Los Angeles City Employees' Retirement System

Risk Assessment

Including Review of Funded Status of the Retirement and Health Plans as of June 30, 2020

February 26, 2021

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Segal

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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, 2020 funding valuations for LACERS.

The results included in our June 30, 2020 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.

The results included throughout this report do not reflect the impact of any phase-in of the cost from the adoption of new actuarial assumptions with the June 30, 2020 actuarial valuations. That is, the full cost of the new actuarial assumptions is reflected in this report. Segal is available to provide additional analysis on the effects of a phase-in if any such phase-in is approved by the Board.[2]

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

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[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.

[2] We understand that while a preliminary request to consider the phase-in has been made by the City, the City is still preparing its budget and the outcome of that budget preparation might influence its decision to make a final request for the Board to consider and allow for the phase-in.

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 provided by the Retirement Plan.[3] 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, 2020 valuations. We have also included a projection of future results based on a stochastic modeling of future investment returns for 2020/2021 and thereafter. The stochastic modeling is useful for assessing the distribution of future results based on random variations in actual investment returns each year, and introduces a relative likelihood for the range of potential outcomes.

[3] 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.

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.

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)[4] and contribution rates[5] 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, 2011	69.4%	$4.7B	73.2%	$4.1B	24.14%
June 30, 2020	68.4%	$8.2B	71.6%	$7.4B	32.25%

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 32.25% of total payroll in the June 30, 2020 valuations. Using a deterministic projection, this report shows the effect of either unfavorable (0.00%) or favorable (14.00%) hypothetical market returns for 2020/2021 on key valuation results. In particular, the changes in the total employer contribution rate

[4] For example, the UAAL increased by $422.0 million in the June 30 2011 valuations, $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 $3.0B), as a result of the assumptions adopted by the Board following the economic assumptions study and the experience studies over the last ten years.

[5] For example, the increase in the employer's total rate (normal cost plus UAAL) was 1.37% in the June 30, 2011 valuations, 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 12.63%), as a result of the assumptions adopted by the Board following the economic assumptions study and the experience studies over the last ten years.

(relative to the June 30, 2020 valuation aggregate employer contribution rate of 32.25%) in the June 30, 2021 valuation and in the June 30, 2027 valuation (when all the investment gains or losses are fully recognized at the end of the seven-year asset smoothing period) are as shown in the following table:[6]

	2020/2021 Single Plan-Year Investment Return		
Contribution Rate Change	**0.00%**	**7.00% (Baseline)**	**14.00%**
June 30, 2021	+1.3% of payroll	+0.7% of payroll	+0.1% of payroll
June 30, 2027	+6.4% of payroll	+1.2% of payroll	-3.9% of payroll

As of June 30, 2020, the longest-duration amortization base is 22 years, and will be fully amortized on June 30, 2042. We note that under the unfavorable (0.00%) hypothetical market return scenario for 2020/2021, the last portion of the resulting deferred investment loss under the seven-year asset smoothing method will be recognized in the June 30, 2027 valuations and paid off in 15 years on June 30, 2042, which is the same year the 22-year base will be fully amortized. This implies that regardless of the hypothetical market return scenario for 2020/2021, the System is projected to reach full funding at the end of 22 years and the total employer contribution rate is projected to approach about 9% of payroll on June 30, 2042.

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,[7] there is a 50% chance that the employer contribution rates would be between 10% and 46% 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 25% chance LACERS would be fully funded at the end of 10 years and 57% chance LACERS would be fully funded at the end of 20 years.

For Tier 1 and Tier 1 Enhanced, these projections reflect that effective July 1, 2026, member contribution rates will be reduced by 1% of payroll (pursuant to ERIP Ordinance No. 180926), and the employer's normal cost rate for Tier 1 and Tier 1 Enhanced will therefore increase by 1% of payroll. (The increase in the employer's total normal cost rate effective July 1, 2026 when expressed as a percentage of payroll for all Tiers combined, including the payroll of Tier 3 members, is projected at about 0.50% of payroll.) The inclusion of this shift in normal cost is a refinement in our projections for the June 30, 2020 Risk Report.

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

[7] For the stochastic modeling, we have used the expected return, standard deviation and other information about LACERS' asset portfolio that we used in developing the 7.00% expected investment return assumption we recommended to the Board for the June 30, 2020 valuations. This modeling assumes no further assumption changes, method changes or non-investment experience that differs significantly from assumptions.

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 33 and 34) and by an increase in the ratios of plan assets and liabilities to active member payroll (as shown in Section 2, Charts 9a and 9b on pages 35 and 36). 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.

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[8] and market value of assets to the actuarial accrued liabilities (AAL)[9] 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, 2011 to 2020 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, 2011 to 2020 are provided separately for the Retirement and Health Plans in *Charts 2a* and *2b,* respectively.[10] The results in *Charts 2a* and *2b* show that the reductions in the investment return assumption in the June 30, 2011, 2014, 2017, and 2020[11] valuations, together with the changes in the mortality tables and other assumptions from the four triennial experience studies recommending assumptions used in the June 30, 2011, 2014, 2018, and 2020[10] valuations, have had the most impact on the UAAL for LACERS,[12] followed by the investment experience, especially during 2009 to 2013.

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[8] 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.

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

[10] For the Health Plan, *Chart 2b* shows changes only for the past seven valuations, from June 30, 2014 to 2020, because detailed information regarding the change in UAAL is not readily available in Segal's valuation reports from June 30, 2011 to 2013.

[11] 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.

[12] For example, for the Retirement and Health Plans combined, the UAAL increased by $422.0 million in the June 30 2011 valuations, $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 $3.0B), 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.

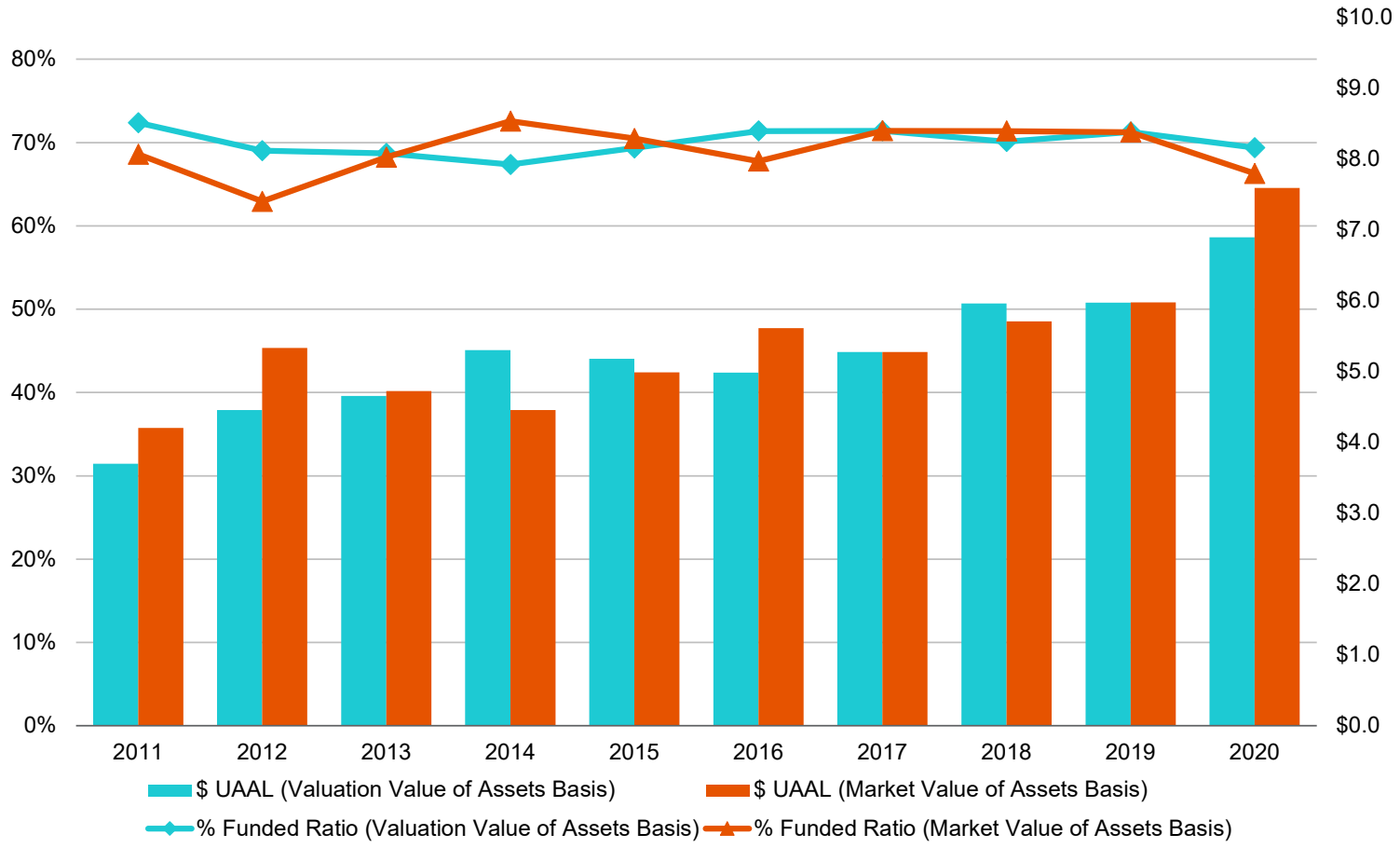
Finally, *Charts 2a* and *2b* show some "negative amortization" due to the initial 30-year amortization of the combined base established June 30, 2012. The negative amortization from the combined base is expected to continue through June 30, 2022. Current assumptions and amortization policy generally will not entail negative amortization 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

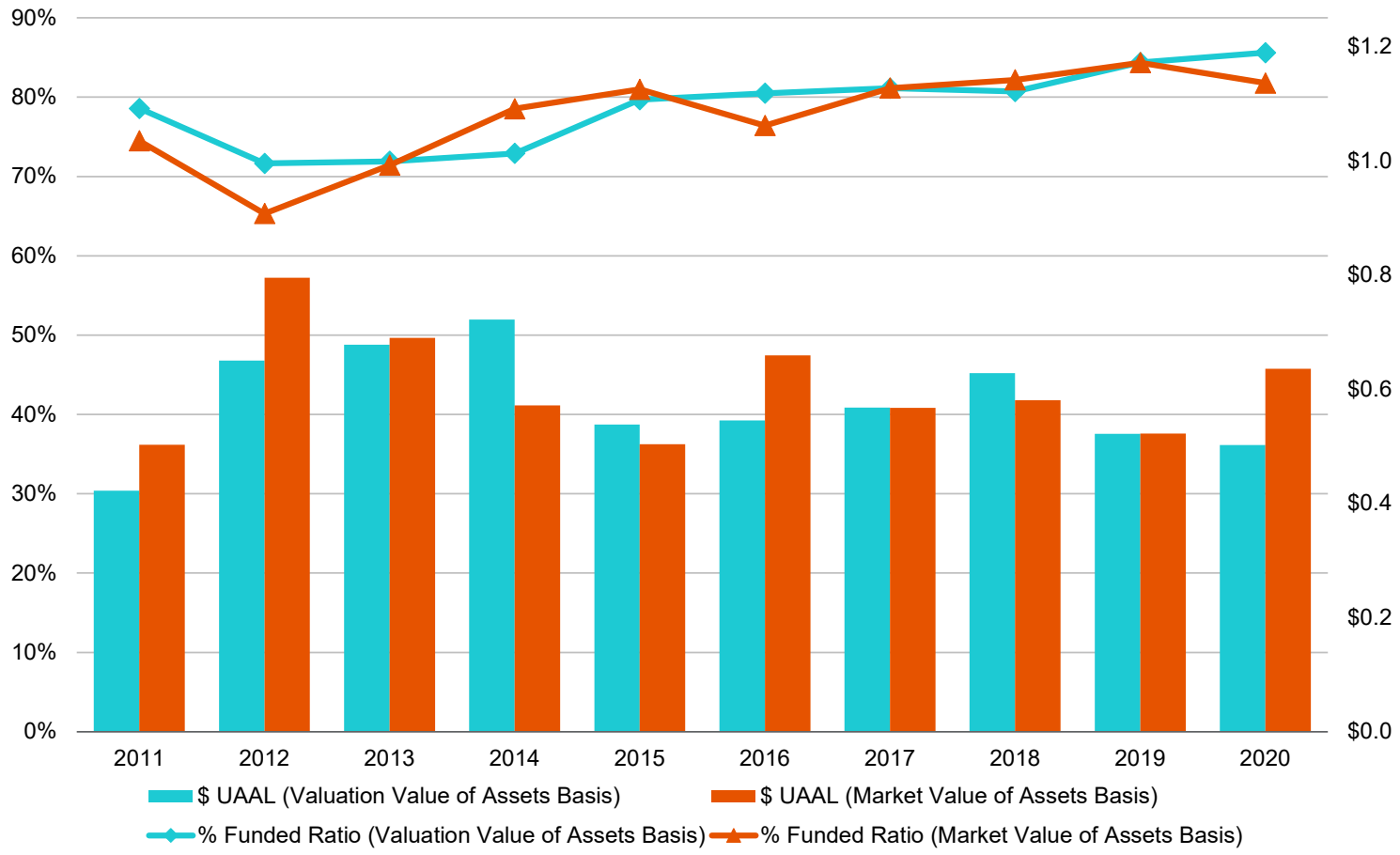
RETIREMENT PLAN

Funded Ratio (Percentages) and Dollar UAAL ($ Billions) in June 30, 2011 to 2020 Valuations



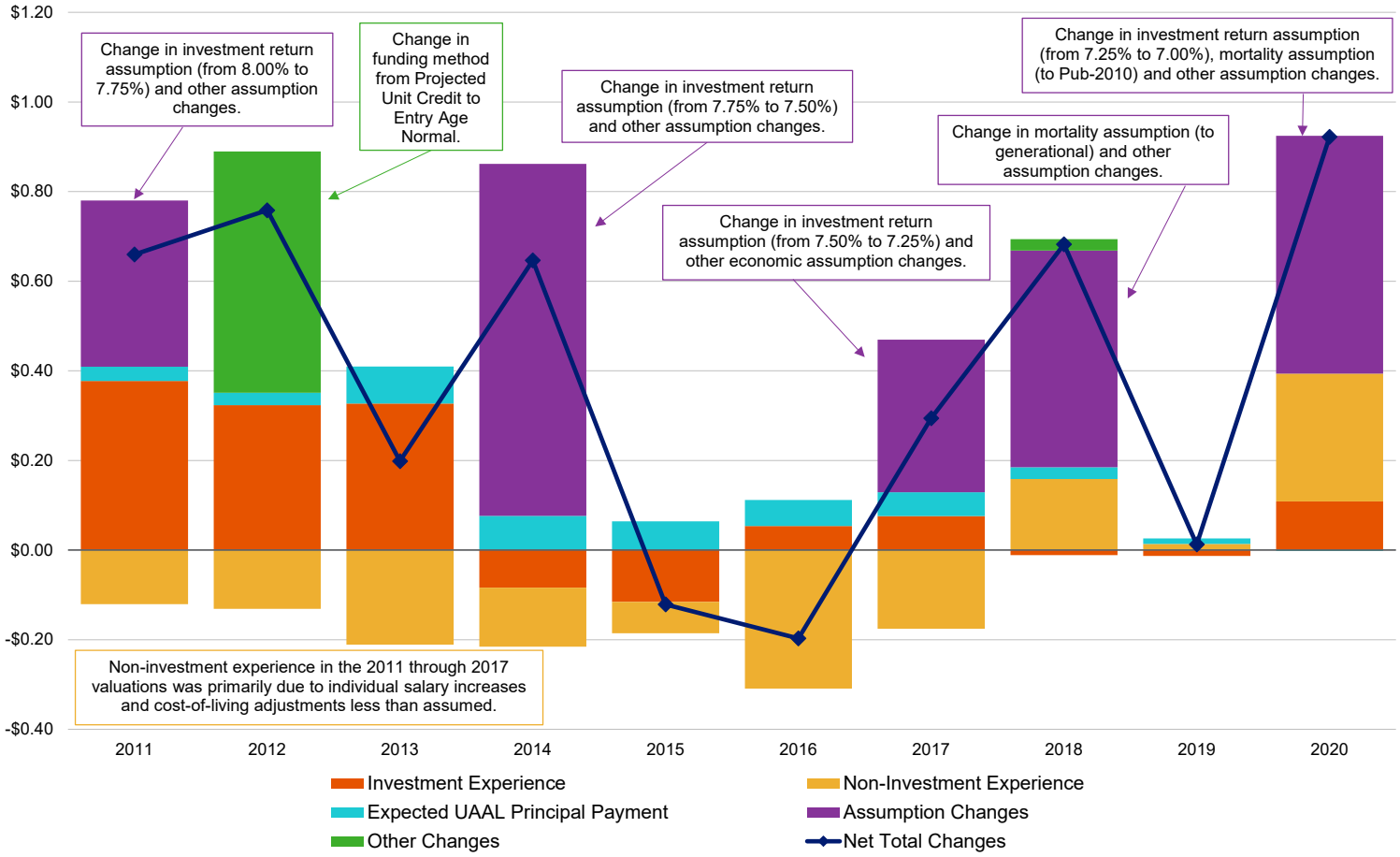
HEALTH PLAN

Funded Ratio (Percentages) and Dollar UAAL ($ Billions) in June 30, 2011 to 2020 Valuations



RETIREMENT PLAN

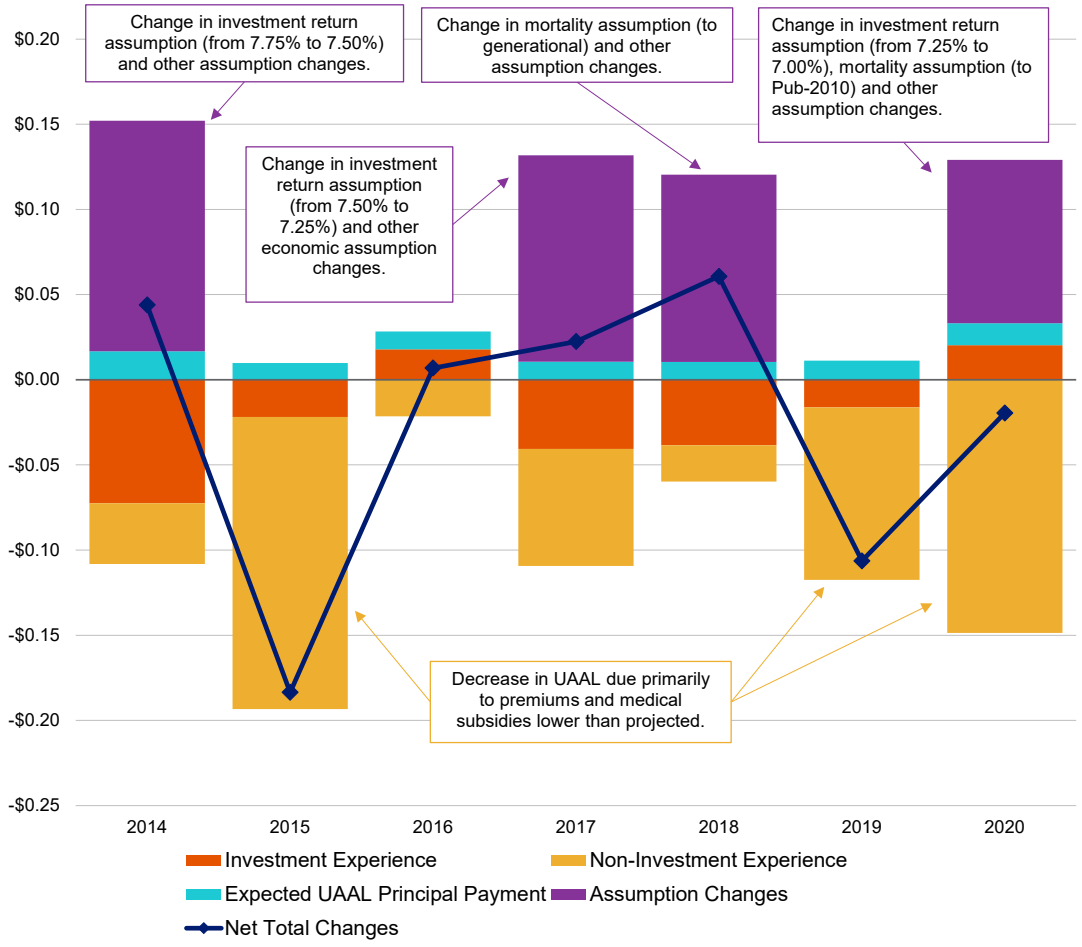
Factors that Changed UAAL in June 30, 2011 to 2020 Valuations ($ Billions)



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 2020 Valuations ($ Billions)



Employer Contribution Rates

The total (normal cost[13] plus UAAL payment) employer contribution rates determined in the June 30, 2011 to 2020 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[14] 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, 2011 valuation. For the Retirement Plan, the UAAL rate generally increased between the June 30, 2011 and the June 30, 2020 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.[15] For the Health Plan, the UAAL rate generally decreased between the June 30, 2011 and the June 30, 2020 valuations. A primary source of the decrease reflected in the June 30, 2011 valuation was a freeze in the medical subsidy for non-retired members who were not contributing. Other sources of decreases 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[16] for the City. The next greatest impact was from the investment experience during 2011 to 2020. Favorable non-investment experience and additional required member contributions have partially offset the contribution rate increases.

For the Health Plan, *Chart 4b* shows that the non-investment experience[17] (primarily medical premiums and subsidies lower than projected) has had the most impact on decreasing the UAAL contribution rates[16] for the City, offset somewhat from changes in the investment return, mortality tables and other assumptions.

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

[14] 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.

[15] 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).

[16] For example, for the Retirement and Health Plans combined, the increase in the employer's total rate (normal cost plus UAAL) was 1.37% in the June 30, 2011 valuations, 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 12.63%), as a result of the assumptions adopted by the Board following the economic assumptions study and the experience studies over the last ten years.

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

Chart 3a

RETIREMENT PLAN

Employer Contribution Rates in June 30, 2011 to 2020 Valuations
(% of Payroll – Contributions Received on July 15)

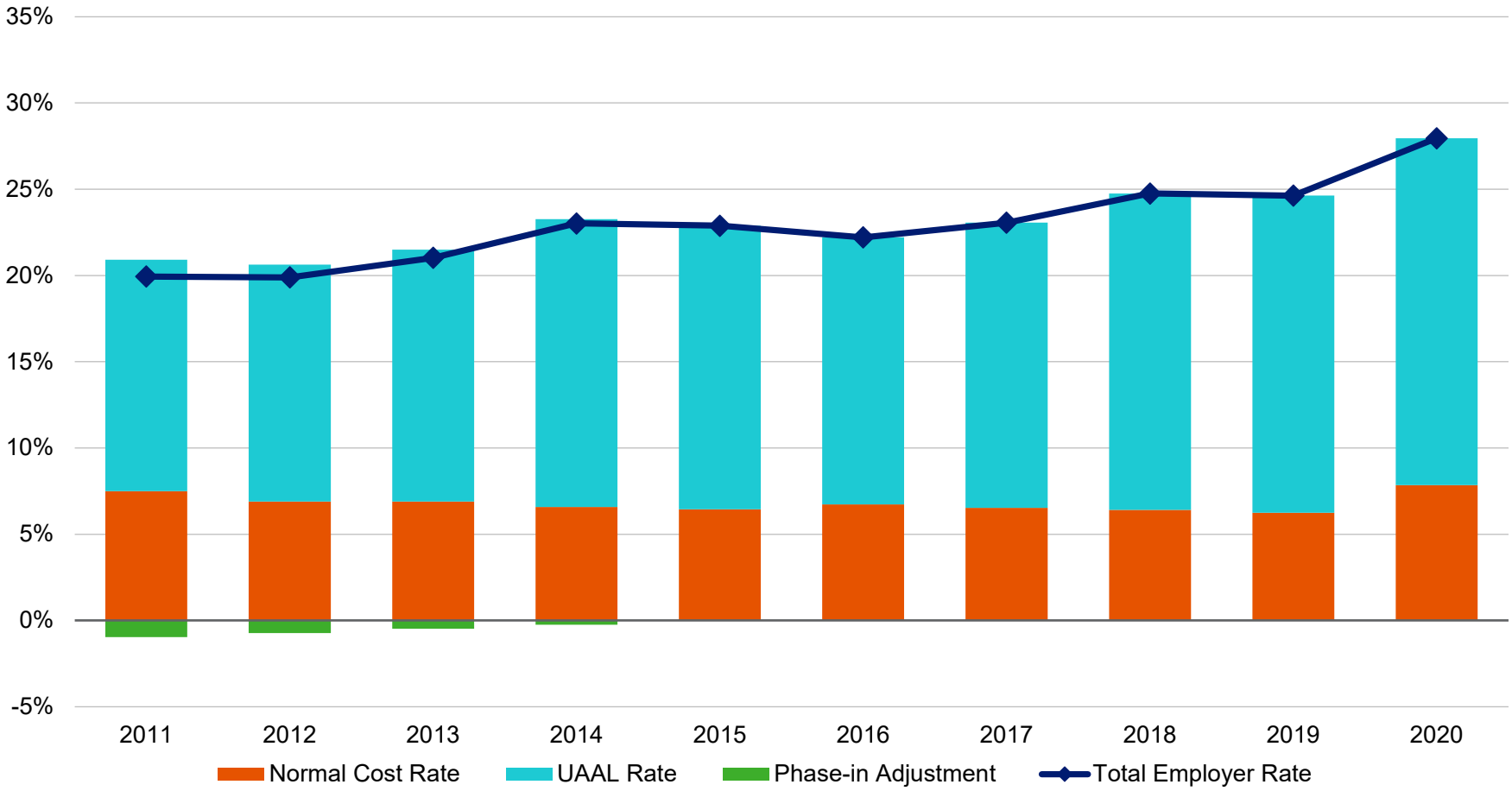
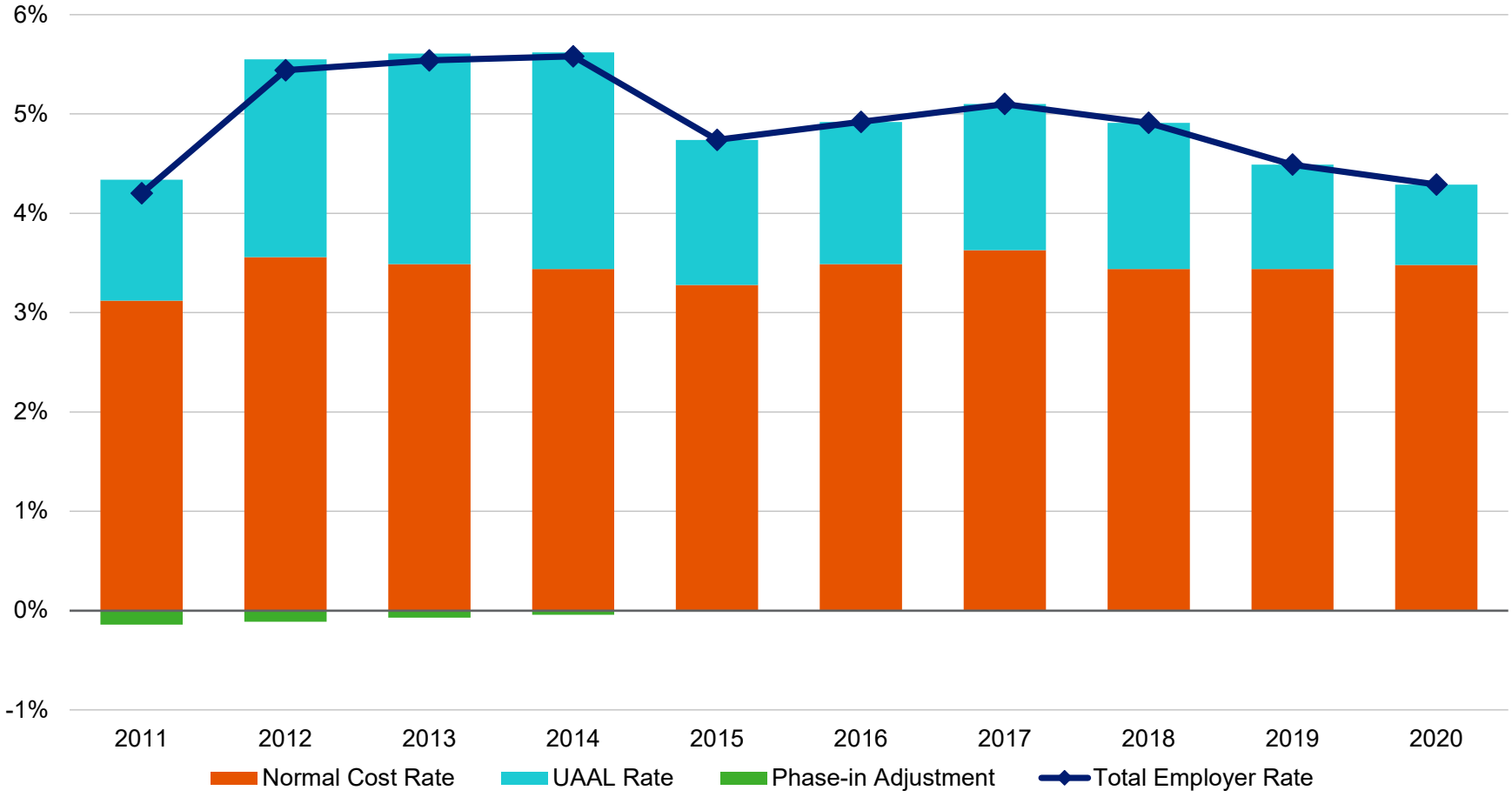


Chart 3b

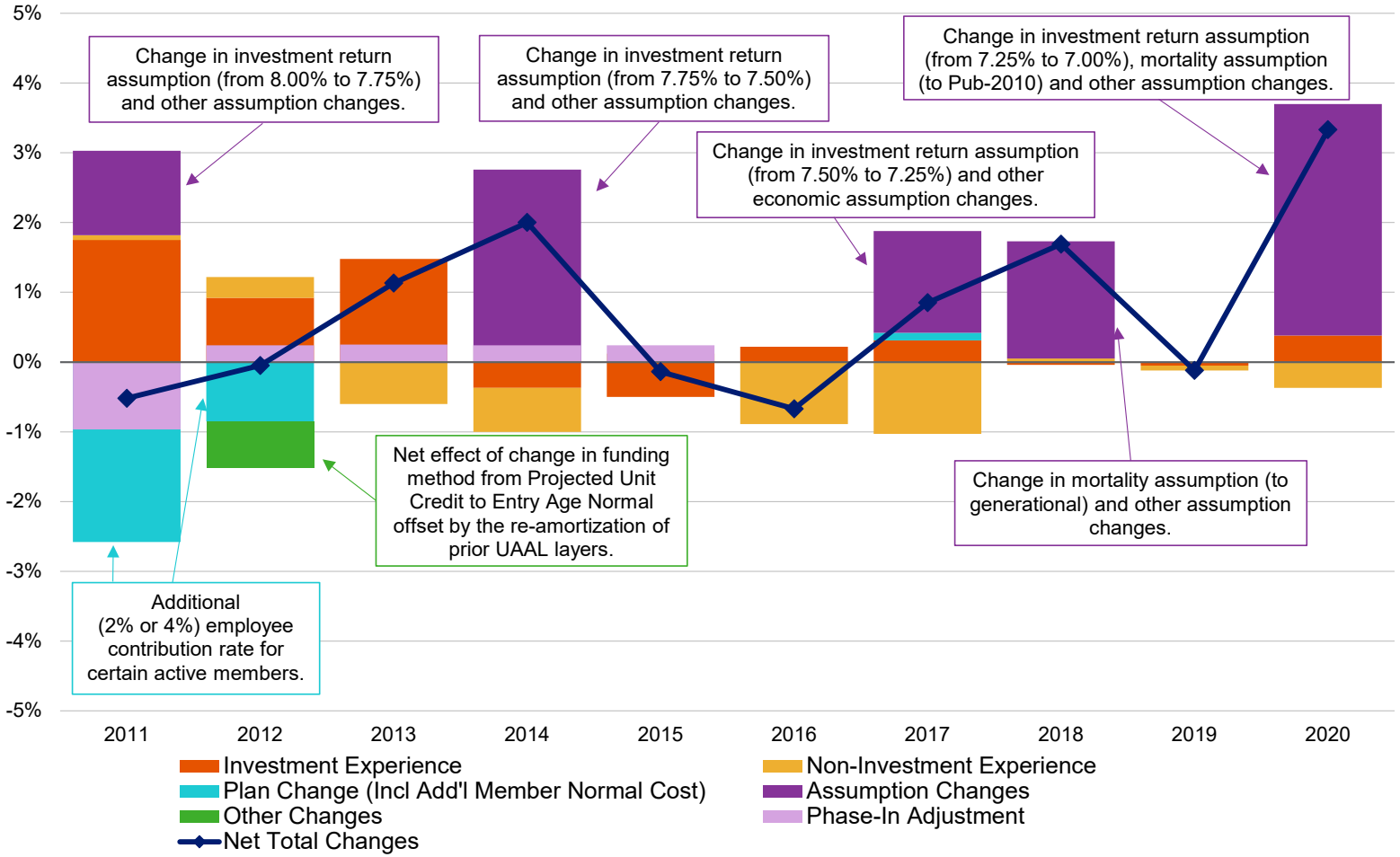
HEALTH PLAN

Employer Contribution Rates in June 30, 2011 to 2020 Valuations
(% of Payroll – Contributions Received on July 15)



RETIREMENT PLAN

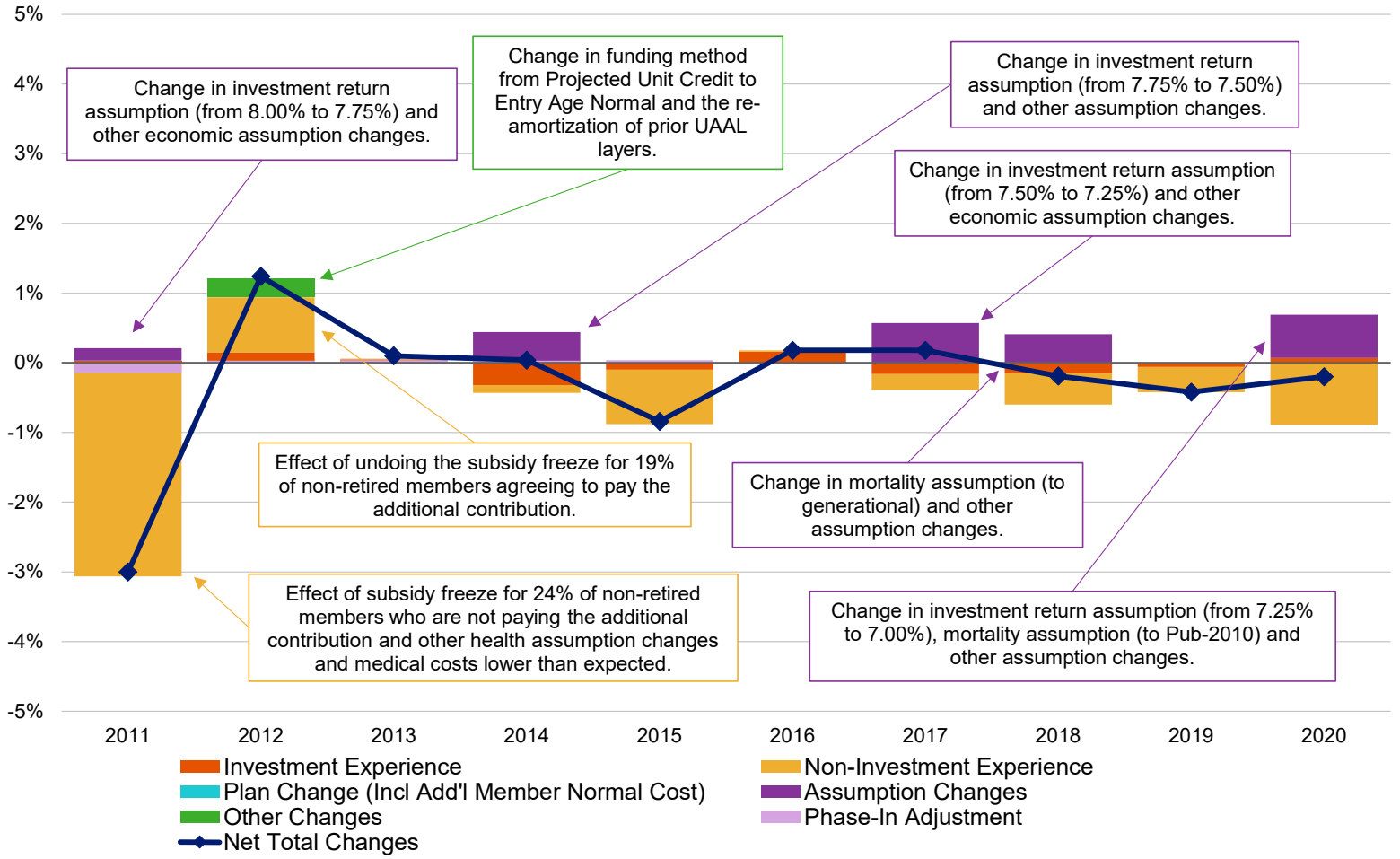
Factors that Affected Employer Contribution Rates in June 30, 2011 to 2020 Valuations (% of Payroll – Contributions Received on July 15)



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, 2011 to 2020 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 2011 to 2020 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 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, 2020 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 2020/2021 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. However, in preparing the illustration for this risk report, we have included results beyond 6 years to illustrate an aspect of the operation of the current funding policy for the Health Plan. Specifically, we note that for the Health Plan, the UAAL contribution rate is expected to drop in the 2024 to 2028 valuations even though there would still be an increase in the total UAAL amount in those years. This is the result of having experience gains that emerged in prior valuations[18] amortized over shorter periods (i.e., 15 years) than the period used for the combined UAAL base from the 2012 valuation (i.e., 22 years). As we previously pointed out in last year's Risk Report, the Board could make an adjustment to its funding policy so as to smooth out these projected changes in the employer's rate. Based on a recent follow-up discussion with LACERS' staff, we will bring that topic back for further discussion with the Board before the June 30, 2021 valuations.

The following table summarizes for the Retirement and Health Plans the resulting aggregate contribution changes (relative to the June 30, 2020 valuation aggregate employer contribution rate of 32.25%) in the immediately next valuation as well as in June 30, 2027 valuations when all of the investment gains and losses are fully recognized in the (smoothed) actuarial value of assets.

[18] This anomaly will be exacerbated under Scenario 3 with a 14.00% return for 2020/2021 and we have leveled out the UAAL contribution rates for those years when the total UAAL contribution rate would have become negative [credit].

	2020/2021 Single Plan-Year Investment Return		
Contribution Rate Change	**0.00%**	**7.00% (Baseline)**	**14.00%**
June 30, 2021	+1.3% of payroll	+0.7% of payroll	+0.1% of payroll
June 30, 2027	+6.4% of payroll	+1.2% of payroll	-3.9% of payroll

As of June 30, 2020, the longest-duration amortization base is 22 years, and will be fully amortized on June 30, 2042. We note that under the unfavorable (0.00%) hypothetical market return scenario for 2020/2021, the last portion of the resulting deferred investment loss under the seven-year asset smoothing method will be recognized in the June 30, 2027 valuations and paid off in 15 years on June 30, 2042, which is the same year the 22-year base will be fully amortized. This implies that regardless of the hypothetical market return scenario for 2020/2021, the System is projected to reach full funding at the end of 22 years and the total employer contribution rate is projected to approach about 9% of payroll on June 30, 2042.[19]

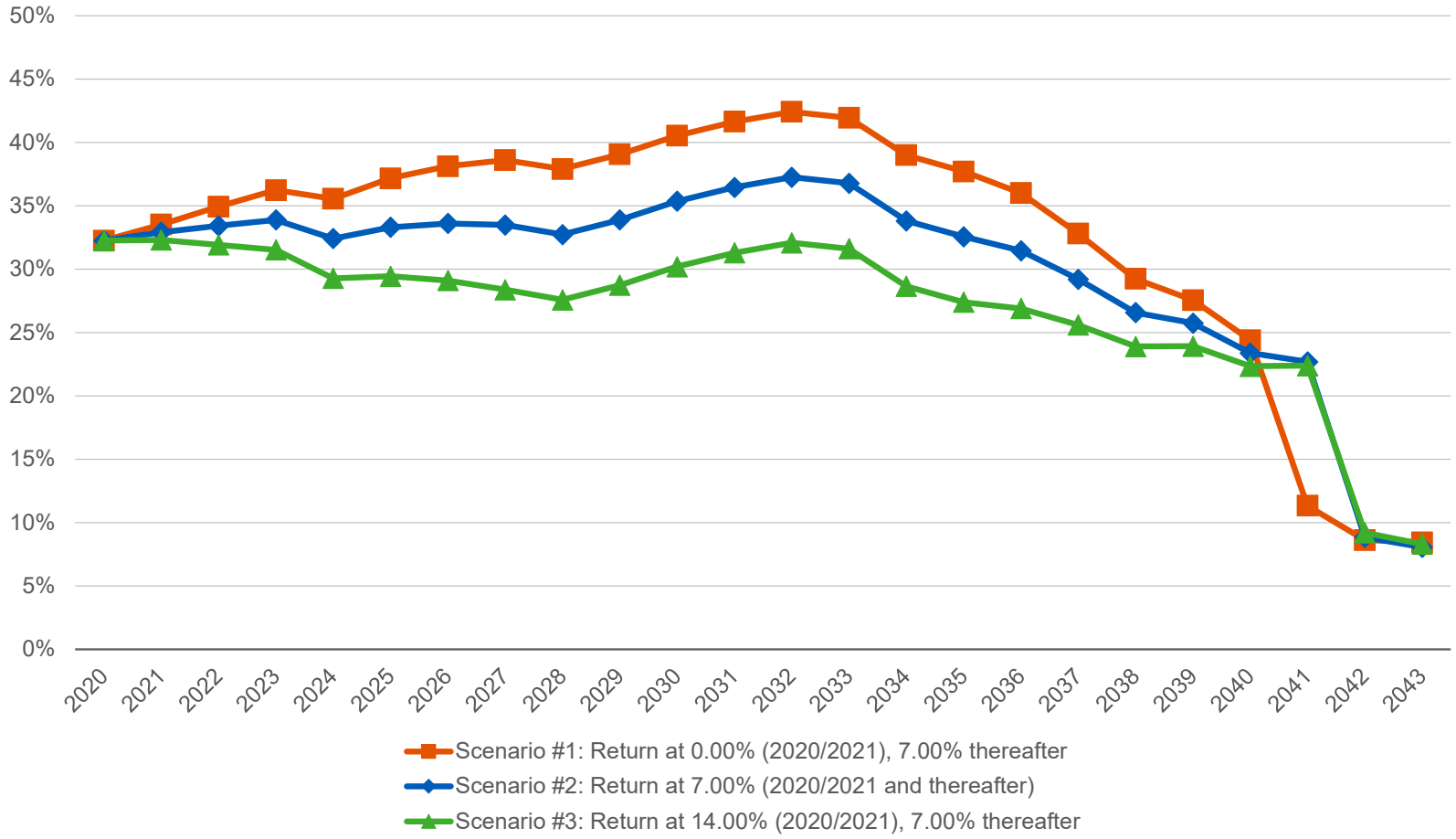
While we have not assigned a probability on the 2020/2021 market return coming in at these rates, the Board and other stakeholders monitoring LACERS can interpolate between these scenarios to estimate the funded status and employer contribution rates for the June 30, 2021 and next several valuations as the actual investment experience for the 2020/2021 year becomes available throughout the year. Additionally, comparable experience in upcoming future years is likely to have a similar impact on the System absent any significant plan or assumption changes.

For Tier 1 and Tier 1 Enhanced, projections reflect that effective July 1, 2026, member contribution rates will be reduced by 1% of payroll (pursuant to ERIP Ordinance No. 180926), and the employer's normal cost rate for Tier 1 and Tier 1 Enhanced will therefore increase by 1% of payroll. (The increase in the employer's total normal cost rate effective July 1, 2026 when expressed as a percentage of payroll for all Tiers combined, including the payroll of Tier 3 members, is projected at about 0.50% of payroll.) The inclusion of this shift in normal cost is a refinement in our projections for the June 30, 2020 Risk Report.

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

RETIREMENT AND HEALTH PLANS

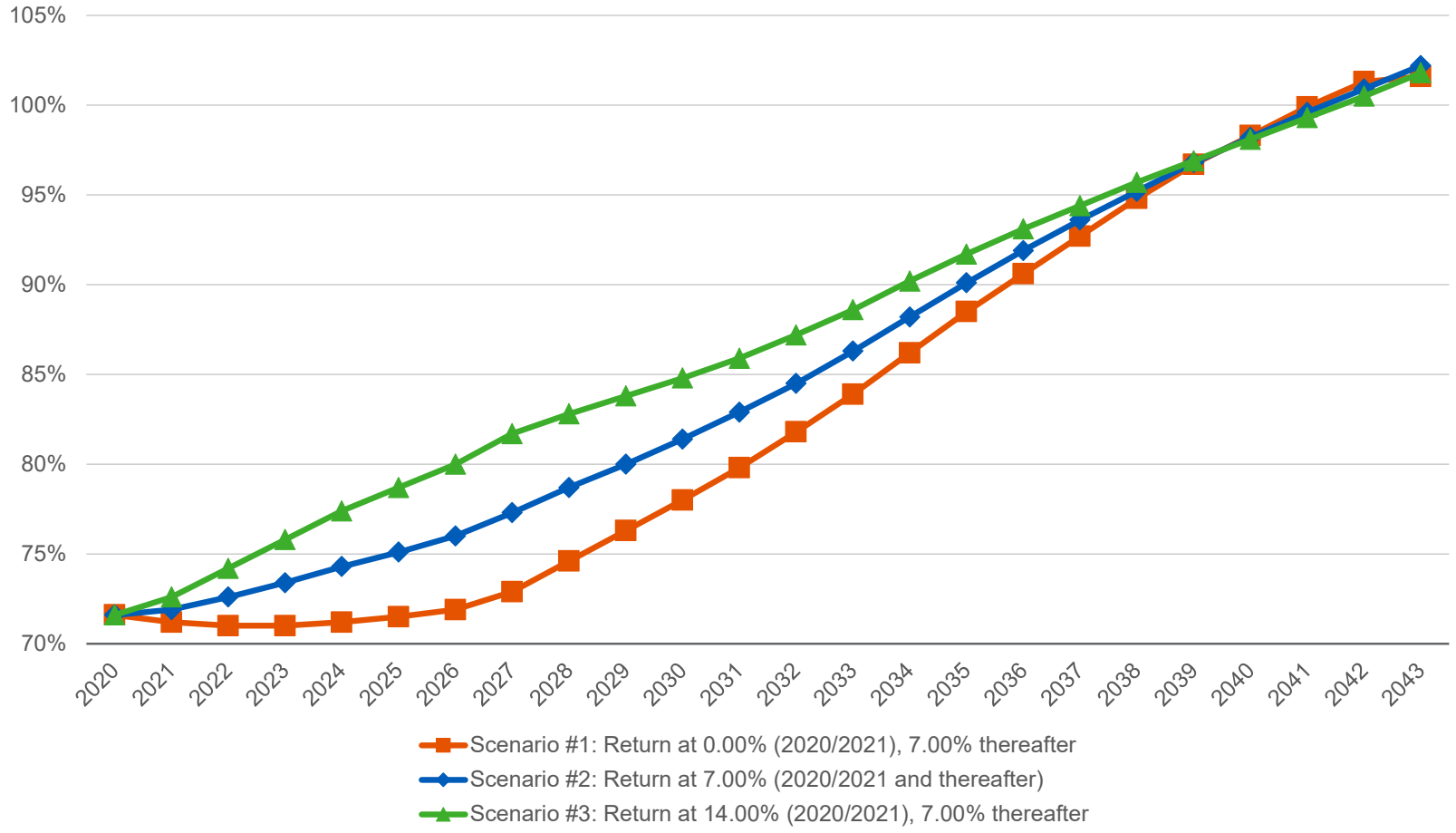
Projected Employer Contribution Rates
Under Three Hypothetical Market Return Scenarios for 2020/2021
for the June 30, 2020 to 2043 Valuations (% of Payroll – Contributions Received on July 15)



Note: The contribution rates under all scenarios would be expected to approach 9% (the projected aggregate Normal Cost rate) on June 30, 2042 when the final amortization base is fully recognized in 22 years.

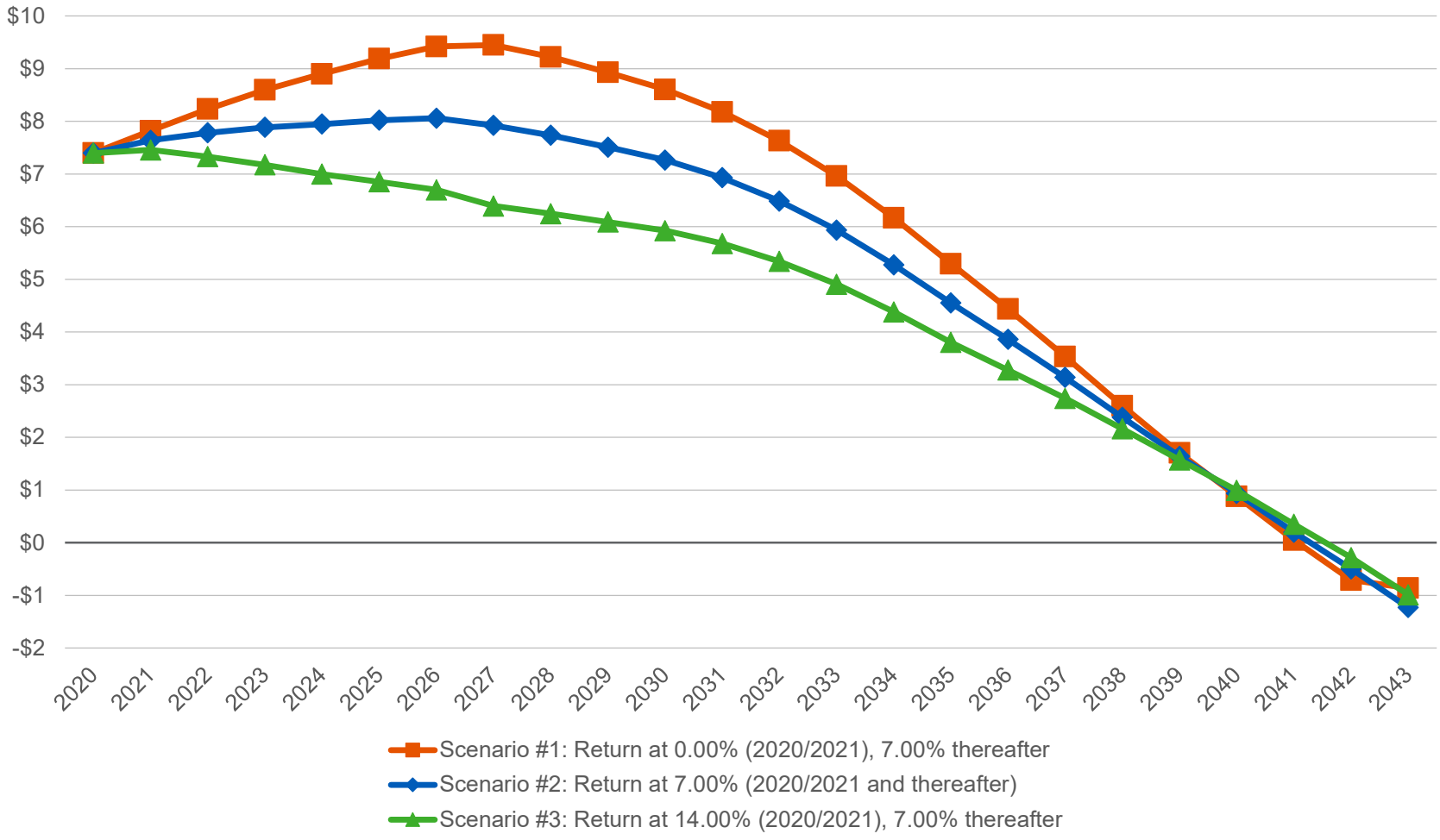
RETIREMENT AND HEALTH PLANS

Projected Funded Ratios (on Valuation Value of Assets) Under Three Hypothetical Market Return Scenarios for 2020/2021 for the June 30, 2020 to 2043 Valuations



RETIREMENT AND HEALTH PLANS

Projected UAAL (on Valuation Value of Assets)
Under Three Hypothetical Market Return Scenarios for 2020/2021
for the June 30, 2020 to 2043 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, 2020 valuations. We have performed the stochastic modeling of future market returns using the expected return, standard deviation and other information about LACERS' asset portfolio[20] 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[21] that the annual return of LACERS' investment portfolio would average between 5.8% and 9.5%, the funded ratio would be between 87% and 132% and the corresponding UAAL would be between $6.8 billion and a surplus (or a negative UAAL) of $16.8 billion.

On an Actuarial (Smoothed) Value of Assets basis, the funded ratio for the Retirement and Health Plans combined is about 71.6% as of the June 30, 2020 valuation. There is a 25% chance LACERS would be fully funded at the end of 10 years and a 57% 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	45%	14%	2%

The total employer contribution rate is about 32% of payroll based on the June 30, 2020 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, 2030 valuation), there is a 50% chance that the employer contribution rates would be between 10% and 46% of payroll. At the end of 20 years (i.e., the June 30, 2040 valuation), there is a 50% chance that the employer contribution

[20] For the stochastic modeling, we have used the expected return, standard deviation and other information about LACERS' asset portfolio that we applied in developing the 7.00% expected investment return assumption we recommended to the Board for the June 30, 2020 valuations. This modeling assumes no further assumption changes, method changes or non-investment experience that differs significantly from assumptions.

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

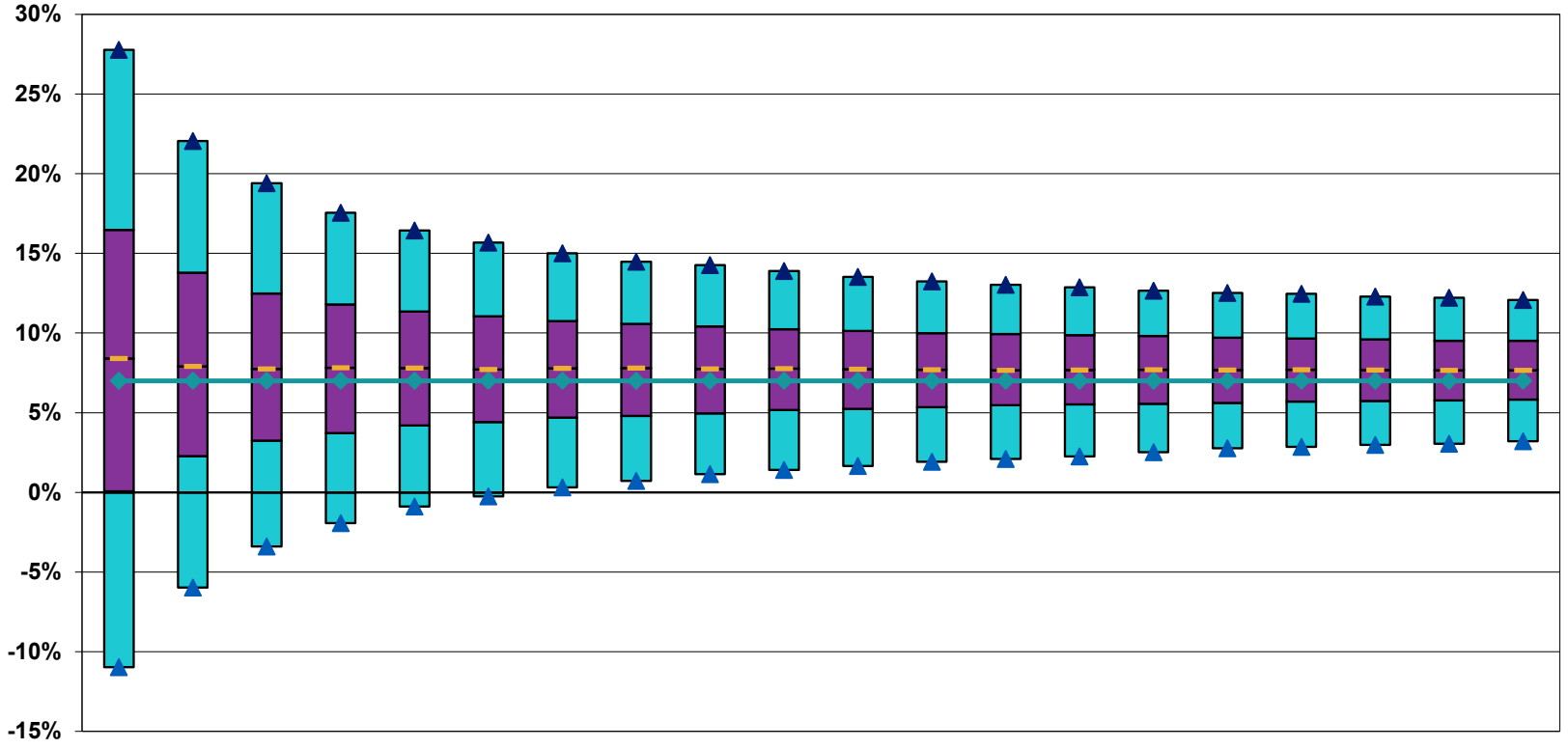
rates would be between 0% and 39% of payroll. The probabilities that the total employer contribution rate would increase at least by 5%, 10% or 15% of payroll at any point in the next 20 years are as follows:

	Total Employer Rate Increases by at least		
	5% of Payroll (to 37% of Payroll)	**10% of Payroll (to 42% of Payroll)**	**15% of Payroll (to 47% of Payroll)**
Probability	59%	47%	38%

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

	Total Employer Rate Spike in a Single Year by		
	2% of Payroll	**4% of Payroll**	**6% of Payroll**
Probability	21%	8%	3%

Projected Cumulative Investment Return for Plan Years Ending June 30

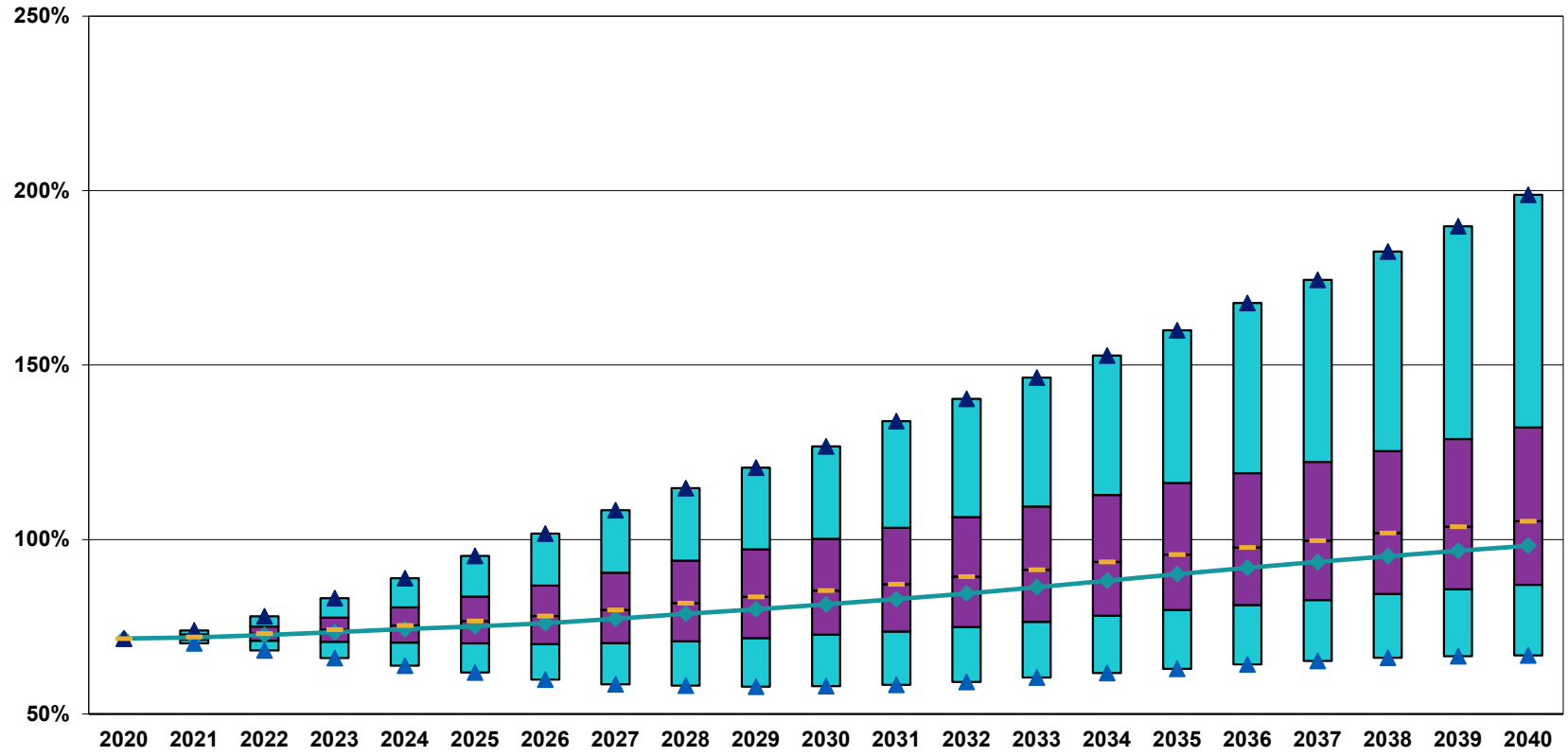


	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
▲ 95th	27.8%	22.0%	19.4%	17.5%	16.4%	15.7%	15.0%	14.5%	14.3%	13.9%	13.5%	13.2%	13.0%	12.9%	12.7%	12.5%	12.5%	12.3%	12.2%	12.1%
— 75th	16.5%	13.8%	12.5%	11.8%	11.3%	11.1%	10.7%	10.6%	10.4%	10.2%	10.1%	10.0%	9.9%	9.9%	9.8%	9.7%	9.7%	9.6%	9.5%	9.5%
50th	8.4%	7.9%	7.8%	7.8%	7.8%	7.7%	7.8%	7.8%	7.7%	7.8%	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%	7.7%
— 25th	0.1%	2.3%	3.2%	3.7%	4.2%	4.4%	4.7%	4.8%	5.0%	5.2%	5.2%	5.4%	5.5%	5.5%	5.5%	5.6%	5.7%	5.7%	5.8%	5.8%
▲ 5th	-11.0%	-6.0%	-3.4%	-1.9%	-0.9%	-0.3%	0.3%	0.7%	1.1%	1.4%	1.6%	1.9%	2.1%	2.3%	2.5%	2.8%	2.9%	3.0%	3.1%	3.2%
◆	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. The above results are consistent with that observation.

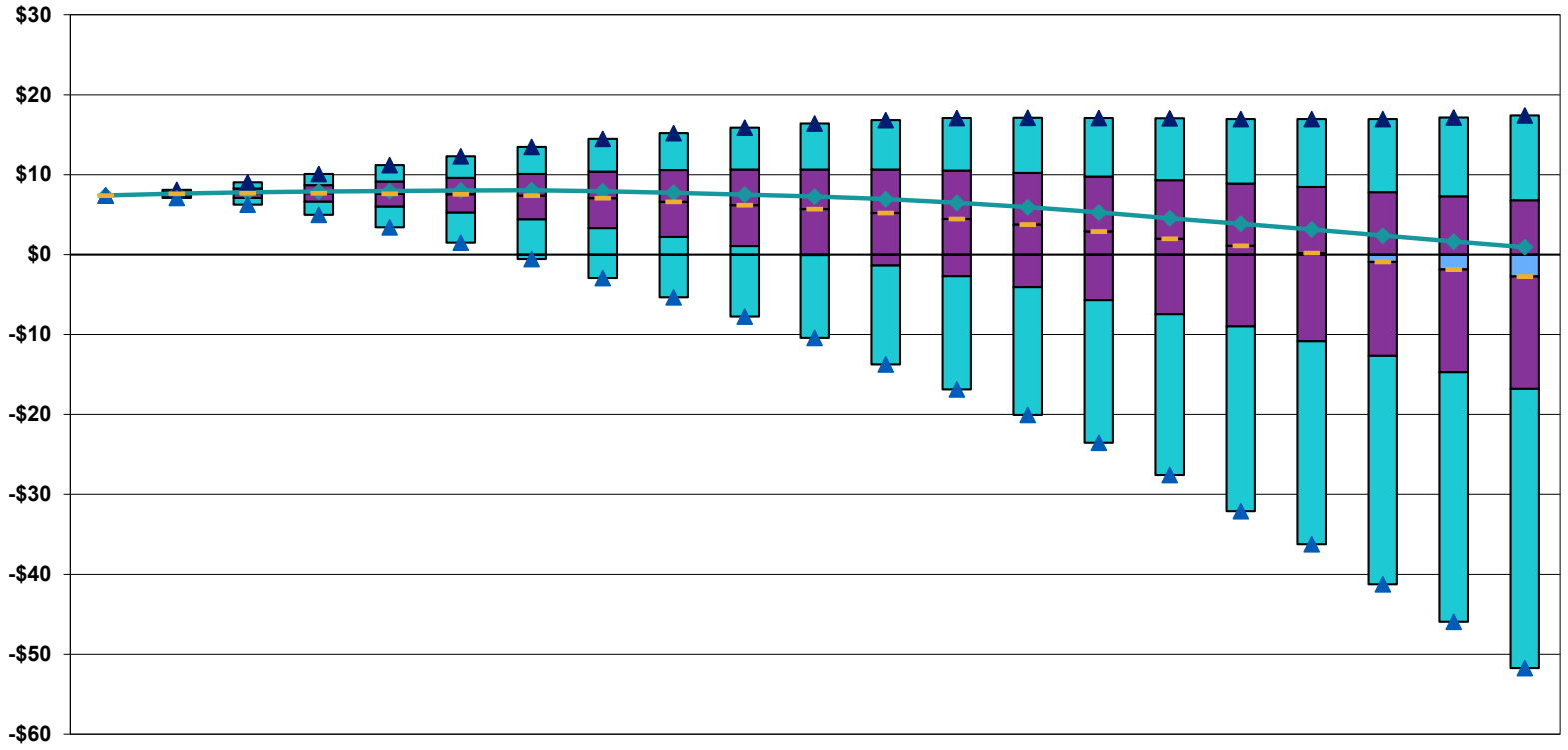
Projected Funded Ratios (on Actuarial Value of Assets Basis)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
▲ 95th	71.6%	73.9%	78.0%	83.2%	88.9%	95.3%	101.7%	108.4%	114.7%	120.6%	126.7%	134.0%	140.3%	146.4%	152.8%	159.9%	167.8%	174.4%	182.6%	189.8%	198.8%
— 75th	71.6%	72.8%	75.0%	77.6%	80.6%	83.7%	86.8%	90.5%	93.9%	97.2%	100.2%	103.4%	106.4%	109.4%	112.8%	116.2%	119.0%	122.3%	125.3%	128.8%	132.1%
— 50th	71.6%	72.0%	73.0%	74.1%	75.4%	76.6%	78.0%	79.8%	81.8%	83.5%	85.4%	87.1%	89.3%	91.3%	93.5%	95.7%	97.7%	99.6%	101.9%	103.6%	105.2%
— 25th	71.6%	71.2%	71.0%	70.7%	70.5%	70.2%	70.0%	70.3%	70.8%	71.7%	72.7%	73.6%	74.9%	76.4%	78.1%	79.8%	81.2%	82.6%	84.4%	85.8%	87.0%
▲ 5th	71.6%	70.2%	68.2%	66.0%	63.8%	61.8%	59.9%	58.5%	58.1%	57.8%	58.0%	58.3%	59.1%	60.4%	61.7%	62.9%	64.2%	65.2%	66.1%	66.5%	66.7%
◆	71.6%	71.9%	72.6%	73.4%	74.3%	75.1%	76.0%	77.3%	78.7%	80.0%	81.4%	82.9%	84.5%	86.3%	88.2%	90.1%	91.9%	93.6%	95.2%	96.8%	98.2%

◆ Baseline deterministic projection

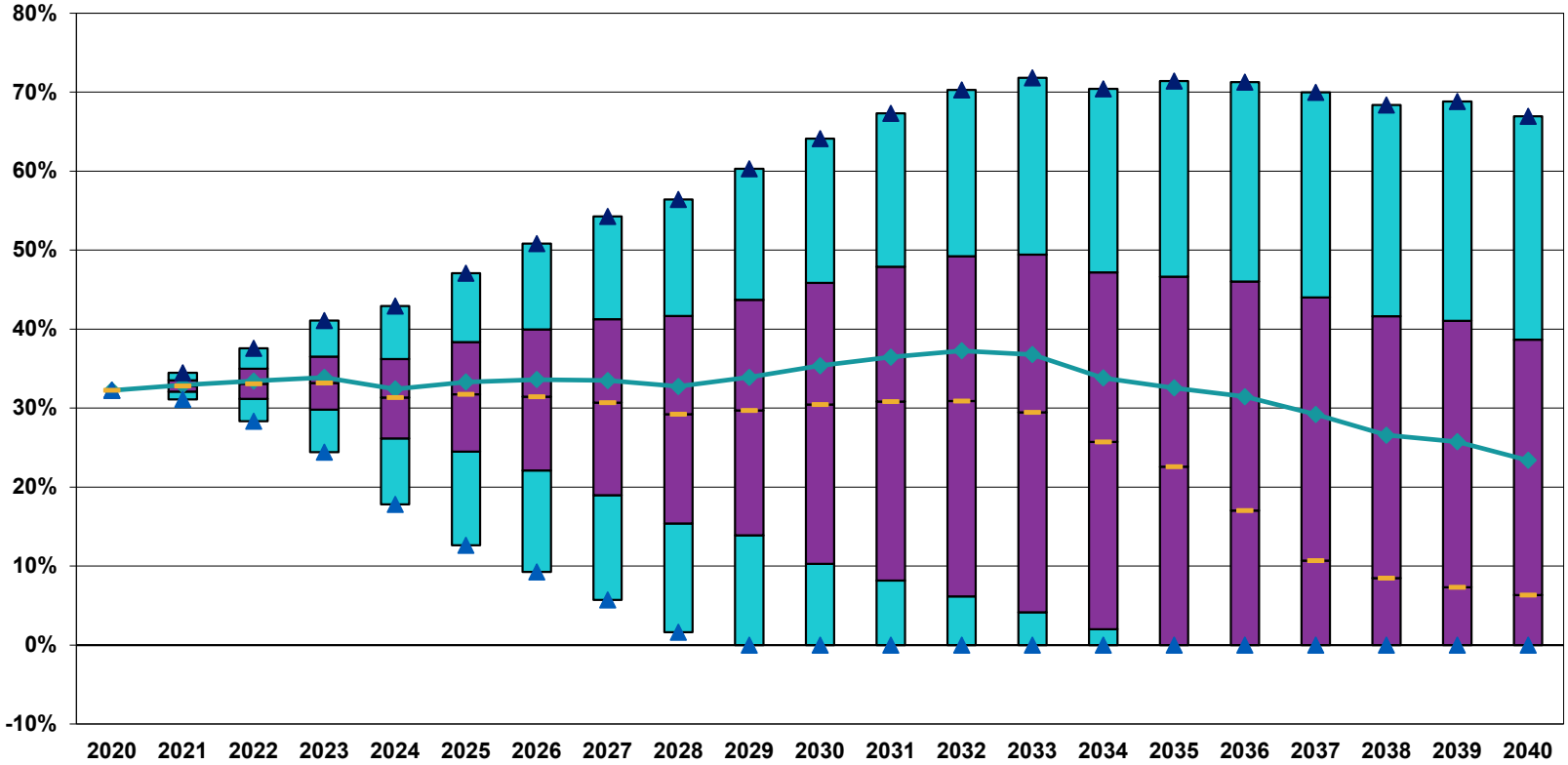
Projected UAAL (on Actuarial Value of Assets Basis)



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
▲ 95th	7.4	7.1	6.2	5.0	3.4	1.5	-0.6	-2.9	-5.3	-7.8	-10.4	-13.7	-16.9	-20.1	-23.5	-27.6	-32.1	-36.2	-41.3	-46.0	-51.7
— 75th	7.4	7.4	7.1	6.6	6.0	5.3	4.4	3.3	2.2	1.1	-0.1	-1.4	-2.7	-4.1	-5.7	-7.5	-9.0	-10.8	-12.7	-14.7	-16.8
— 50th	7.4	7.6	7.7	7.7	7.6	7.5	7.4	7.0	6.6	6.2	5.7	5.2	4.5	3.8	2.9	2.0	1.1	0.2	-0.9	-1.9	-2.7
— 25th	7.4	7.8	8.2	8.7	9.1	9.6	10.1	10.4	10.6	10.6	10.7	10.7	10.5	10.2	9.8	9.3	8.9	8.4	7.8	7.3	6.8
▲ 5th	7.4	8.1	9.0	10.1	11.2	12.3	13.5	14.5	15.2	15.9	16.4	16.8	17.1	17.1	17.1	17.0	17.0	16.9	16.9	17.1	17.4
◆	7.4	7.6	7.8	7.9	8.0	8.0	8.1	7.9	7.7	7.5	7.3	6.9	6.5	5.9	5.3	4.6	3.9	3.1	2.4	1.6	0.9

◆ Baseline deterministic projection

Projected Employer Contribution Rates



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
▲ 95th	32.3%	31.1%	28.4%	24.4%	17.8%	12.6%	9.2%	5.7%	1.6%	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	32.3%	32.1%	31.2%	29.8%	26.2%	24.5%	22.1%	19.0%	15.4%	13.9%	10.3%	8.2%	6.2%	4.2%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
▬ 50th	32.3%	32.8%	33.1%	33.2%	31.3%	31.8%	31.4%	30.7%	29.2%	29.7%	30.5%	30.8%	30.9%	29.5%	25.7%	22.6%	17.0%	10.7%	8.5%	7.3%	6.3%
— 25th	32.3%	33.5%	35.0%	36.5%	36.2%	38.3%	40.0%	41.2%	41.7%	43.7%	45.9%	47.9%	49.2%	49.4%	47.2%	46.6%	46.0%	44.0%	41.6%	41.0%	38.7%
▲ 5th	32.3%	34.5%	37.6%	41.1%	42.9%	47.1%	50.8%	54.3%	56.4%	60.3%	64.1%	67.3%	70.3%	71.8%	70.4%	71.4%	71.3%	70.0%	68.4%	68.8%	67.0%
◆	32.3%	32.9%	33.4%	33.9%	32.4%	33.3%	33.6%	33.5%	32.7%	33.9%	35.4%	36.5%	37.3%	36.8%	33.8%	32.6%	31.5%	29.2%	26.6%	25.7%	23.4%

◆ 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, 2011 to 2020, 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 6.1 as of June 30, 2020. This means that a 1% asset gain or loss in 2020/2021 (relative to the assumed investment return) would amount to 6.1% of one year's payroll. Similarly, the Retirement Plan's LVR was 9.2 as of June 30, 2020, so a 1% liability gain or loss in 2020/2021 would amount to 9.2% of one year's payroll. Based on LACERS' policy to amortize actuarial experience over a period of 15 years, there would be a 0.5% 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, 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, 2020 AVR	10% Investment Loss Compares to	LVR	10% Liability Change Compares to
Retirement Plan	6.1	61% of payroll	9.2	92% of payroll
Health Plan	1.2	12% of payroll	1.4	14% of payroll
Combined	7.3	73% of payroll	10.6	106% of payroll

Chart 12a

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, 2011 to 2020 Valuations

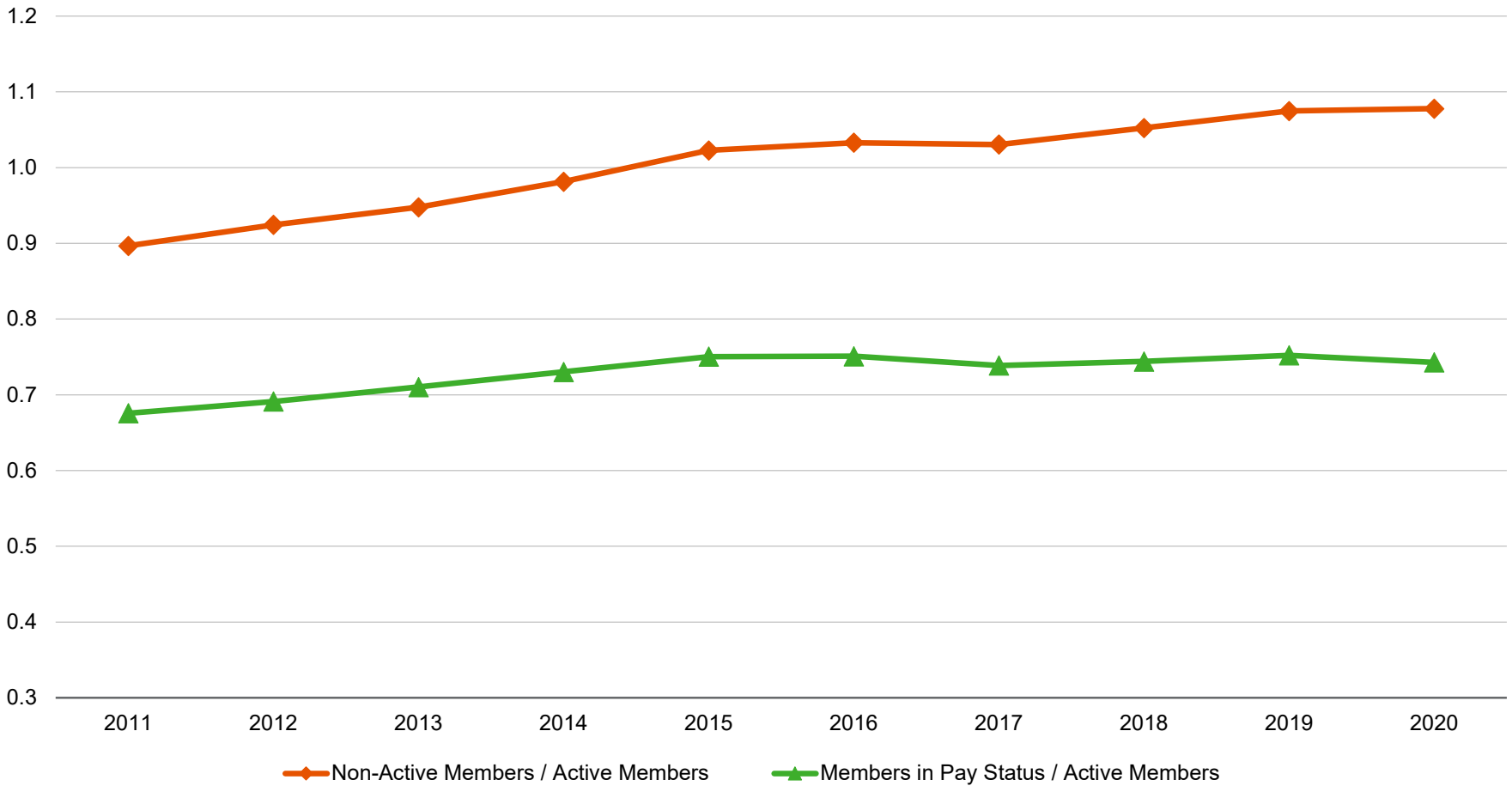


Chart 12b

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, 2011 to 2020 Valuations

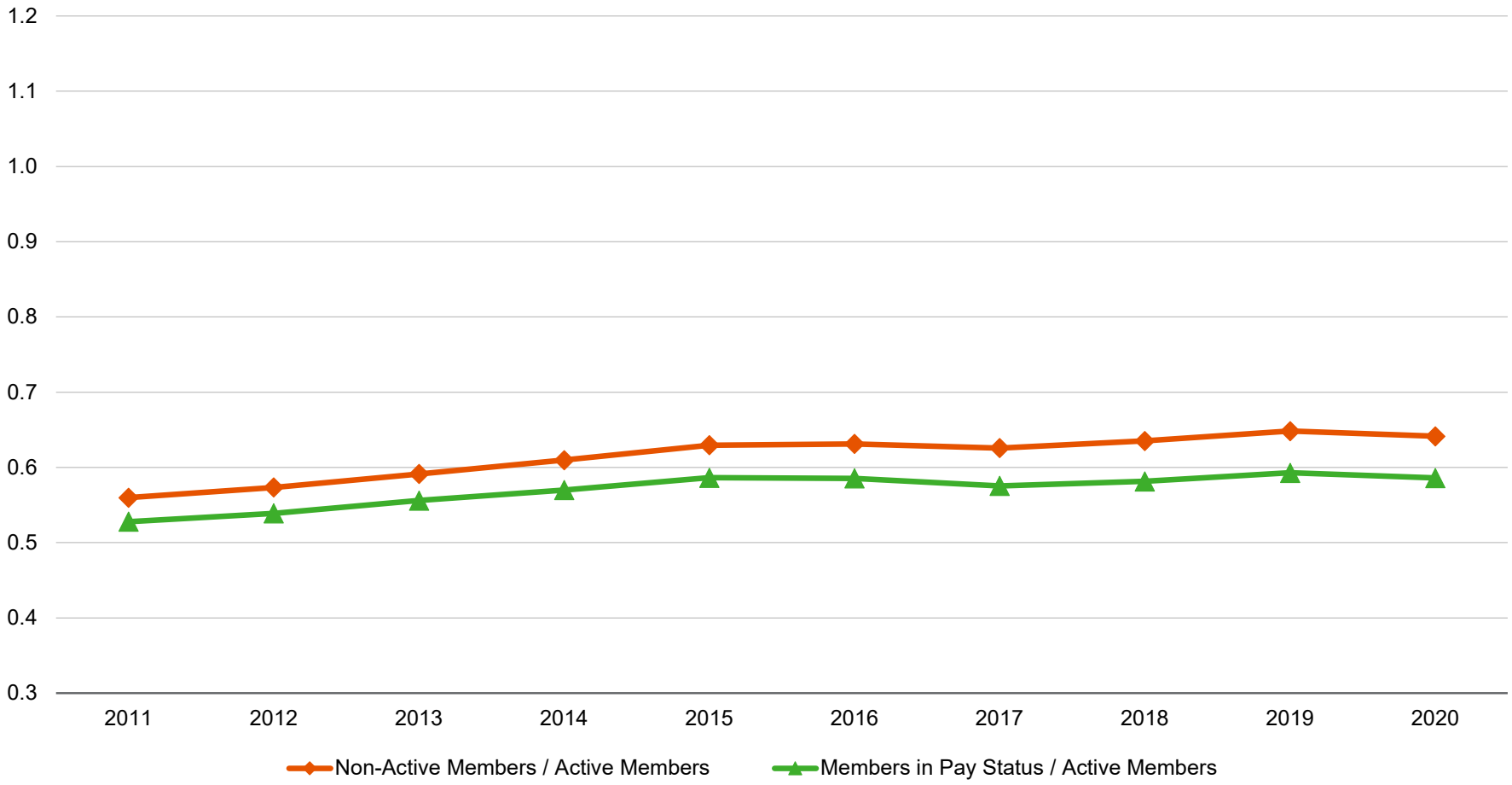


Chart 13a

RETIREMENT PLAN

Volatility Ratios in June 30, 2011 to 2020 Valuations

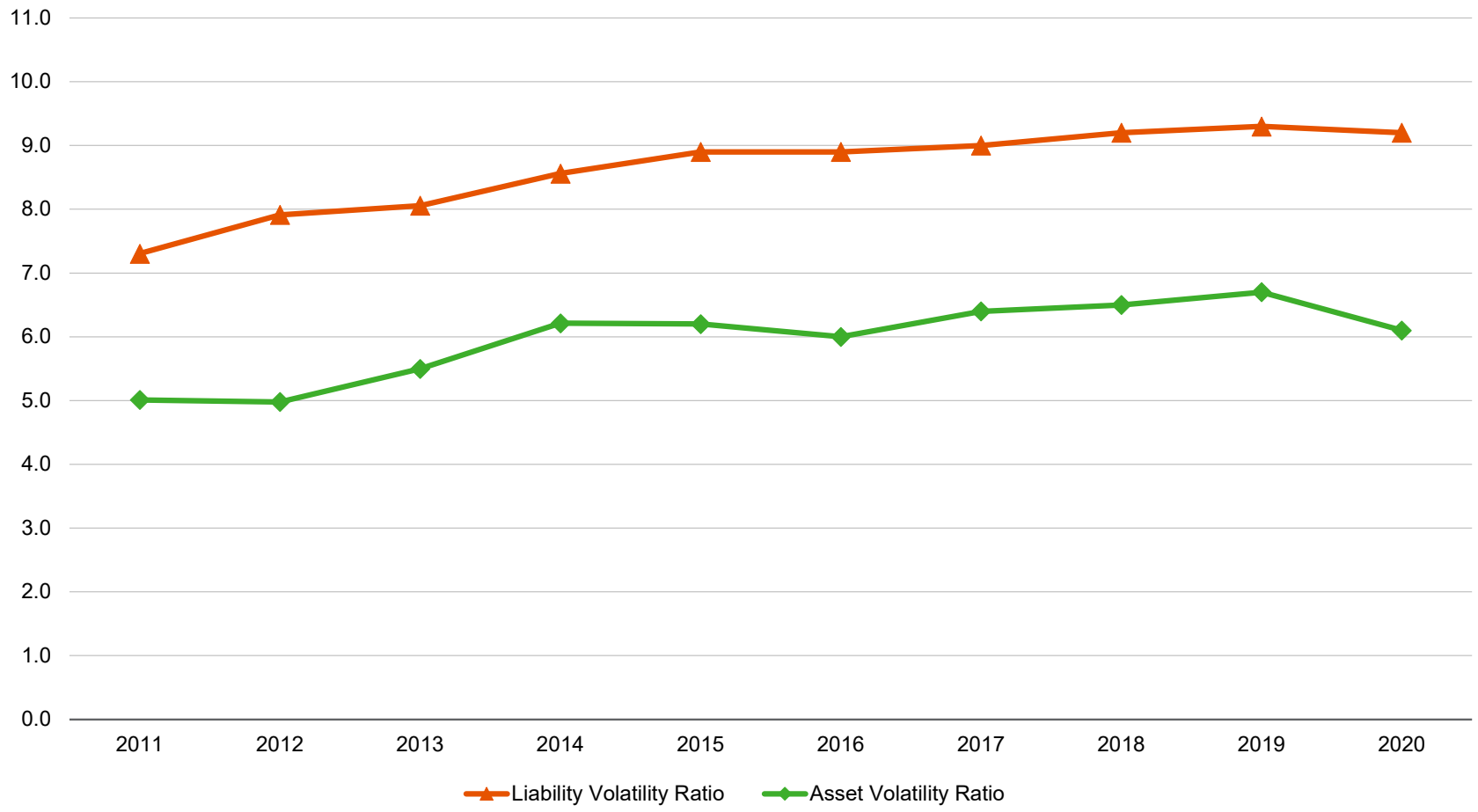
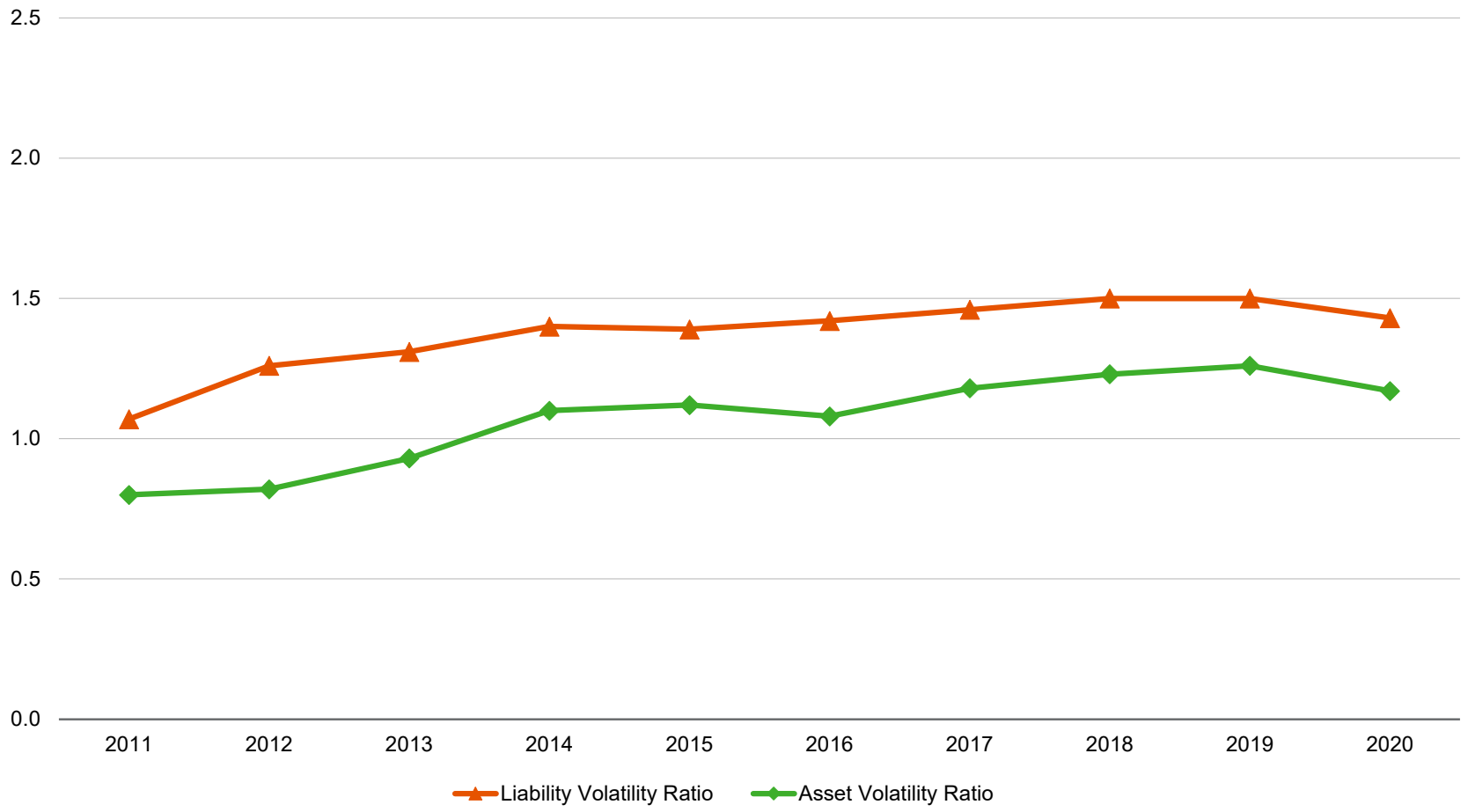


Chart 13b

HEALTH PLAN

Volatility Ratios in June 30, 2011 to 2020 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, 2020 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. Our Actuarial Technology and Systems unit, comprised of both actuaries and programmers, is responsible for the initial development and maintenance of these models. The models have a modular structure that allows for a high degree of accuracy, flexibility and user control. The client team programs the assumptions and the plan provisions, validates the models, and reviews test lives and results, under the supervision of the responsible actuary.

Deterministic Projection

In addition, we have prepared the deterministic projection using the following assumptions and methods applied in the June 30, 2020 actuarial valuation:

- Non-economic assumptions will remain unchanged.
- Retirement benefit formulas will remain unchanged.
- 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% for the Retirement and Health Plans, respectively. These assumptions have been developed by

analyzing the increase in the actual benefit payments over the last five years, combined with the projected benefit payments based on the actuarial assumptions described herein for the next five years

- All other actuarial assumptions used in the June 30, 2020 actuarial valuation will be realized.

Stochastic Projection

Besides the assumptions and methods discussed above for the deterministic projection, the following additional assumptions or parameters are used in projecting 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, 2020 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%

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 LACERS' investment portfolio. These assumptions are the same as those used in the stochastic simulation in the last triennial experience study dated June 17, 2020.

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

	Asset Class	20-Year Arithmetic Return	Standard Deviation	Correlation Matrix												
					1	2	3	4	5	6	7	8	9	10	11	12	13
1	Large Cap U.S. Equity	8.34%	16.17%	1	1.00												
2	Small/Mid Cap U.S. Equity	9.52%	20.15%	2	0.86	1.00											
3	Developed International Equity	9.30%	18.23%	3	0.83	0.74	1.00										
4	Emerging International Equity	11.67%	24.73%	4	0.72	0.67	0.78	1.00									
5	Core Bonds	4.46%	5.47%	5	0.15	0.07	0.17	0.17	1.00								
6	High Yield Bonds, Bank Loans	6.38%	10.06%	6	0.13	0.07	0.14	0.13	0.84	1.00							
7	Emerging Market Debt	6.76%	11.31%	7	0.51	0.47	0.54	0.64	0.45	0.35	1.00						
8	US Treasuries, Cash	3.07%	2.31%	8	(0.06)	(0.07)	(0.05)	(0.03)	0.23	0.17	0.07	1.00					
9	TIPS	3.69%	6.11%	9	0.04	0.01	0.08	0.14	0.68	0.52	0.35	0.24	1.00				
10	Real Estate, REITS	7.94%	15.03%	10	0.48	0.49	0.46	0.41	0.16	0.15	0.33	0.03	0.15	1.00			
11	Commodities	6.29%	17.66%	11	0.31	0.30	0.38	0.42	0.10	0.04	0.31	0.02	0.22	0.27	1.00		
12	Private Equity	12.82%	22.05%	12	0.75	0.70	0.70	0.63	0.05	0.07	0.39	(0.06)	-	0.43	0.32	1.00	
13	Private Credit/Private Debt	8.57%	11.62%	13	0.40	0.39	0.41	0.41	0.21	0.30	0.43	0.01	0.14	0.30	0.22	0.47	1.00

Other Considerations

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

[22] That survey included responses from 34 investment advisors, including LACERS' investment advisor at NEPC.

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

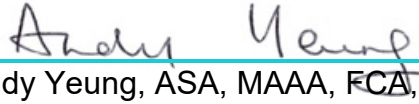
[24] These returns are gross of inflation and before any adjustment for administrative expenses. The annual inflation assumption based on the Horizon Survey was 2.29%. The annual adjustment for administrative expenses was 0.15%.

Actuarial Certification

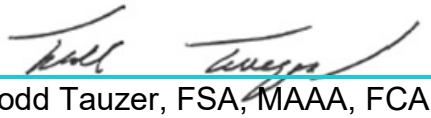
The actuarial calculations in this report were completed under the supervision of Andy Yeung, ASA, MAAA, FCA, Enrolled Actuary and Thomas Bergman, ASA, MAAA, Enrolled Actuary.

The actuarial opinions expressed in this report were prepared by Paul Angelo, FSA, MAAA, FCA, Enrolled Actuary, Andy Yeung, ASA, MAAA, FCA, Enrolled Actuary, and Todd Tauzer, FSA, MAAA, FCA, CERA. 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 2020/2021)

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
2019	$ 5,974,857	71.3%	2021	$ 2,445,017	6.25%	18.38%	24.63%	$ 602,208	
2020	$ 6,897,093	69.4%	2022	$ 2,524,480	7.85%	20.11%	27.96%	$ 705,845	$ 103,637
2021	$ 7,099,496	69.8%	2023	$ 2,606,525	7.55%	20.93%	28.48%	$ 742,338	$ 36,493
2022	$ 7,196,149	70.7%	2024	$ 2,691,237	7.39%	21.46%	28.85%	$ 776,422	$ 34,084
2023	$ 7,255,170	71.6%	2025	$ 2,778,702	7.24%	21.94%	29.18%	$ 810,825	$ 34,403
2024	$ 7,277,081	72.7%	2026	$ 2,869,010	7.09%	20.79%	27.88%	$ 799,880	$ (10,945)
2025	$ 7,300,225	73.6%	2027	$ 2,962,253	7.49%	21.18%	28.67%	$ 849,278	$ 49,398
2026	$ 7,293,285	74.6%	2028	$ 3,058,526	7.32%	21.55%	28.87%	$ 882,997	$ 33,719
2027	$ 7,130,272	76.1%	2029	$ 3,157,928	7.14%	21.57%	28.71%	$ 906,641	$ 23,644
2028	$ 6,921,523	77.6%	2030	$ 3,260,561	6.97%	21.04%	28.01%	$ 913,283	$ 6,642
2029	$ 6,674,481	79.2%	2031	$ 3,366,529	6.81%	21.91%	28.72%	$ 966,867	$ 53,584
2030	$ 6,405,558	80.7%	2032	$ 3,475,942	6.66%	22.74%	29.40%	$ 1,021,927	$ 55,060
2031	$ 6,062,547	82.3%	2033	$ 3,588,910	6.49%	23.83%	30.32%	$ 1,088,157	$ 66,230
2032	$ 5,638,564	84.1%	2034	$ 3,705,549	6.37%	24.30%	30.67%	$ 1,136,492	$ 48,335
2033	$ 5,117,009	86.0%	2035	$ 3,825,980	6.23%	23.68%	29.91%	$ 1,144,351	$ 7,859
2034	$ 4,510,531	88.0%	2036	$ 3,950,324	6.11%	20.86%	26.97%	$ 1,065,402	$ (78,949)
2035	$ 3,856,040	90.0%	2037	$ 4,078,710	6.01%	19.24%	25.25%	$ 1,029,874	$ (35,528)
2036	$ 3,242,976	91.8%	2038	$ 4,211,268	5.92%	18.27%	24.19%	$ 1,018,706	$ (11,168)
2037	$ 2,629,437	93.5%	2039	$ 4,348,134	5.82%	16.59%	22.41%	$ 974,417	$ (44,289)
2038	$ 1,989,342	95.2%	2040	$ 4,489,448	5.75%	14.49%	20.24%	$ 908,664	$ (65,753)
2039	$ 1,356,282	96.8%	2041	$ 4,635,355	5.66%	13.86%	19.52%	$ 904,821	$ (3,843)
2040	$ 754,205	98.3%	2042	$ 4,786,004	5.60%	11.92%	17.52%	$ 838,508	$ (66,313)
2041	$ 119,073	99.7%	2043	$ 4,941,549	5.55%	11.37%	16.92%	$ 836,110	$ (2,398)
2042	$ (483,017)	101.1%	2044	$ 5,102,150	5.49%	-0.52%	4.97%	$ 253,577	$ (582,533)
2043	$ (1,118,540)	102.5%	2045	$ 5,267,970	5.45%	-1.17%	4.28%	$ 225,469	$ (28,108)

Detailed Scenario Test Results – Under Scenario 2 (Assuming 7.00% Market Return for 2020/2021)

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
2019	$ 521,637	84.4%	2021	$ 2,445,017	3.44%	1.05%	4.49%	$ 109,781	
2020	$ 502,107	85.6%	2022	$ 2,524,480	3.48%	0.81%	4.29%	$ 108,300	$ (1,481)
2021	$ 541,034	85.3%	2023	$ 2,606,525	3.54%	0.89%	4.43%	$ 115,469	$ 7,169
2022	$ 587,037	84.9%	2024	$ 2,691,237	3.57%	1.00%	4.57%	$ 122,990	$ 7,521
2023	$ 631,161	84.6%	2025	$ 2,778,702	3.60%	1.10%	4.70%	$ 130,599	$ 7,609
2024	$ 673,106	84.4%	2026	$ 2,869,010	3.63%	0.90%	4.53%	$ 129,966	$ (633)
2025	$ 720,632	84.2%	2027	$ 2,962,253	3.65%	0.98%	4.63%	$ 137,152	$ 7,186
2026	$ 767,743	84.0%	2028	$ 3,058,526	3.68%	1.05%	4.73%	$ 144,668	$ 7,516
2027	$ 791,429	84.4%	2029	$ 3,157,928	3.71%	1.06%	4.77%	$ 150,633	$ 5,965
2028	$ 813,260	84.7%	2030	$ 3,260,561	3.73%	0.99%	4.72%	$ 153,898	$ 3,265
2029	$ 834,840	85.1%	2031	$ 3,366,529	3.74%	1.43%	5.17%	$ 174,050	$ 20,152
2030	$ 859,063	85.4%	2032	$ 3,475,942	3.76%	2.20%	5.96%	$ 207,166	$ 33,116
2031	$ 868,228	86.0%	2033	$ 3,588,910	3.77%	2.36%	6.13%	$ 220,000	$ 12,834
2032	$ 847,949	86.9%	2034	$ 3,705,549	3.79%	2.79%	6.58%	$ 243,825	$ 23,825
2033	$ 817,672	88.0%	2035	$ 3,825,980	3.80%	3.06%	6.86%	$ 262,462	$ 18,637
2034	$ 765,102	89.3%	2036	$ 3,950,324	3.81%	3.03%	6.84%	$ 270,202	$ 7,740
2035	$ 694,398	90.7%	2037	$ 4,078,710	3.83%	3.47%	7.30%	$ 297,746	$ 27,544
2036	$ 616,077	92.1%	2038	$ 4,211,268	3.83%	3.43%	7.26%	$ 305,738	$ 7,992
2037	$ 508,544	93.8%	2039	$ 4,348,134	3.85%	2.94%	6.79%	$ 295,238	$ (10,500)
2038	$ 390,846	95.4%	2040	$ 4,489,448	3.86%	2.47%	6.33%	$ 284,182	$ (11,056)
2039	$ 282,270	96.8%	2041	$ 4,635,355	3.87%	2.34%	6.21%	$ 287,856	$ 3,674
2040	$ 184,185	98.0%	2042	$ 4,786,004	3.88%	1.98%	5.86%	$ 280,460	$ (7,396)
2041	$ 81,755	99.2%	2043	$ 4,941,549	3.88%	1.88%	5.76%	$ 284,633	$ 4,173
2042	$ (13,329)	100.1%	2044	$ 5,102,150	3.88%	-0.01%	3.87%	$ 197,453	$ (87,180)
2043	$ (112,831)	101.1%	2045	$ 5,267,970	3.89%	-0.12%	3.77%	$ 198,602	$ 1,149

Detailed Scenario Test Results – Under Scenario 2 (Assuming 7.00% Market Return for 2020/2021)

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
2019	$ 6,496,493	73.1%	2021	$ 2,445,017	9.69%	19.43%	29.12%	$ 711,989	
2020	$ 7,399,200	71.6%	2022	$ 2,524,480	11.33%	20.92%	32.25%	$ 814,145	$ 102,156
2021	$ 7,640,530	71.9%	2023	$ 2,606,525	11.09%	21.82%	32.91%	$ 857,807	$ 43,662
2022	$ 7,783,186	72.6%	2024	$ 2,691,237	10.96%	22.46%	33.42%	$ 899,412	$ 41,605
2023	$ 7,886,331	73.4%	2025	$ 2,778,702	10.84%	23.04%	33.88%	$ 941,424	$ 42,012
2024	$ 7,950,187	74.3%	2026	$ 2,869,010	10.72%	21.69%	32.41%	$ 929,846	$ (11,578)
2025	$ 8,020,857	75.1%	2027	$ 2,962,253	11.14%	22.16%	33.30%	$ 986,430	$ 56,584
2026	$ 8,061,028	76.0%	2028	$ 3,058,526	11.00%	22.60%	33.60%	$ 1,027,665	$ 41,235
2027	$ 7,921,702	77.3%	2029	$ 3,157,928	10.85%	22.63%	33.48%	$ 1,057,274	$ 29,609
2028	$ 7,734,784	78.7%	2030	$ 3,260,561	10.70%	22.03%	32.73%	$ 1,067,181	$ 9,907
2029	$ 7,509,321	80.0%	2031	$ 3,366,529	10.55%	23.34%	33.89%	$ 1,140,917	$ 73,736
2030	$ 7,264,621	81.4%	2032	$ 3,475,942	10.42%	24.94%	35.36%	$ 1,229,093	$ 88,176
2031	$ 6,930,775	82.9%	2033	$ 3,588,910	10.26%	26.19%	36.45%	$ 1,308,157	$ 79,064
2032	$ 6,486,513	84.5%	2034	$ 3,705,549	10.16%	27.09%	37.25%	$ 1,380,317	$ 72,160
2033	$ 5,934,680	86.3%	2035	$ 3,825,980	10.03%	26.74%	36.77%	$ 1,406,813	$ 26,496
2034	$ 5,275,633	88.2%	2036	$ 3,950,324	9.92%	23.89%	33.81%	$ 1,335,604	$ (71,209)
2035	$ 4,550,437	90.1%	2037	$ 4,078,710	9.84%	22.71%	32.55%	$ 1,327,620	$ (7,984)
2036	$ 3,859,053	91.9%	2038	$ 4,211,268	9.75%	21.70%	31.45%	$ 1,324,444	$ (3,176)
2037	$ 3,137,982	93.6%	2039	$ 4,348,134	9.67%	19.53%	29.20%	$ 1,269,655	$ (54,789)
2038	$ 2,380,188	95.2%	2040	$ 4,489,448	9.61%	16.96%	26.57%	$ 1,192,846	$ (76,809)
2039	$ 1,638,552	96.8%	2041	$ 4,635,355	9.53%	16.20%	25.73%	$ 1,192,677	$ (169)
2040	$ 938,390	98.2%	2042	$ 4,786,004	9.48%	13.90%	23.38%	$ 1,118,968	$ (73,709)
2041	$ 200,828	99.6%	2043	$ 4,941,549	9.43%	13.25%	22.68%	$ 1,120,743	$ 1,775
2042	$ (496,346)	100.9%	2044	$ 5,102,150	9.37%	-0.53%	8.84%	$ 451,030	$ (669,713)
2043	$ (1,231,371)	102.2%	2045	$ 5,267,970	9.34%	-1.29%	8.05%	$ 424,071	$ (26,959)

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, 2011	69.4%	$4.7B	73.2%	$4.1B	24.14%
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%

[1] For the June 30, 2011 – 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 25.25%, 26.17%, 27.11%, and 28.88%, respectively.