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North Carolina Retirement Systems

Experience Study
for the
Five-Year Period from January 1, 2015 – December 31, 2019

Larry Langer, ASA, FCA, EA, MAAA
Jonathan Craven, ASA, FCA, EA, MAAA

July 30, 2020

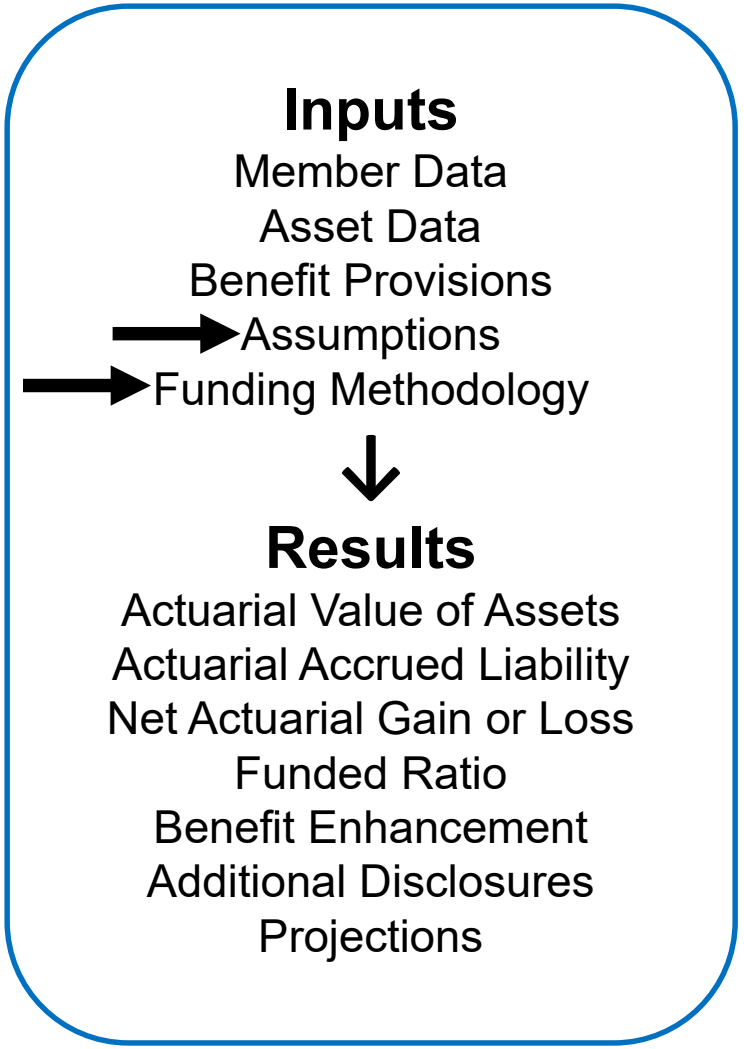
Agenda

- Discussion of the experience review process
- Impact of inflation, investment return and individual salary increases
- Funding methodology

- No decisions are to be made today.
- We will cover all of the assumptions and give a comprehensive cost impact at the October Board meeting for the Boards to discuss

The Actuarial Valuation Process

- The diagram to the right summarizes the inputs and results of the actuarial valuation process.
- A detailed summary of the valuation process and a glossary of actuarial terms are provided in Appendix A of the actuarial reports.
- Assumptions and the Funding Methodology are the focus of an Experience Study.



Purpose of the Experience Study

- From GFOA Best Practice **Enhancing Reliability of Actuarial Valuations for Pension Plans:**
  - **Actuarial Experience Study.** While an actuarial gain/loss analysis helps provide a better understanding of a plan's assumed and actual experience during the year, this timeframe is not long enough to identify trends. An actuarial experience study reviews the differences between a plan's assumed and actual experience over multiple years (typically 3 to 5), with the goal of examining the trends related to actual experience and recommending changes to assumptions, if needed.
- The assumptions and funding methodology of the North Carolina Retirement Systems are reviewed every five years and documented in the Experience Study.
  - The last experience study was reviewed and adopted in January 2016 and first used in the December 31, 2015 valuations.
  - The results of this experience study will be used for the December 31, 2020 through 2024 actuarial valuations and for purposes of plan administration beginning in calendar year 2022.

Experience Study Process

- Based on five-year period from January 1, 2015 – December 31, 2019
  - Compare Experience (“Actual”) with Assumptions (“Expected”)
  - Consider trends observed during the previous Experience Study
- Make Judgments About Future Trends:
  - Plan-Specific Experience vs. National Trends
  - Long-Term vs. Short-Term Factors
- Recommend changes in assumptions and funding methodology as needed based on Actuarial Standards of Practice
  - ASOP 4 - Measuring Pension Obligations and Determining Pension Plan Costs or Contributions
  - ASOP 27 - Selection of Economic Assumptions for Measuring Pension Obligations
  - ASOP 35 – Selection of Demographic and Other Noneconomic Assumptions for Measuring Pension Obligations
  - ASOP 44 - Selection and Use of Asset Valuation Methods for Pension Valuations
- Implement effective with the December 31, 2020 Actuarial Valuation, which determines contribution rates effective July 1, 2022

Items Reviewed during the Experience Review

- Demographic Assumptions
- Economic Assumptions
- Funding Methodology
- Administrative Factors

Our focus today is a small but important subset of the above.

Demographic Assumptions

- Retirement
- Termination
- Disability
- Mortality
- Proportion of deaths in line of duty
- Return to service of lapsed members

Demographic Assumptions are assumptions related to people. They tend to be established based on behavior of the members of the retirement system.

Demographic assumptions are set based on ASOP 35 and should reflect the best estimate of future experience, which is typically informed by studying trends in census information over the experience review period.

Economic Assumptions

- Inflation
- Investment return
- Individual salary increases
- Real return
- Real wage growth
- Social Security increases
- System payroll growth

Economic Assumptions are assumptions related to money. They tend to be driven by external factors outside of the control of stakeholders.

Economic Assumptions are set based on ASOP 27. They tend to be based on the future economic environment.

Funding Methodology

- Actuarial cost method
- Asset valuation method
- Amortization method
- Employer Contribution Stabilization Policies
- Employer contribution phase in policy
- Administrative expenses

Once the assumptions are determined, the next step is to systematically fund the benefits expected to be paid.

The components of the Funding Methodology define how benefits are systematically funded.

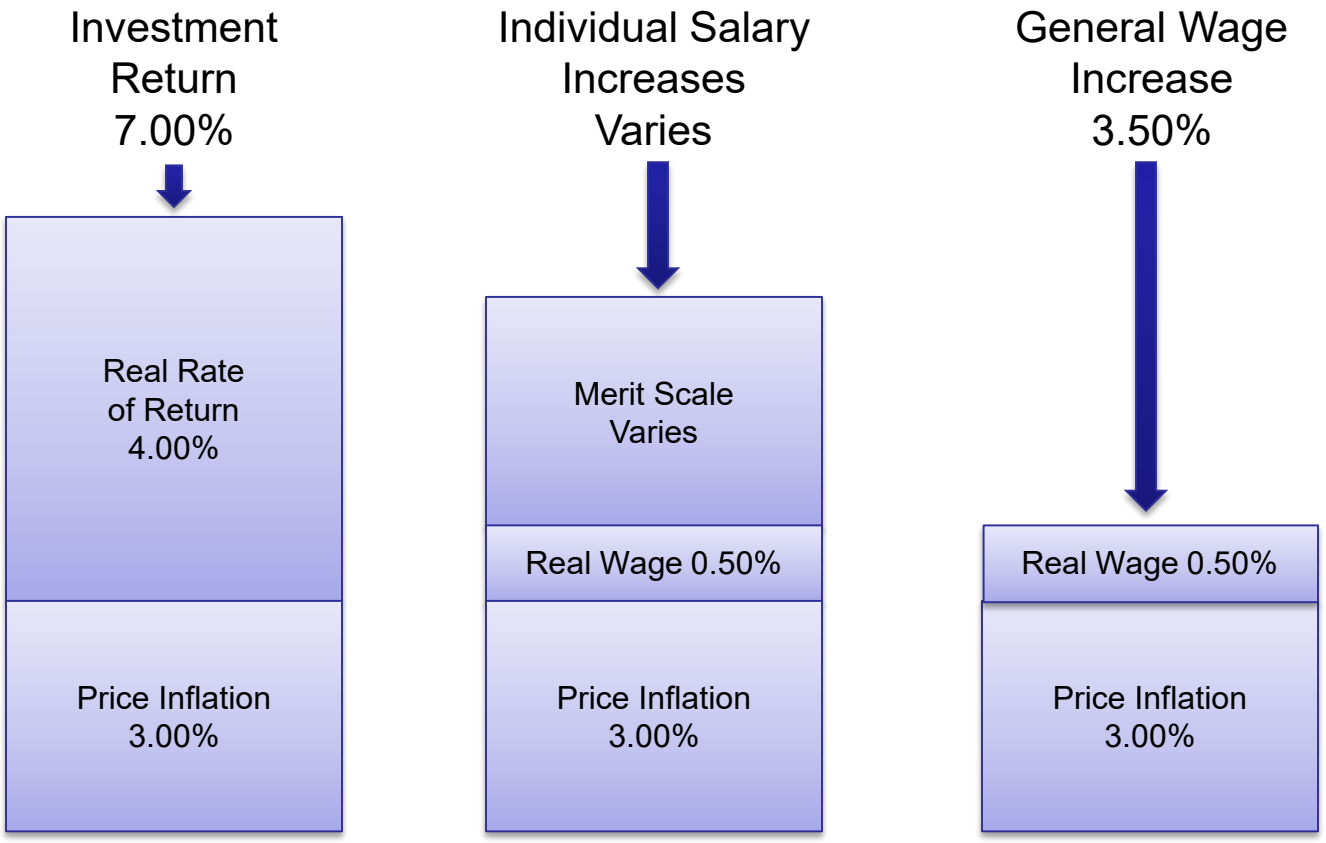
Administrative

- Assumptions used for transfer benefit from Supplemental Retirement Plans
- Assumptions used for withdrawal liability
- CBBC cap factor
- COLA assumption used in service purchases
- Mortality and interest used for optional forms of benefit

While not intuitive, these items are reviewed during the experience review.

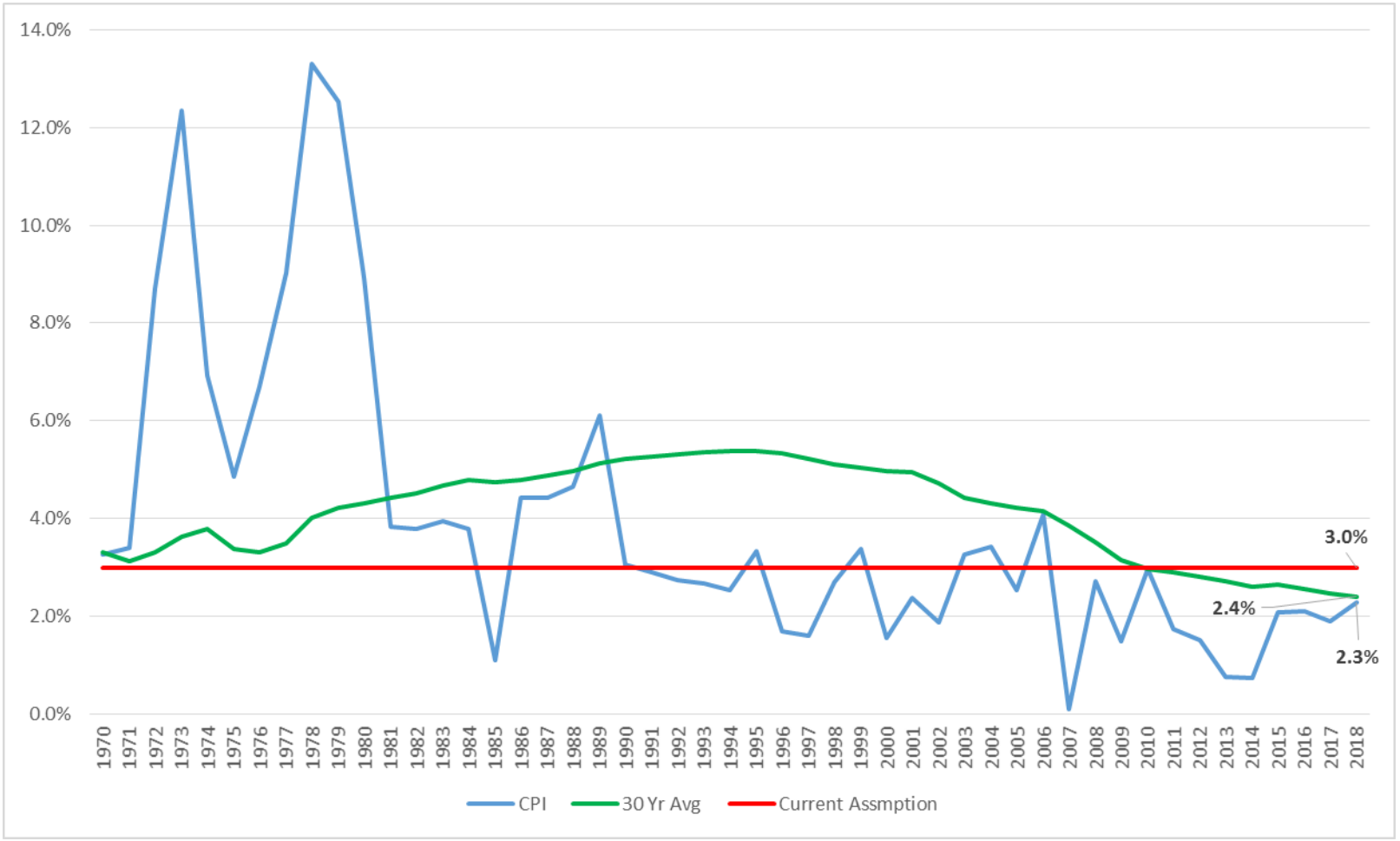
They tend to be based on the recommendations made for the actuarial valuations, with some adjustments.

Economic Assumptions
Building Block Method

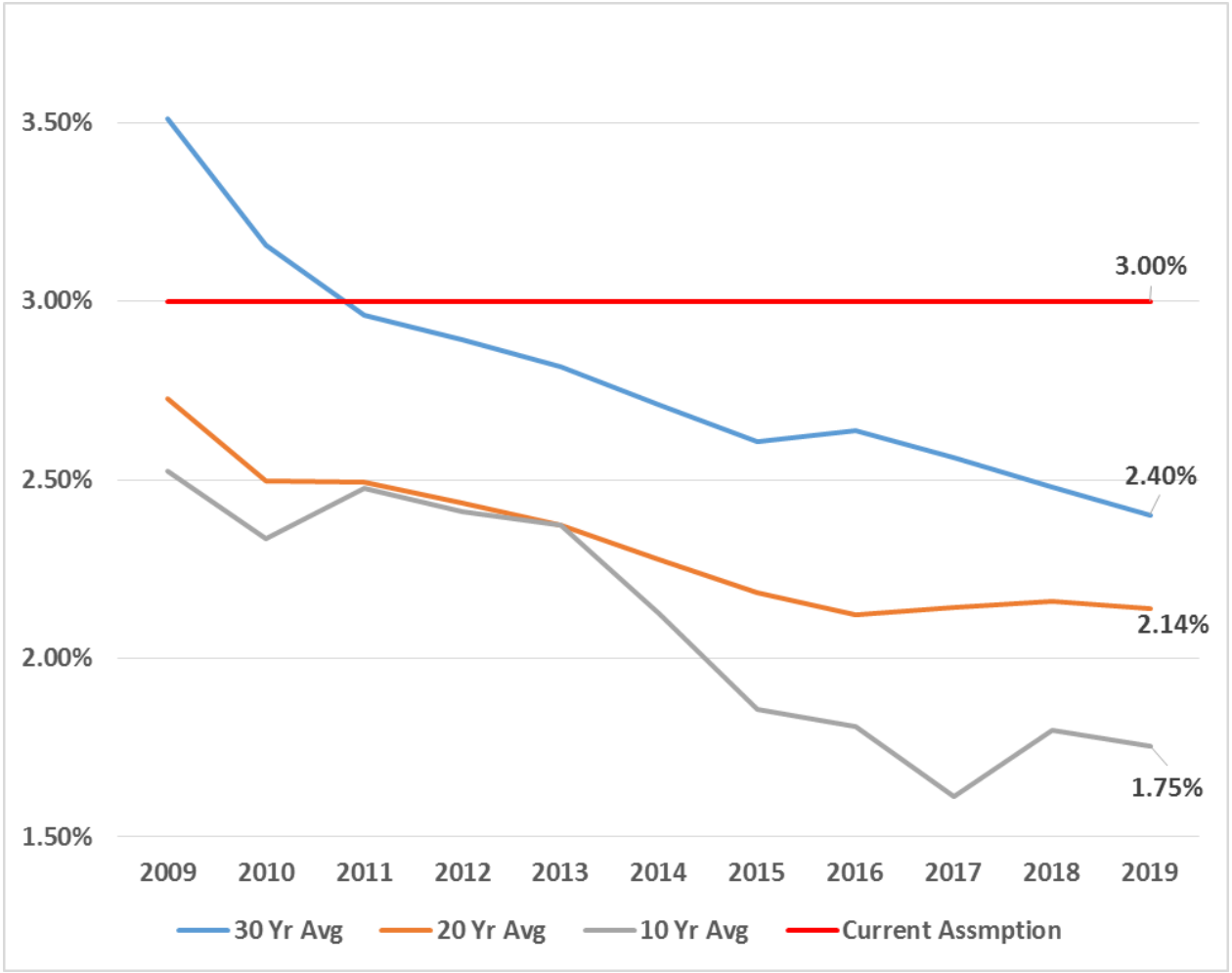


The building block approach used for setting economic assumptions calls for consistency across all assumptions. For example, the same price inflation should be used for the investment return, individual salary increases and general wage increase assumption.

CPI Last 50 Years



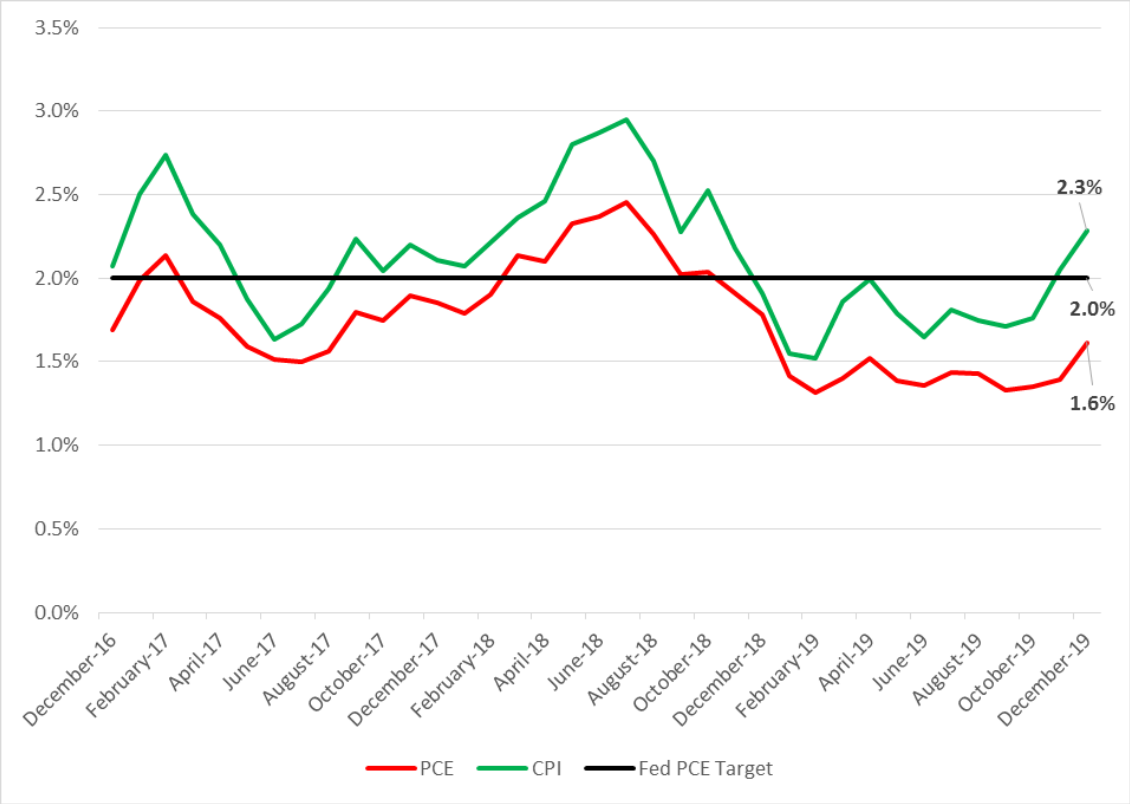
Rolling CPI Averages



Federal Reserve Board
Monetary Policy

- Policy during most of post WWII period was to combat price inflation
- Policy since 2012 has been to have an inflation target of 2.0%
  - Price index target is the Personal Consumption Expenditures index (PCE)
  - Since 2000, the CPI has averaged 0.5% higher than the PCE
  - Since 2008, the CPI has averaged 0.3% higher than the PCE
- A “symmetric” 2.0% target has been discussed which indicates a willingness to let inflation run higher than the 2.0% target

PCE, PCE Target, and CPI



CPI is based on a fixed basket of consumer goods while the PCE basket of goods changes with substitution.

For example, if there were an outbreak of mad cow disease and the price of beef skyrocketed, the CPI will reflect the total increase in price. If consumers bought less beef and substituted pork, the PCE will reflect the shift in consumer behavior – the basket of goods would change to more pork and less beef.

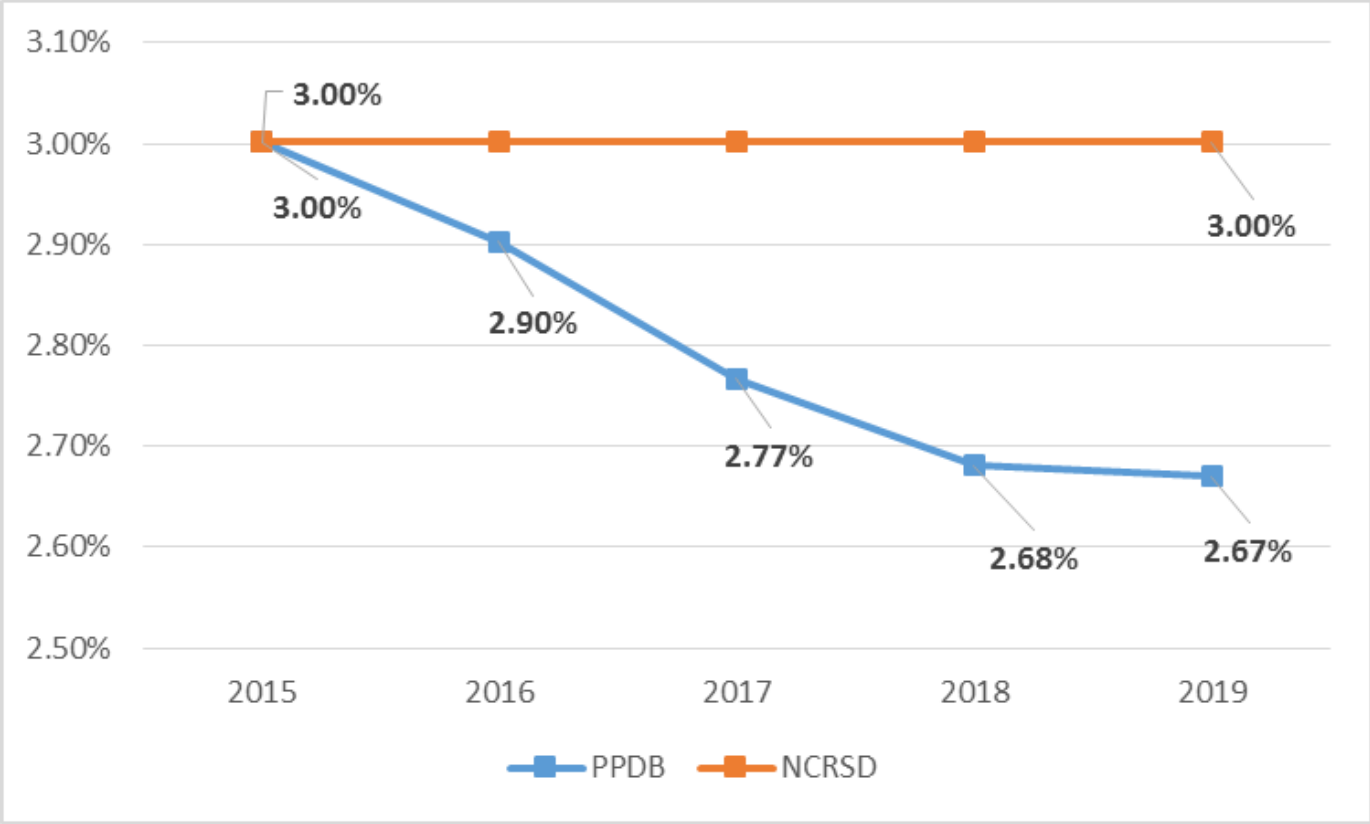
2020 Social Security Report
Long Range Inflation Assumption*

- High: 3.0%
- Intermediate: 2.4%
- Low: 1.8%

*From “The Long-Range Economic Assumptions for the 2020 Trustees Report” authored by the Office of the Chief Actuary of the Social Security Administration dated April 22, 2020

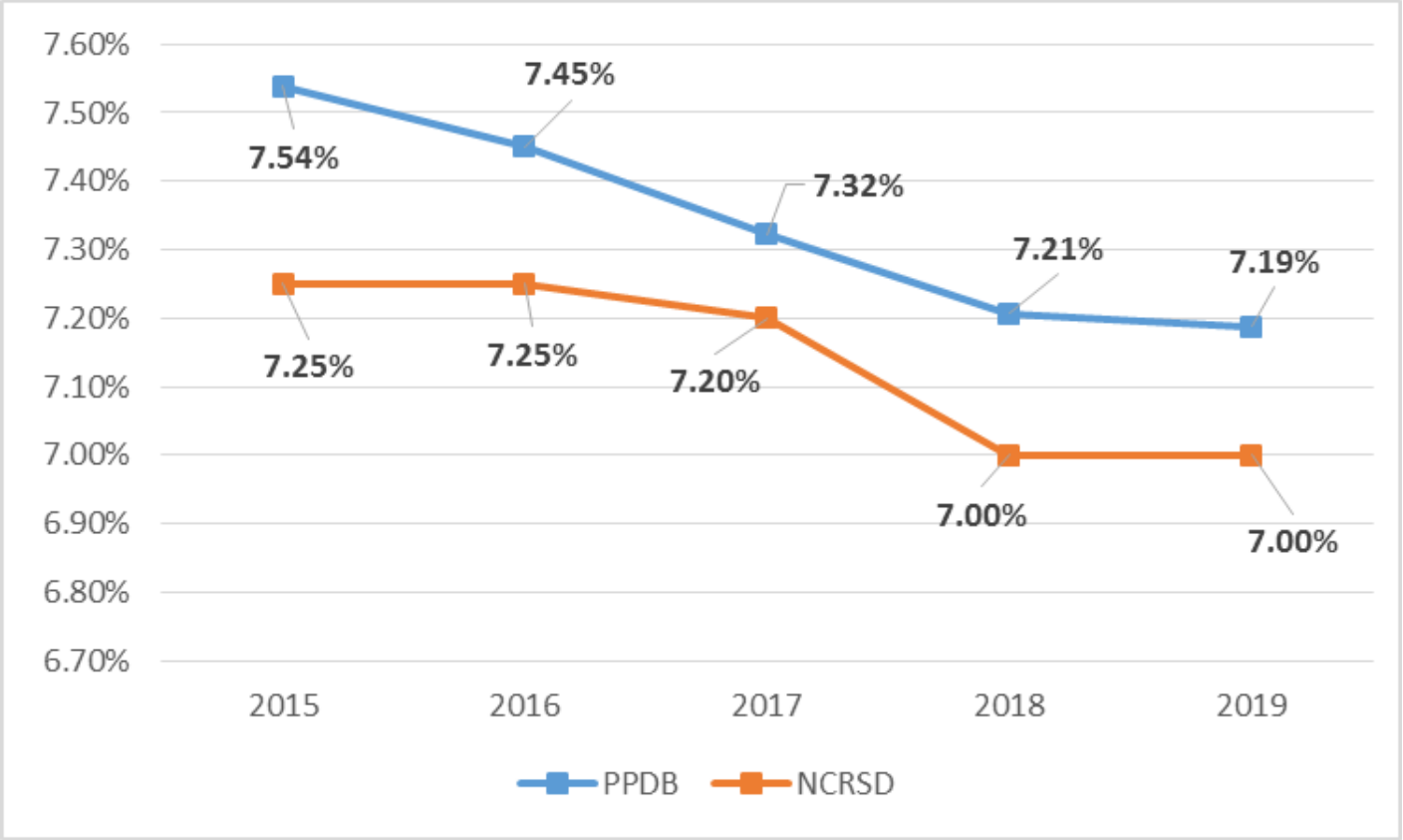
https://www.ssa.gov/OACT/TR/2020/2020_Long-Range_Economic_Assumptions.pdf

Average Assumed Inflation Rate
Public Plans Database*



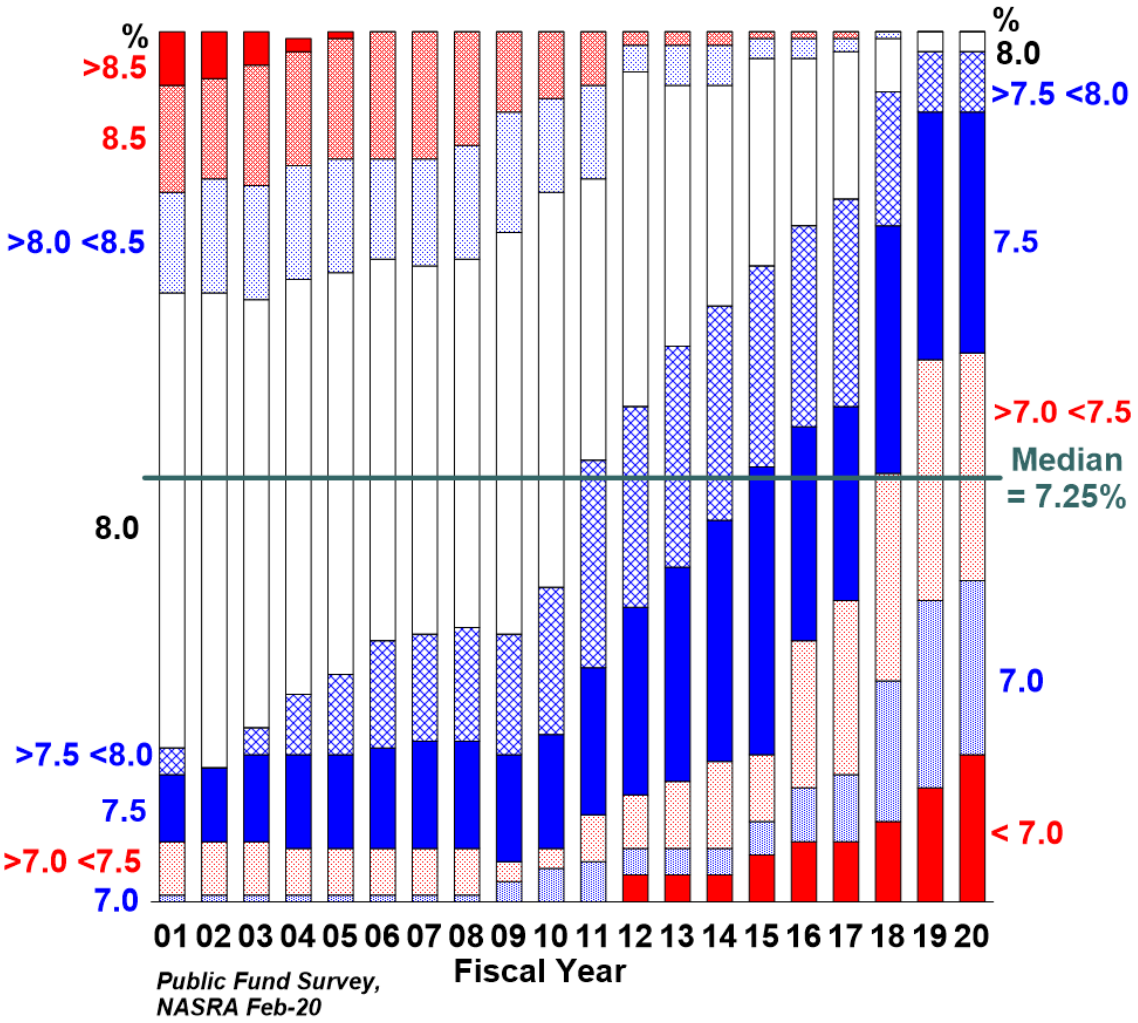
- Center for Retirement Research at Boston College
- https://publicplansdata.org/

Average Expected Return Assumption Public Plans Database



- Center for Retirement Research at Boston College
- https://publicplansdata.org/

Change in Distribution of Public Pension Investment Return Assumptions (NASRA)



https://www.nasra.org/files/Issue%20Briefs/NASRAInvReturnAssumptBrief.pdf

The reduction in assumed returns over the past 20 years has been driven by lower expectations of future returns by investment professionals and has resulted in increases in liabilities and employer contribution rates.

The latest information presented to the IAC puts NCRS at the 6th percentile in long-term investment risk, and the 7.0% return assumption is well over 10th percentile among peers.

https://files.nc.gov/nctreasurer/documents/files/IMD/MeetingDocuments/5-20-20_iac_performance_presentation.pdf

Expected Returns - Asset Allocation Studies and Actuarial Assumptions

The following slide was presented at the April 2018 Board Meeting. This information was a primary consideration for reducing the investment return assumption to 7.00%.

Current Information

2016 IMD Asset Allocation Study

- Study performed in 2016
  - Based on market conditions and asset allocation as of year-end 2015
  - Incorporates Employer Contribution Rate Stabilization Policies adopted by Boards in 2016
- Expected range of annualized passive compound returns is summarized below
  - All returns are net of expenses
- Both 7.25% (pre-2017 assumption) and 7.20% (adopted in 2017) are somewhat greater than the median 20-year expected return, and close to (but greater than) median 30-year expected return
- At Feb. 2018 Investment Advisory Committee meeting, it was noted that there have been only modest changes in return expectations since the 2016 study, so that there is no urgent need for a new study

Horizon	5th Percentile	25th Percentile	50th Percentile	75th Percentile	95th Percentile
10 Years	0.2%	4.0%	5.9%	8.0%	11.5%
20 Years	2.2%	4.8%	6.7%	8.5%	11.8%
30 Years	3.1%	5.3%	7.1%	8.7%	12.0%

Source: North Carolina Department of State Treasurer and Buck Consulting

North Carolina Total Retirement Plans

9

Projected returns are based on the asset allocation, which is a key consideration to setting the investment return assumption.

An updated asset allocation study may be available later this year to assist in setting this assumption.

Impact of Lower Inflation on Results

- In anticipation of lower returns when the next asset allocation study is performed, the following slides are based on lowering inflation and related economic assumptions by 0.50%

- Consistent with the building block approach, when we lower the inflation assumption by 0.50% from 3.00% to 2.50%:

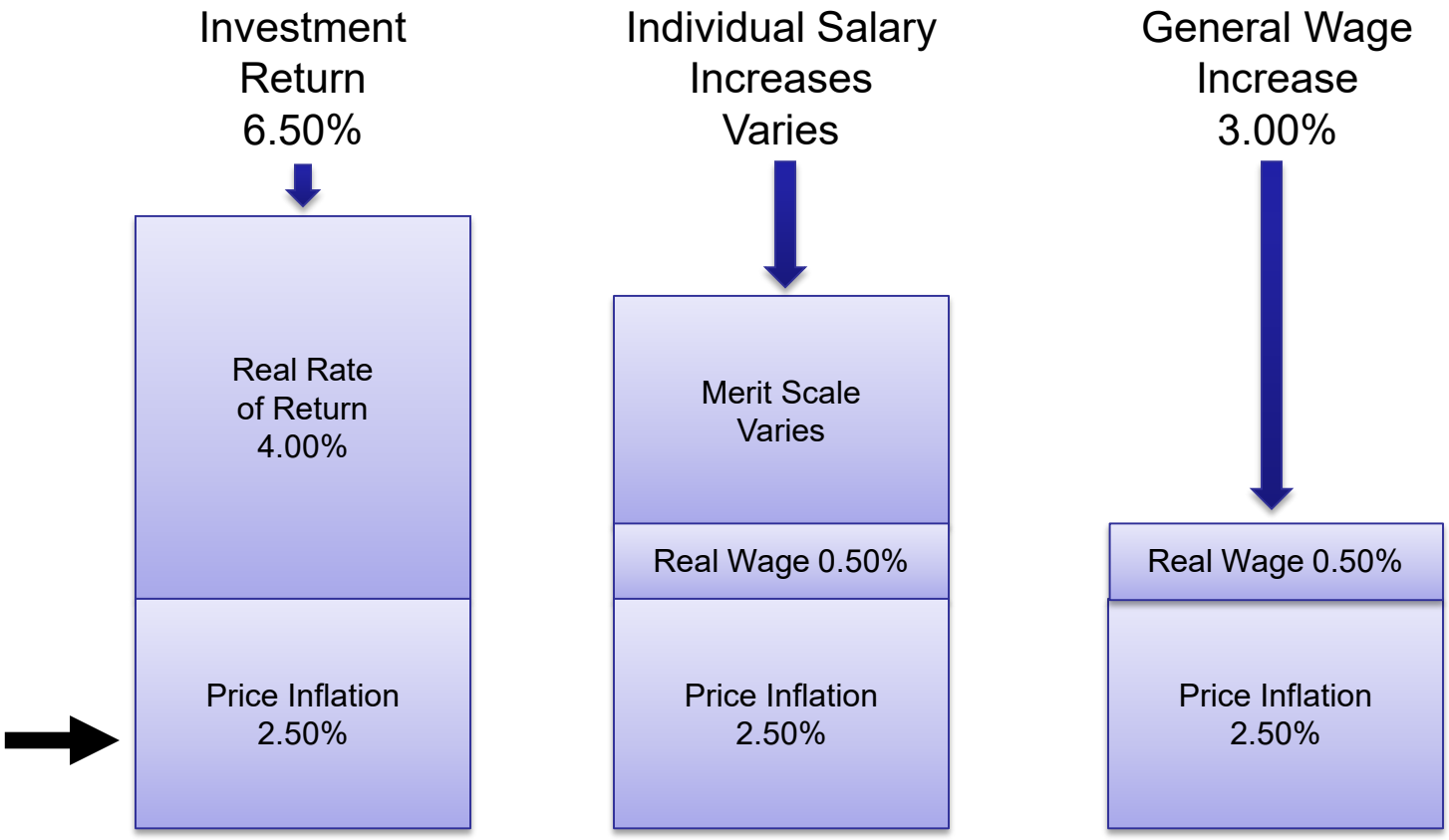
  - Assuming no change in the real return, the assumed rate of return decreases from 7.00% to 6.50%

  - Assuming no change in merit and real wage growth, individual salary increase will reduce by 0.50% - *It is important to note that if the investment return ends up being reduced to 6.50%, but the study does not end up justifying reducing the pay assumption by 0.50%, then the contribution rates would be higher than those shown in the graphs later in this presentation and the funded percentages would be lower*.

- The impact of this change in assumptions is phased in over a 5 year period similar with past practice

At the October Board meeting, we will present actual recommendations for real return and merit and real wage growth as well as all other assumptions and funding methodology. The purpose of the following is to inform stakeholders of the magnitude of this potential change.

Economic Assumptions
Building Block Method



The building block approach used for setting economic assumptions calls for consistency across all assumptions. For example, the same price inflation should be used for the investment return, individual salary increases and general wage increase assumption. The reduction in price inflation impacts investment return, individual salary increases and general wage increases.

Projections
TSERS

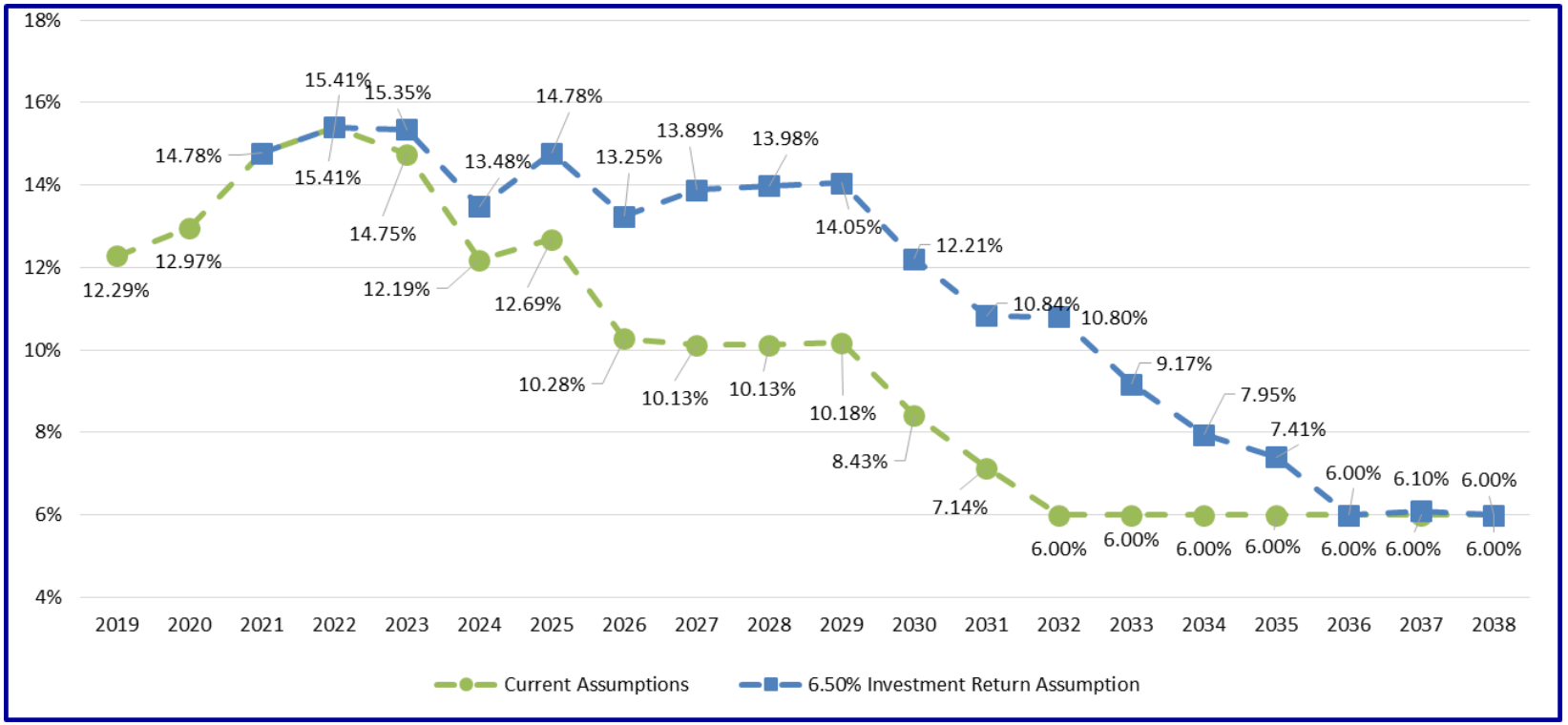
- Projections of contribution requirements and funded status into the future can be helpful planning tools for stakeholders. This section provides such projections. The projections of the actuarial valuation are known as deterministic projections. Deterministic projections are based on one scenario in the future. The baseline deterministic projection is based on December 31, 2018 valuation results.

- Key Projection Assumptions
  - Baseline valuation interest rate of 7.00% for all years in conjunction with direct rate smoothing of the employer contribution rate over a 3-year period beginning July 1, 2019.
  - Baseline investment return on market value of assets of 14.88% for calendar 2019, 7.00% thereafter.
  - Actuarial assumptions and methods as described in Appendix D. All future demographic experience is assumed to be exactly realized.
  - The contribution rate under the Employer Contribution Rate Stabilization Policy (ECRSP) is contributed until fiscal year ending 2022.
  - The actuarially determined employer contribution rate is contributed for fiscal years ending 2023 and beyond.
  - 0% increase in the total active member population
  - No cost-of-living adjustments granted
  - Future pay increases based on long-term salary increase assumptions

- The ECRSP adopted by the Board of Trustees on January 21, 2016 requires that recommended contributions be 0.35% of payroll greater than the appropriated contribution during the prior year, with the following bounds: (1) contributions may not be less than the actuarially determined employer contribution (ADEC) rate and (2) contributions may not be greater than a contribution determined using the same assumptions used to calculate the ADEC but using a discount rate equal to the long-term Treasury bond yield.

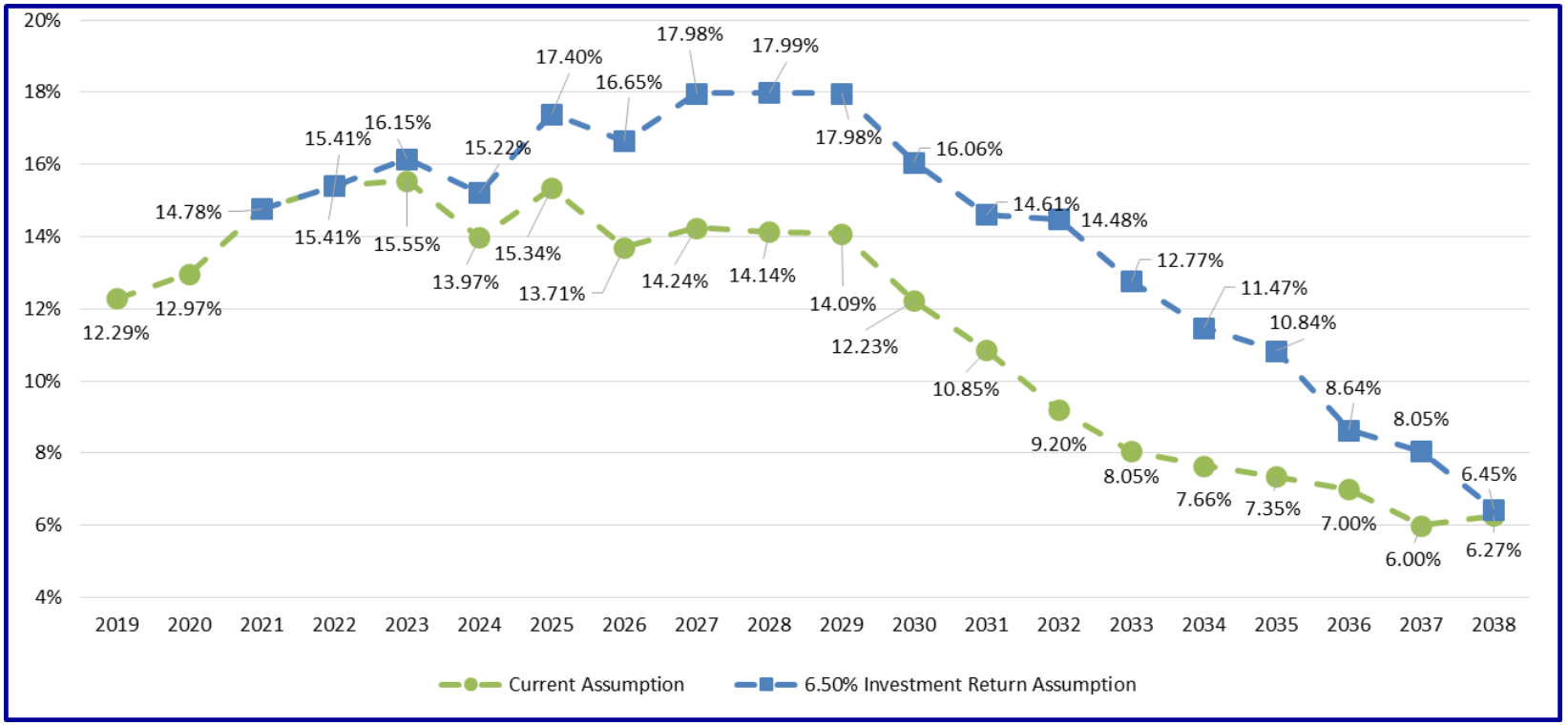
- In addition, we have provided alternate deterministic projections:
  - Estimated 2020 asset return of 0.00%
  - 6.50% investment return assumption based on:
    - valuation interest rate of 6.50% for all years in conjunction with direct rate smoothing of the employer contribution rate over a 5-year period beginning July 1, 2022; includes 2.50% inflation and 0.50% decrease in individual salary increases.
    - Investment return on market value of assets of 6.50% beginning December 31, 2020.
    - Direct rate smoothing of employer contribution rate over a 5-year period beginning July 1, 2022 through June 30, 2027.

Projected Contribution Rates
TSERS



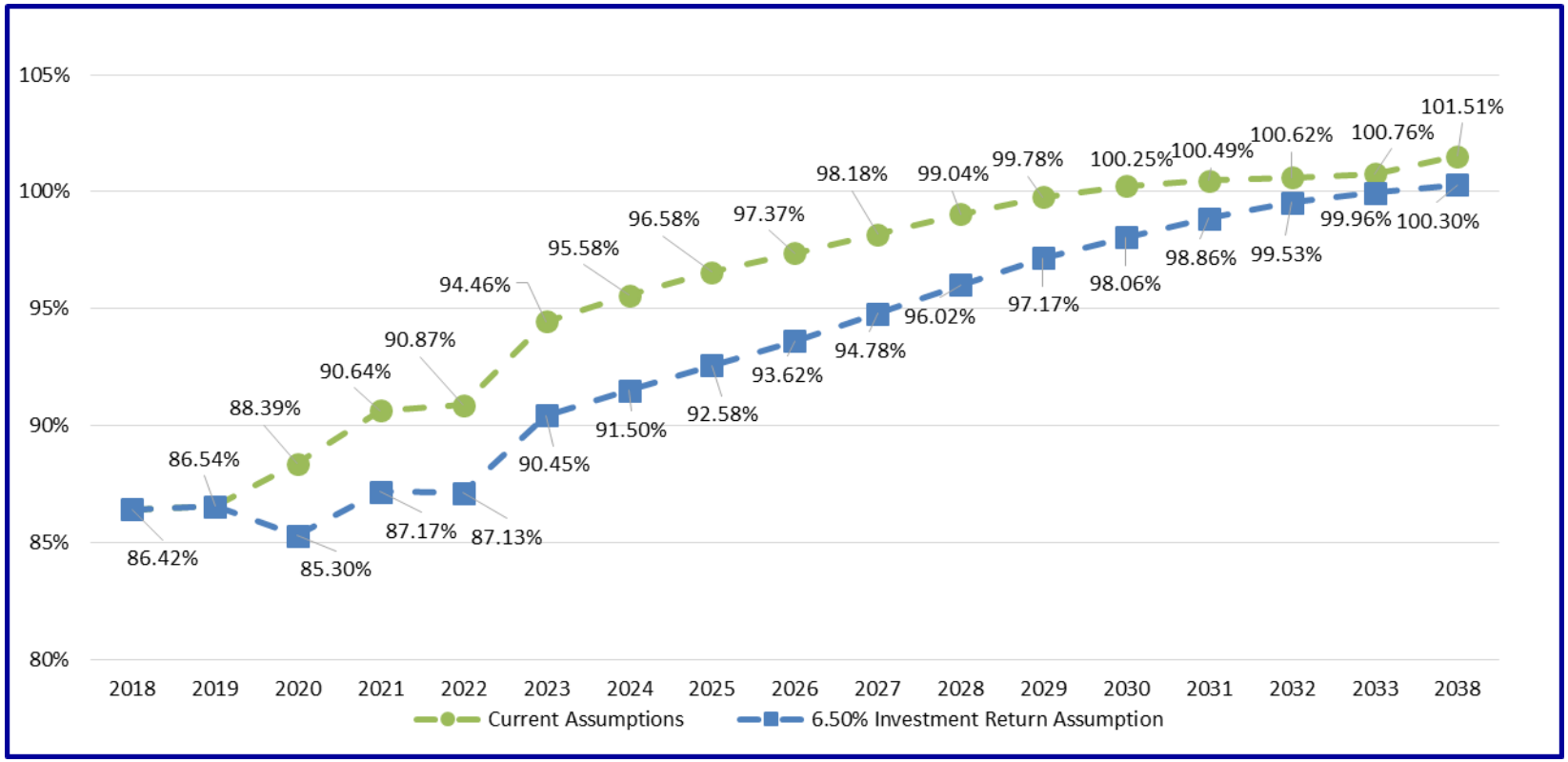
Assumes a 7.00% return for 2020. Lowering the expected return assumption to 6.50% increases the 2027 contribution rate from 10.13% to 13.89% or 3.76% when direct rate smoothing is fully implemented.

Projected Contribution Rates
TSERS



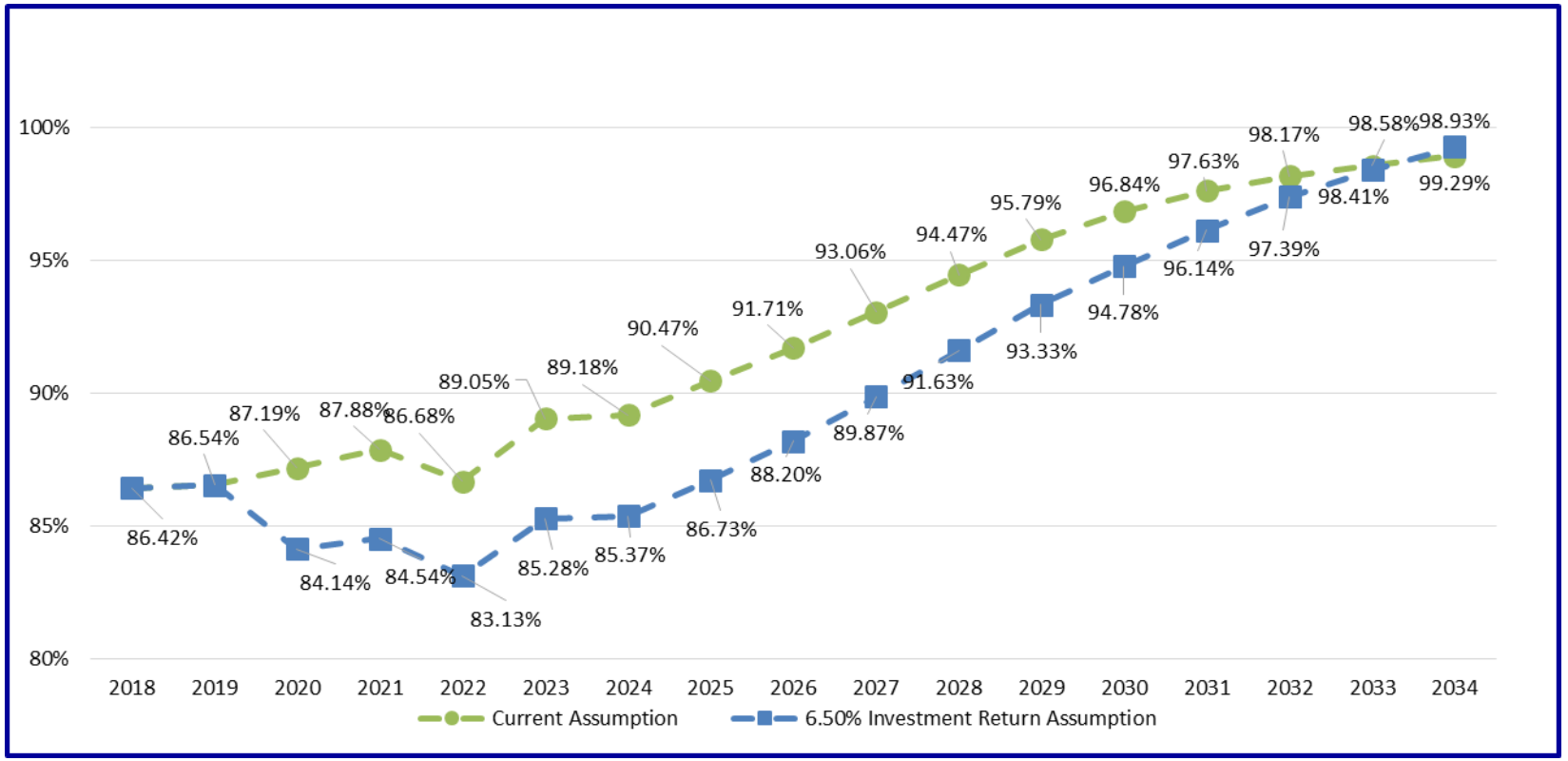
Assumes a 0.00% return for 2020. The 2027 contribution is 4.11% higher under the current assumption and 4.09% higher under the 6.50% investment return assumption.

Projected Funded Ratio
TSERS



Assumes a 7.00% return for 2020. Lowering the expected return assumption to 6.50% decreases the funded ratio by 4.08% as of December 31, 2024 when returns are fully reflected.

Projected Funded Ratio
TSERS



Assumes a 0.00% return for 2020. The December 31, 2024 funded ratio is 6.40% lower under the current assumption and 6.13% lower under the 6.50% investment return assumption.

Projections
LGERS

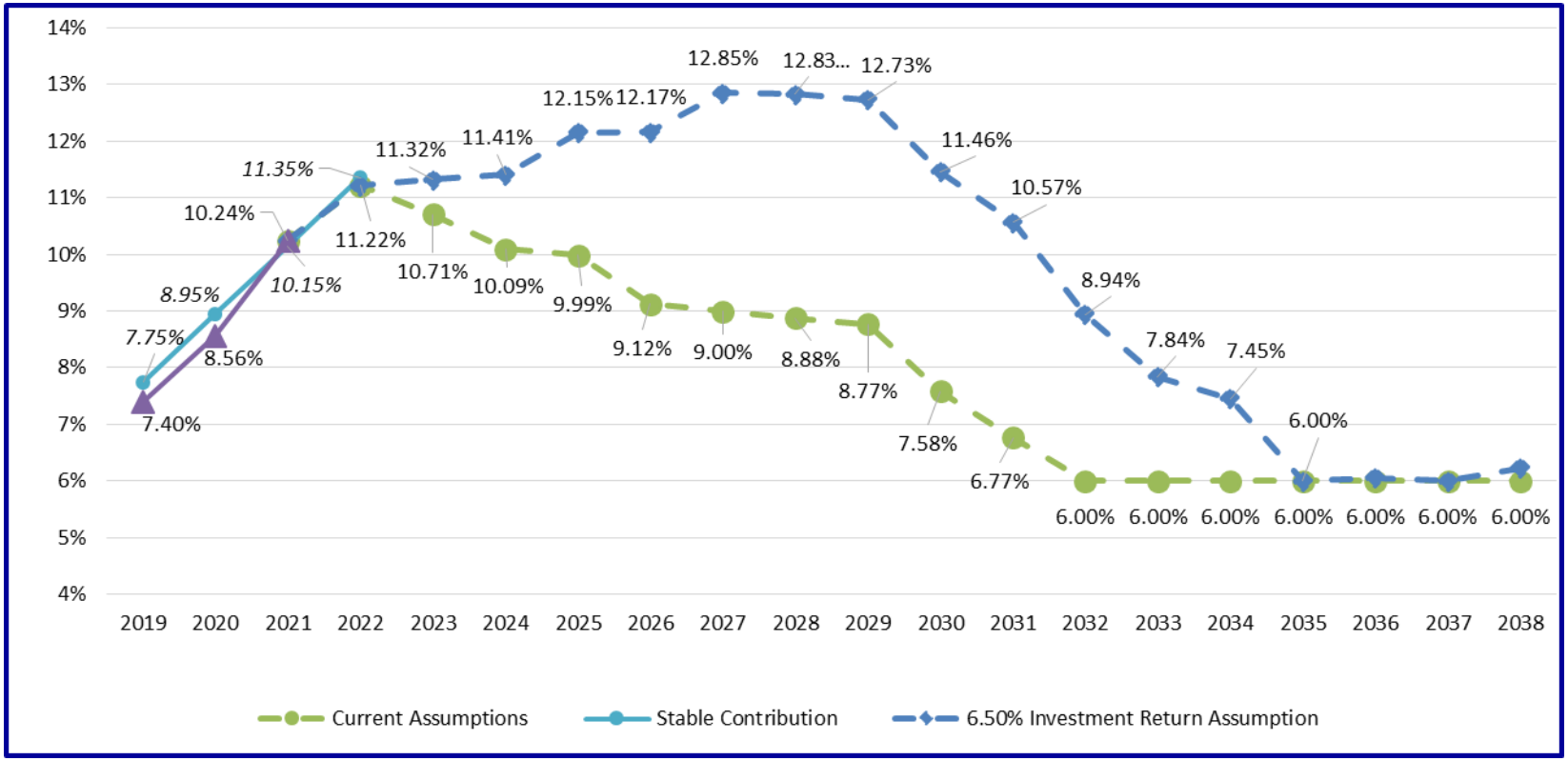
- Projections of contribution requirements and funded status into the future can be helpful planning tools for stakeholders. This section provides such projections. The projections of the actuarial valuation are known as deterministic projections. Deterministic projections are based on one scenario in the future. The baseline deterministic projection is based on December 31, 2018 valuation results and assumptions.

- Key Projection Assumptions
  - Valuation interest rate of 7.00% for all years in conjunction with direct rate smoothing of the employer contribution rate over a 3-year period beginning July 1, 2019.
  - Baseline investment return of 14.88% on market value of assets in calendar 2019 and 7.00% thereafter.
  - Actuarial assumptions and methods as described in Appendix D of the latest actuarial valuation report. All future demographic experience is assumed to be exactly realized.
  - The contribution rate under the Employer Contribution Rate Stabilization Policy (ECRSP) and Direct Rate Smoothing is contributed until fiscal year ending 2022.
  - The actuarially determined employer contribution rate is contributed for fiscal years ending 2023 and beyond.
  - 0% increase in the total active member population
  - No cost-of-living adjustments granted
  - Future pay increases based on long-term salary increase assumptions

Projections
LGERS

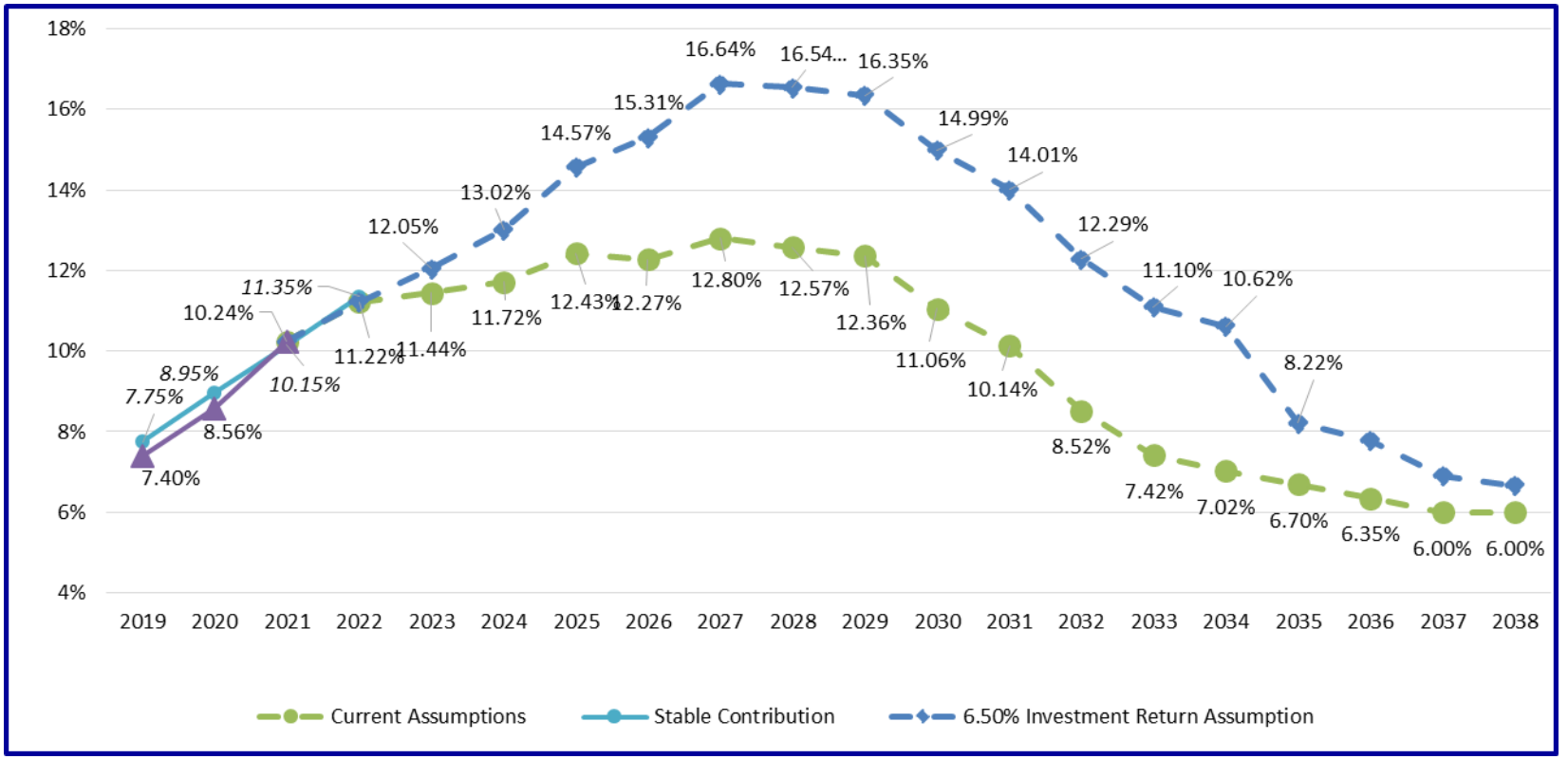
- The revised ECRSP adopted by the Board of Trustees on January 31, 2019 requires that recommended contributions for general employees be set at 8.95% of payroll for fiscal year ending 2020, 10.15% for fiscal year ending 2021, and 11.35% for fiscal year ending 2022, with the following additional adjustments, if applicable:
  - If the underlying actuarially determined employer contribution rate (ADEC) for a given fiscal year is 50% higher than the scheduled employer contribution rate for that fiscal year, the scheduled employer contribution rate for the current and future fiscal years increases 0.50%;
  - If the underlying ADEC for a given fiscal year is 50% lower than the scheduled employer contribution rate for that fiscal year, the scheduled employer contribution rate for the current and future fiscal year decreases 0.50%;
  - If the General Assembly grants any additional COLA beyond the amount of COLA granted by the Board, increases the multiplier for active employees, or changes the benefit structure in a way that has a cost to the system, the schedule of contributions for the current and future fiscal years will be increased by the cost of the benefit enhancement. The cost of any COLA granted by the Board under the authority allowed by statute will not impact the scheduled contribution rates.
  - Contribution rates for law enforcement officers will be 0.75% higher than contribution rates for general employees.
- In addition, we have provided alternate deterministic projections:
  - Estimated 2020 asset return of 0.00%
  - 6.50% investment return assumption based on:
    - valuation interest rate of 6.50% for all years in conjunction with direct rate smoothing of the employer contribution rate over a 5-year period beginning July 1, 2022; includes 2.50% inflation and 0.50% decrease in individual salary increases.
    - Investment return on market value of assets of 6.50% beginning December 31, 2020.
    - Direct rate smoothing of employer contribution rate over a 5-year period beginning July 1, 2022 through June 30, 2027.

Projected Contribution Rates
LGERS General Employees and Firefighters



Assumes a 7.00% return for 2020. Lowering the expected return assumption to 6.50% increases the 2027 contribution rate from 9.00% to 12.85% or 3.85% when direct rate smoothing is fully implemented.

Projected Contribution Rates
LGERS General Employees and Firefighters



Assumes a 0.00% return for 2020. The 2027 contribution is 3.80% higher under the current assumption and 3.79% under the 6.50% investment return assumption.

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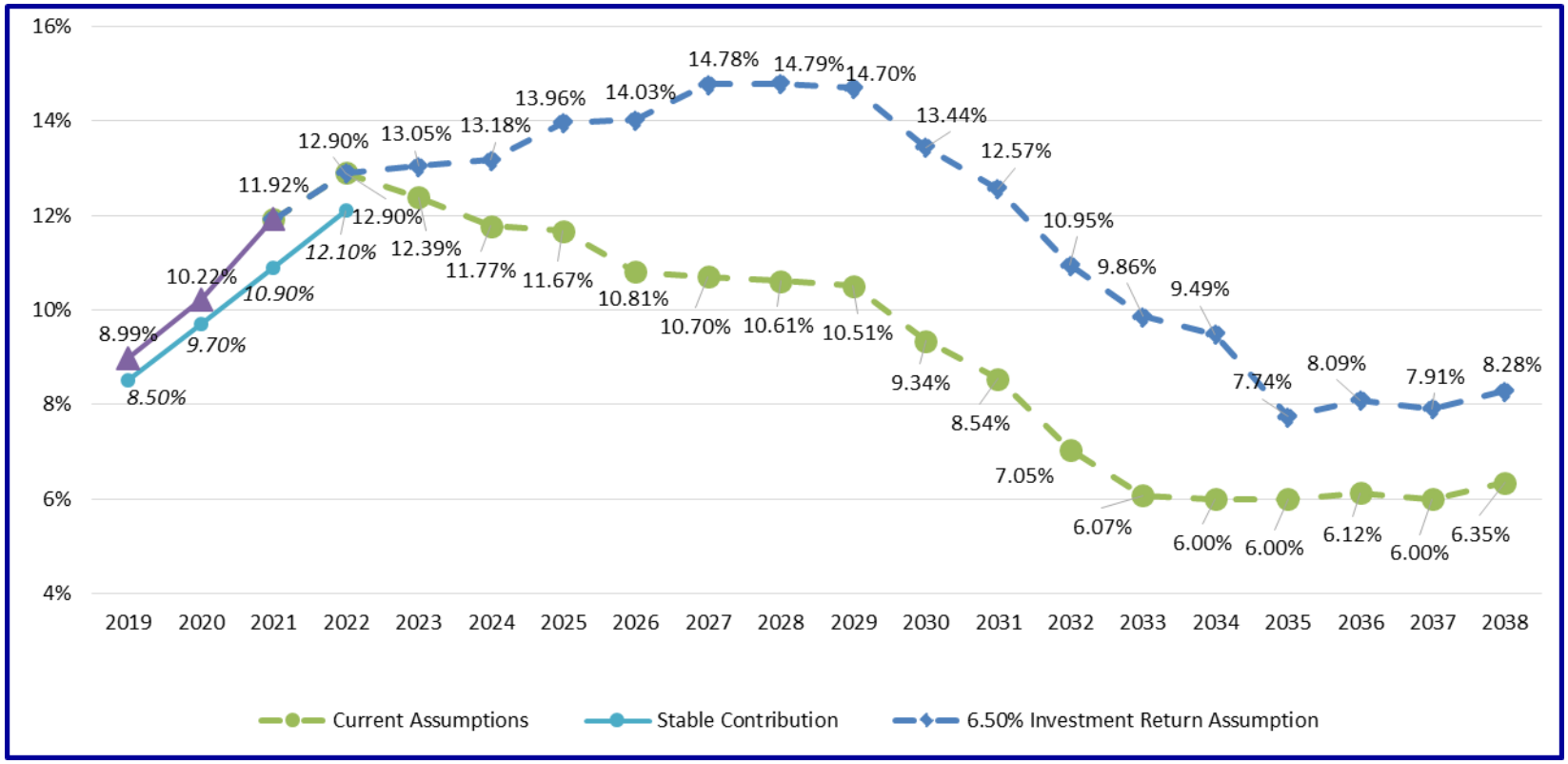
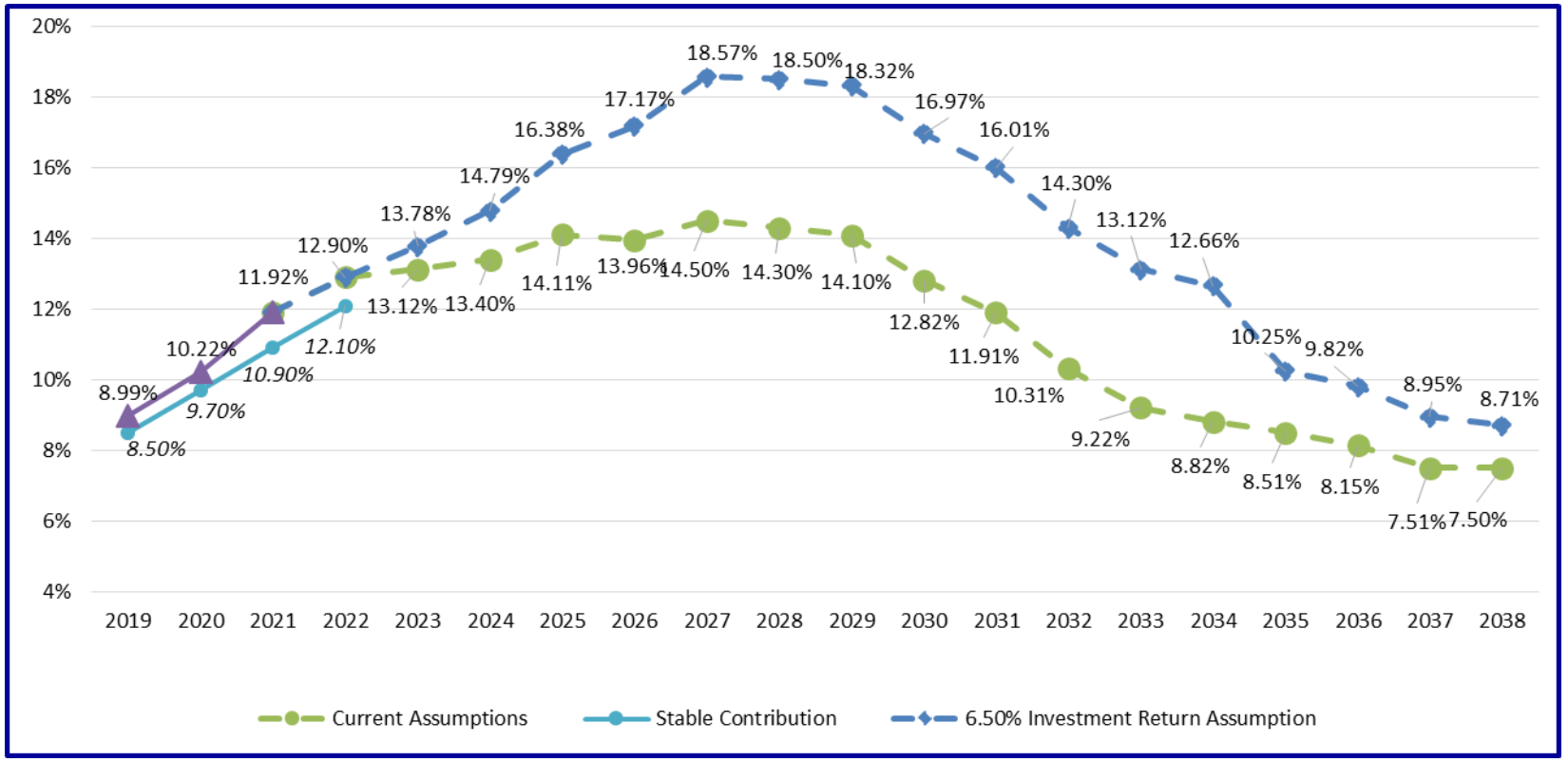
Projected Contribution Rates
LGERS Law Enforcement Officers



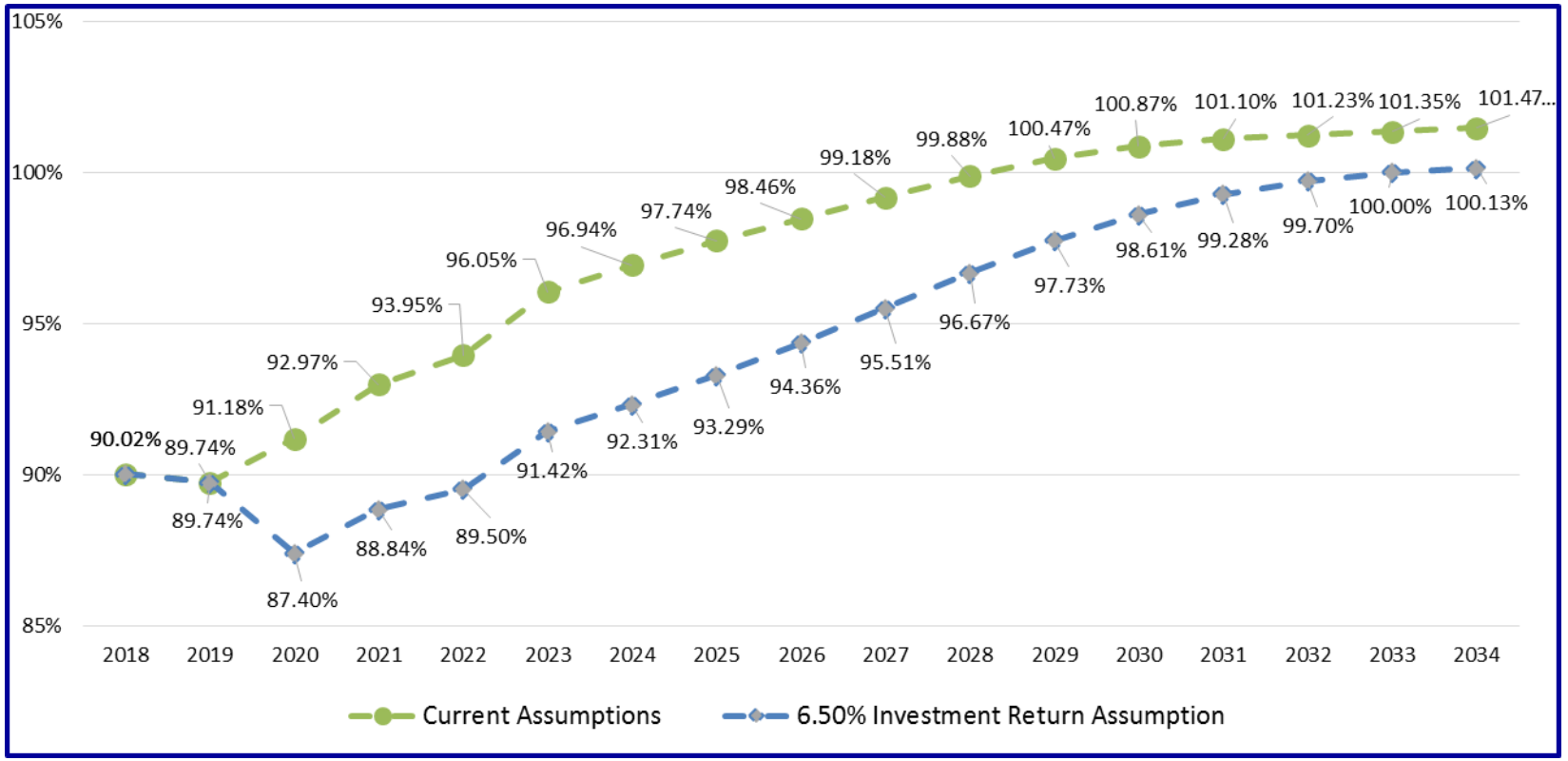
Assumes a 7.00% return for 2020. Lowering the expected return assumption to 6.50% increases the 2027 contribution rate from 10.70% to 14.78% or 4.08% when direct rate smoothing is fully implemented.

Projected Contribution Rates
LGERS Law Enforcement Officers



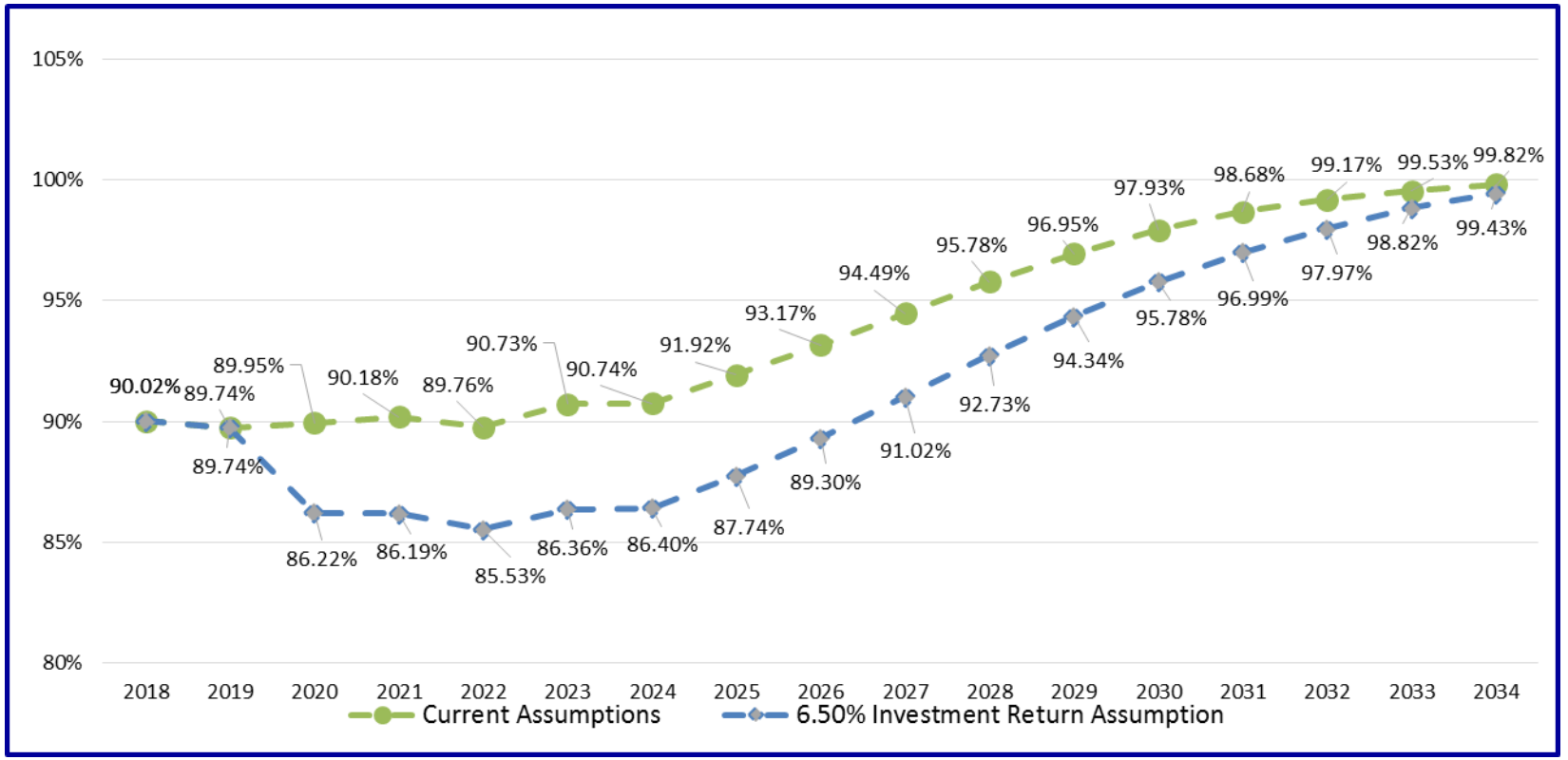
Assumes a 0.00% return for 2020. The 2027 contribution is 3.80% higher under the current assumption and 3.79% under the 6.50% investment return assumption.

Projected Funded Ratio
LGERS



Assumes a 7.00% return for 2020. Lowering the expected return assumption to 6.50% decreases the funded ratio by 4.63% as of December 31, 2024 when returns are fully reflected.

Projected Funded Ratio
LGERS



Assumes a 0.00% return for 2020. The December 31, 2024 funded ratio is 6.20% lower under the current assumption and 5.91% lower under the 6.50% investment return assumption.

Funding Methodology

- The Funding Methodology is the payment plan for the benefits and is composed of the Actuarial Cost Method, the Asset Valuation Method and Amortization Method.
- The Funding Methodology is rather consistent across the plans except for death benefits. We will focus on plans other than death benefits.
- The Contribution Rate Stabilization Plans will be discussed when the new asset allocation and resulting market expectations are available.
- In general, the Funding Methodology being used is best practice.
- We have one modest recommendation to the asset valuation method.

The Funding Methodology used by the North Carolina Retirement Systems is a major contributor to NCRS being well funded compared to peers.

Funding Methodology
Actuarial Cost Method

- Actuarial Cost Methods allocate costs to the actuarial accrued liability (i.e. the amount of money that should be in the fund) for past service and normal cost (i.e. the cost of benefits accruing during the year) for current service.
  - The Board of Trustees has adopted Entry Age Normal as its actuarial cost method
  - This method develops normal costs that stay level as a percent of payroll

The actuarial cost method is consistent with GFOA Best Practices.

http://www.gfoa.org/core-elements-funding-policy

Funding Methodology
Asset Valuation Method

- Asset Valuation Methods smooth or average the market value returns over time to alleviate contribution volatility that results from market returns.
  - Asset returns in excess of or less than the expected return on market value of assets reflected over a five-year period
  - Assets corridor: not greater than 120% of market value and not less than 80% of market value
- While Actuarial Standards of Practice 44 calls for a corridor for long smoothing periods, the five-year period is sufficiently short to permit the elimination of the corridor.
- The elimination of the corridor will ameliorate contribution volatility during extreme markets

The asset valuation method is consistent with GFOA Best Practices.

http://www.gfoa.org/core-elements-funding-policy

Funding Methodology
Amortization Methods

- Amortization Methods determine the payment schedule for unfunded actuarial accrued liability (i.e. the difference between the actuarial accrued liability and actuarial value of assets)
  - Payment level: the payment is determined as a level dollar amount, similar to a mortgage payment
  - Payment period: a 12-year closed amortization period was adopted for fiscal year ending 2012. A new amortization base is created each year based on the prior years' experience.
- For fiscal years beginning subsequent to January 1, 2017, the sum of the "normal contribution" and the "accrued liability contribution" shall not be less than the employee contribution.

When compared to other Public Sector Retirement Systems in the United States, the funding policy is quite aggressive in that the policy pays down the pension debt over a much shorter period of time (12 years) compared to the national average of around 24 years.

In addition, payments are developed to stay level instead of the increasing policy many systems use which results in lower payments early on.

As such it is a best practice among public retirement systems.

Actuarial Certification

- The results were prepared under the direction of actuaries who meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinions contained herein. These results have been prepared in accordance with all applicable Actuarial Standards of Practice, and we are available to answer questions about them.
- Future actuarial measurements may differ significantly from current measurements due to plan experience differing from that anticipated by the economic and demographic assumptions, increases or decreases expected as part of the natural operation of the methodology used for these measurements, and changes in plan provisions or applicable law.

Larry Langer, ASA, EA, MAAA, FCA
Principal and Consulting Actuary

Jonathan T. Craven, ASA, EA, MAAA, FCA
Consulting Actuary