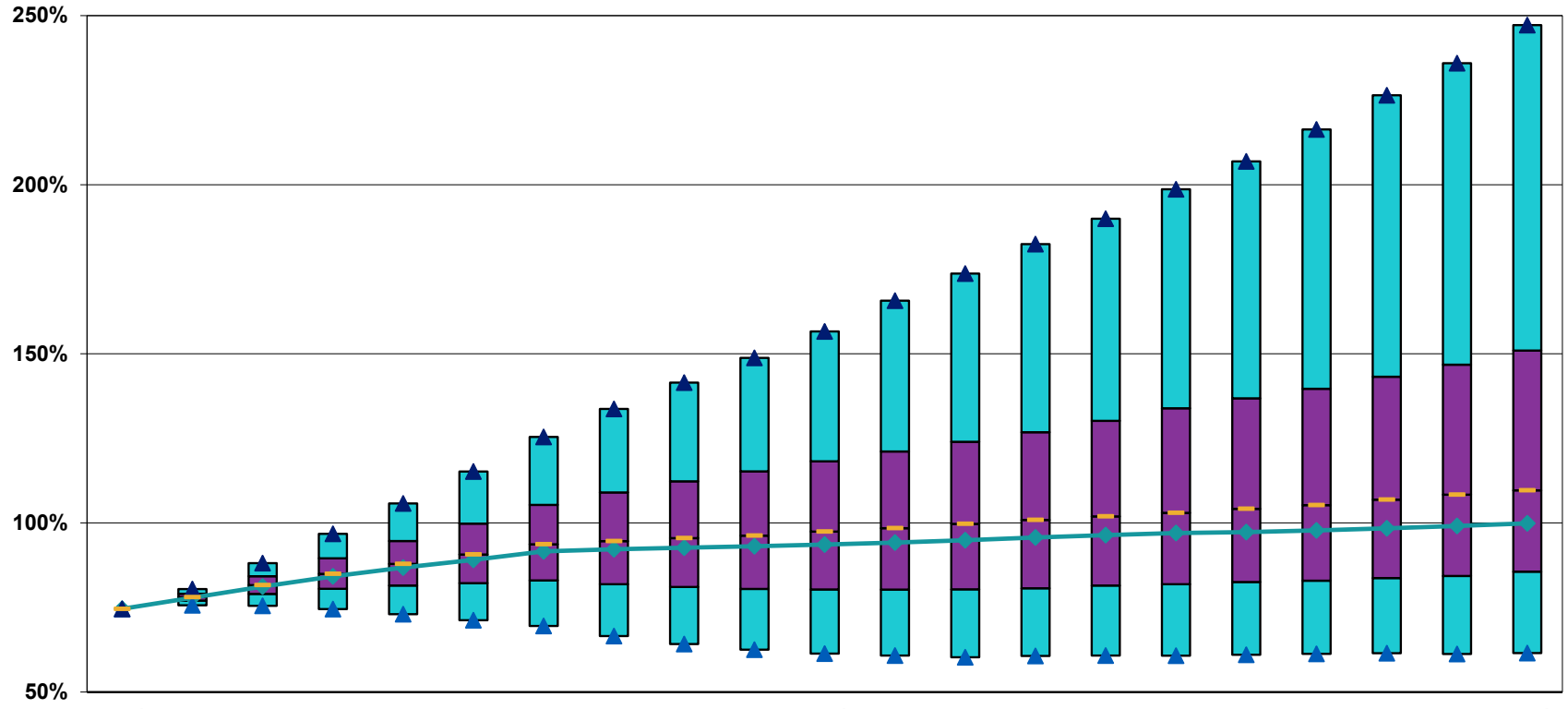


	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
▲ 95th	28.5%	22.5%	19.9%	17.8%	16.6%	15.9%	15.1%	14.6%	14.4%	14.0%	13.6%	13.3%	13.1%	12.9%	12.7%	12.5%	12.5%	12.3%	12.2%	12.1%
— 75th	16.7%	13.9%	12.5%	11.8%	11.3%	11.0%	10.7%	10.5%	10.3%	10.1%	10.0%	9.9%	9.8%	9.7%	9.7%	9.6%	9.5%	9.5%	9.4%	9.4%
50th	8.2%	7.7%	7.5%	7.6%	7.6%	7.5%	7.6%	7.6%	7.5%	7.5%	7.5%	7.5%	7.4%	7.4%	7.5%	7.4%	7.4%	7.4%	7.4%	7.4%
— 25th	-0.5%	1.8%	2.9%	3.3%	3.8%	4.0%	4.3%	4.4%	4.6%	4.8%	4.9%	5.0%	5.1%	5.2%	5.2%	5.3%	5.4%	5.4%	5.5%	5.5%
▲ 5th	-12.1%	-6.9%	-4.1%	-2.6%	-1.5%	-0.9%	-0.3%	0.1%	0.6%	0.8%	1.1%	1.4%	1.6%	1.8%	2.1%	2.3%	2.4%	2.5%	2.6%	2.8%
◆	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%	7.0%

◆ Current investment return assumption

Note: In our triennial experience study for the June 30, 2020 valuations, we estimated that over a 15-year period there would be a 59% likelihood that the future average geometric return would meet or exceed the 7.00% investment return assumption. Due to updated assumptions in Horizon's 2021 survey, the above results reflect a 56% likelihood that the future average geometric return would meet or exceed the 7.00% investment return assumption over a 15-year period.

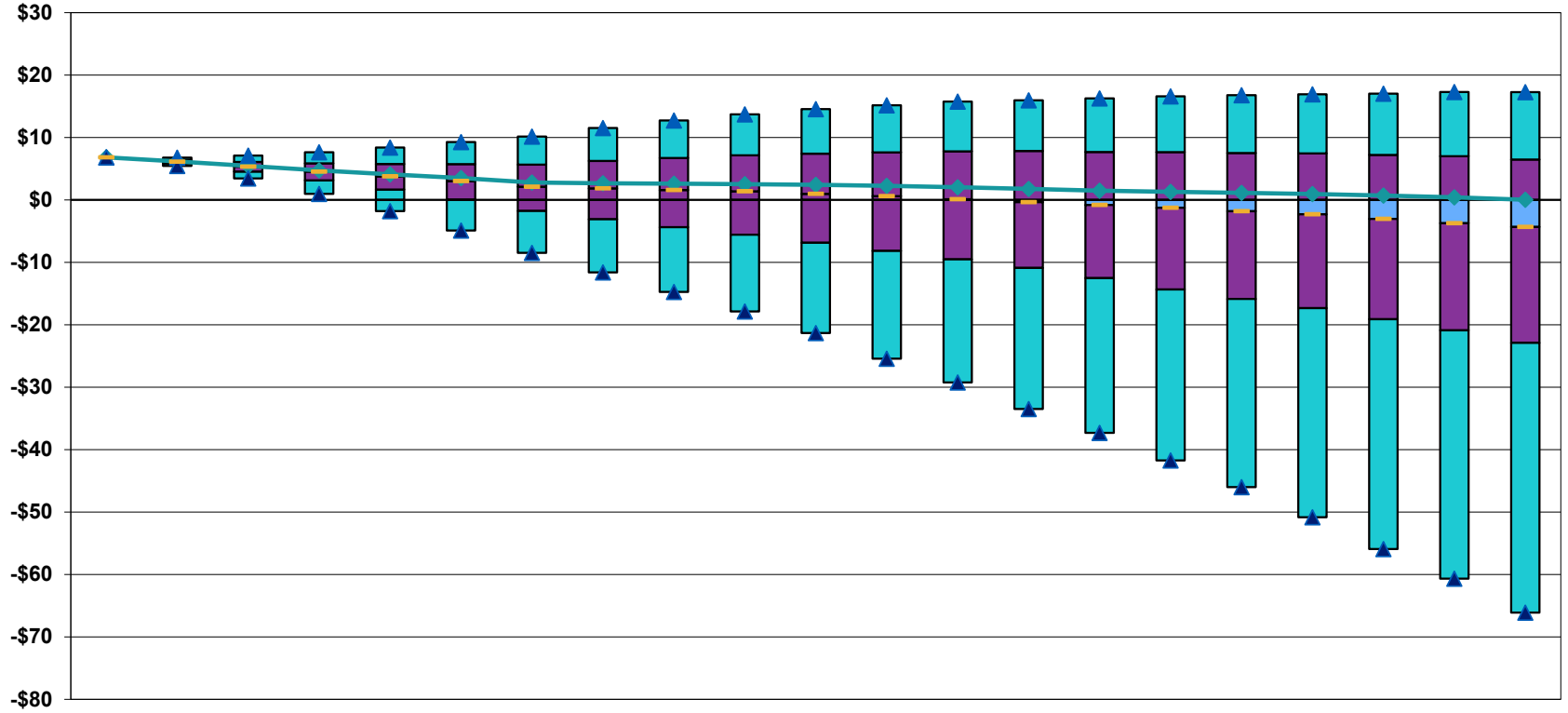
Projected Funded Ratios (on Actuarial Value of Assets Basis)



	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
▲ 95th	74.6%	80.4%	88.1%	96.8%	105.8%	115.2%	125.4%	133.7%	141.5%	148.8%	156.6%	165.7%	173.7%	182.4%	189.9%	198.6%	206.9%	216.3%	226.4%	235.9%	247.2%
— 75th	74.6%	79.0%	84.3%	89.5%	94.7%	99.8%	105.3%	109.0%	112.3%	115.2%	118.2%	121.1%	124.0%	126.8%	130.2%	133.9%	136.8%	139.7%	143.2%	146.8%	151.0%
50th	74.6%	78.0%	81.6%	84.9%	87.9%	90.7%	93.7%	94.6%	95.5%	96.2%	97.5%	98.4%	99.7%	100.9%	101.9%	103.0%	104.2%	105.3%	106.9%	108.3%	109.6%
— 25th	74.6%	77.0%	79.0%	80.5%	81.5%	82.2%	83.0%	81.9%	81.1%	80.5%	80.3%	80.3%	80.4%	80.7%	81.5%	81.9%	82.6%	82.9%	83.7%	84.3%	85.6%
▲ 5th	74.6%	75.7%	75.5%	74.6%	73.0%	71.2%	69.5%	66.5%	64.2%	62.5%	61.4%	60.8%	60.3%	60.7%	60.8%	60.8%	61.0%	61.3%	61.5%	61.3%	61.5%
◆	74.6%	77.9%	81.2%	84.2%	86.8%	89.1%	91.6%	92.2%	92.7%	93.1%	93.6%	94.2%	94.9%	95.7%	96.4%	97.0%	97.3%	97.8%	98.4%	99.1%	99.9%

◆ Baseline deterministic projection

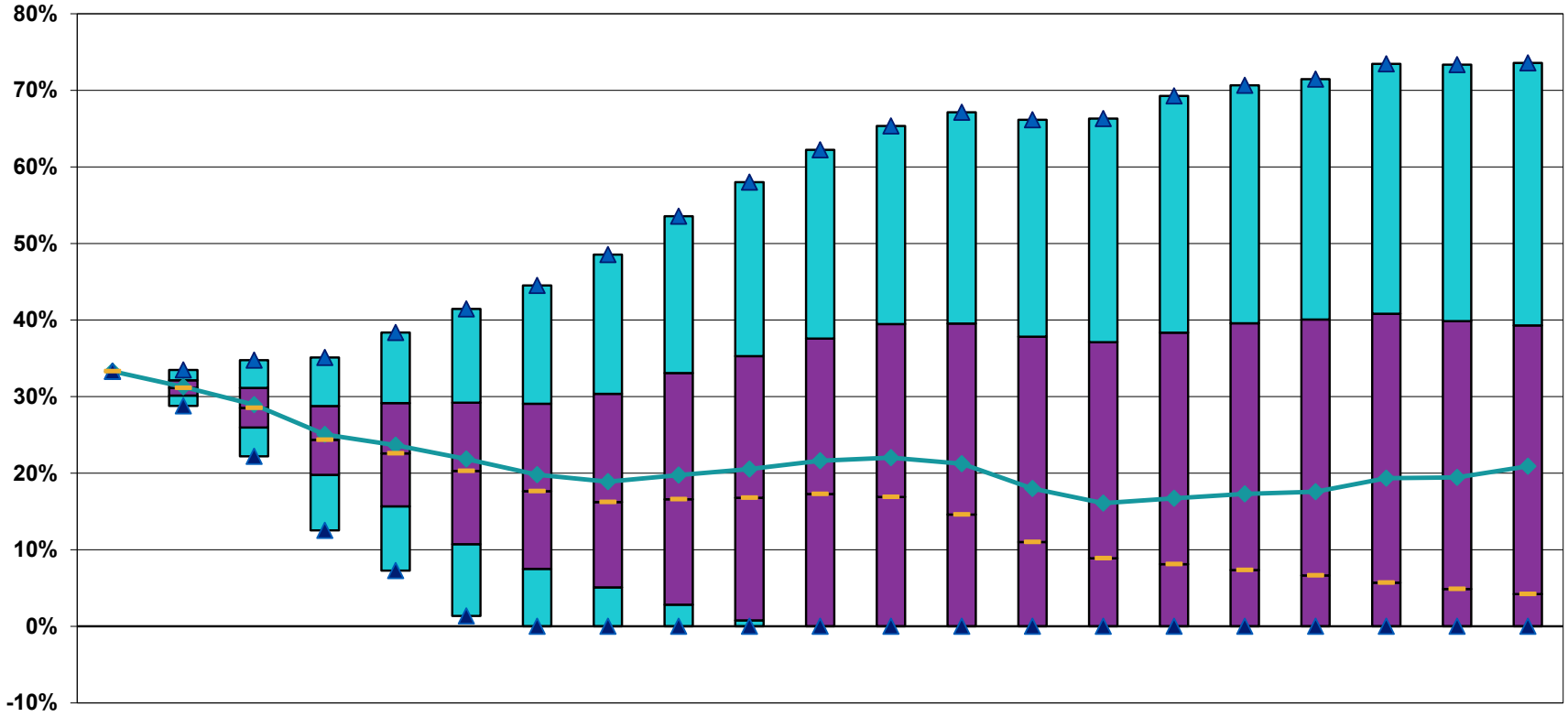
Projected UAAL (on Actuarial Value of Assets Basis)
$ in Billions



	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
▲ 95th	6.8	5.4	3.4	1.0	-1.8	-4.9	-8.5	-11.6	-14.7	-17.9	-21.3	-25.4	-29.2	-33.5	-37.3	-41.7	-46.0	-50.8	-55.9	-60.7	-66.1
— 75th	6.8	5.8	4.6	3.1	1.7	0.1	-1.8	-3.1	-4.4	-5.6	-6.9	-8.2	-9.5	-10.9	-12.5	-14.3	-15.9	-17.3	-19.1	-20.9	-22.9
— 50th	6.8	6.1	5.3	4.5	3.8	3.0	2.1	1.8	1.6	1.4	1.0	0.6	0.1	-0.4	-0.8	-1.3	-1.8	-2.3	-3.0	-3.7	-4.3
— 25th	6.8	6.4	6.1	5.8	5.8	5.7	5.7	6.2	6.7	7.1	7.4	7.6	7.8	7.8	7.7	7.7	7.5	7.5	7.2	7.0	6.5
▲ 5th	6.8	6.8	7.1	7.6	8.4	9.3	10.2	11.5	12.7	13.7	14.5	15.2	15.8	16.0	16.3	16.6	16.8	16.9	17.0	17.3	17.3
◆	6.8	6.2	5.4	4.7	4.1	3.5	2.8	2.7	2.6	2.5	2.4	2.3	2.0	1.8	1.5	1.3	1.1	0.9	0.7	0.4	0.0

◆ Baseline deterministic projection

Projected Employer Contribution Rates
Percent of Payroll



	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041
▲ 95th	33.3%	28.8%	22.2%	12.5%	7.3%	1.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
— 75th	33.3%	30.1%	26.0%	19.8%	15.7%	10.7%	7.5%	5.1%	2.8%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
50th	33.3%	31.1%	28.5%	24.4%	22.6%	20.3%	17.7%	16.2%	16.6%	16.8%	17.3%	16.9%	14.6%	11.0%	8.9%	8.1%	7.3%	6.7%	5.7%	4.9%	4.2%
— 25th	33.3%	32.1%	31.1%	28.8%	29.2%	29.2%	29.1%	30.4%	33.1%	35.3%	37.6%	39.5%	39.6%	37.8%	37.1%	38.4%	39.6%	40.1%	40.8%	39.9%	39.3%
▲ 5th	33.3%	33.5%	34.8%	35.1%	38.4%	41.5%	44.5%	48.5%	53.6%	58.0%	62.2%	65.3%	67.1%	66.2%	66.3%	69.3%	70.7%	71.5%	73.5%	73.4%	73.6%
◆	33.3%	31.3%	28.9%	25.1%	23.7%	21.9%	19.8%	18.9%	19.7%	20.5%	21.6%	22.0%	21.2%	18.0%	16.1%	16.7%	17.3%	17.6%	19.4%	19.5%	20.9%

◆ Baseline deterministic projection

Plan Maturity Measures that Affect Primary Risks

The annual actuarial valuations consider the number and demographic characteristics of covered members, including active members and non-active members (inactive vested, retirees and beneficiaries). In the past 10 valuations from June 30, 2012 to 2021, LACERS has become more mature, indicated by the continued increase in the ratio of non-active to active members covered by the Retirement and Health Plans as shown in *Charts 12a* and *12b*, respectively. The Charts also show the ratio of members in pay status (retirees and beneficiaries) to active members. This ratio excludes the inactive vested 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 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 for the Retirement and Health Plans in *Charts 13a* and *13b*, respectively. 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 also detailed for the Retirement and Health Plans in *Charts 13a* and *13b*, respectively. 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.

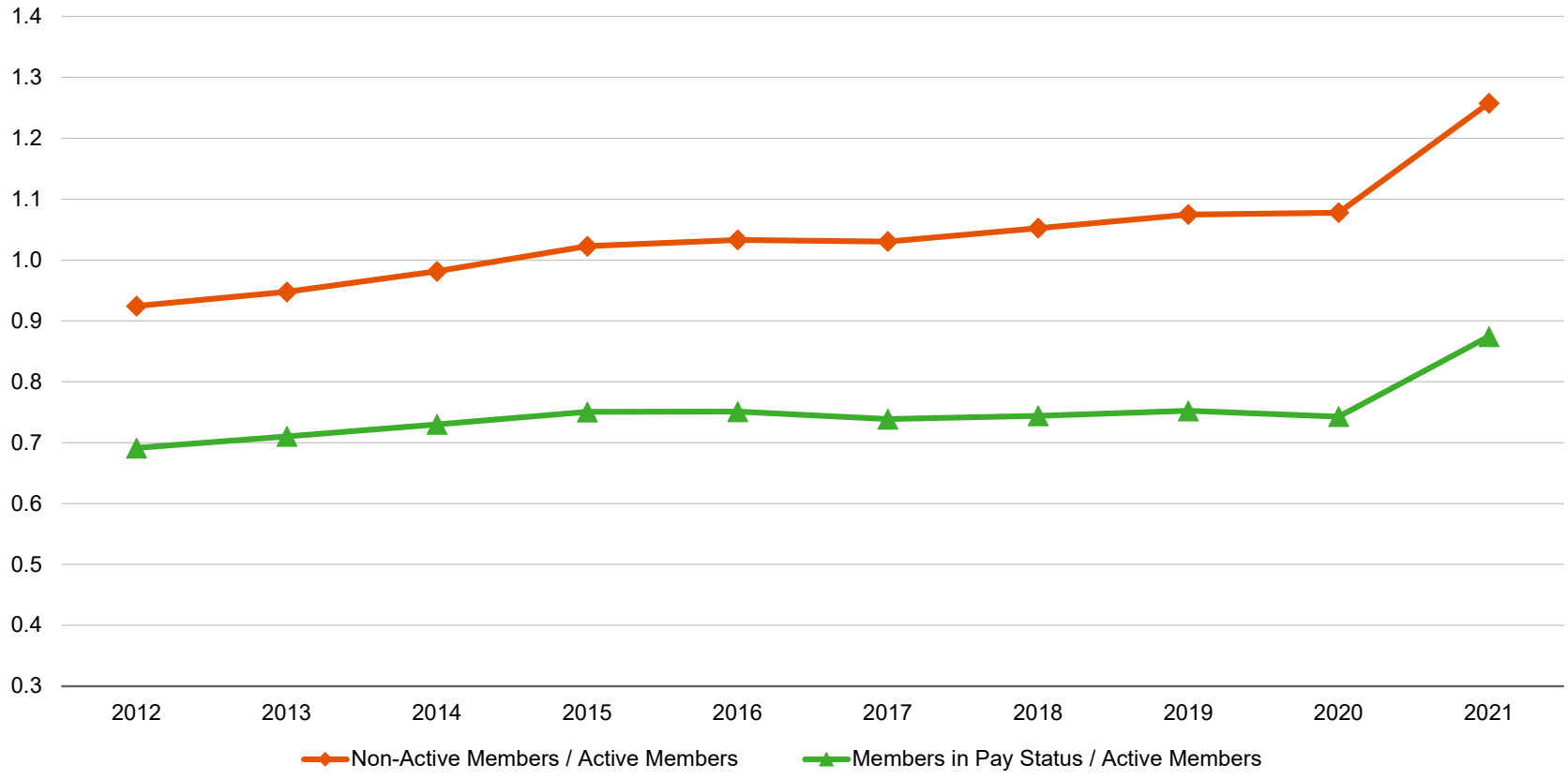
In particular, the Retirement Plan's AVR was 8.4 as of June 30, 2021. This means that a 1% asset gain or loss in 2021/2022 (relative to the assumed investment return) would amount to 8.4% of one year's payroll. Similarly, the Retirement Plan's LVR was 10.3 as of June 30, 2021, so a 1% liability gain or loss in 2021/2022 would amount to 10.3% of one year's payroll. Based on LACERS' policy to amortize actuarial experience over a period of 15 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 0.9% of payroll decrease or increase in the required contribution rate for each 1% liability gain or loss, respectively, for the Retirement Plan.

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

Plan	June 30, 2021 AVR	10% Investment Loss Compares to	LVR	10% Liability Change Compares to
Retirement Plan	8.4	84% of payroll	10.3	103% of payroll
Health Plan	1.7	17% of payroll	1.6	16% of payroll
Combined	10.1	101% of payroll	11.9	119% of payroll

RETIREMENT PLAN

Ratios of Members in Pay-Status (Retirees and Beneficiaries) to Active Members & Non-Active Members (Inactive Vested, Retirees and Beneficiaries) to Active Members in June 30, 2012 to 2021 Valuations



HEALTH PLAN

Ratios of Members in Pay-Status (Retirees and Beneficiaries) to Active Members & Non-Active Members (Inactive Vested, Retirees and Beneficiaries) to Active Members in June 30, 2012 to 2021 Valuations

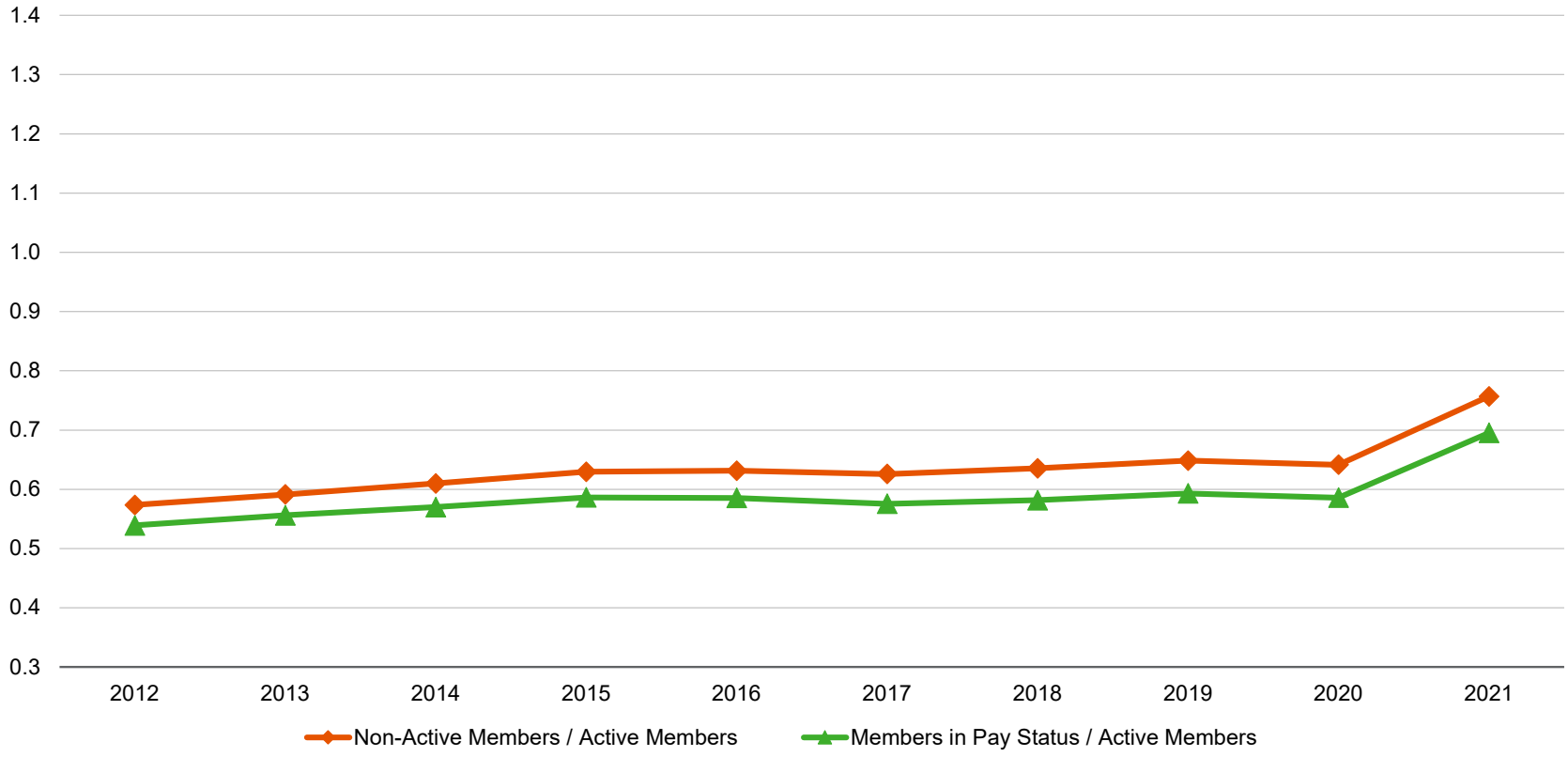


Chart 13a

RETIREMENT PLAN

Volatility Ratios in June 30, 2012 to 2021 Valuations

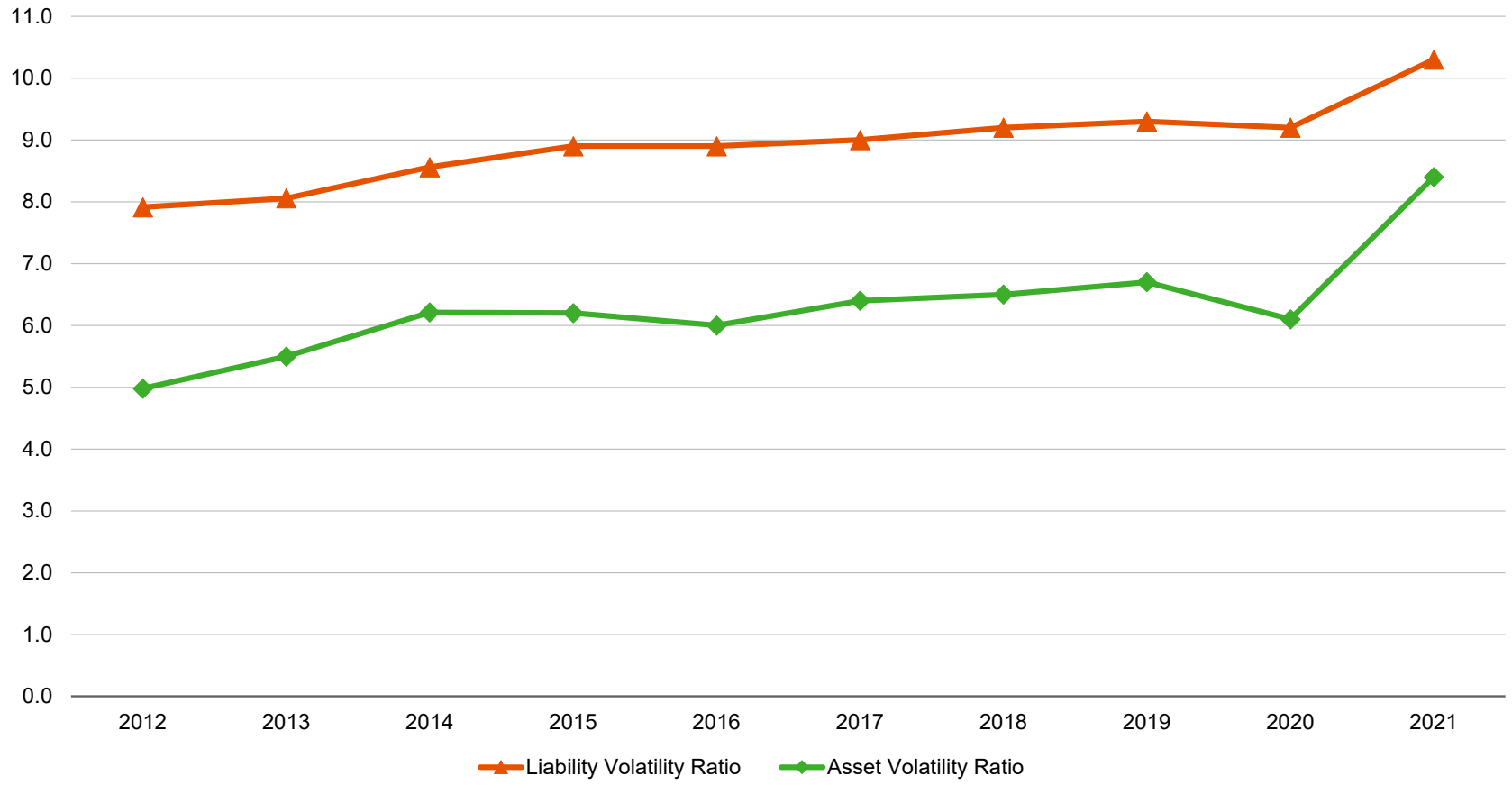
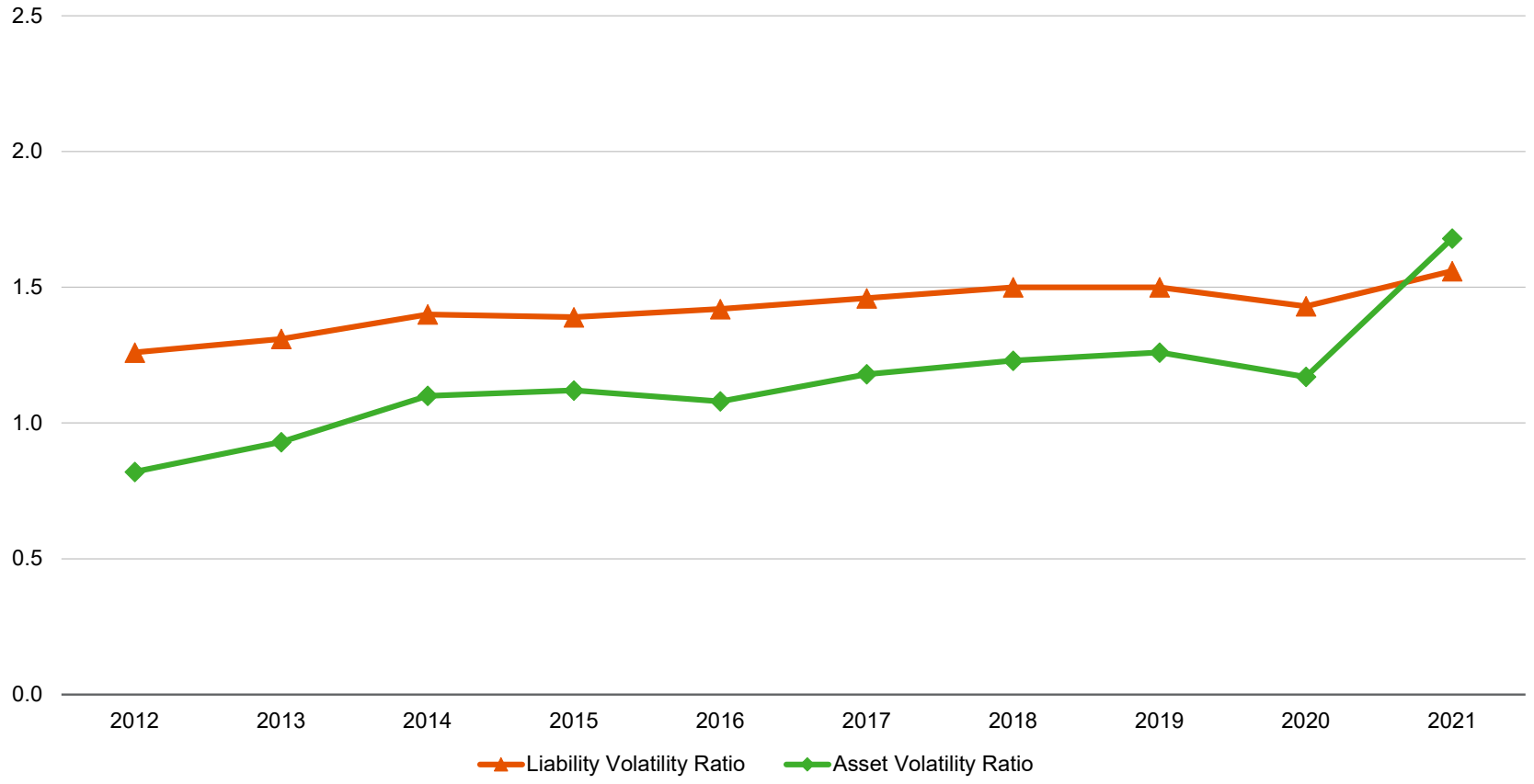


Chart 13b

HEALTH PLAN

Volatility Ratios in June 30, 2012 to 2021 Valuations



Appendix: Actuarial Assumptions & Methods, Actuarial Certification, and Detailed Scenario Test Results

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, 2021 valuations.

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. Deterministic cost projections are based on a proprietary forecasting model. 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, 2021 actuarial valuation:

- Non-economic assumptions will remain unchanged.
- Retirement benefit formulas will remain unchanged.
- Los Angeles Charter and Administrative Code will remain unchanged.
- UAAL amortization method will remain unchanged (i.e., 15-year layers for actuarial gains/losses, 20-year layers for assumption or method changes, 30-year layers for actuarial surplus, and level percent of pay).
- Economic assumptions will remain unchanged, including the annual 7.00% investment earnings and 3.25% active payroll growth assumptions.
- Deferred investment gains and losses will be recognized over a seven-year period.

- In estimating the benefit payments for the open group, we have assumed that the annual payments will increase by 5.5% and 6.0% for the Retirement and Health Plans, respectively. These assumptions, which were unchanged from last year since we ignored the effect of the recent City Separation Incentive Program, were developed by analyzing the increase in the actual benefit payments over the five years ending June 30, 2020, combined with the increase in the projected benefit payments based on the actuarial assumptions described herein for the five years after July 1, 2020.
- All other actuarial assumptions used in the June 30, 2021 actuarial valuations 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 LACERS' 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 LACERS at the last triennial experience study and used by Segal to set the investment return assumption of 7.00% that was applied in the June 30, 2021 valuations. That target asset allocation is as follows:

Asset Class	Target Allocation
Large Cap U.S. Equity	15.01%
Small/Mid Cap U.S. Equity	3.99%
Developed International Large Cap Equity	17.01%
Developed International Small Cap Equity	2.97%
Emerging International Large Cap Equity	5.67%
Emerging International Small Cap Equity	1.35%
Core Bonds	13.75%
High Yield Bonds	2.00%
Bank Loans	2.00%
TIPS	4.00%
Emerging Market Debt (External)	2.25%
Emerging Market Debt (Local)	2.25%
Core Real Estate	4.20%
Non-Core Real Estate	2.80%
Cash	1.00%
Commodities	1.00%
Private Equity	14.00%
Private Credit/Debt	3.75%
REITS	1.00%
Total	100.00%

We understand that the Board adopted a new target asset allocation on May 11, 2021, however, we have not used the newly adopted target allocation to produce the stochastic projection results provided herein for the reasons discussed next.

Based on information provided by LACERS for the June 30, 2021 valuations, the implementation of the new target allocation for several asset categories is expected to take several years and LACERS' investment consultant, NEPC, has provided the System with interim policy targets for years 2021-2025. Furthermore, in NEPC's asset/liability study report that we found in the agenda for the May 11, 2021 Board meeting, it was noted that the proposed asset mix that was adopted by the Board is anticipated to provide higher expected returns, better diversification and favorable liquidation, along with lower projected contribution rates and improved funded status (under the 50th percentile). This means that everything else being equal, the stochastic projection results in this report, prepared using the target allocation that was used to develop the 7.00% investment return assumption starting with the June 30, 2020 valuations, could be viewed as being somewhat more conservative. With all of this said, NEPC's report mentioned that none of their proposed asset mixes represent a major departure from the current target allocation (i.e., the allocation we used for the stochastic projections).

For these reasons, we have continued to use the target asset allocation that was provided by LACERS at the last triennial experience study and used by Segal to set the investment return assumption of 7.00% that was applied in the June 30, 2021 valuations, until we are scheduled to review that assumption at the time of the next experience study.

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 2021 survey prepared by Horizon Actuarial Services.[21] We used the assumptions that were closest to the asset classes found in LACERS' investment portfolio.

A summary of the 20-year arithmetic returns,[22,23] 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	Large Cap U.S. Equity	7.96%	16.42%	1	1.00												
2	Small/Mid Cap U.S. Equity	9.01%	20.17%	2	0.90	1.00											
3	Developed International Equity	8.79%	18.32%	3	0.82	0.77	1.00										
4	Emerging International Equity	10.78%	24.33%	4	0.72	0.70	0.80	1.00									
5	Core Bonds	3.38%	5.52%	5	0.19	0.15	0.20	0.18	1.00								
6	High Yield Bonds, Bank Loans	5.46%	9.88%	6	0.63	0.63	0.62	0.62	0.43	1.00							
7	Emerging Market Debt	5.99%	11.26%	7	0.48	0.45	0.52	0.61	0.49	0.60	1.00						
8	US Treasuries, Cash	1.91%	1.30%	8	(0.06)	(0.06)	(0.04)	(0.03)	0.12	(0.10)	0.01	1.00					
9	TIPS	2.56%	5.64%	9	0.05	0.02	0.07	0.12	0.66	0.27	0.35	0.13	1.00				
10	Real Estate, REITS	7.65%	17.62%	10	0.60	0.62	0.55	0.49	0.28	0.52	0.43	(0.01)	0.19	1.00			
11	Commodities	5.45%	17.31%	11	0.34	0.34	0.42	0.44	0.08	0.38	0.33	0.02	0.18	0.25	1.00		
12	Private Equity	12.27%	22.25%	12	0.74	0.74	0.69	0.61	0.10	0.51	0.38	(0.03)	0.01	0.50	0.33	1.00	
13	Private Credit/Private Debt	7.52%	11.42%	13	0.54	0.55	0.54	0.52	0.26	0.71	0.44	(0.04)	0.11	0.46	0.37	0.54	1.00

Other Considerations

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

[21] That survey included responses from 39 investment advisors, including LACERS' investment advisor at NEPC.

[22] Note that only 24 investment advisors provided long-term (e.g., 20-year) capital market assumptions in the survey.

[23] These returns are gross of inflation and before any adjustment for administrative expenses. The annual inflation assumption based on the Horizon Survey was 2.24%. The annual adjustment for administrative expenses was 0.15%.

Actuarial Certification

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

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. We are members of the American Academy of Actuaries and we meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion herein.

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

Andy Yeung, ASA, MAAA, FCA, EA
Vice President and Actuary

Todd Tauzer, FSA, MAAA, FCA, CERA
Vice President and Consulting Actuary

Detailed Scenario Test Results – Under Scenario 2 (Assuming 7.00% Market Return for 2021/2022)

RETIREMENT PLAN

Projection of UAAL, Funded Ratio and City Contributions
(Contributions Received on July 15)
($ In Thousands)

	June 30 of Valuation Year			City Contributions (July 15)					
Valuation Year	UAAL	Funded Ratio	Fiscal Year End	Fiscal Year Pay	Normal Cost	UAAL Amortization	Total Rate	Contribution Amount	Incremental Increase
2020	$ 6,897,093	69.4%	2022	$ 2,254,165	7.85%	20.11%	27.96%	$ 630,265	
2021	$ 6,621,308	71.6%	2023	$ 2,327,425	7.75%	21.64%	29.39%	$ 684,030	$ 53,765
2022	$ 6,074,272	74.9%	2024	$ 2,403,067	7.49%	19.86%	27.35%	$ 657,239	$ (26,791)
2023	$ 5,456,966	78.2%	2025	$ 2,481,166	7.35%	17.91%	25.26%	$ 626,743	$ (30,496)
2024	$ 4,853,390	81.3%	2026	$ 2,561,804	7.21%	14.34%	21.55%	$ 552,069	$ (74,674)
2025	$ 4,309,449	84.0%	2027	$ 2,645,063	7.63%	12.67%	20.30%	$ 536,948	$ (15,121)
2026	$ 3,796,699	86.4%	2028	$ 2,731,027	7.46%	11.17%	18.63%	$ 508,790	$ (28,158)
2027	$ 3,194,394	88.9%	2029	$ 2,819,786	7.29%	9.46%	16.75%	$ 472,314	$ (36,476)
2028	$ 3,088,670	89.6%	2030	$ 2,911,429	7.11%	8.70%	15.81%	$ 460,297	$ (12,017)
2029	$ 3,015,832	90.1%	2031	$ 3,006,050	6.95%	9.67%	16.62%	$ 499,606	$ 39,309
2030	$ 2,952,800	90.6%	2032	$ 3,103,747	6.78%	10.60%	17.38%	$ 539,431	$ 39,825
2031	$ 2,844,925	91.2%	2033	$ 3,204,619	6.62%	11.81%	18.43%	$ 590,611	$ 51,180
2032	$ 2,688,722	91.9%	2034	$ 3,308,769	6.46%	12.34%	18.80%	$ 622,049	$ 31,438
2033	$ 2,468,545	92.7%	2035	$ 3,416,304	6.32%	11.65%	17.97%	$ 613,910	$ (8,139)
2034	$ 2,201,981	93.6%	2036	$ 3,527,334	6.19%	8.49%	14.68%	$ 517,813	$ (96,097)
2035	$ 1,927,336	94.5%	2037	$ 3,641,972	6.07%	6.68%	12.75%	$ 464,351	$ (53,462)
2036	$ 1,739,174	95.1%	2038	$ 3,760,336	5.96%	7.39%	13.35%	$ 502,005	$ 37,654
2037	$ 1,598,265	95.6%	2039	$ 3,882,547	5.86%	8.04%	13.90%	$ 539,674	$ 37,669
2038	$ 1,410,389	96.2%	2040	$ 4,008,730	5.77%	8.39%	14.16%	$ 567,636	$ 27,962
2039	$ 1,173,031	96.8%	2041	$ 4,139,014	5.68%	10.22%	15.90%	$ 658,103	$ 90,467
2040	$ 893,552	97.6%	2042	$ 4,273,532	5.61%	10.37%	15.98%	$ 682,910	$ 24,807
2041	$ 502,597	98.7%	2043	$ 4,412,421	5.55%	11.87%	17.42%	$ 768,644	$ 85,734
2042	$ 62,677	99.8%	2044	$ 4,555,825	5.50%	-0.07%	5.43%	$ 247,381	$ (521,263)
2043	$ (493,826)	101.3%	2045	$ 4,703,889	5.44%	-0.58%	4.86%	$ 228,609	$ (18,772)
2044	$ (526,932)	101.5%	2046	$ 4,856,766	5.41%	-0.60%	4.81%	$ 233,610	$ 5,001

Detailed Scenario Test Results – Under Scenario 2 (Assuming 7.00% Market Return for 2021/2022)

HEALTH PLAN

Projection of UAAL, Funded Ratio and City Contributions
(Contributions Received on July 15)
($ In Thousands)

	June 30 of Valuation Year				City Contributions (July 15)				
Valuation Year	UAAL	Funded Ratio	Fiscal Year End	Fiscal Year Pay	Normal Cost	UAAL Amortization	Total Rate	Contribution Amount	Incremental Increase
2020	$ 502,107	85.6%	2022	$ 2,254,165	3.48%	0.81%	4.29%	$ 96,704	
2021	$ 189,701	94.6%	2023	$ 2,327,425	3.62%	0.30%	3.92%	$ 91,235	$ (5,469)
2022	$ 82,014	97.8%	2024	$ 2,403,067	3.68%	0.24%	3.92%	$ 94,200	$ 2,965
2023	$ (17,978)	100.5%	2025	$ 2,481,166	3.72%	-0.04%	3.68%	$ 91,307	$ (2,893)
2024	$ (119,014)	102.9%	2026	$ 2,561,804	3.76%	-0.26%	3.50%	$ 89,663	$ (1,644)
2025	$ (206,576)	104.9%	2027	$ 2,645,063	3.78%	-0.43%	3.35%	$ 88,610	$ (1,053)
2026	$ (296,847)	106.7%	2028	$ 2,731,027	3.82%	-0.60%	3.22%	$ 87,939	$ (671)
2027	$ (405,811)	108.8%	2029	$ 2,819,786	3.84%	-0.79%	3.05%	$ 86,003	$ (1,936)
2028	$ (415,986)	108.6%	2030	$ 2,911,429	3.87%	-0.79%	3.08%	$ 89,672	$ 3,669
2029	$ (420,366)	108.3%	2031	$ 3,006,050	3.89%	-0.77%	3.12%	$ 93,789	$ 4,117
2030	$ (424,536)	108.1%	2032	$ 3,103,747	3.91%	-0.75%	3.16%	$ 98,078	$ 4,289
2031	$ (428,776)	107.8%	2033	$ 3,204,619	3.94%	-0.74%	3.20%	$ 102,548	$ 4,470
2032	$ (433,085)	107.6%	2034	$ 3,308,769	3.95%	-0.72%	3.23%	$ 106,873	$ 4,325
2033	$ (437,501)	107.4%	2035	$ 3,416,304	3.98%	-0.71%	3.27%	$ 111,713	$ 4,840
2034	$ (441,730)	107.2%	2036	$ 3,527,334	4.00%	-0.69%	3.31%	$ 116,755	$ 5,042
2035	$ (446,155)	107.0%	2037	$ 3,641,972	4.01%	-0.67%	3.34%	$ 121,642	$ 4,887
2036	$ (450,885)	106.8%	2038	$ 3,760,336	4.03%	-0.66%	3.37%	$ 126,723	$ 5,081
2037	$ (455,672)	106.7%	2039	$ 3,882,547	4.04%	-0.65%	3.39%	$ 131,618	$ 4,895
2038	$ (460,573)	106.5%	2040	$ 4,008,730	4.05%	-0.63%	3.42%	$ 137,099	$ 5,481
2039	$ (465,198)	106.4%	2041	$ 4,139,014	4.07%	-0.62%	3.45%	$ 142,796	$ 5,697
2040	$ (470,033)	106.3%	2042	$ 4,273,532	4.08%	-0.61%	3.47%	$ 148,292	$ 5,496
2041	$ (475,157)	106.2%	2043	$ 4,412,421	4.08%	-0.59%	3.49%	$ 153,994	$ 5,702
2042	$ (480,247)	106.1%	2044	$ 4,555,825	4.09%	-0.58%	3.51%	$ 159,909	$ 5,915
2043	$ (485,448)	106.0%	2045	$ 4,703,889	4.10%	-0.57%	3.53%	$ 166,047	$ 6,138
2044	$ (490,786)	106.0%	2046	$ 4,856,766	4.11%	-0.56%	3.55%	$ 172,415	$ 6,368

Note: For purposes of these projections, and consistent with the Plan's funding policy, we have amortized the UAAL as of June 30, 2022 over a 20-year period because the UAAL contribution rate is expected to be negative (a credit) in the June 30, 2022 valuation even though there would still be a positive UAAL amount in that year

Detailed Scenario Test Results – Under Scenario 2 (Assuming 7.00% Market Return for 2021/2022)

RETIREMENT AND HEALTH PLANS

Projection of UAAL, Funded Ratio and City Contributions
(Contributions Received on July 15)
($ In Thousands)

	June 30 of Valuation Year			City Contributions (July 15)					
Valuation Year	UAAL	Funded Ratio	Fiscal Year End	Fiscal Year Pay	Normal Cost	UAAL Amortization	Total Rate	Contribution Amount	Incremental Increase
2020	$ 7,399,200	71.6%	2022	$ 2,254,165	11.33%	20.92%	32.25%	$ 726,969	
2021	$ 6,811,009	74.6%	2023	$ 2,327,425	11.37%	21.94%	33.31%	$ 775,265	$ 48,296
2022	$ 6,156,285	77.9%	2024	$ 2,403,067	11.17%	20.10%	31.27%	$ 751,439	$ (23,826)
2023	$ 5,438,988	81.2%	2025	$ 2,481,166	11.07%	17.87%	28.94%	$ 718,050	$ (33,389)
2024	$ 4,734,376	84.2%	2026	$ 2,561,804	10.97%	14.08%	25.05%	$ 641,732	$ (76,318)
2025	$ 4,102,873	86.8%	2027	$ 2,645,063	11.41%	12.24%	23.65%	$ 625,558	$ (16,174)
2026	$ 3,499,852	89.1%	2028	$ 2,731,027	11.28%	10.57%	21.85%	$ 596,729	$ (28,829)
2027	$ 2,788,583	91.6%	2029	$ 2,819,786	11.13%	8.67%	19.80%	$ 558,317	$ (38,412)
2028	$ 2,672,685	92.2%	2030	$ 2,911,429	10.98%	7.91%	18.89%	$ 549,969	$ (8,348)
2029	$ 2,595,466	92.7%	2031	$ 3,006,050	10.84%	8.90%	19.74%	$ 593,395	$ 43,426
2030	$ 2,528,264	93.1%	2032	$ 3,103,747	10.69%	9.85%	20.54%	$ 637,509	$ 44,114
2031	$ 2,416,149	93.6%	2033	$ 3,204,619	10.56%	11.07%	21.63%	$ 693,159	$ 55,650
2032	$ 2,255,637	94.2%	2034	$ 3,308,769	10.41%	11.62%	22.03%	$ 728,922	$ 35,763
2033	$ 2,031,044	94.9%	2035	$ 3,416,304	10.30%	10.94%	21.24%	$ 725,623	$ (3,299)
2034	$ 1,760,251	95.7%	2036	$ 3,527,334	10.19%	7.80%	17.99%	$ 634,568	$ (91,055)
2035	$ 1,481,182	96.4%	2037	$ 3,641,972	10.08%	6.01%	16.09%	$ 585,993	$ (48,575)
2036	$ 1,288,289	97.0%	2038	$ 3,760,336	9.99%	6.73%	16.72%	$ 628,728	$ 42,735
2037	$ 1,142,593	97.3%	2039	$ 3,882,547	9.90%	7.39%	17.29%	$ 671,292	$ 42,564
2038	$ 949,815	97.8%	2040	$ 4,008,730	9.82%	7.76%	17.58%	$ 704,735	$ 33,443
2039	$ 707,833	98.4%	2041	$ 4,139,014	9.75%	9.60%	19.35%	$ 800,899	$ 96,164
2040	$ 423,518	99.1%	2042	$ 4,273,532	9.69%	9.76%	19.45%	$ 831,202	$ 30,303
2041	$ 27,440	99.9%	2043	$ 4,412,421	9.63%	11.28%	20.91%	$ 922,638	$ 91,436
2042	$ (417,570)	100.9%	2044	$ 4,555,825	9.59%	-0.65%	8.94%	$ 407,290	$ (515,348)
2043	$ (979,274)	102.2%	2045	$ 4,703,889	9.54%	-1.15%	8.39%	$ 394,656	$ (12,634)
2044	$ (1,017,717)	102.3%	2046	$ 4,856,766	9.52%	-1.16%	8.36%	$ 406,025	$ 11,369

Historical Funded Status, UAAL, and Employer Contribution Rates

RETIREMENT AND HEALTH PLANS

	Market Value Basis		Valuation Value Basis		Total (Aggregate) Employer Contribution Rate (% of Payroll – Contributions Received on July 15)[1]
Valuation Date	Funded Status	UAAL	Funded Status	UAAL	
June 30, 2012	63.3%	$6.1B	69.4%	$5.1B	25.33%
June 30, 2013	68.7%	$5.4B	69.1%	$5.3B	26.56%
June 30, 2014	73.4%	$5.0B	68.1%	$6.0B	28.60%
June 30, 2015	71.9%	$5.5B	70.7%	$5.7B	27.62%
June 30, 2016	69.0%	$6.3B	72.6%	$5.5B	27.13%
June 30, 2017	72.8%	$5.8B	72.8%	$5.8B	28.16%
June 30, 2018	72.9%	$6.3B	71.6%	$6.6B	29.66%
June 30, 2019	73.1%	$6.5B	73.1%	$6.5B	29.12%
June 30, 2020	68.4%	$8.2B	71.6%	$7.4B	32.25%
June 30, 2021	84.7%	$4.1B	74.6%	$6.8B	33.31%

[1] For the June 30, 2012 – 2014 valuation dates, the rates shown are with adjustment for the five-year phase-in of the increase in the employer contribution rates due to assumption changes from the 2011 experience study. The rates without adjustment for those years were 26.17%, 27.11%, and 28.88%, respectively.