



Orange County Employees Retirement System

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

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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 Orange County Employees Retirement System (OCERS) 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, 2017 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 system, 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 OCERS.

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 OCERS' 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 OCERS 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 OCERS.

Plan Risk Assessment

In Section 2, we start by discussing some of the historical factors that have caused changes in OCERS' 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 OCERS to illustrate the impact on the funded status and employer contribution rates using relevant economic scenario tests. These tests illustrate the effect of future investment returns on the portfolio coming in different from the current 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 rates² 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.

Valuation Date	Market Value Basis		Valuation Value Basis		Aggregate Employer Contribution Rate (% of Payroll)
	Funded Status	UAAL	Funded Status	UAAL	
December 31, 2009	63%	\$4,394 M	69%	\$3,704 M	30%
December 31, 2018	69%	\$6,354 M	72%	\$5,709 M	40% ³

¹ For example, the UAAL increased by \$935 million and \$854 million in the December 31, 2012 and December 31, 2017 valuations, respectively, as a result of the two immediately preceding experience studies.

² For example, the increase in the employer's total rate (normal cost plus UAAL) was 4.63% in the December 31, 2012 valuation and 4.81% in the December 31, 2017 valuation, as a result of the two immediately preceding experience studies.

³ The employer contribution is 41% before reflecting the three-year phase-in of the UAAL employer cost impact due to assumption changes in the December 31, 2017 valuation.

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 (uses 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 40% of total payroll in the December 31, 2018 valuation. Using a deterministic projection that assumes OCERS were to earn a favorable market return of 14.00% in 2019, there would be an increase in the total employer contribution rate to 41% of payroll in the December 31, 2019 valuation. This would be followed by a gradual decrease in the total employer contribution to 39% of payroll over next four years through the December 31, 2023 valuation when all the investment gains are fully recognized at the end of the 5-year asset smoothing period. Alternatively, an unfavorable market return of 0% in 2019 would bring an increase in the total employer contribution rate to 43% of payroll in the 2019 valuation and to 48% of payroll by the 2023 valuation.

Furthermore, under either favorable or unfavorable hypothetical market return scenarios for 2019, at the end of 20 years the System would be expected to reach full funding and the total employer contribution rate would be expected to approach about 11% of payroll⁴. That 11% of payroll is the employer normal cost rate after OCERS' UAAL layers as of December 31, 2018 are paid off over periods ranging from 15 to 20 years and any new UAALs resulting from the hypothetical market experience in 2019 are paid off over 20 years, all pursuant to the Board's actuarial funding policy. This means that the Board's funding policy is very effective in achieving the general policy goal of achieving the long-term full funding of the costs of the benefits paid by OCERS.

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

Plan Maturity Measures

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

Funded Status and UAAL

One common measure of OCERS' financial status is the funded ratio. This ratio compares the valuation⁵ and market value of assets to the actuarial accrued liabilities (AAL)⁶ of OCERS. The overall level of funding of OCERS has only slightly increased as a result of strengthening of the economic and non-economic assumptions especially in the two triennial experience studies recommending assumptions used in the December 31, 2012 and 2017 valuations. Unfavorable investment experience also had an impact. The funding 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 from 7.75% to 7.25% in the December 31, 2012 valuation and from 7.25% to 7.00% in the December 31, 2017 valuation. These reductions together with the changes in the mortality tables and other assumptions from the two triennial

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

experience studies recommending assumptions used in the December 31, 2012 and 2017 valuations have had by far the most impact on the UAAL for OCERS,⁷ followed by the unfavorable investment experience during 2009 to 2018.

Chart 2 also shows that the unfavorable investment experience was offset to some extent by favorable non-investment experience. The non-investment experience included smaller salary increases received by active members and smaller cost-of-living-adjustment (COLA) increases received by retirees and beneficiaries than those expected under the actuarial assumptions. The non-investment experience also included the scheduled delay in implementing the contribution rates determined in the annual valuation.

It is important to note that OCERS 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 unfunded liability. We believe these actions are essential for OCERS' fiscal health going forward.

⁷ For instance, the UAAL increased by \$935 million and \$854 million in the December 31, 2012 and December 31, 2017 valuations, respectively, as a result of the two immediately preceding experience studies.

Chart 1

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

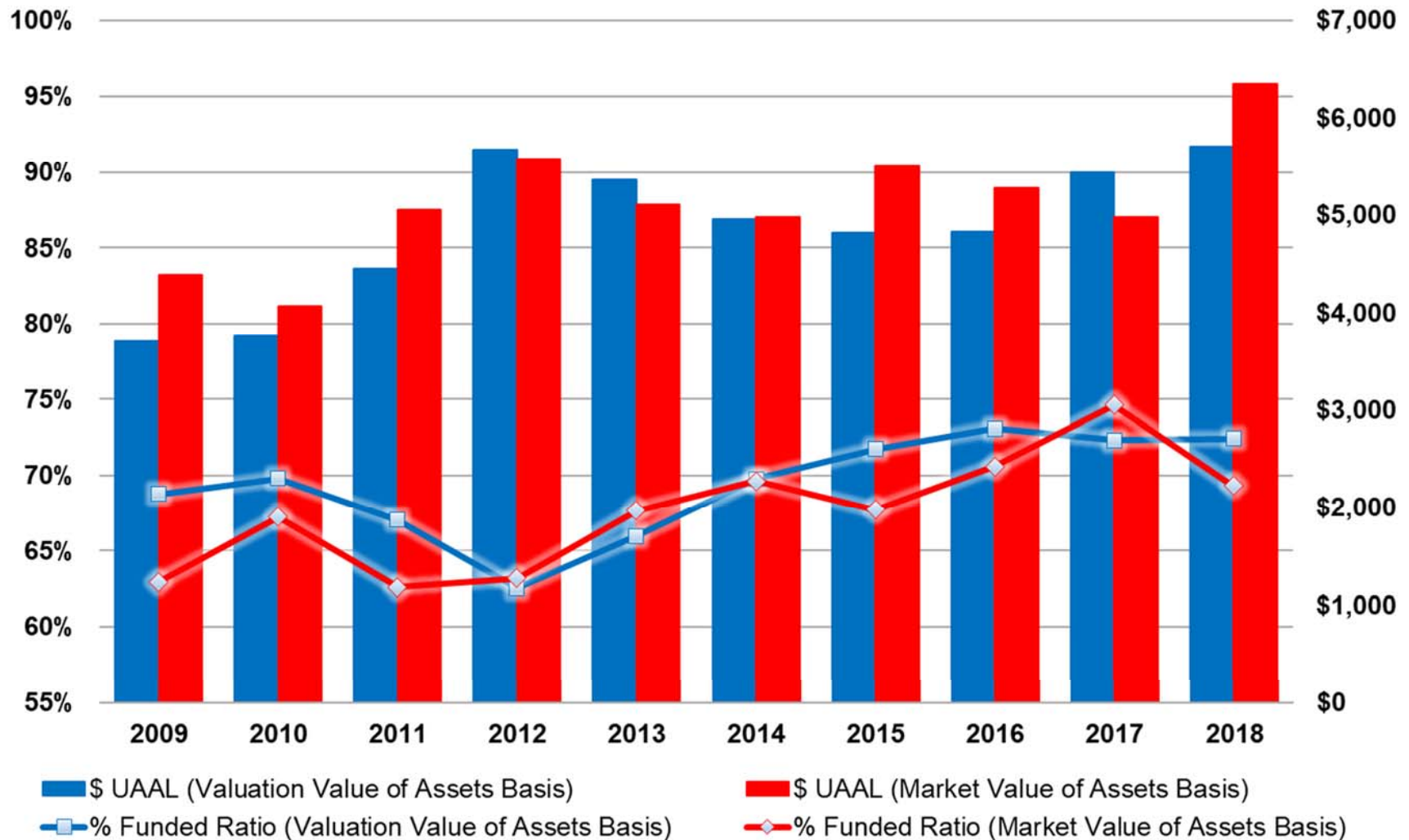
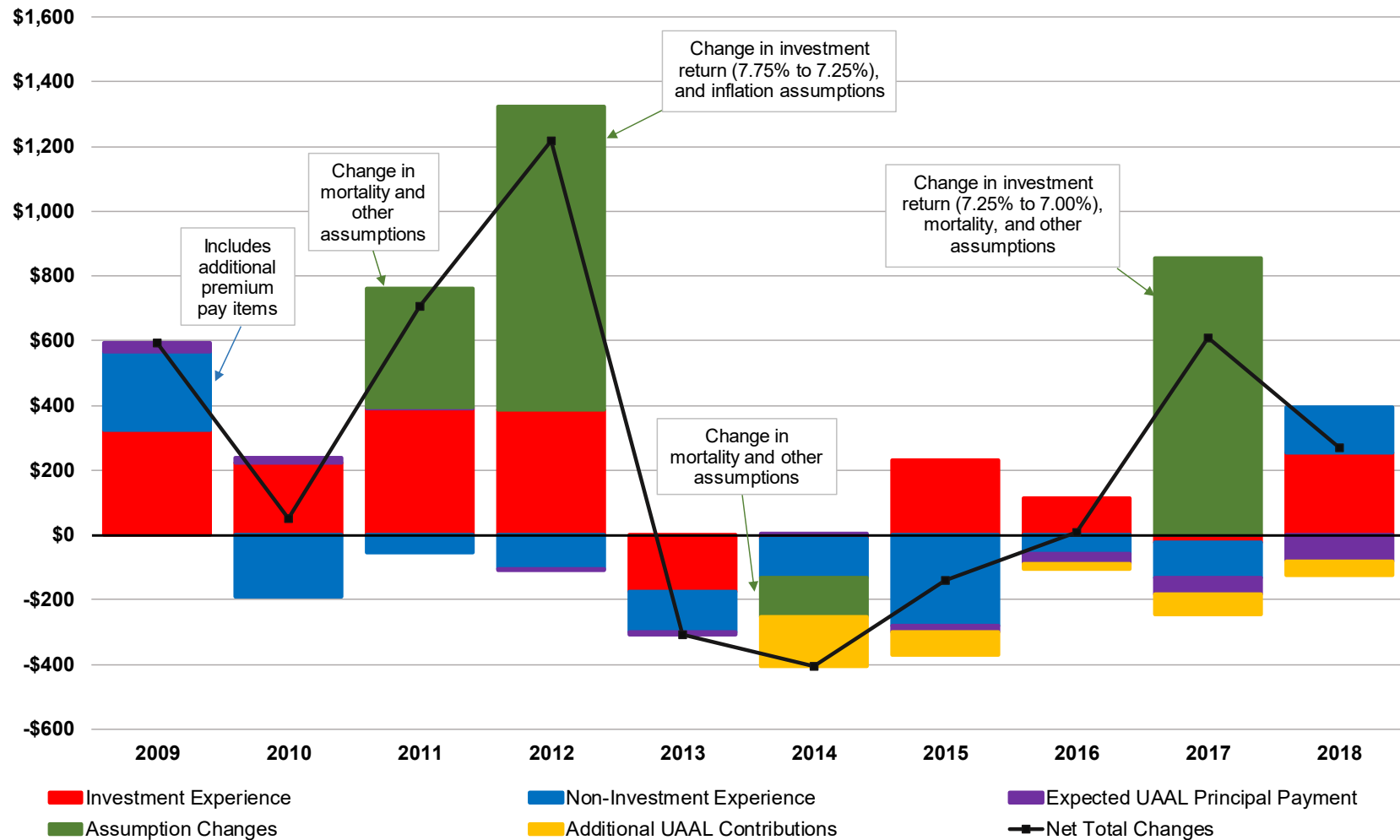


Chart 2

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 cost⁸ 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 rates⁹ are provided in Chart 4.

Except for the increase caused by using new actuarial assumptions in the December 31, 2012 valuation, the employer's aggregate normal cost rates in Chart 3 have stayed relatively flat during the last 10 years. The changes to the employer's aggregate normal cost rates from assumption changes 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.

Chart 4 shows that the changes in the investment return (from 7.75% to 7.25% in the December 31, 2012 valuation, from 7.25% to 7.00% in the December 31, 2017 valuation), mortality tables and other assumptions from the two triennial experience studies performed before those two valuations have had by far the most impact on increasing the UAAL contribution rates¹⁰ for the employers. The next greatest impact was from the unfavorable investment experience in 2008, that was recognized from 2009 to 2012 under OCERS' asset smoothing policy.

⁸ 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.

⁹ 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.

¹⁰ For instance, the increase in the employer's total rate (normal cost plus UAAL) was 4.63% in the December 31, 2012 valuation and 4.81% in the December 31, 2017 valuation, as a result of the two experience studies.

Chart 3

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

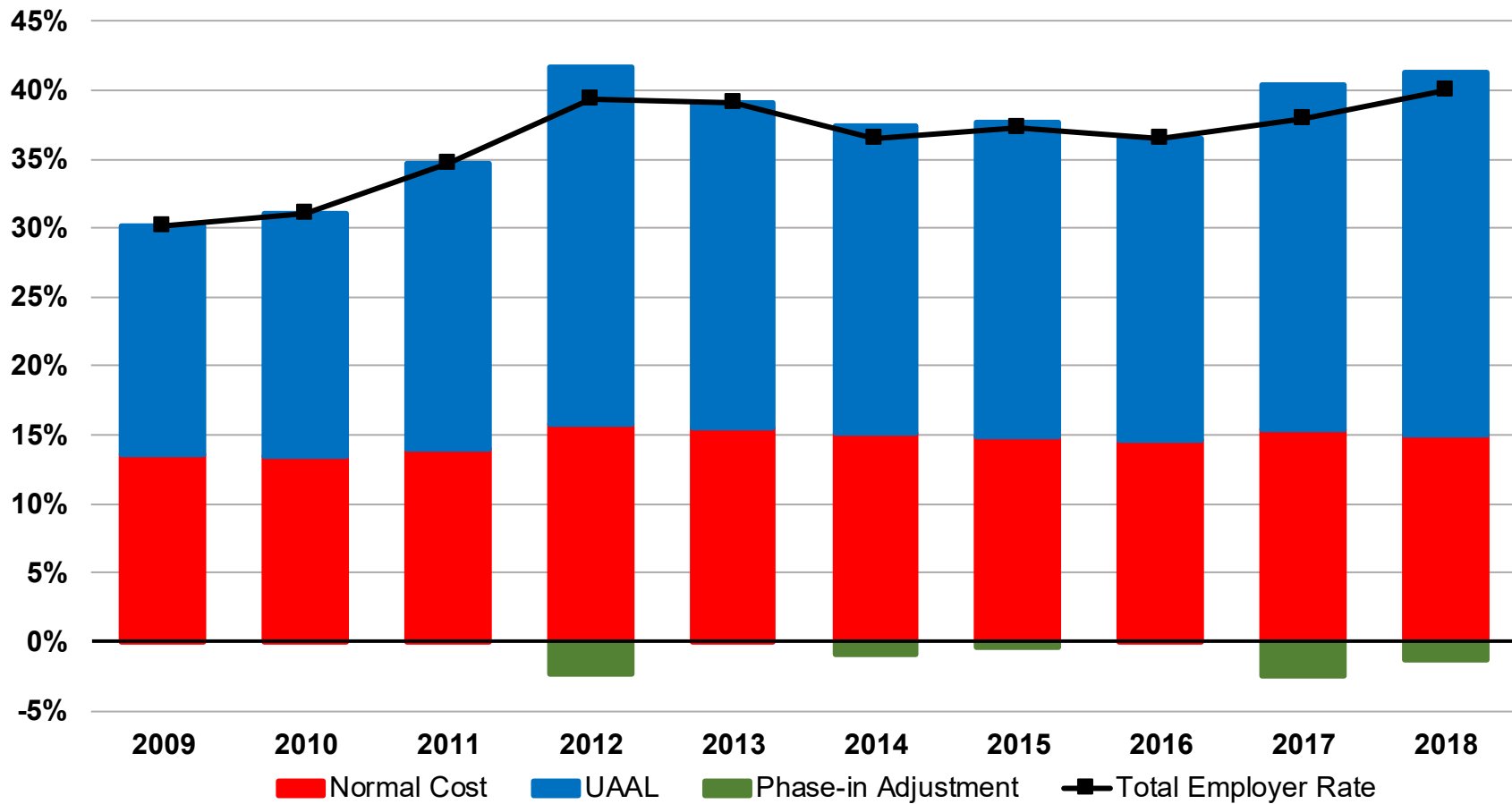
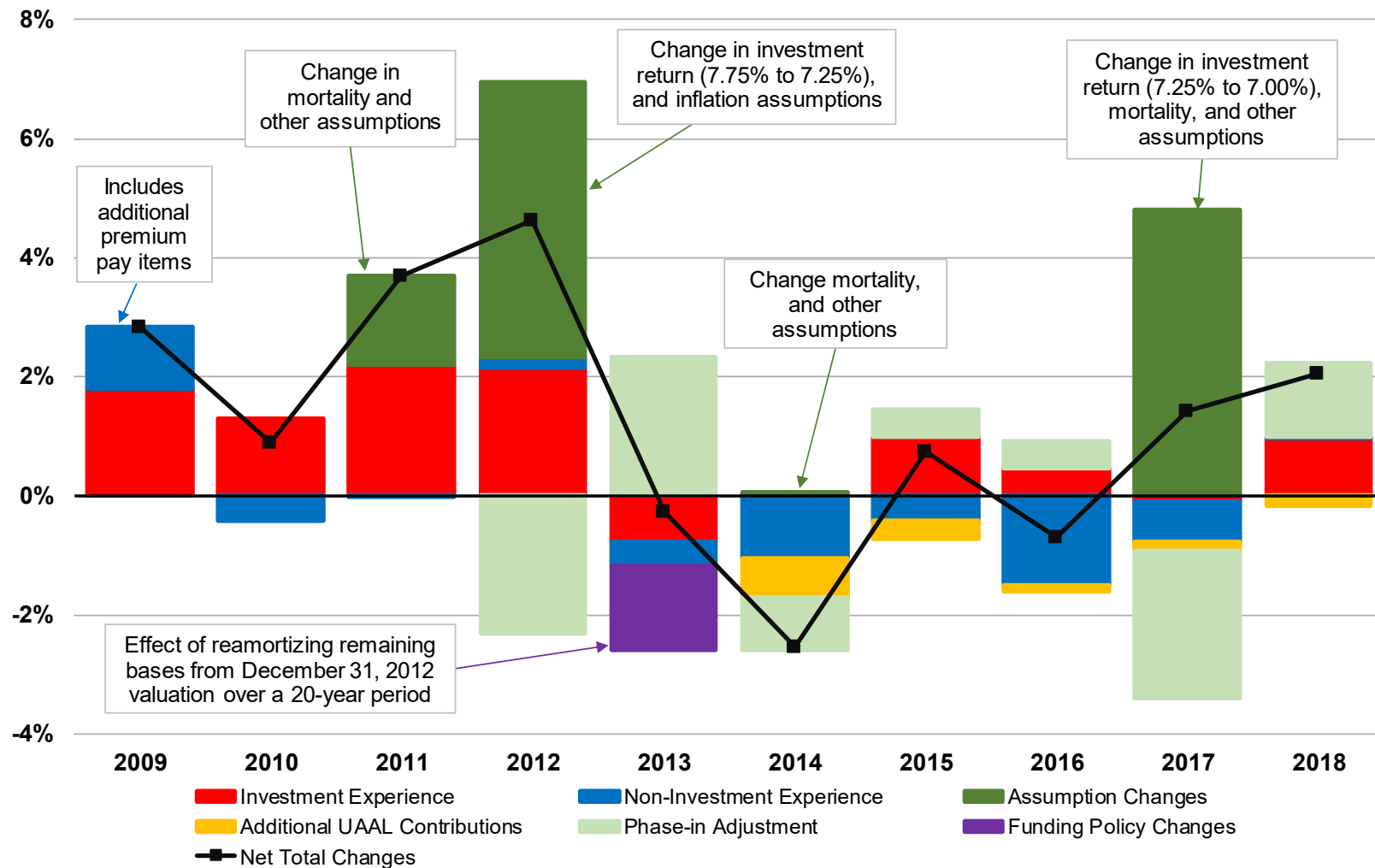


Chart 4

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 and investment experience.

In general, we anticipate the following risk factors to have an ongoing influence on those financial metrics in our future valuations:

- Asset/liability mismatch risk – the potential that future plan experience does not affect asset and liability values in the same way, causing them to diverge.

The most significant asset/liability mismatch risk to OCERS 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. As an example and as part of our assumption sensitivity analysis that we are performing for OCERS on an annual basis, we estimated that the total (employer and employee) contribution rate would increase by about 4% of payroll for a 0.25% reduction in only the investment return assumption.¹¹

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.

¹¹ See Alternative #2 included in our “Sensitivity Illustrations of Retirement Costs, Unfunded Actuarial Accrued Liability and Funded Ratio under Alternative Inflation and Investment Return Assumptions” letter dated July 3, 2019.

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 OCERS.

- 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 OCERS 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, 2020 actuarial valuation) is scheduled to be performed in 2020 following the December 31, 2019 valuation. Even though the economic assumptions included in our annual sensitivity analysis might not correspond to whatever investment return and inflation assumptions we would recommend to the Board at the next triennial experience study, the results from that analysis could still provide the stakeholders the approximate financial impact of such changes in assumptions.

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

Aside from updates to the mortality tables to anticipate continued improvement in life expectancy for the System's members, there were no major changes in the other 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 unfavorable 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, 2017 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 included data from public sector retirement plans.¹² 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, 2020 valuation, the Board should still be aware that there will likely be some increase in liabilities and contribution rates for General members. For Safety members, we expect that additional margins in the current mortality assumption will be sufficient to absorb the effect of the new benefit weighted mortality assumptions.

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

ASOP 51 does not require the actuary to evaluate 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. OCERS 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 OCERS has essentially no contribution risk.

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

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

¹² We note that a similar recommendation to use benefit weighted mortality tables was made by OCERS' actuarial auditor in 2018.

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 OCERS 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 unfunded liabilities and contribution rates if OCERS 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%. The following table summarizes the resulting contribution changes (relative to the December 31, 2018 valuation aggregate employer contribution rate of approximately 40%) 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.

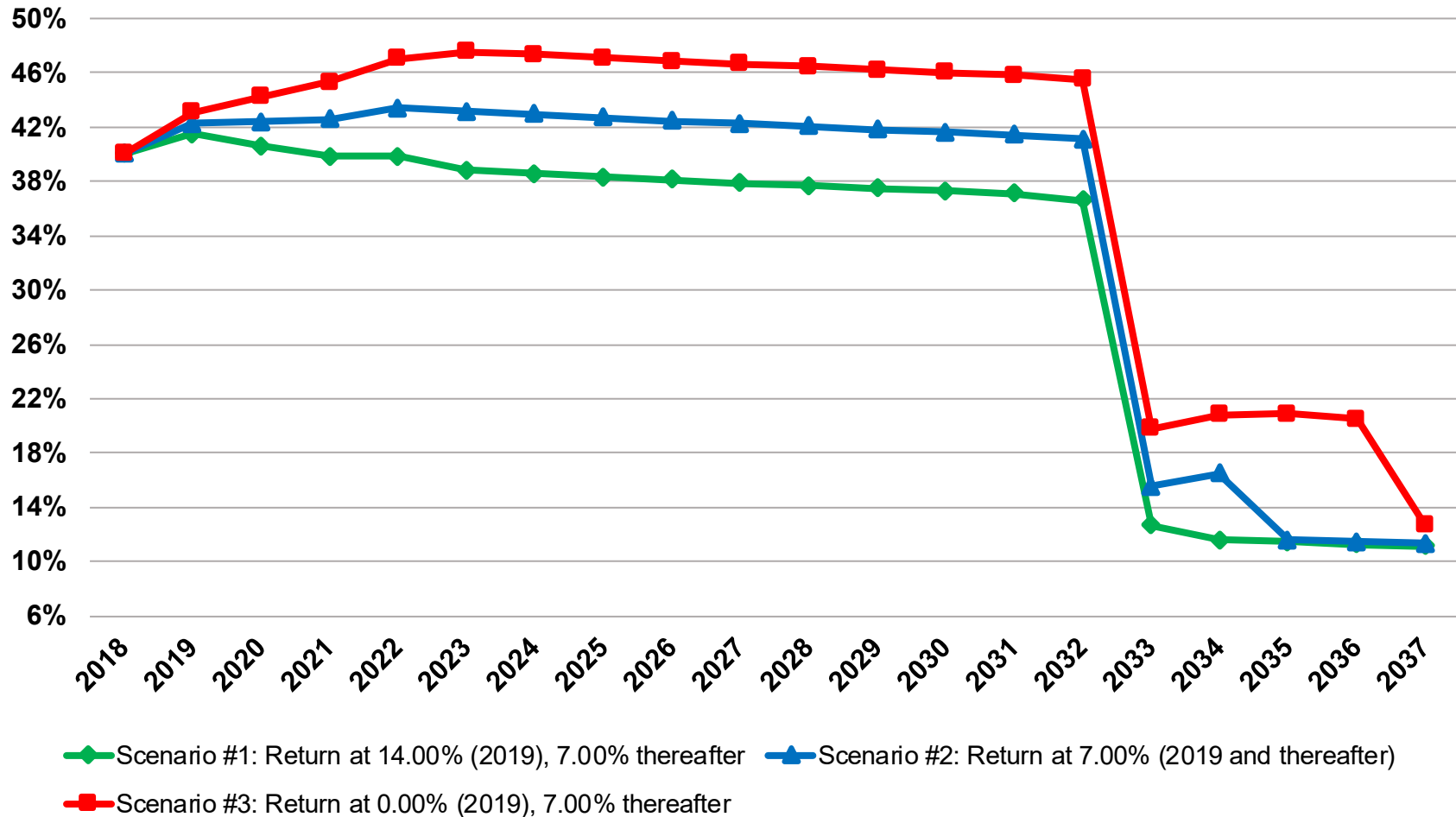
Contribution Rate Change	2019 Single Year Investment Return		
	14%	7% (baseline)	0%
December 31, 2019	+1% of payroll	+2% of payroll	+3% of payroll
December 31, 2023	-1% of payroll	+3% of payroll	+8% of payroll

Furthermore, under either favorable or unfavorable hypothetical market return scenarios for 2019, the total employer contribution rate would be expected to approach about 11% of payroll at the end of 20 years. That 11% of payroll is the employer normal cost rate after OCERS' UAAL layers as of December 31, 2018 are paid off over periods ranging from 15 to 20 years and any new UAALs resulting from the hypothetical market experience in 2019 are paid off over 20 years pursuant to the Board's actuarial funding policy. This means that the Board's

funding policy is very effective in achieving the general policy goal of achieving the long-term full funding of the costs of the benefits paid by OCERS.

While we have not assigned a probability on the 2019 market return coming in at these rates, the Board and other stakeholders monitoring OCERS 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 System absent any significant plan or assumption changes.

Chart 5
 Projected Employer Contribution Rates Under
 Three Hypothetical Market Return Scenarios for 2019 (% of Payroll)



Note: The plan is paying the Normal Cost only starting in the December 31, 2035 valuation for Scenario 1 and Scenario 2.

Chart 6

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

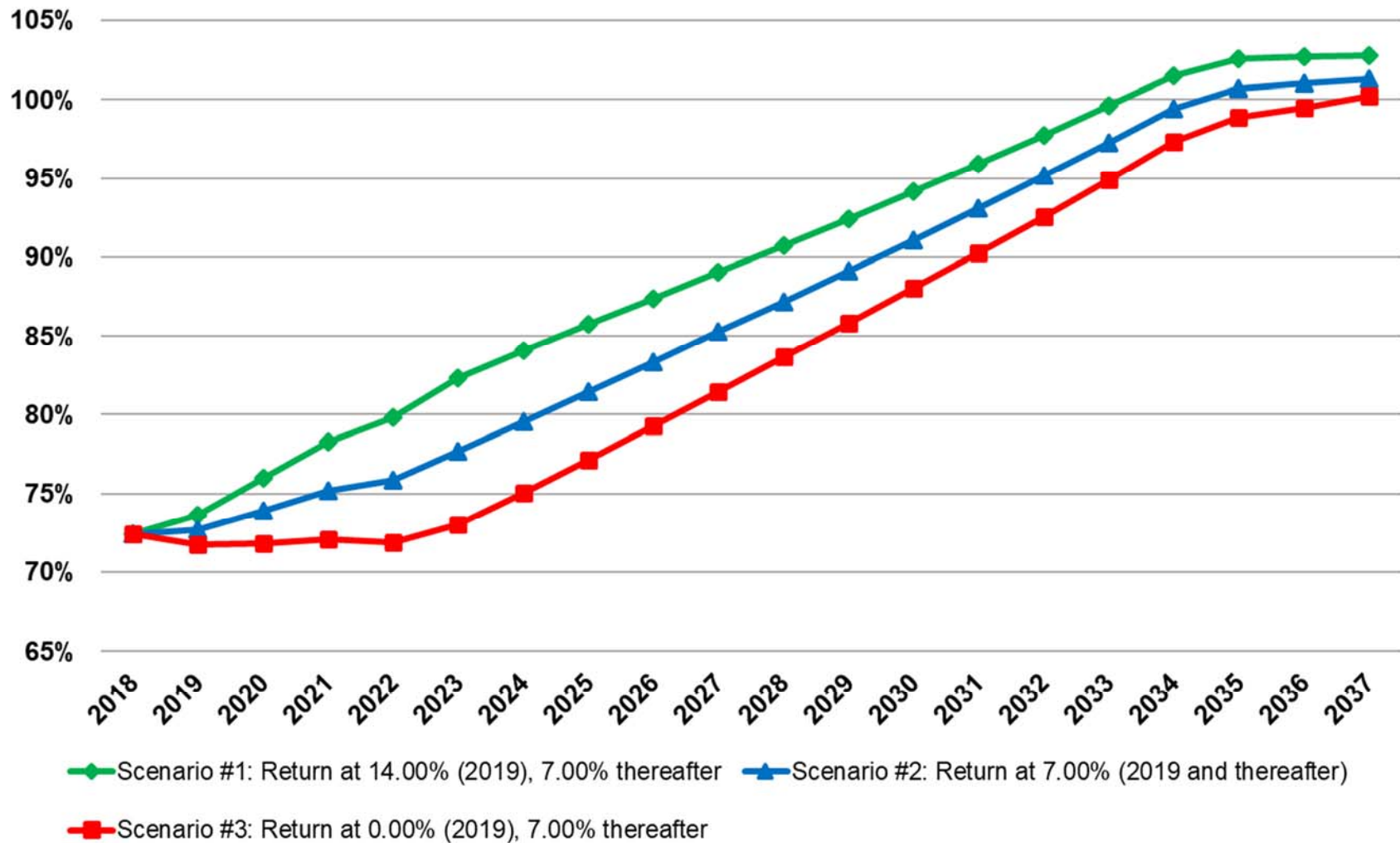
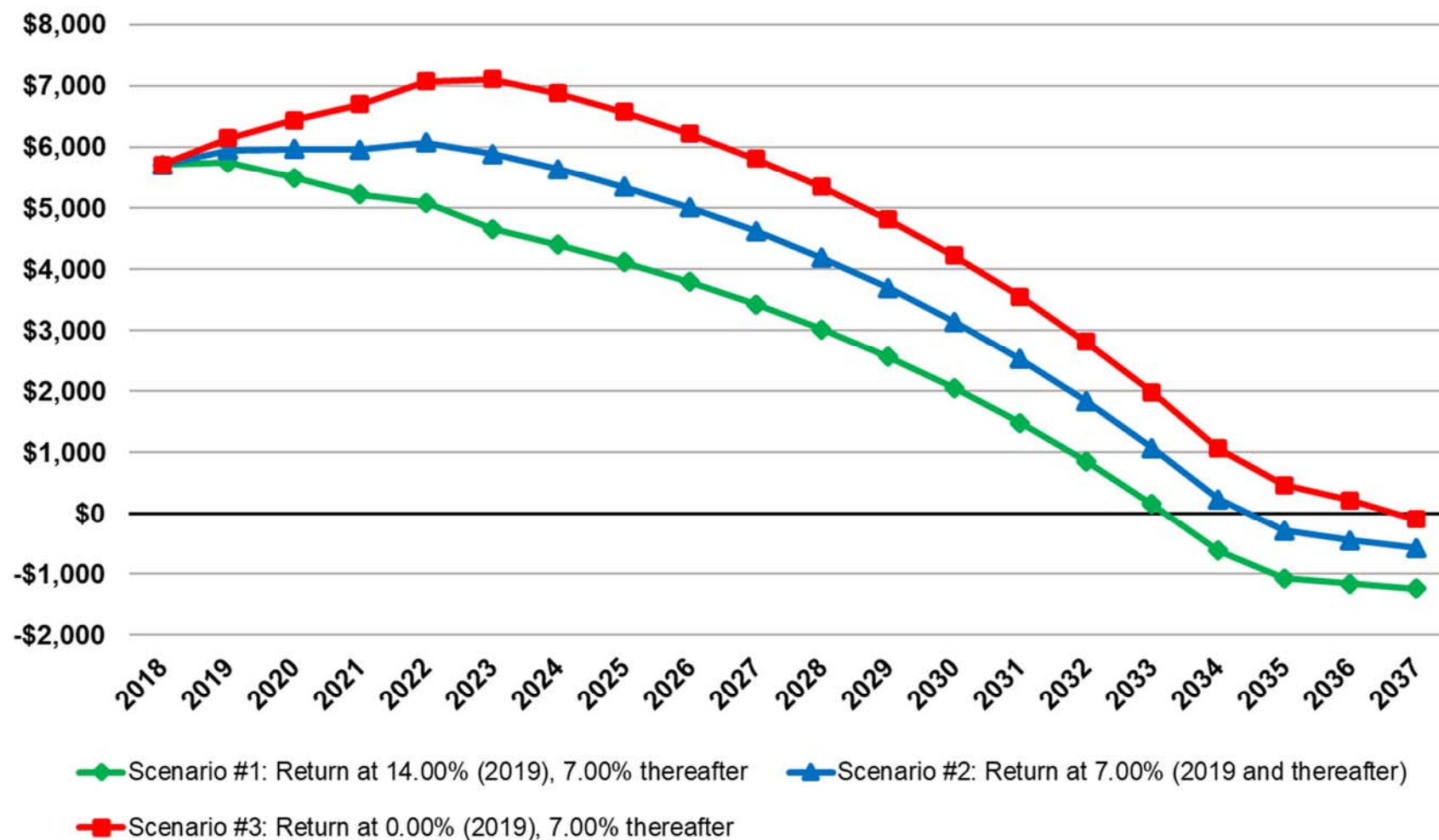


Chart 7

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 members in pay status (retirees and beneficiaries). In the past 10 valuations from December 31, 2009 to 2018, OCERS has become more mature, indicated by the continued increase in the ratio of members in pay status to active members seen in Chart 8. This ratio excludes vested terminated members who have relatively small liabilities. The increase in this ratio 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. It is important to note that virtually all pension plans are becoming more mature, so as a local reference and comparison we have included average data that CalPERS makes publically available. OCERS has historically been less mature than CalPERS plans on average but that difference has diminished over time.

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 and 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 as 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, OCERS' AVR was 7.7 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 7.7% of one year's payroll. Similarly, OCERS' LVR was 11.0 as of December 31, 2018, so a 1% liability gain or loss in 2019 would amount to 11.0% of one year's

payroll¹³. Based on OCERS' 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 0.8% 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 OCERS' 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.

¹³ The 7.7 and 11.0 are the AVR and LVR, respectively, for the entire System. 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 In
December 31, 2009 to 2018 Valuations

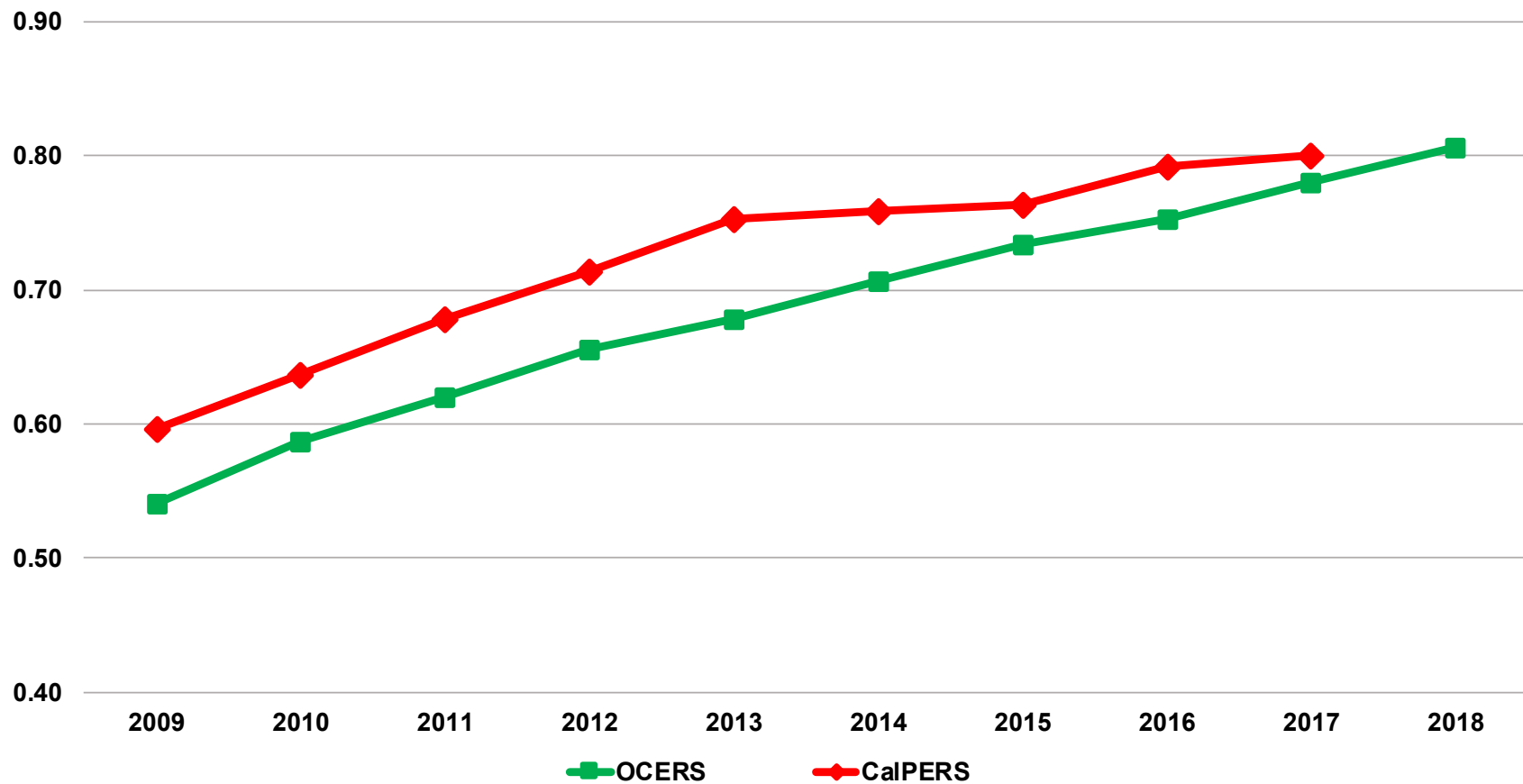


Chart 9

Asset Volatility Ratio in December 31, 2009 to 2018 Valuations

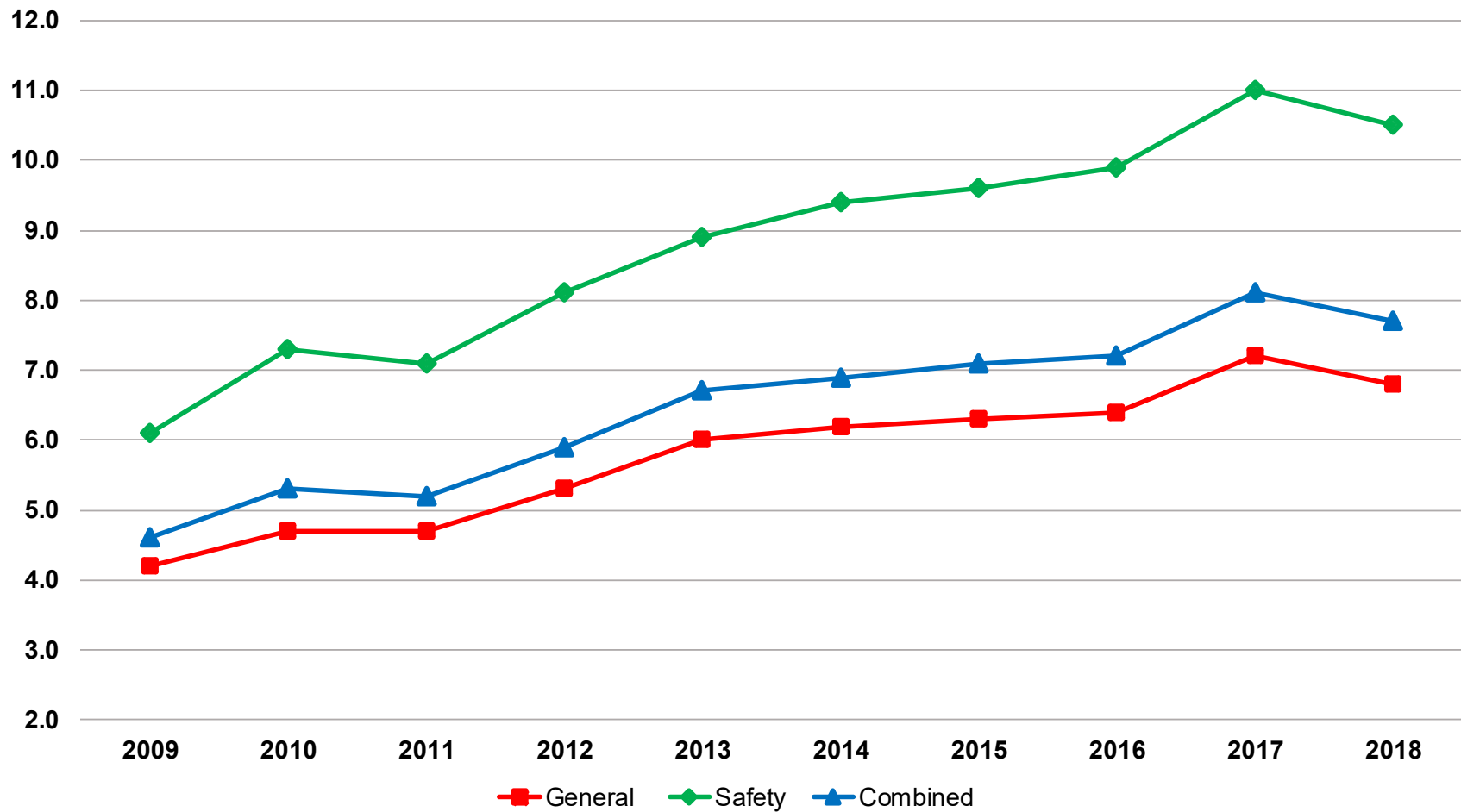
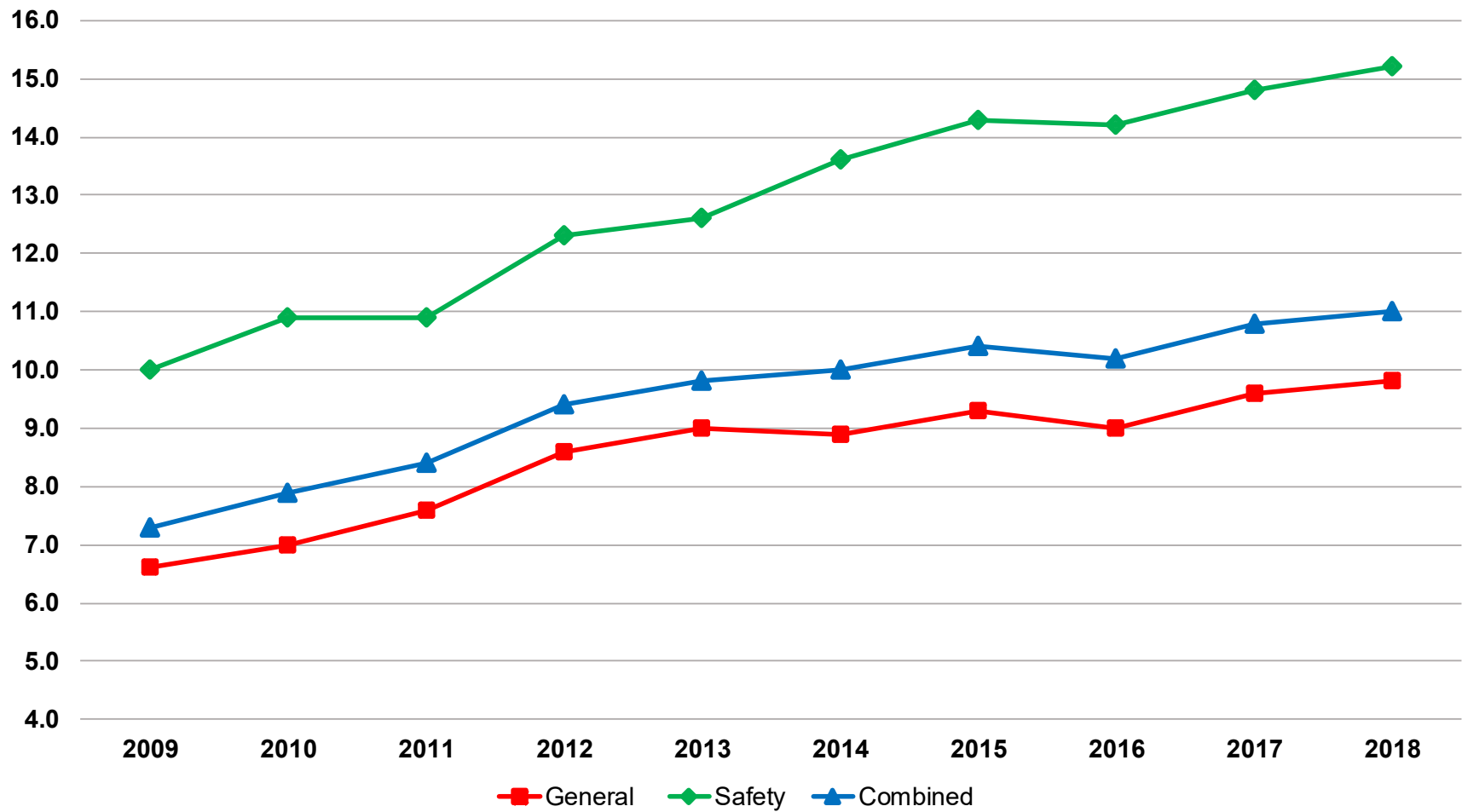


Chart 10

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 both deterministic and stochastic projections,

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

Actuarial Certification

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

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

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