Sonoma County Employees' Retirement Association

Risk Assessment Including Review of Funded Status of the Pension Plan as of December 31, 2018

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September 30, 2019

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Section 1: Introduction and Executive Summary

Introduction

The results included in our December 31, 2018 funding valuation report for the Pension Plan were prepared based on a fixed set of economic and non-economic actuarial assumptions under the premise that future experience of the Sonoma County Employees' Retirement Association (SCERA) would be consistent with those assumptions. While those assumptions are reviewed every three years (with the assumptions from the last triennial experience study adopted by the Board of Retirement for use starting with the December 31, 2018 valuation), there is a risk that emerging results may differ significantly as actual experience is fluid and will not completely track current assumptions.

The purpose of this report is to assist the Board of Retirement, participating employers and members and other stakeholders to better understand and assess the risk profile of the Association, as well as the particular risks inherent in using a fixed set of actuarial assumptions in preparing the results in our December 31, 2018 funding valuation for SCERA.

New Actuarial Standard of Practice on Risk Assessment

The Actuarial Standards Board approved the new Actuarial Standard of Practice No. 51 (ASOP 51) regarding risk assessment when performing a funding valuation and it is effective with SCERA's December 31, 2018 actuarial valuation for benefits provided by the Pension Plan. 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 SCERA 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 SCERA.

Plan Risk Assessment

In Section 2, we start by discussing some of the historical factors that have caused changes in SCERA's funded status and employer contribution rates. It is important to understand how the combination of decisions and experience have led to the current financial status of the plan. We follow this with a discussion of the most significant risk factors going forward. Even though we have not included a numerical analysis of all the risk factors, we have been directed by SCERA to illustrate the impact on the funded status and employer contribution rates using relevant economic scenario tests. These tests, which we originally provided in our letter dated April 26, 2019, illustrate the effect of future investment returns on the portfolio coming in different from the current 7.00% annual investment return assumption used in the December 31, 2018 valuation. The Standard also requires disclosure of plan maturity measures and other historical information that are significant to understanding the risks associated with the Pension Plan and this information is included in this report.

Executive Summary

Historical Funded Status and Employer Contribution Rates

The following table provides a summary of financial changes to the plan over the last 10 valuations. The unfunded actuarial accrued liability (UAAL) [1] and contribution rates[2] 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		Aggregate Employer Contribution Rate
Valuation Date	Funded Status	UAAL	Funded Status	UAAL	(% of Payroll)
December 31, 2009	65%	$694 M	80%	$402 M	20%
December 31, 2018	84%	$494 M	87%	$405 M	21%

[1] For example, the UAAL increased by $19 million in the December 31, 2009 valuation, $54 million in the December 31, 2010 valuation, $81 million in the December 31, 2012 valuation, $94 million in the December 31, 2015 valuation, and $32 million in the December 31, 2018 valuation, as a result of the experience studies over the last ten years.

[2] For example, the increase in the employer's total rate (normal cost plus UAAL) was 0.43% in the December 31, 2009 valuation, 1.80% in the December 31, 2010 valuation, 1.79% in the December 31, 2012 valuation, 2.29% in the December 31, 2015 valuation, and 1.25% in the December 31, 2018 valuation, as a result of the experience studies over the last ten years.

Future Funded Status and Employer Contribution Rates

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

The total employer contribution rate is about 21% of total payroll in the December 31, 2018 valuation. The employer contribution rates in the December 31, 2021 and December 31, 2022 valuations will increase as a result of the sunsets of the additional UAAL contributions paid by most Safety and most General members, respectively.[3] The increase will be about 3%, both for Safety and General.

Using a deterministic projection, this report shows the effect of either favorable (14%) or unfavorable (0%) hypothetical market returns for 2019 on key valuation results. In particular, the changes in the total employer contribution rate in the December 31, 2019 valuation and in the December 31, 2023 valuation (when all the investment gains or losses are fully recognized at the end of the 5-year asset smoothing period) are as shown in the following table:

	2019 Single Year Investment Return		
Contribution Rate Change	14%	7% (baseline)	0%
December 31, 2019	-1% of payroll	+0% of payroll	+1% of payroll
December 31, 2023	-3% of payroll	+0% of payroll	+4% of payroll

[3] General County and Court members pay an additional UAAL contribution equal to 3.03% of payroll, with a sunset date of June 30, 2024. Safety County members pay an additional UAAL contribution equal to 3.00% of payroll, with a sunset date during the last pay period in June 2023. Due to the 18-month scheduled delay, the employer contribution rates projected for the December 31, 2021 valuation reflect the sunset of the UAAL contributions paid by the Safety members, and the contribution rates projected for the December 31, 2022 valuation reflect the sunset of the UAAL contributions paid by the General members, even though they would still be paying those contributions at the dates of those valuations.

Furthermore, under either the favorable (14%) or the assumed (7%) hypothetical market return scenarios for 2019, at the end of 20 years the Association would be expected to reach full funding and the total employer contribution rate would be expected to approach about 9% of payroll.[4] Similarly, the same would be true under the unfavorable (0%) hypothetical market return scenario for 2019 when the last portion of the deferred investment losses under the 5-year asset smoothing method is recognized in the December 31, 2023 valuation and paid off 20 years thereafter in the December 31, 2043 valuation. This means that the Board's funding policy is very effective in achieving the general policy goal of achieving the long-term full funding of the costs of the benefits paid by SCERA.

Plan Maturity Measures

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

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

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

Evaluation of Historical Trends

Funded Status and UAAL

One common measure of SCERA's financial status is the funded ratio. This ratio compares the valuation[5] and market value of assets to the actuarial accrued liabilities (AAL)[6] of SCERA. The overall level of funding of SCERA has improved as a result of contributing the Actuarially Determined Contribution (ADC), proceeds from Pension Obligation Bonds and other favorable experience, offset somewhat by the strengthening of the actuarial assumptions and unfavorable investment experience. The funded ratios and UAAL for the past 10 valuations from December 31, 2009 to 2018 measured using both actuarial and market value of assets bases are provided in Chart 1.

The factors that caused the changes in the UAAL for the past 10 valuations from December 31, 2009 to 2018 are specified in Chart 2. The results in Chart 2 reflect the changes in the investment return assumption in the

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[5] The valuation value of assets is equal to the market value of assets excluding unrecognized returns from the last few years and any non-valuation reserves. Unrecognized returns are based on the difference between actual and expected returns on a market value basis and are recognized over a five-year period.

[6] 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 pensionsers, beneficiaries and deferred vested members, the actuarial accrued liability is the single sum present value of the lifetime benefit expected to be paid to those members.

December 31, 2010,[7] 2012, 2015, and 2018 valuations. These reductions together with the changes in the mortality tables and other assumptions from the four triennial experience studies recommending assumptions used in the December 31, 2009, 2012, 2015, and 2018 valuations have had the most impact on the UAAL for SCERA,[8] followed by the investment experience, especially during 2009 to 2012.

Chart 2 also shows that the unfavorable investment experience was offset to some extent by favorable non-investment experience and proceeds from Pension Obligation Bonds.[9] The non-investment experience included smaller salary increases received by active members and changes in compensation earnable and cashout amounts. The non-investment experience also included the scheduled delay in implementing the contribution rates determined in the annual valuation.

Finally, Chart 2 shows some "negative amortization" prior to 2012 due to the higher investment return and payroll growth assumptions used in these years. Current assumptions and amortization policy generally will not entail negative amortization in the future.

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[7] The Board has a practice of reviewing the investment return and other actuarial assumptions at the same time in the triennial experience study. However, as a result of the Great Recession in 2008 and 2009, the Board accepted Segal's recommendation to review the investment return and other economic assumptions as part of the December 31, 2010 valuation instead of the December 31, 2009 valuation.

[8] For example, the UAAL increased by $19 million in the December 31, 2009 valuation, $54 million in the December 31, 2010 valuation, $81 million in the December 31, 2012 valuation, $94 million in the December 31, 2015 valuation, and $32 million in the December 31, 2018 valuation, as a result of the experience studies over the last ten years.

[9] Besides $289.3 million in proceeds from the issuance of Pension Obligation Bonds in September 2010, the County also made $3.7 million in additional UAAL contributions during calendar year 2015.

It is important to note that SCERA has taken significant strides in risk management and resulting long-term plan sustainability. This includes strengthening of assumptions, particularly the expected return discount rate, and adopting a funding policy that eliminates negative amortization and promotes intergenerational equity. 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 SCERA's fiscal health going forward.

Chart 1

Funded Ratio (Percentages) and Dollar UAAL ($ Millions)
In December 31, 2009 to 2018 Valuations

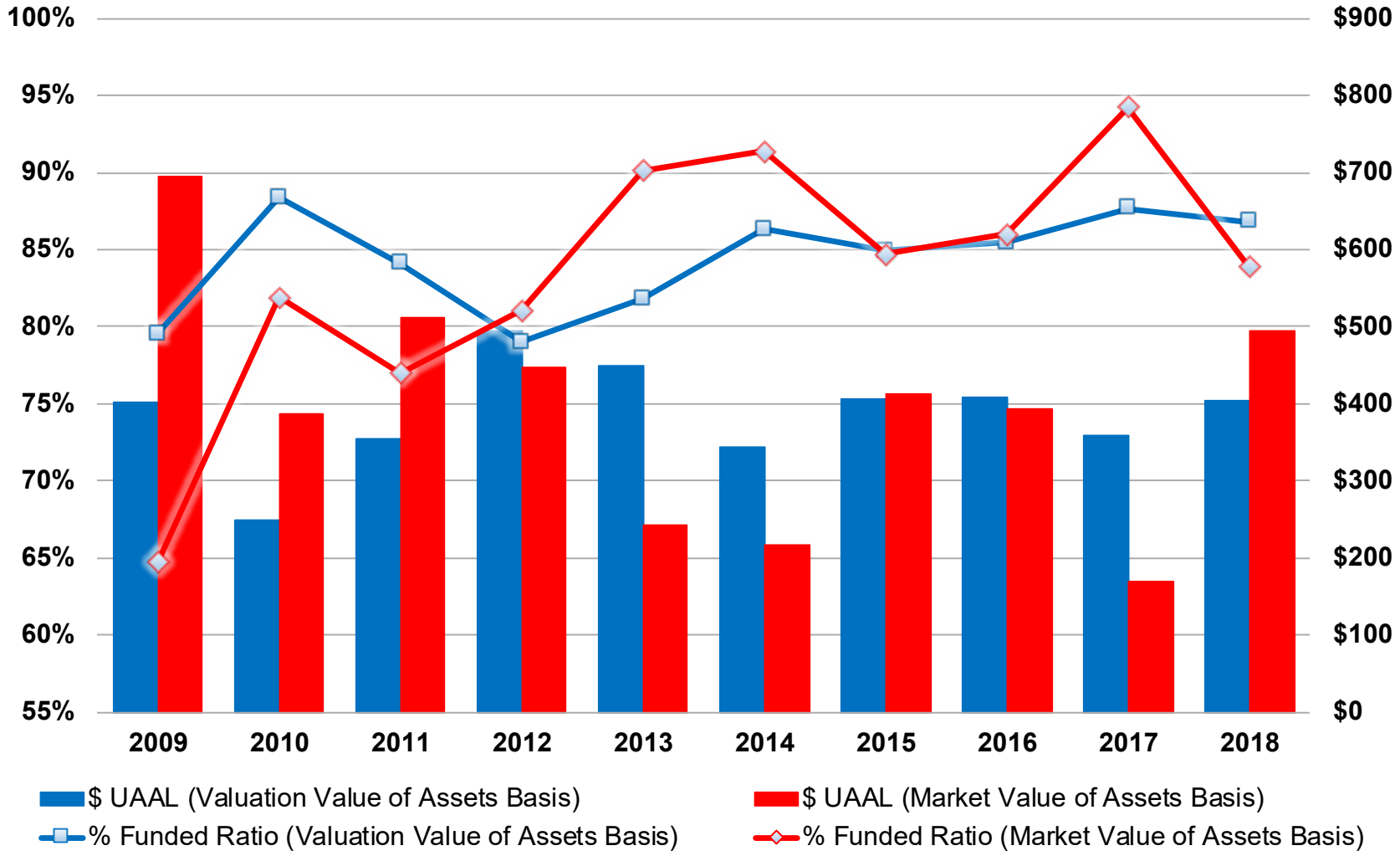
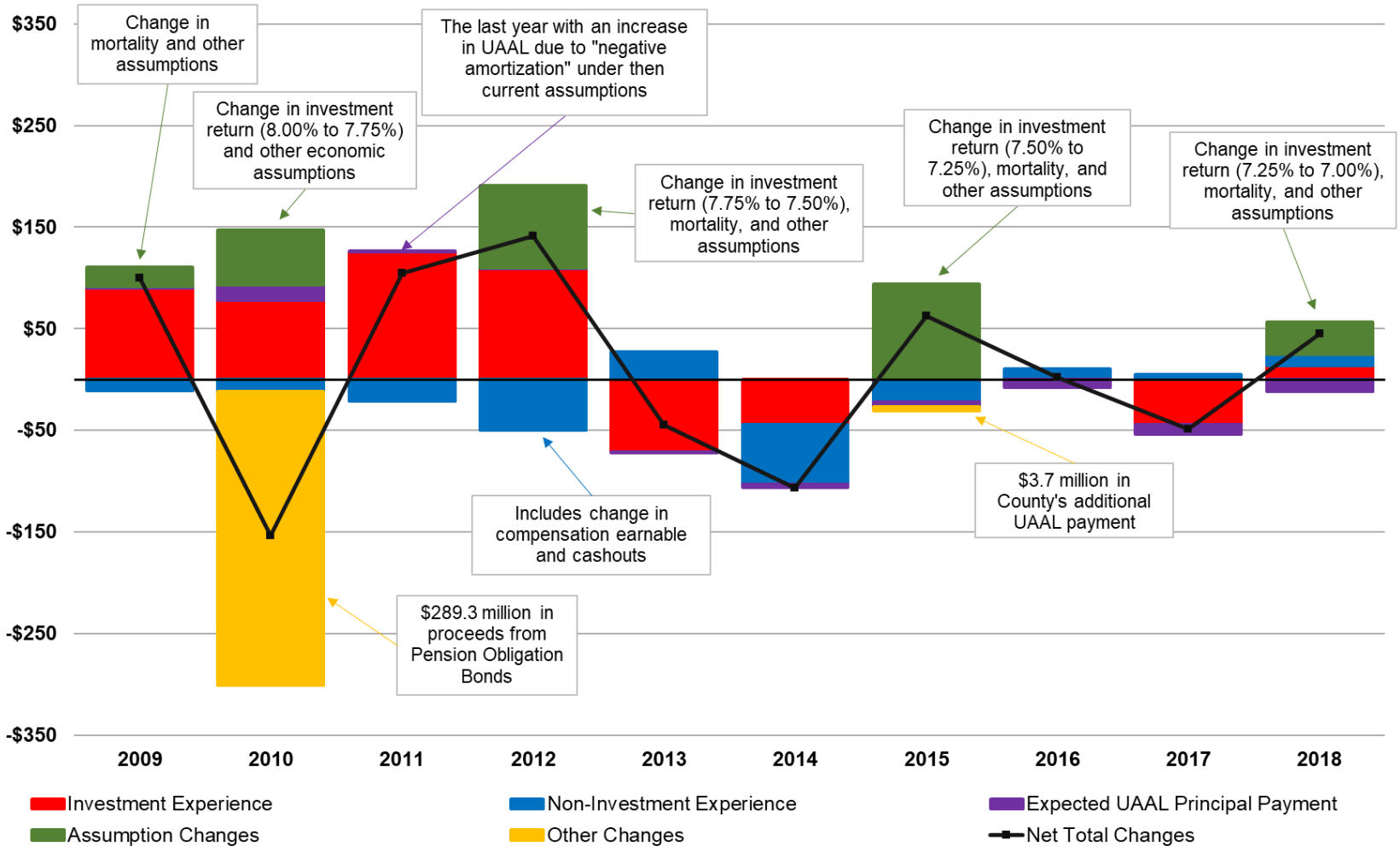


Chart 2

Factors that Changed UAAL in December 31, 2009 to 2018 Valuations ($ Millions)



Note: The primary source of investment losses starting in the December 31, 2008 valuation is the Great Recession, which was recognized in the Actuarial Value of Assets over five years.

Employer Contribution Rates

The total (normal cost[10] plus UAAL payment) employer contribution rates determined in the December 31, 2009 to 2018 valuations are provided in Chart 3 and the factors that caused the changes in the total employer aggregate rates[11] are provided in Chart 4.

The aggregate employer normal cost rates as shown in Chart 3 have stayed relatively flat since the December 31, 2012 valuation. The aggregate employer normal cost rate increased between the December 31, 2011 and the December 31, 2012 valuation as a result of a change in how the additional contributions paid by most members are applied.[12] 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 under the Public Employees' Pension Reform Act of 2013 (PEPRA) as new members have been enrolled in the lower cost PEPRA benefit tiers starting on January 1, 2013. In addition, active legacy members represented by some of the bargaining groups have agreed to pay additional employee Normal Cost contributions that are above those determined under the County Employees Retirement Law of 1937 (CERL), as permitted under PEPRA. As the specific amount of those higher contributions are dependent on the specific bargaining agreements, we have included in this report only the minimum member contribution rates specified in the CERL, consistent with how the employer normal cost rates have been reported in the annual valuation reports.

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[10] 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.

[11] There are separate contribution rates determined in the valuation for the General and Safety membership groups and for the different benefit tiers and employers. 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.

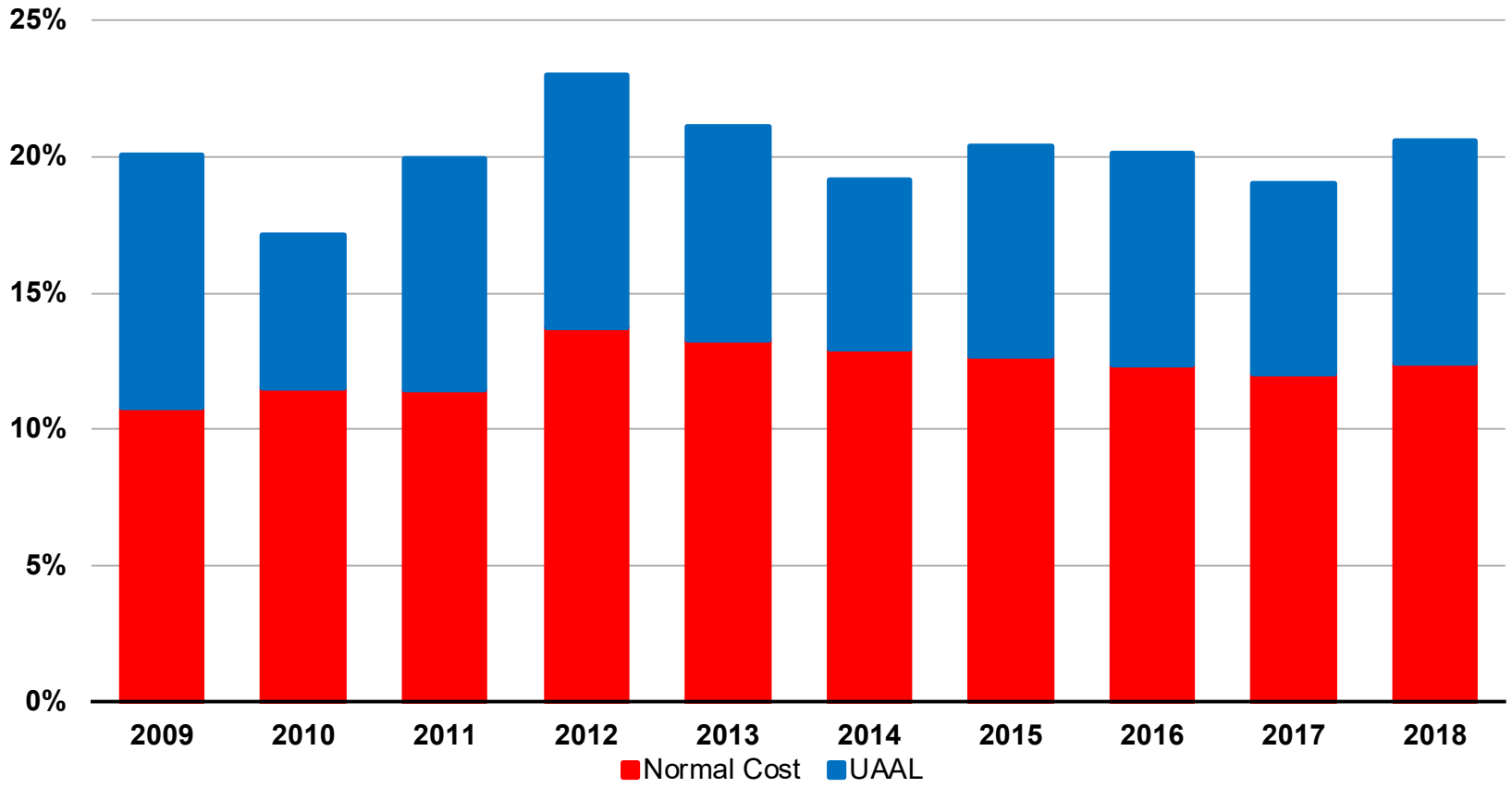
[12] In the valuations prior to December 31, 2012, the employer normal cost rate was reduced to reflect the additional 3.03% and 3.00% of payroll contribution rates paid by most General and Safety members, respectively. Starting with the December 31, 2012 valuation, the employer UAAL contribution rate was reduced instead to reflect those contributions.

Chart 4 shows that the changes in the investment return, mortality tables and other assumptions have had the most impact on increasing the UAAL contribution rates[13] for the employers. The next greatest impact was from the investment experience during 2009 to 2018. Favorable non-investment experience and the proceeds from Pension Obligation Bonds have decreased the contribution rates.

[13] For example, the total aggregate employer contribution rate increased by 0.43% in the December 31, 2009 valuation, 1.80% in the December 31, 2010 valuation, 1.79% in the December 31, 2012 valuation, 2.29% in the December 31, 2015 valuation, and 1.25% in the December 31, 2018 valuation, as a result of the experience studies over the last ten years.

Chart 3

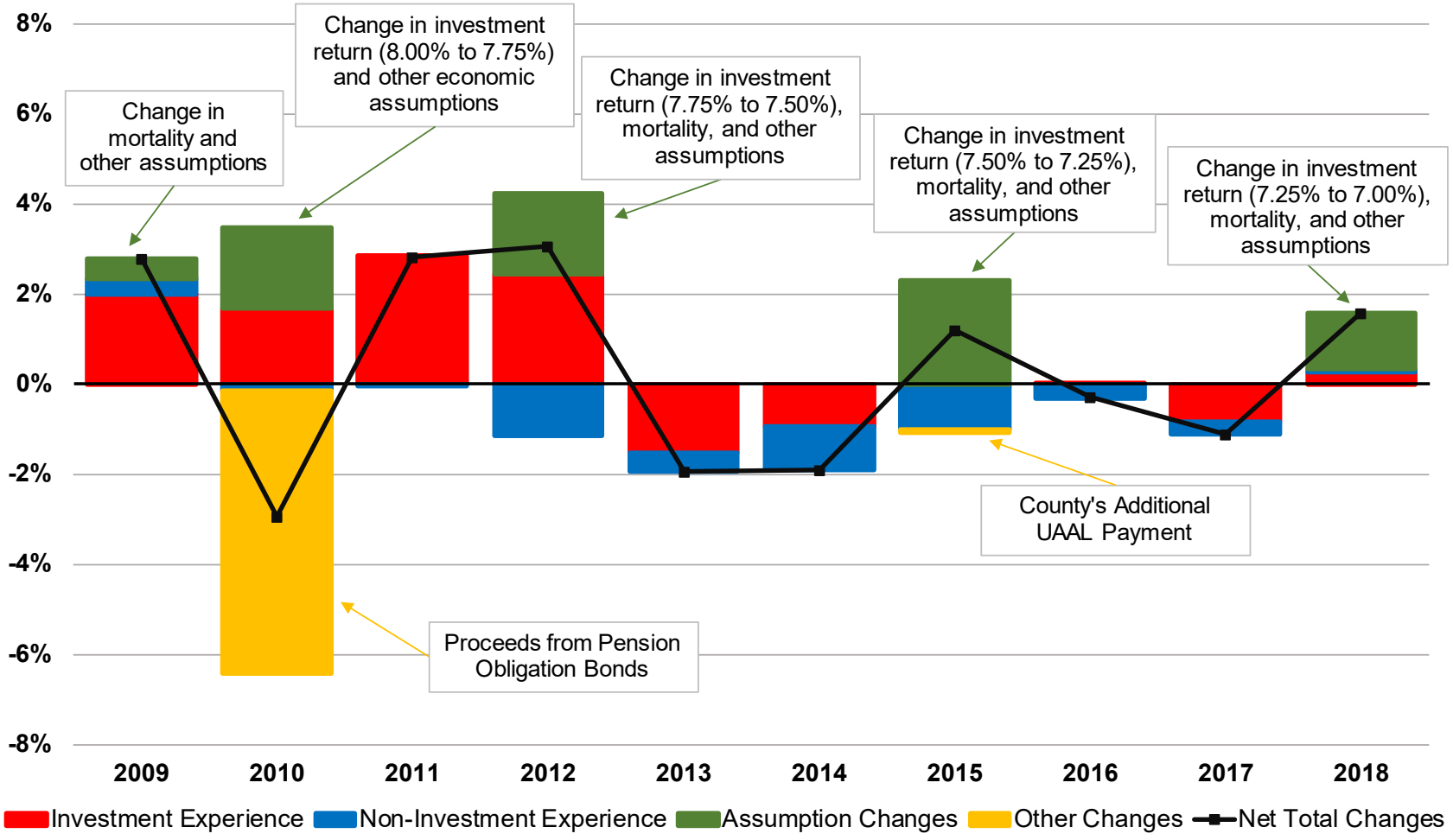
Employer Contribution Rates in December 31, 2009 to 2018 Valuations (% of Payroll)



Note: The above rates were determined without adjustment for the phase-in of the increase in the employer contribution rates due to assumption changes in the experience studies. In addition, employer normal cost rates have not been adjusted to reflect additional member contribution rates that some active legacy members have agreed to pay as permitted by PEPRA.

Chart 4

Factors that Affected Employer Contribution Rates in December 31, 2009 to 2018 Valuations (% of Payroll)



Note: The primary source of investment losses starting in the December 31, 2008 is the Great Recession, which was recognized in the Actuarial Value of Assets over five years.

Assessment of Primary Risk Factors Going Forward

As discussed in the Evaluation of Historical Trends section, in the 2009 to 2018 valuations the funded ratios and the employer contribution rates have changed mainly as a result of changes in actuarial assumptions, investment experience, non-investment experience, and proceeds from Pension Obligation Bonds.

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

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

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

- 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 SCERA can better understand the risk associated with earning either more or less than the assumed rate.

Also, the Board has a policy of reviewing the investment return and the other actuarial assumptions every three years, with the next triennial experience study (recommending assumptions for the December 31, 2021 actuarial valuation) scheduled to be performed in 2021 following the December 31, 2020 valuation.

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

  Changes to the mortality tables were the most major change to the non-economic assumptions in the last experience study. As can be observed from Charts 2 and 4, there had been relatively small impact on the UAAL and employer contribution rates due to non-investment related experience relative to the assumptions used in the last 10 valuations. However, in the last triennial experience study recommending assumptions for the December 31, 2018 valuation, we alerted the Board that it should consider a new benefit weighted mortality basis when choosing the next mortality table, pending the availability of mortality experience from the Society of Actuaries (SOA) that includes data from public sector retirement plans.[14] In January 2019, the SOA published the public sector mortality tables. While it is premature to estimate the impact of applying those new mortality tables on employer and employee contribution rates until we perform the next triennial experience study recommending assumptions for the December 31, 2021 valuation, the Board should still be aware that there may be some increase in liabilities and contribution rates.

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

  ASOP 51 does not require the actuary to evaluate the particular ability or willingness of the plan sponsor or other contributing entity to make contributions to the plan when due. However, it does require the actuary to

[14] We note that a similar recommendation to use benefit weighted mortality tables was made by SCERA's actuarial auditor in 2018.

consider the potential for and impact of actual contributions deviating from expected in the future. SCERA's employers have a well-established practice of making the Actuarially Determined Contributions (ADC) determined in the annual actuarial valuation, based on the Board of Retirement's Actuarial Funding Policy. As a result, in practice SCERA has essentially no contribution risk.

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

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

Scenario Tests: Deterministic Projections

Since the funded ratio, UAAL and the employer contribution rates have fluctuated as a result of deviation in investment experience in the last 10 valuations, we have examined the risk for SCERA associated with earnings either higher or lower than the assumed rate of 7.00% in future valuations using projections under a deterministic approach.

To measure such risk, we have included a scenario test to study the change in the UAAL and contribution rates if SCERA were to earn market return higher or lower than 7.00% in the next year following the December 31, 2018 valuation. In Charts 5, 6 and 7, we show the aggregate employer contribution rates, funded ratios, and UAAL respectively assuming that the portfolio's market return in 2019 will be as follows: Scenario 1: 14.00%, Scenario 2: 7.00% (baseline) or Scenario 3: 0.00%. The following table summarizes the resulting contribution changes (relative to the December 31, 2018 valuation aggregate employer contribution rate of approximately 21%) in the immediate next valuation as well as in December 31, 2023 valuation where all of the investment gains and losses are fully recognized in the (smoothed) actuarial value of assets.

	2019 Single Year Investment Return		
Contribution Rate Change	14%	7% (baseline)	0%
December 31, 2019	-1% of payroll	+0% of payroll	+1% of payroll
December 31, 2023	-3% of payroll	+0% of payroll	+4% of payroll

Note: The employer contribution rates in the December 31, 2021 and December 31, 2022 valuations combined will increase by about 3% of payroll as a result of the sunsets of the additional UAAL contributions paid by most Safety and most General members, respectively. General County and Court members pay an additional UAAL contribution equal to 3.03% of payroll, with a sunset date of June 30, 2024. Safety County members pay an additional UAAL contribution equal to 3.00% of payroll, with a sunset date during the last pay period in June 2023. Due to the 18-month scheduled delay, the employer contribution rates projected for the December 31, 2021 valuation reflect the sunset of the UAAL contributions paid by the Safety members, and the contribution rates projected for the December 31, 2022 valuation reflect the sunset of the UAAL contributions paid by the General members, even though they would still be paying those contributions at the dates of those valuations.

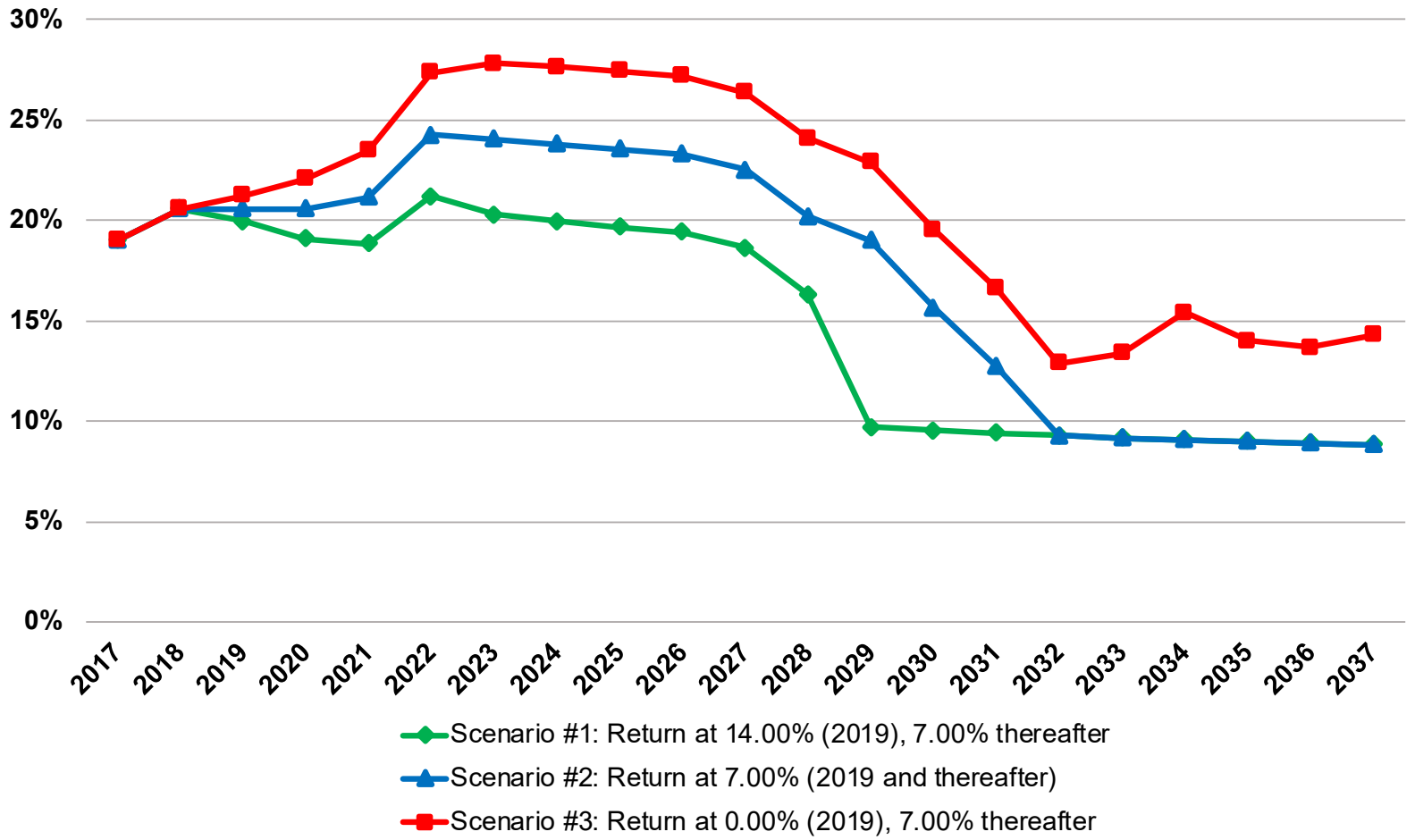
Furthermore, under either the favorable (14%) or the assumed (7%) hypothetical market return scenarios for 2019, at the end of 20 years the Association would be expected to reach full funding and the total employer contribution rate would be expected to approach about 9% of payroll.[15] Similarly, the same would be true under the unfavorable (0%) hypothetical market return scenario for 2019 when the last portion of the deferred investment losses under the 5-year asset smoothing method is recognized in the December 31, 2023 valuation and paid off in 20 years by the December 31, 2043 valuation. This means that the Board's funding policy is very effective in achieving the general policy goal of achieving the long-term full funding of the costs of the benefits paid by SCERA.

While we have not assigned a probability on the 2019 market return coming in at these rates, the Board and other stakeholders monitoring SCERA should still be able to prorate and estimate the funded status and employer contribution rates for the December 31, 2019 and next several valuations as the actual investment experience for the 2019 year becomes available throughout the year. Additionally, comparable experience in upcoming future years are likely to have a similar impact on the Association absent any significant plan or assumption changes.

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

Chart 5

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



Note: The contribution rates under Scenario #3 would also be expected to approach 9% after 2037 when the last portion of the December 31, 2019 deferred investment losses under the 5-year asset smoothing method is recognized in the December 31, 2023 valuation and paid off in 20 years in the December 31, 2043 valuation.

Chart 6

Projected Funded Ratios (on Valuation Value of Assets Basis) Under Three Hypothetical Market Return Scenarios for 2019

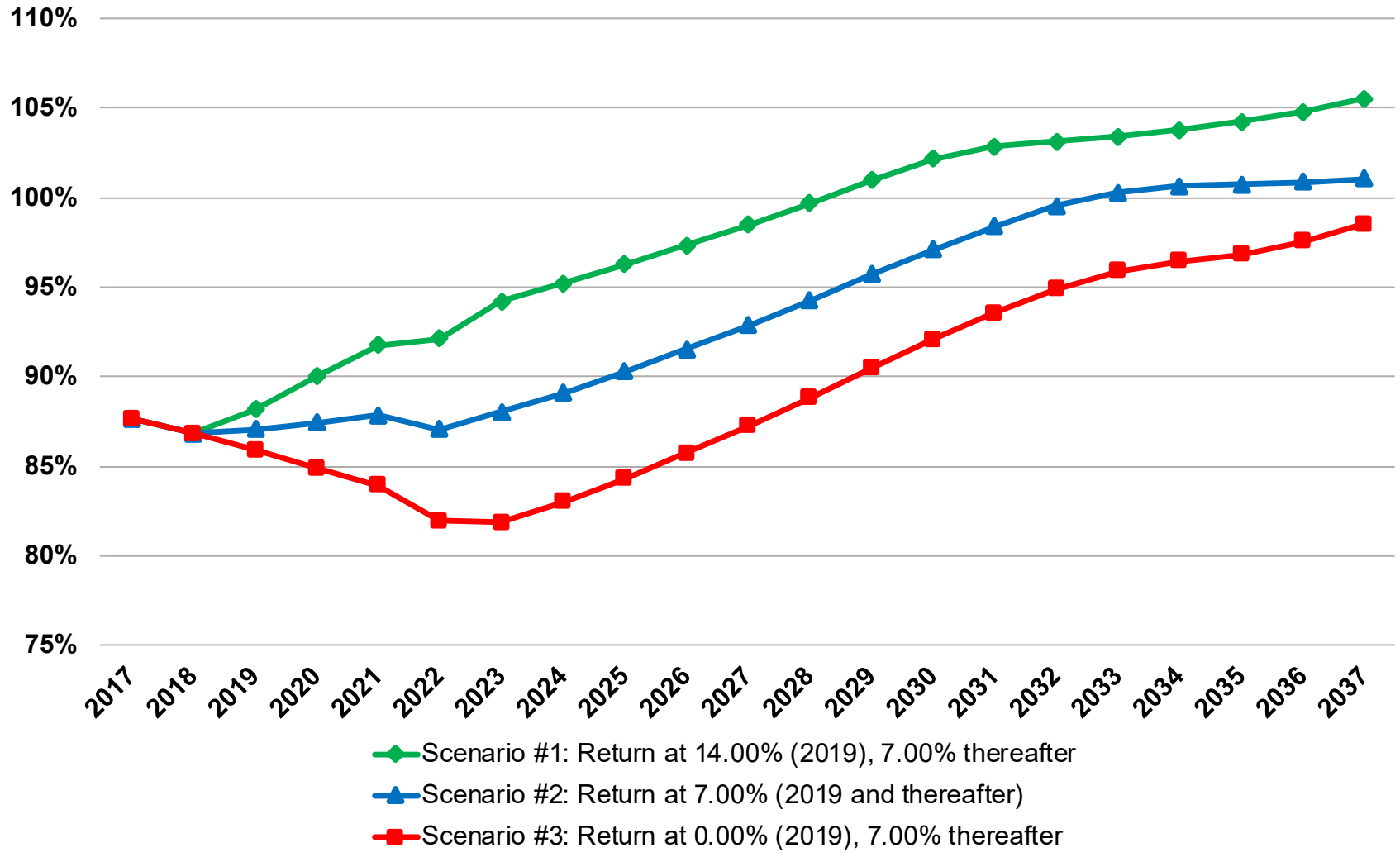
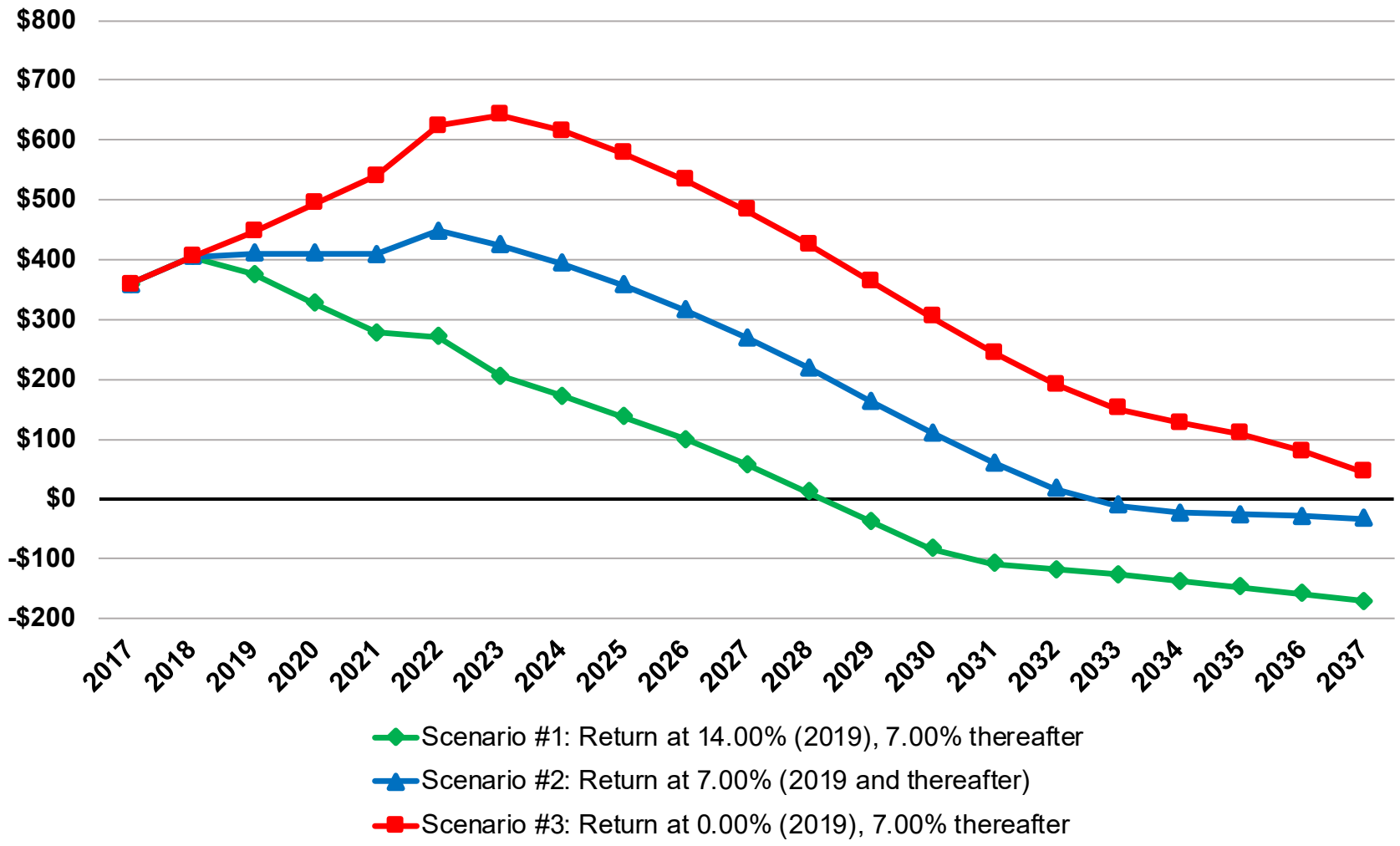


Chart 7

Projected UAAL (on Valuation Value of Assets Basis) Under
Three Hypothetical Market Return Scenarios for 2019 ($ Millions)



Plan Maturity Measures that Affect Primary Risks

The annual actuarial valuation considers the number and demographic characteristics of covered members, including active members and non-active members (vested terminated, retirees and beneficiaries). In the past 10 valuations from December 31, 2009 to 2018, SCERA has become more mature, indicated by the continued increase in the ratio of non-active to active members covered by the Association as shown in Chart 8. The Chart also shows the ratio of members in pay status (retirees and beneficiaries) to active members. This ratio excludes the vested terminated members who have relatively smaller liabilities. The increase in the ratios is significant because any increase in UAAL due to unfavorable future investment and non-investment experience for a relatively larger group of non-active or members would have to be amortized and funded using the payroll of a relatively smaller group of active members.

Besides the ratio of members in pay status to active members, another indicator of a more mature retirement plan is relatively large amounts of assets and/or liabilities compared to active member payroll, which leads to increasing volatility in the level of required contributions. The Asset Volatility Ratio (AVR), which is equal to the market value of assets divided by total payroll, provides an indication of contribution sensitivity to changes in the current level of assets and is detailed in Chart 9. The Liability Volatility Ratio (LVR), which is equal to the actuarial accrued liability divided by payroll, provides an indication of the contribution sensitivity to changes in the current level of liability and is detailed in Chart 10. 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, SCERA's AVR was 6.8 as of December 31, 2018. This means that a 1% asset gain or loss in 2019 (relative to the assumed investment return) would amount to 6.8% of one year's payroll. Similarly, SCERA's LVR was 8.1 as of December 31, 2018, so a 1% liability gain or loss in 2019 would amount to 8.1% of one year's

payroll.[16] Based on SCERA's policy to amortize actuarial experience over a period of 20 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 0.6% of payroll decrease or increase in the required contribution rate for each 1% liability gain or loss respectively.

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

Employee Group	2018			
	AVR	10% Loss Compares to	LVR	10% Change Compares to
General	6.3	63% of payroll	7.6	76% of payroll
Safety	8.8	88% of payroll	10.4	104% of payroll
Combined	6.8	68% of payroll	8.1	81% of payroll

[16] The 6.8 and 8.1 are the AVR and LVR, respectively, for the entire Association. There are considerable differences in those ratios for the General and Safety membership groups.

Chart 8

Ratios of Members in Pay-Status (Retirees and Beneficiaries) to Active Members &
Non-Active Members (Vested Terminated, Retirees and Beneficiaries) to Active Members
In December 31, 2009 to 2018 Valuations

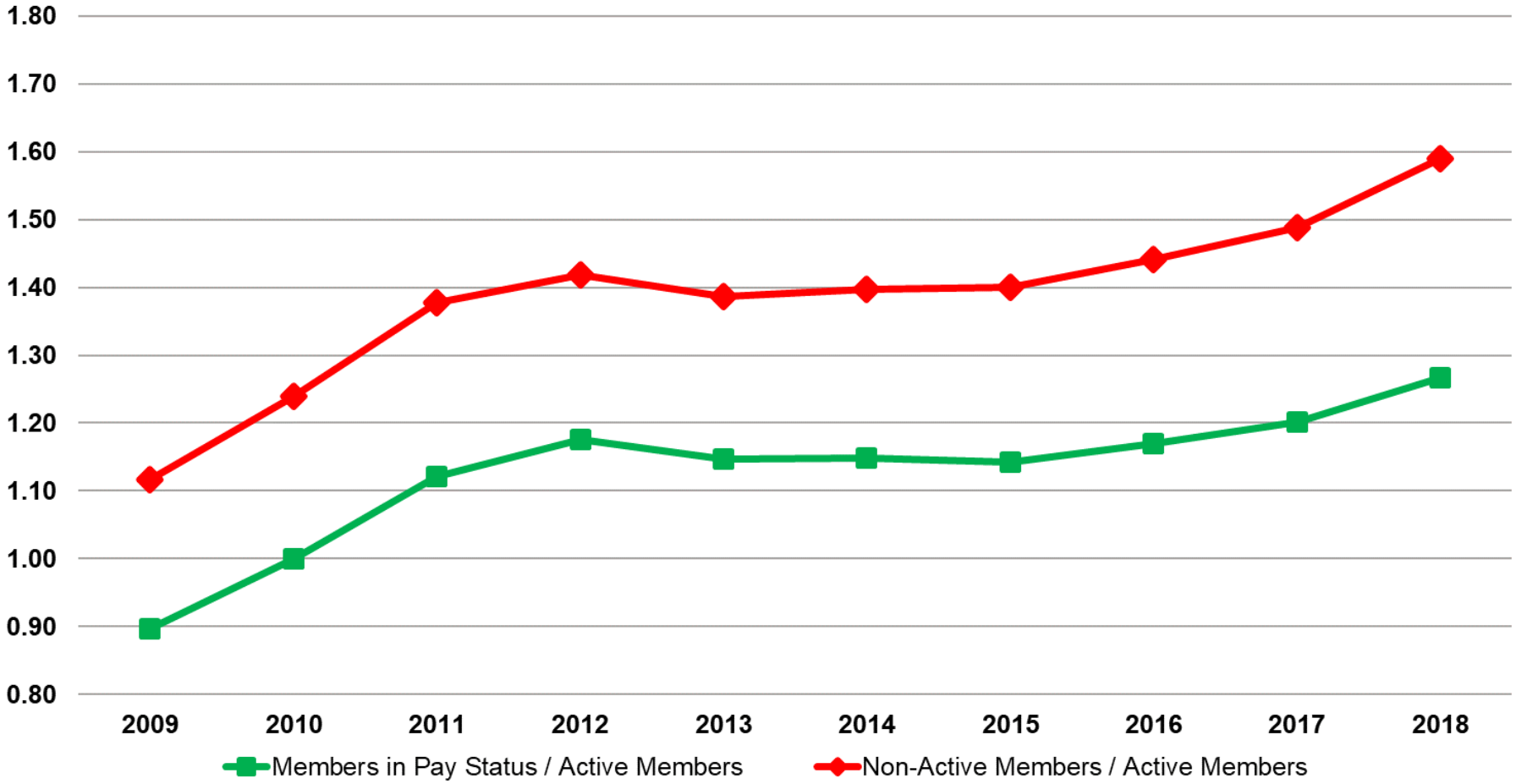


Chart 9

Asset Volatility Ratio in December 31, 2009 to 2018 Valuations

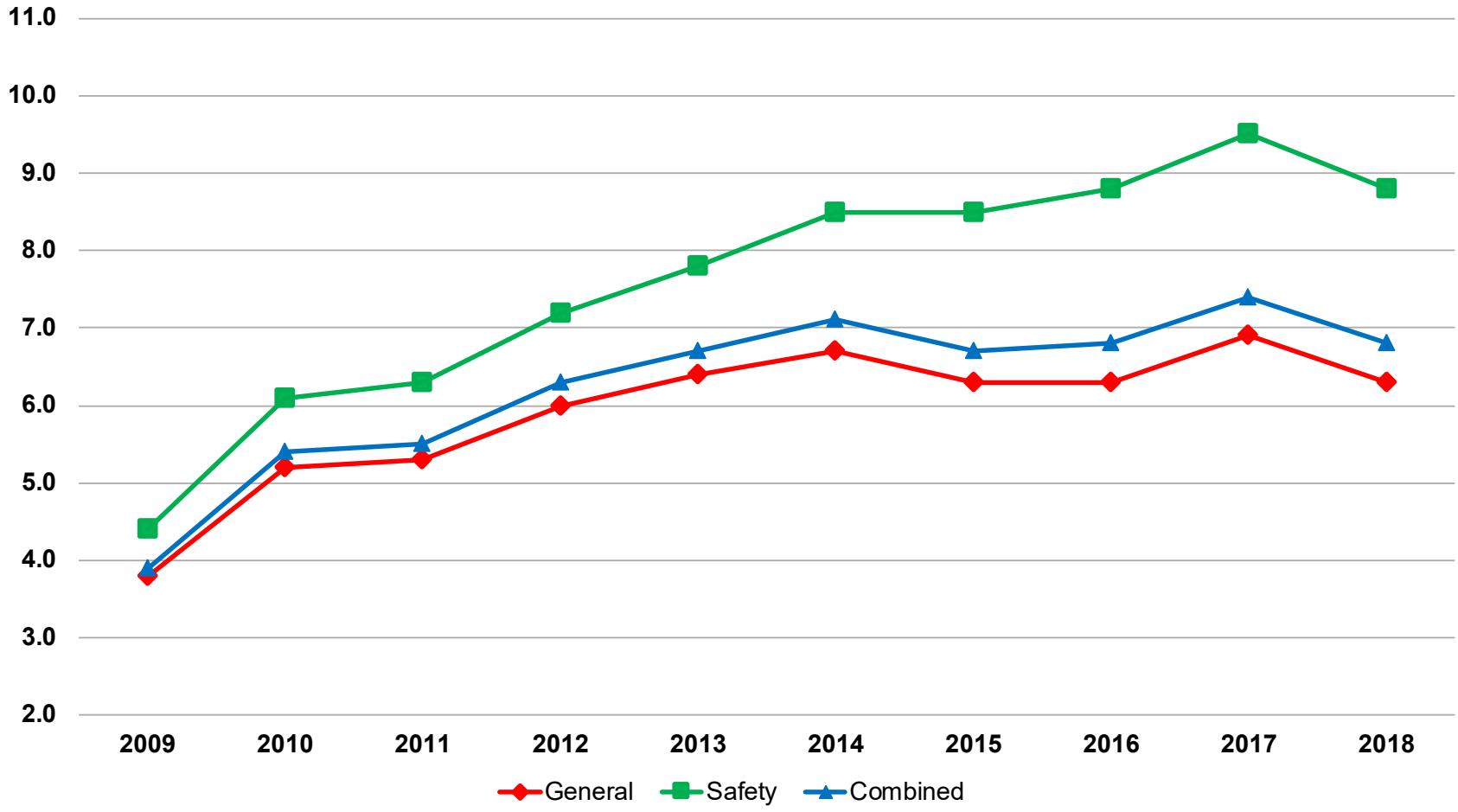
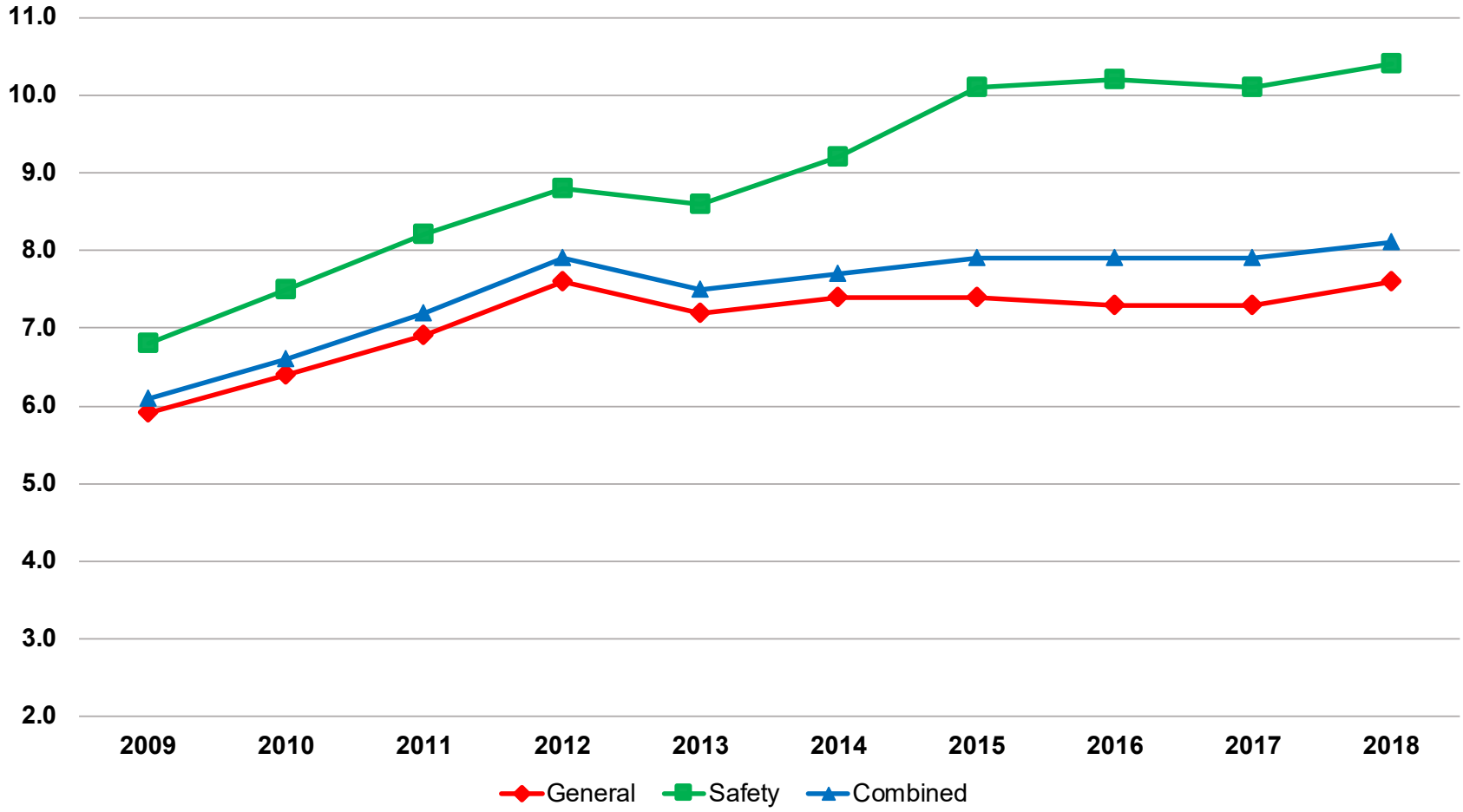


Chart 10

Liability Volatility Ratio in December 31, 2009 to 2018 Valuations



Appendix: Actuarial Assumptions, Methods and Actuarial Certification

Actuarial Assumptions and Methods

Unless otherwise noted, the results included in this report have been prepared based on the assumptions and methods used in preparing the December 31, 2018 valuation.

Deterministic Projection

In addition, we have prepared the deterministic projection using the following assumptions and methods applied in the December 31, 2018 actuarial valuation:

- Non-economic assumptions will remain unchanged.
- Retirement benefit formulas will remain unchanged.
- 1937 Act and PEPRA statutes will remain unchanged.
- UAAL amortization method will remain unchanged (i.e., 20-year layers and level percent of pay).
- Economic assumptions will remain unchanged, including the annual 7.00% investment earnings and 3.25% active payroll growth assumptions.
- Deferred investment gains and losses will be recognized over a 5-year period.
- All other actuarial assumptions used in the December 31, 2018 actuarial valuation will be realized.

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 projections, by their nature, are

not a guarantee of future results. The modeling projections are intended to serve as illustrations of future financial outcomes that are based on the information available to us at the time the modeling is undertaken and completed, and the agreed-upon assumptions and methodologies described herein. Emerging results may differ significantly if the actual experience proves to be different from these assumptions or if alternative methodologies are used. Actual experience may differ due to such variables as demographic experience, the economy, stock market performance and the regulatory environment.

Actuarial Certification

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

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

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