



# FINANCIAL MODELING

## OREGON PUBLIC EMPLOYEES RETIREMENT SYSTEM

**Presented by:**

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December 3, 2021

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# Introduction

- July: Board adopted updated valuation methods and assumptions, including 6.90% rate of return
- October: Milliman presented system-average results from the advisory December 31, 2020 valuation
  - December 31, 2021 actuarial valuation will develop rates for July 2023 – June 2025
- **Today: Long-term financial modeling projections reflecting published investment results through September 30**
  - System average contribution rates
  - System funded status
  - System unfunded actuarial liability (UAL)

# Models and Inputs

- System financials are projected using two different models
  - Steady return model – consistent year-to-year future investment returns
  - Variable return model – future investment returns vary from year to year
- Modeling starts with liabilities and actuarial assumptions from the 12/31/2020 system-wide actuarial valuation report
  - This includes the current Board-adopted 6.90% return assumption for valuing liabilities
- Modeling uses 12/31/2020 assets adjusted for **published regular account returns of +15.39% through September 2021**
  - Returns for October through December 2021 vary in our models based on scenario

# Financial Modeling

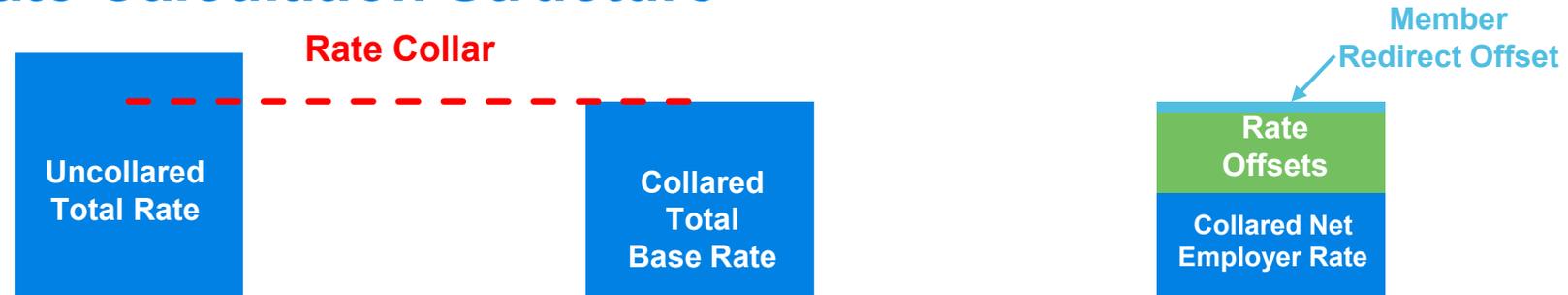
## Comments on System Average Rates

- Projections depict **system average** funded status and employer contribution rates
- Rates shown in this presentation are “employer” rates
  - Redirected member contributions will serve as an offset to “total” rate effective in 2023-2025
- No single employer pays the system average rate
  - Contribution rates vary both by experience pooling group, employer, and type of payroll
- In most scenarios, average employer rates for the 2023-2025 biennium are projected to increase due to the lower return assumption’s effect on the normal cost rate component of the contribution
  - The UAL rate component of the contribution will remain level due to the rate collar, with 2021 investment gains serving as a buffer against potential future poor investment return experience
  - Actual outcome will vary by rate pool and employer
- Rates shown do not include:
  - Contribution rates for the Individual Account Plan (IAP)
  - Employer contribution rates for the RHIA & RHIPA retiree healthcare programs
  - Debt service payments on employer-specific pension obligation bonds

# Rate Collaring

- As part of this year's Experience Study, PERS adopted an updated "rate collar" as part of rate-setting process
- In the December 31, 2020 valuation, the rate collar did not limit any actuarially calculated increases in advisory 2023-2025 contribution rates for the large rate pools and for most independent employers
  - We project this statement will remain true for the December 31, 2021 valuation that will set recommended 2023-2025 employer contribution rates
  - Collared and uncollared rates are equal

# Overview of Rate Calculation Structure



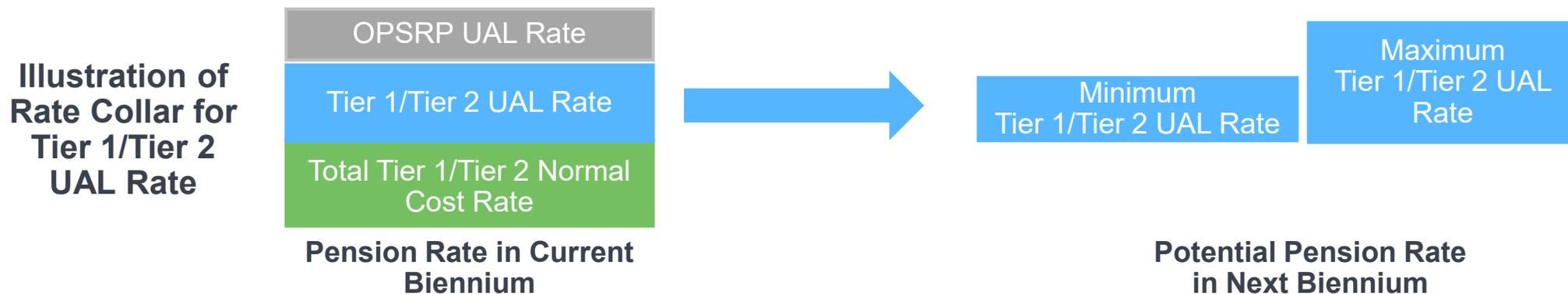
- The ***uncollared total rate*** is the theoretical contribution rate to reach 100% funded status over a specified amortization period if:
  - Contributions at that rate started on the actuarial valuation date, and
  - Actual future experience mirrors the actuarial valuation's assumptions, and
  - The normal cost rate does not change in subsequent years
- The rate collar sets a biennium's ***collared total base rate***, limiting the base rate change for a single biennium when there is a large change in the uncollared rate
- ***Member redirect offset*** reflects estimated portion of collared total base rate paid by redirected member contributions
- Employers pay the ***collared net employer rate***, which reflects the member redirect offset and any rate offset adjustments from:
  - Side account rate offsets for employers with side accounts
  - SLGRP charges/offsets (e.g., Transition Liability/Surplus)

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# Rate Collar Design

The rate collar structure was revised with the assumptions and methods adopted for the 2020 Experience Study

- Rate collar focuses on the biennium-to-biennium change in the UAL Rate component
  - Normal Cost Rate component is always paid in full and is not subject to a rate collar limitation
- The maximum biennium-to-biennium change in UAL Rate permitted by the rate collar is:
  - **SLGRP and School District Pools Tier 1/Tier 2 UAL Rates:** 3% of pay
  - **OPSRP UAL rate:** 1% of pay
  - **Tier 1/Tier 2 UAL Rates of Independent Employers:** greater of 4% of pay or 1/3rd of the difference between the collared and uncollared Tier 1/Tier 2 UAL Rates at the last rate-setting valuation
- UAL Rate is not allowed to decrease at all unless funded status excluding side accounts is at least 87%, and a full collar width decrease is not allowed unless funded status is at least 90%



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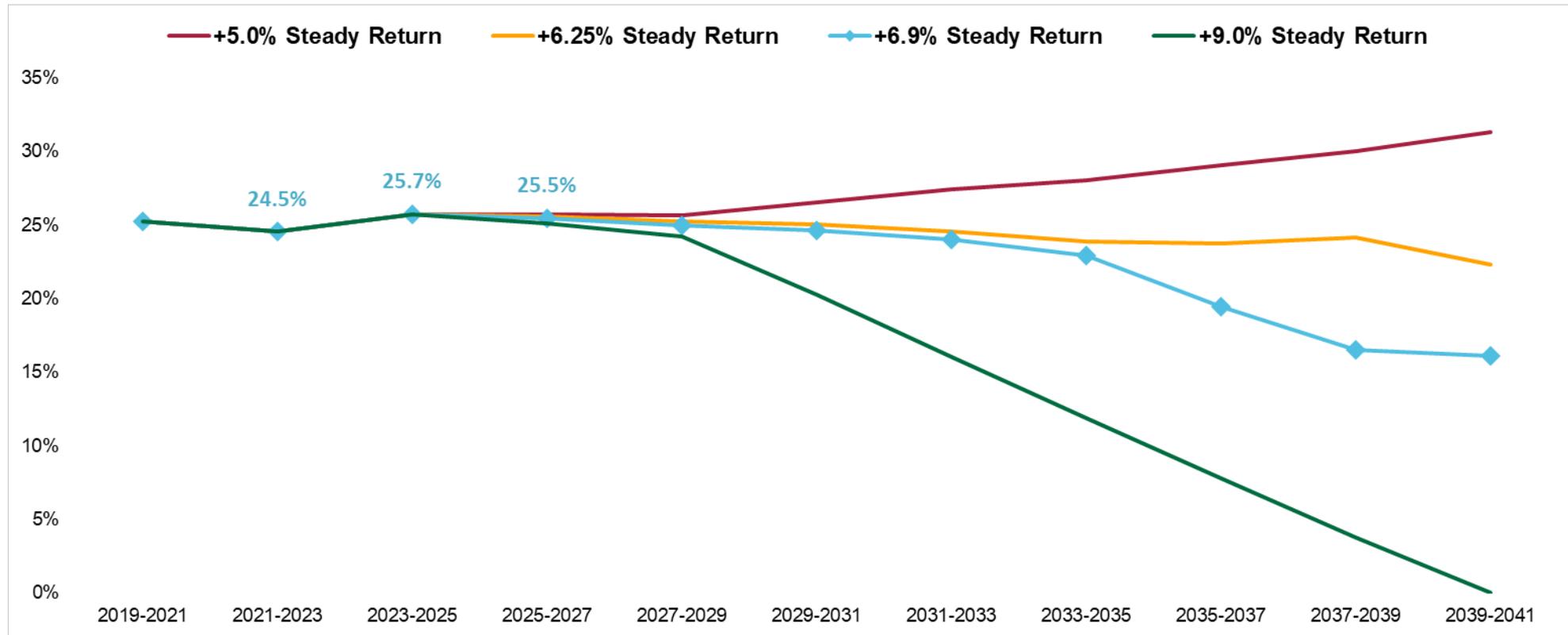
# Steady Return Model

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# Steady Return Model

- The next four slides show financial projections under the current rate setting structure
  - Employer rates adjust each biennium, with changes limited by the rate collar
- Four scenarios for **steady annual actual future investment** return are shown
  - **+5.0%; +6.25%; +6.9%; +9.0%**
- While actual future returns won't be steady year-to-year, the steady return model clearly illustrates the financial dynamics
  - More realistic “noisy” future returns will be shown in the variable return model later in this presentation
  - The effects of near-term and/or long-term future annualized returns worse than +5.0% are captured in the variable return model
- Model incorporates published returns through September 2021 of +15.39%

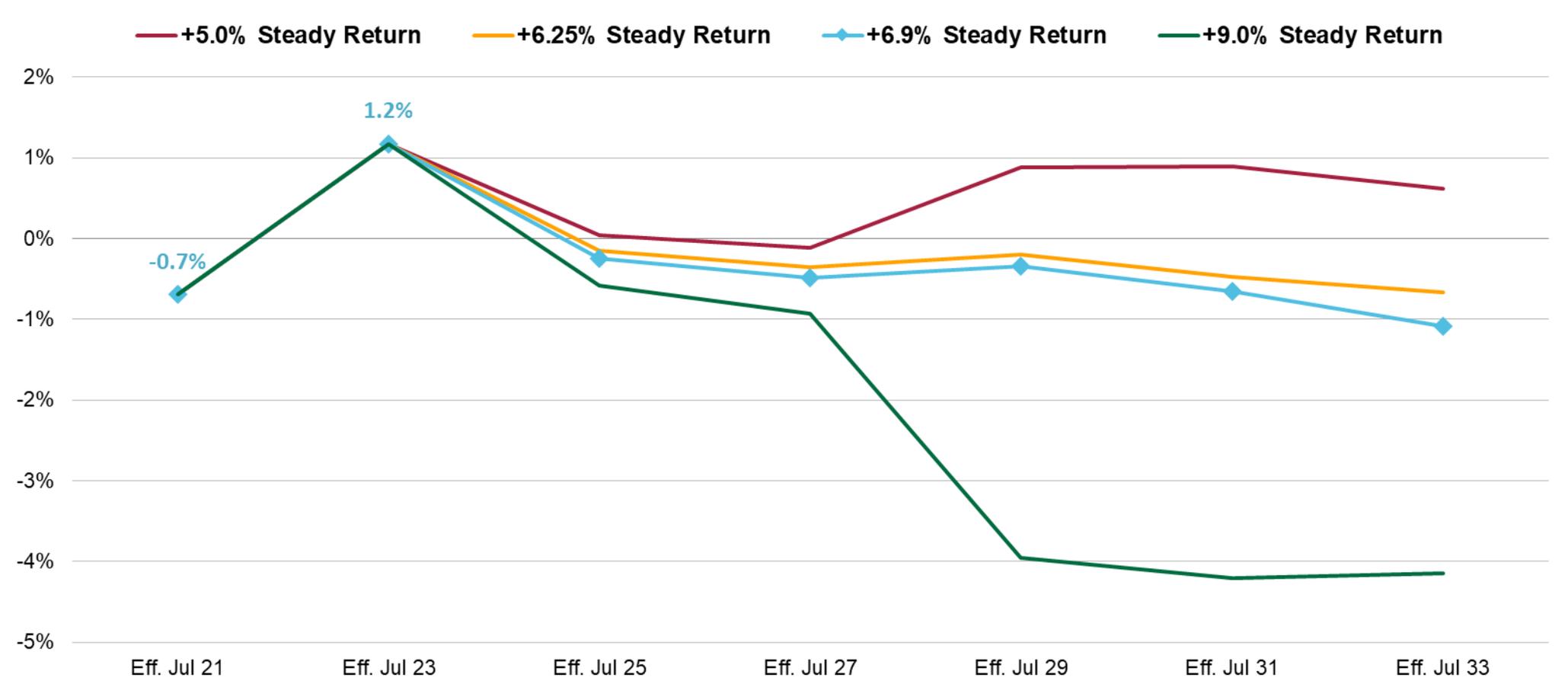
# Employer Collared Base Pension Rates (System Average)



- System average employer collared base pension rates in 2023-25 are projected to increase from 2021-23 rates, as reduction in assumed rate to 6.90% increased the normal cost
- Year-to-date 2021 investment outperformance does not reduce UAL rate due to collar restrictions, but instead provides a cushion which limits the potential increases from underperformance in following biennia
- Blue line: rates decrease as new OPSRP members replace exiting Tier 1 / Tier 2s

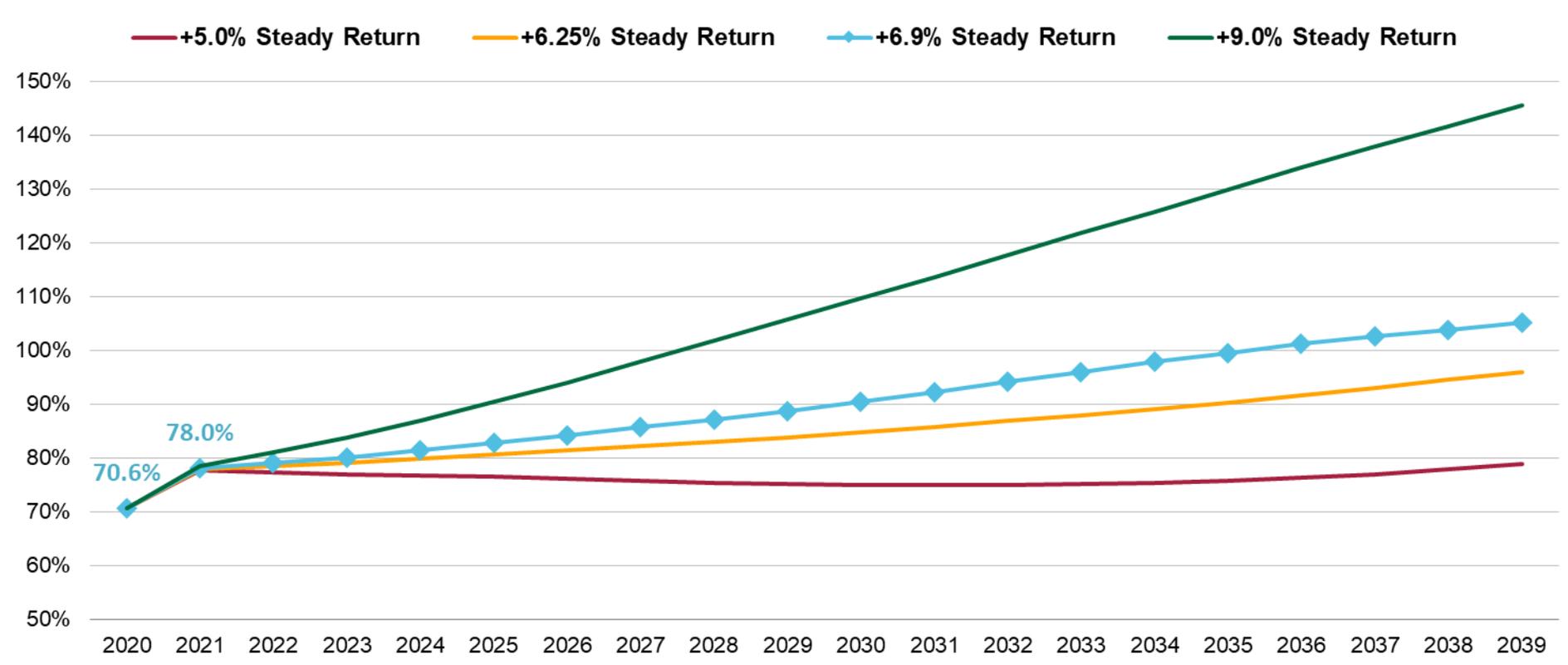
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# Biennial Change in Collared Base Rate (System Average)



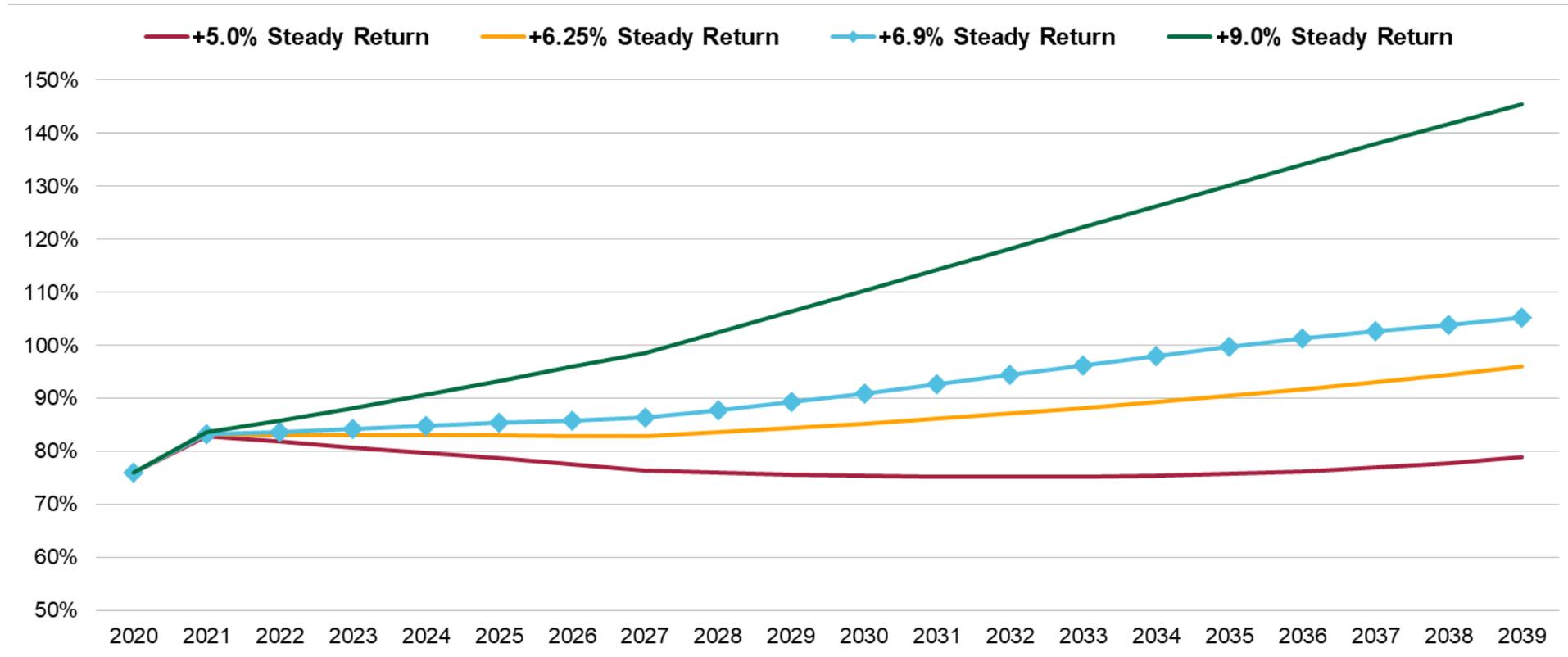
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# System Funded Status (Excluding Side Accounts)



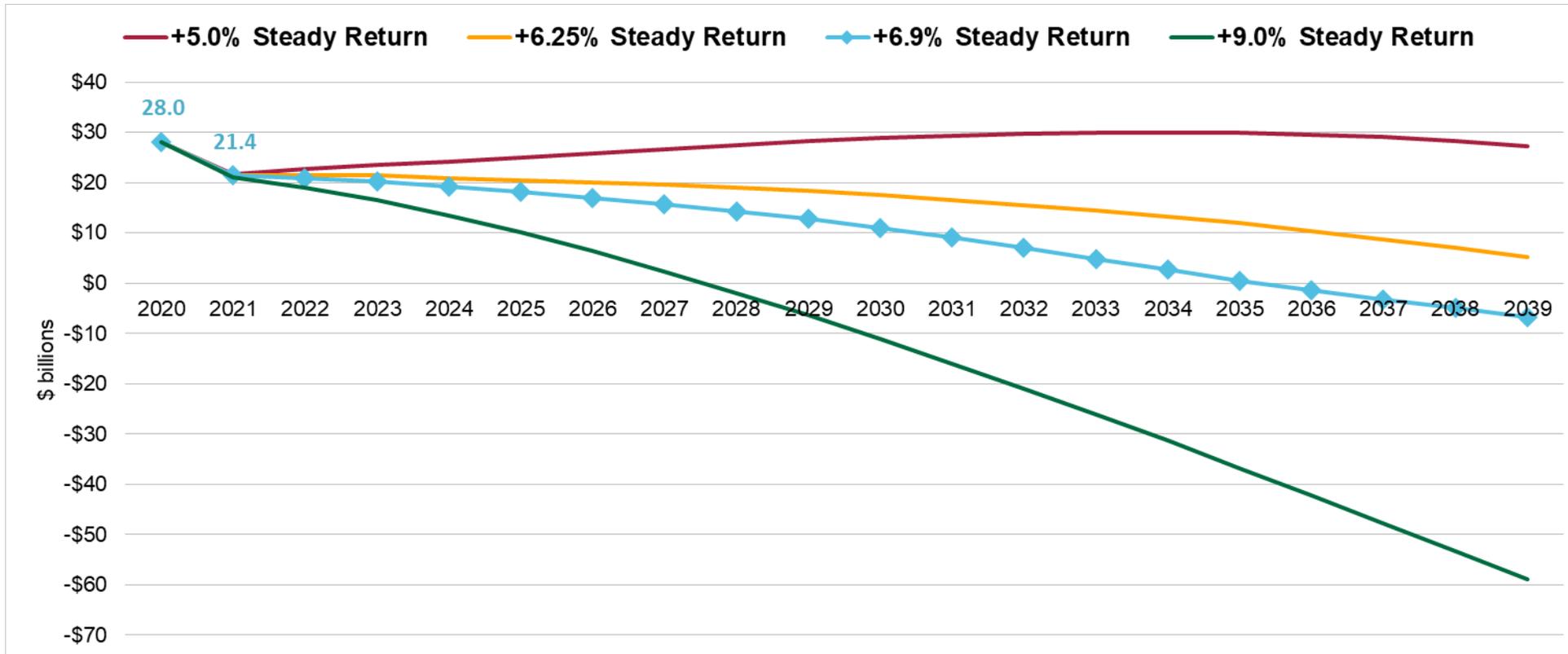
- 2021 funded status increases due to estimated year-end 2021 investment returns
- In steady +6.9% return scenario, funded status projected to reach 100% in 2036

# System Funded Status (Including Side Accounts)



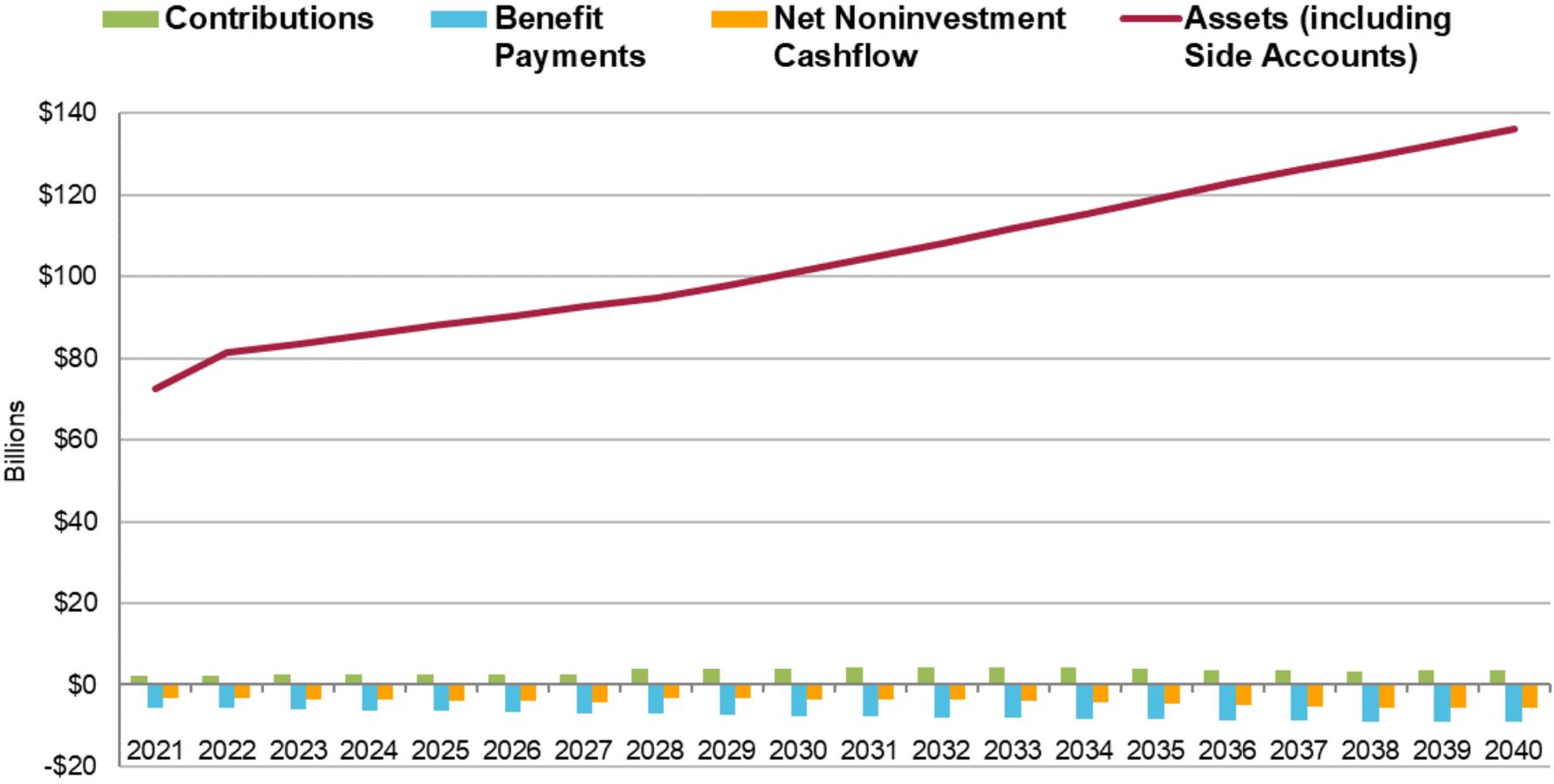
- 2021 funded status increases due to estimated year-end 2021 investment returns
- In steady +6.9% return scenario, funded status projected to reach 100% in 2036

# UAL (Unfunded Actuarial Liability) Excluding Side Accounts



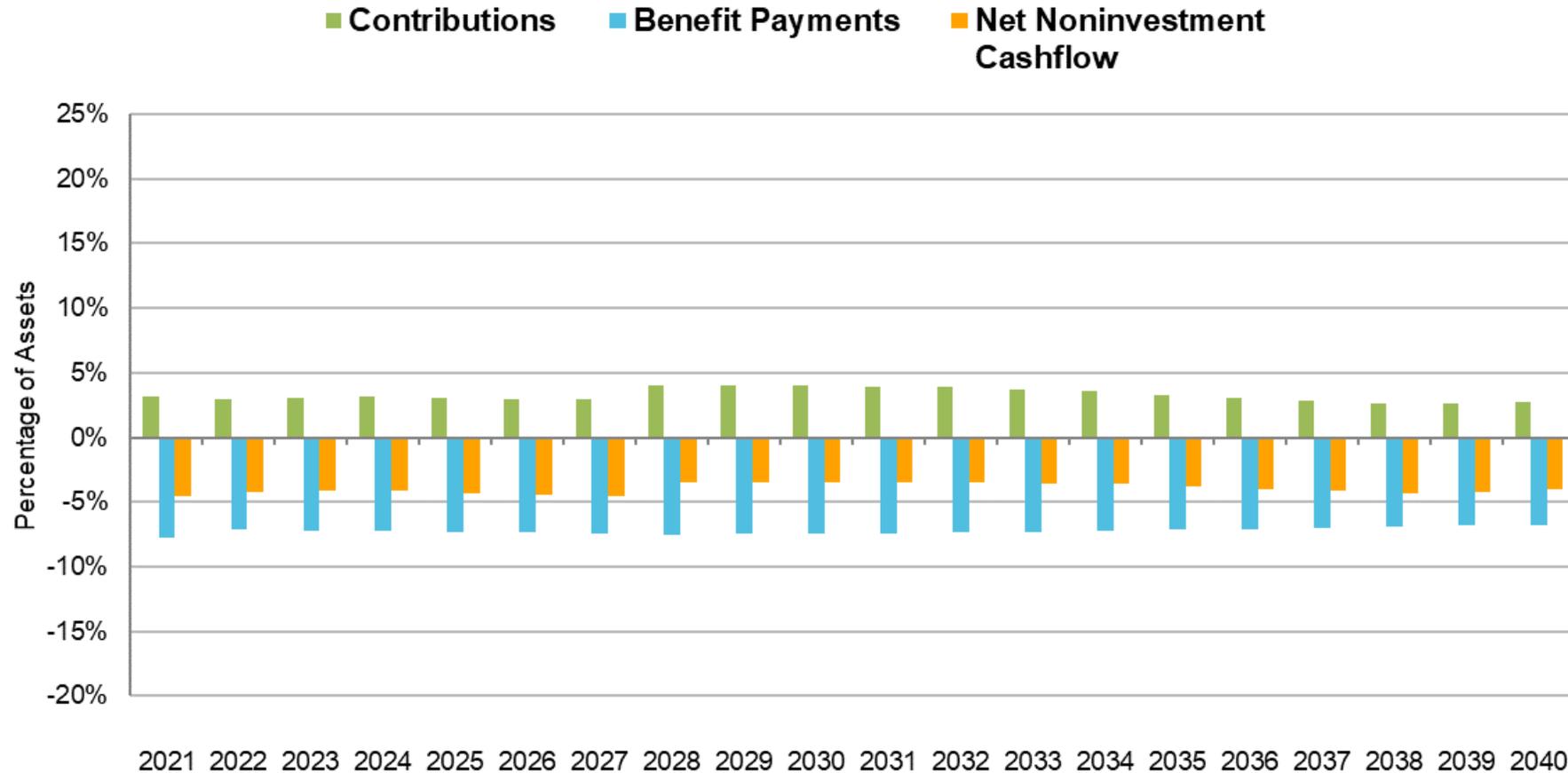
- 2021 UAL decreases due to estimated year-end 2021 investment returns
- At steady +6.9% returns, UAL remains relatively level for a couple years before declining to below \$0 at year-end 2036

# Cash Flow and Asset Balance at +6.90% Actual Return



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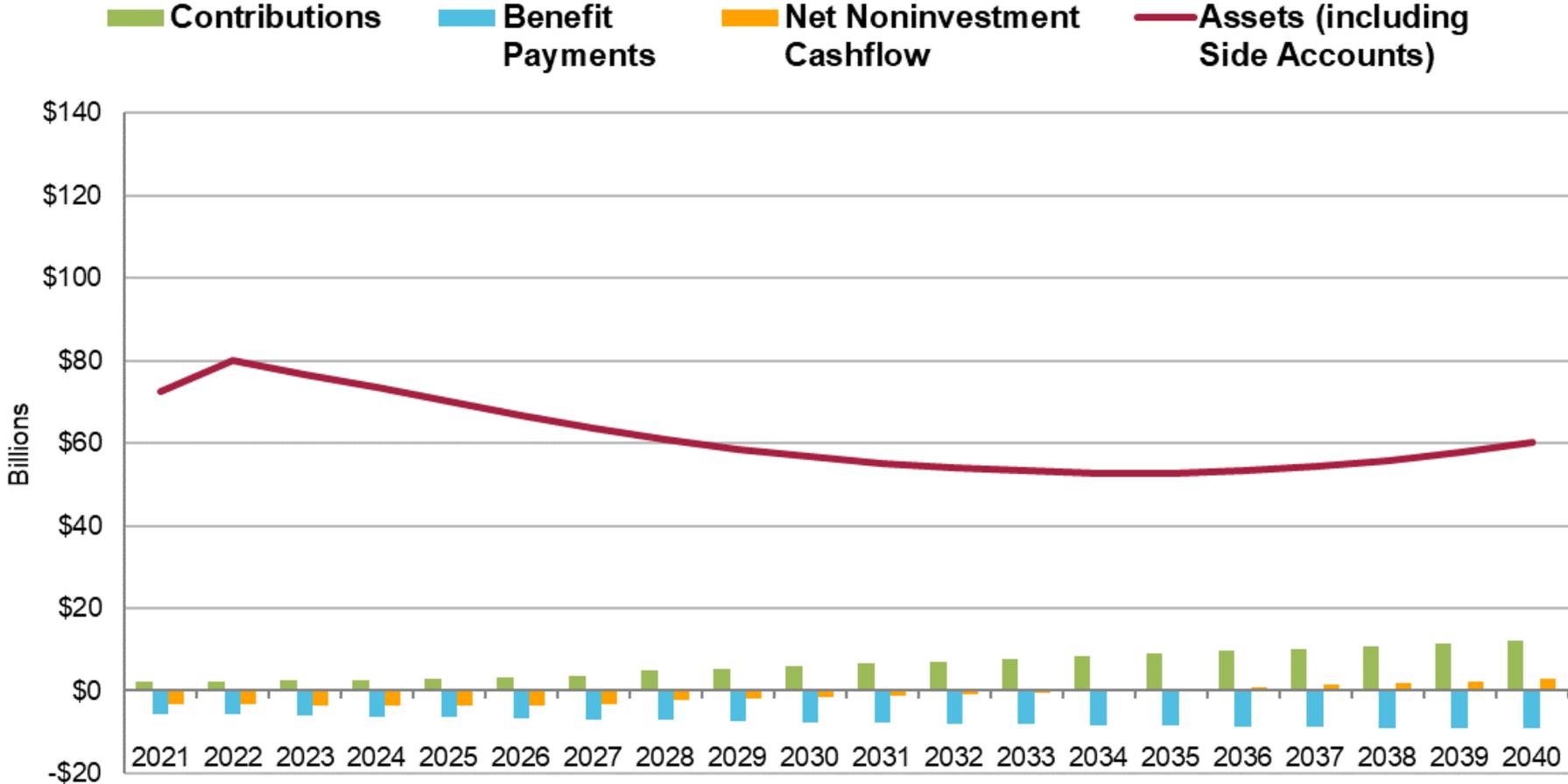
# Cash Flows as % of Assets at +6.90% Actual Future Return



$$\text{Net Noninvestment Cashflow} = \text{Contributions} - \text{Benefit Payments}$$

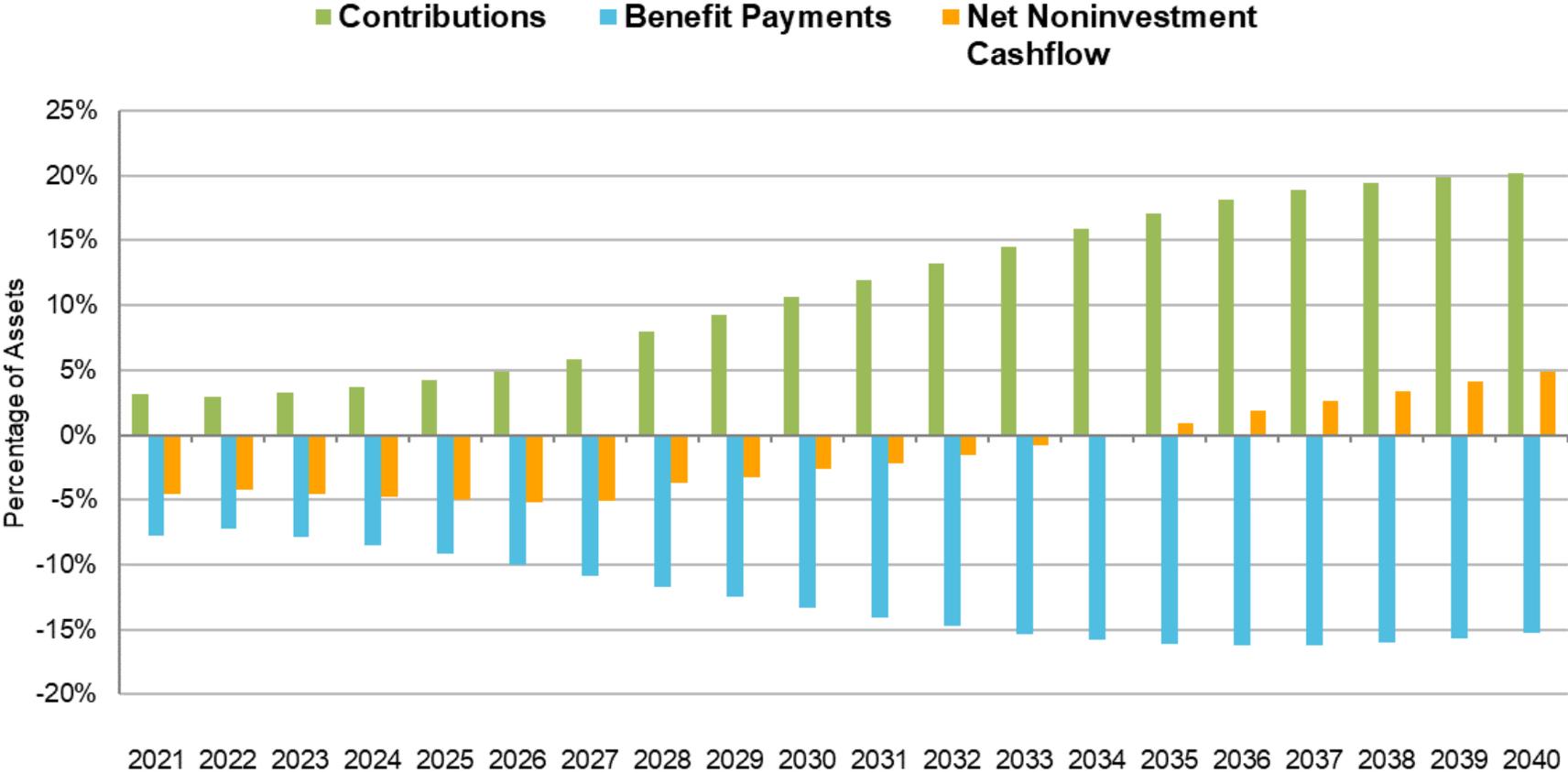
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# Cash Flow and Asset Balance at +0.00% Actual Return



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# Cash Flows as % of Assets at +0.00% Actual Future Return



**Net Noninvestment Cashflow = Contributions – Benefit Payments**



# Variable Return Model

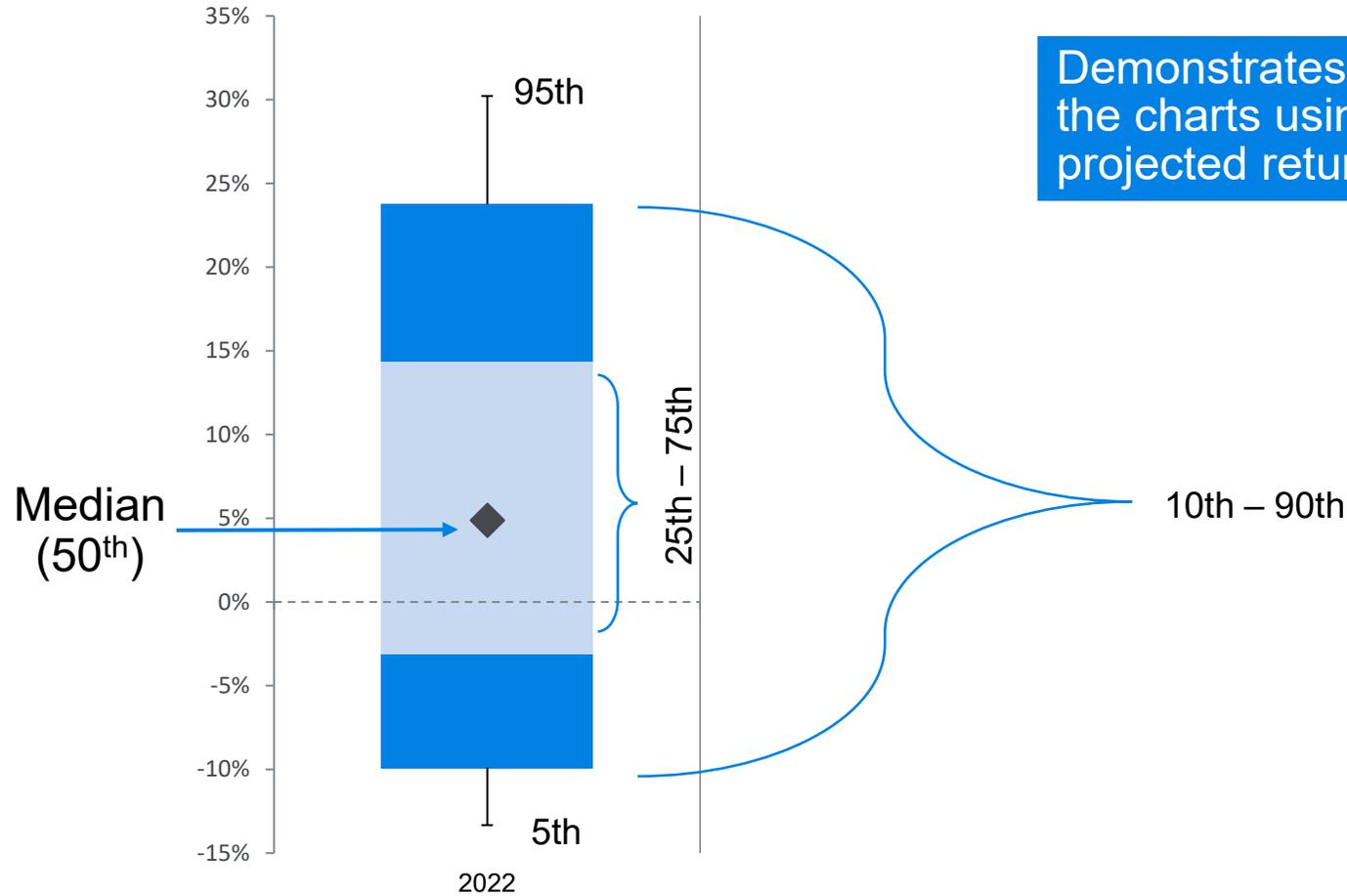
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# Variable Return Model

- Model results are likelihood ranges instead of a single amount
  - The range's distribution is based on a stochastic simulation using 10,000 trials
  - Scenarios were developed by our national capital market specialists, and use the current OPERF target asset allocation policy; for these scenarios, the **median annualized average geometric 20-year return is 6.86%**
  - **Model incorporates published returns through September 2021**
- In our results charts, the dots represent median (50<sup>th</sup> percentile) outcomes
- We display model results from the 5<sup>th</sup> to 95<sup>th</sup> percentiles
  - Ten percent of model outcomes fall outside of the depicted range
- The chart format is demonstrated on the next slide

# PERS Fund Rate of Return

## Projected 2022 Investment Returns

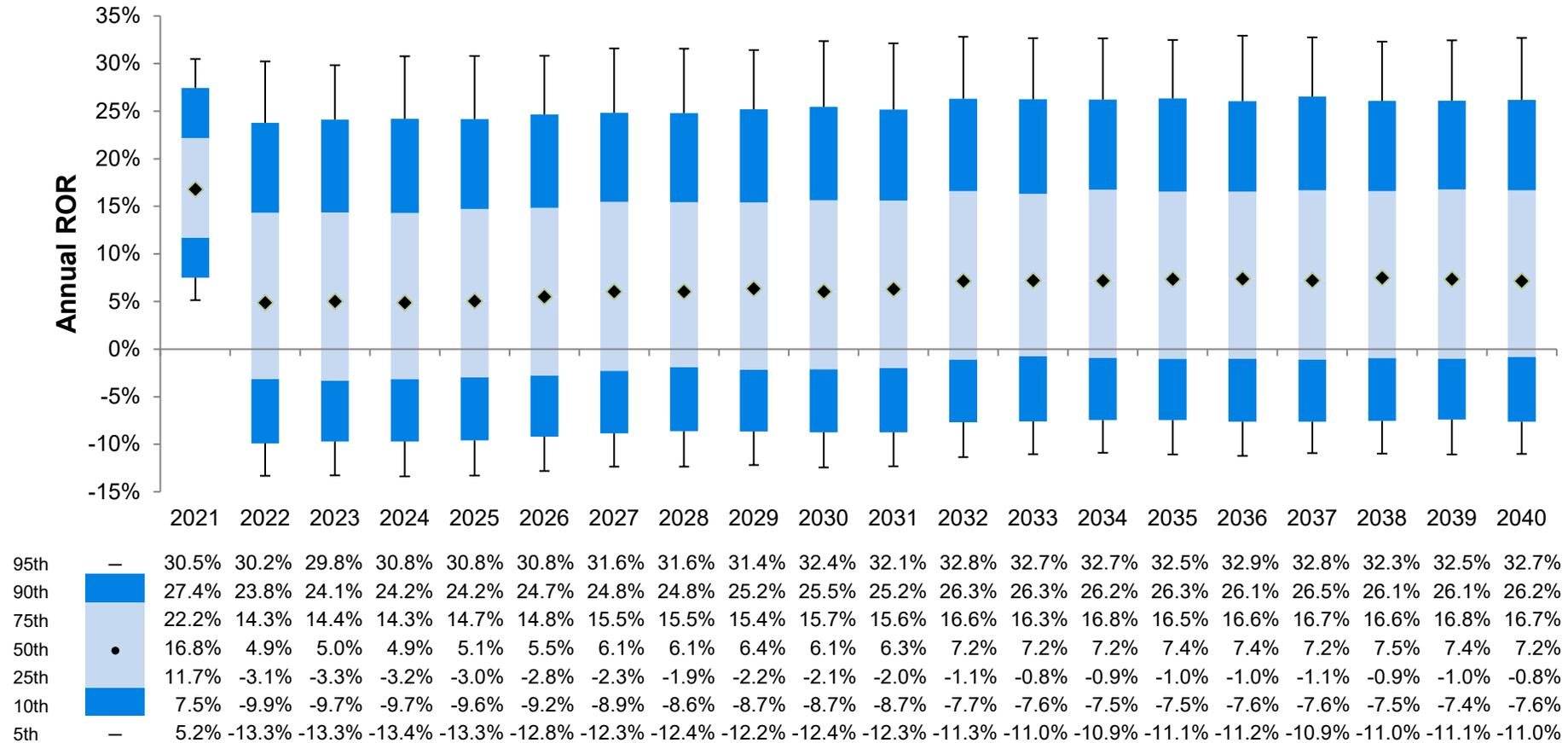


Demonstrates the format of the charts using single year projected returns in 2022.

# PERS Fund Rate of Return

## Single Calendar Year Investment Returns

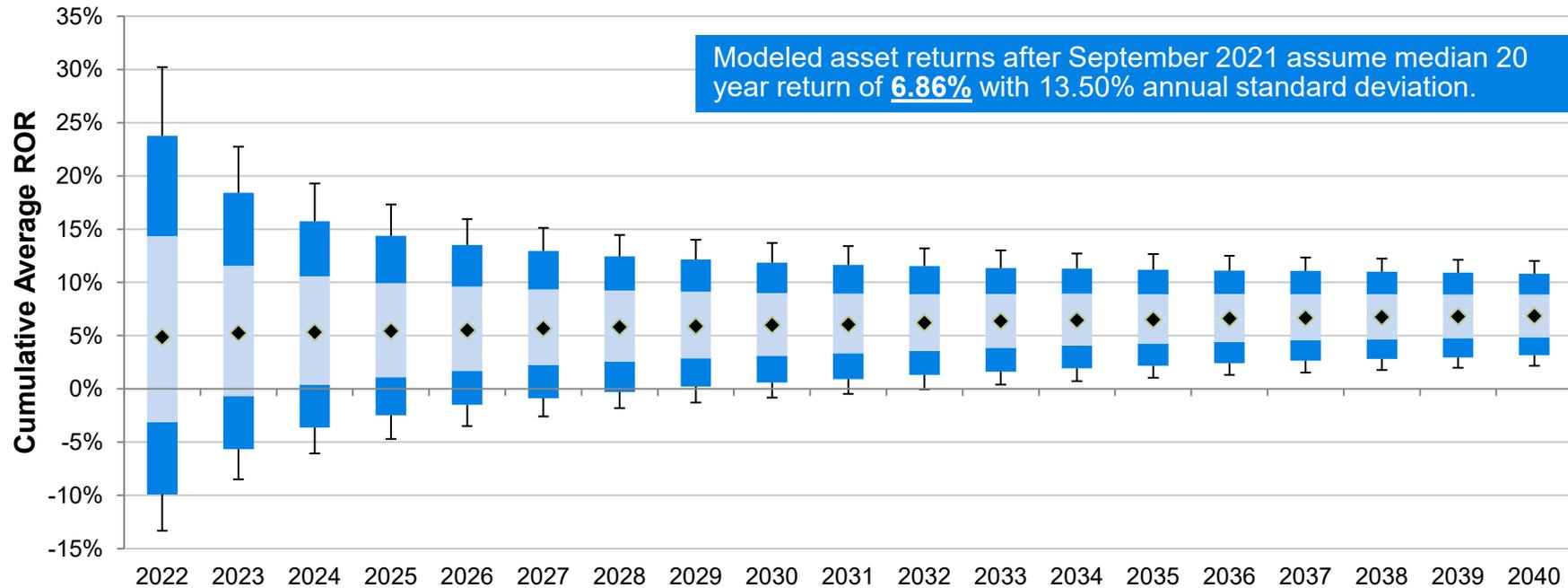
Our capital market outlook model projects lower median returns in the first few years following 2021 due to current low yields on fixed income. Higher median single-year returns are projected in the latter portion of the modeling period.



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# Average Annualized Rate of Investment Return

## Post-2021 Modeled Returns (Geometric Average)

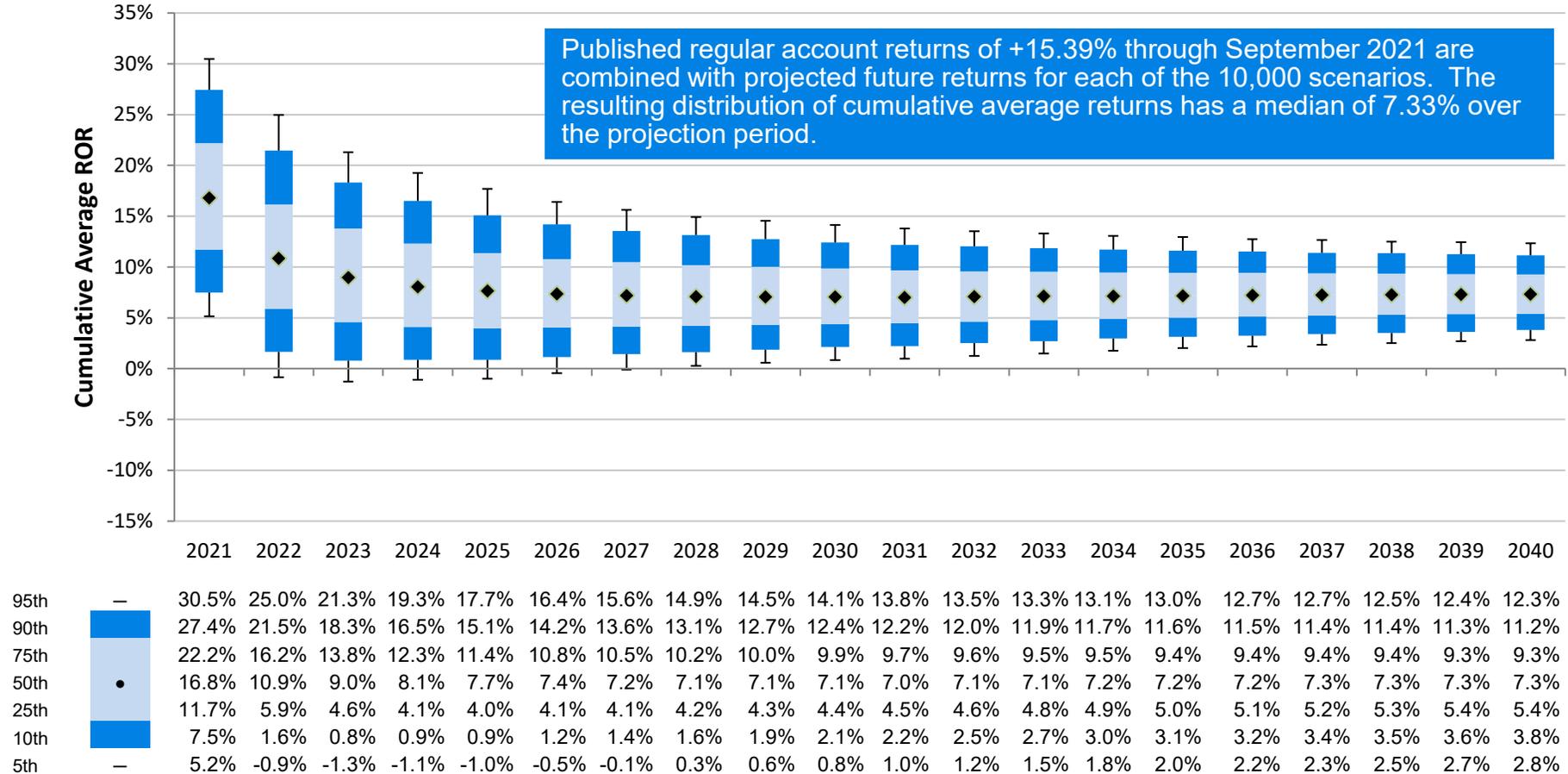


	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040
95th	30.2%	22.8%	19.3%	17.3%	15.9%	15.1%	14.4%	14.0%	13.7%	13.4%	13.2%	13.0%	12.7%	12.7%	12.5%	12.4%	12.2%	12.1%	12.0%
90th	23.8%	18.4%	15.7%	14.4%	13.5%	13.0%	12.5%	12.2%	11.9%	11.7%	11.5%	11.4%	11.3%	11.2%	11.1%	11.1%	11.0%	10.9%	10.8%
75th	14.3%	11.6%	10.6%	9.9%	9.6%	9.4%	9.2%	9.1%	9.0%	8.9%	8.9%	8.9%	8.9%	8.9%	8.9%	8.9%	8.9%	8.9%	8.9%
50th	4.9%	5.3%	5.3%	5.4%	5.5%	5.7%	5.8%	5.9%	6.0%	6.1%	6.2%	6.4%	6.4%	6.5%	6.6%	6.7%	6.7%	6.8%	6.9%
25th	-3.1%	-0.7%	0.4%	1.1%	1.7%	2.3%	2.6%	2.9%	3.1%	3.4%	3.6%	3.9%	4.1%	4.3%	4.4%	4.6%	4.6%	4.8%	4.9%
10th	-9.9%	-5.7%	-3.6%	-2.5%	-1.5%	-0.9%	-0.3%	0.2%	0.6%	0.9%	1.3%	1.6%	1.9%	2.2%	2.4%	2.7%	2.8%	3.0%	3.2%
5th	-13.3%	-8.5%	-6.1%	-4.7%	-3.5%	-2.6%	-1.8%	-1.3%	-0.8%	-0.5%	-0.1%	0.4%	0.7%	1.1%	1.3%	1.5%	1.8%	2.0%	2.2%

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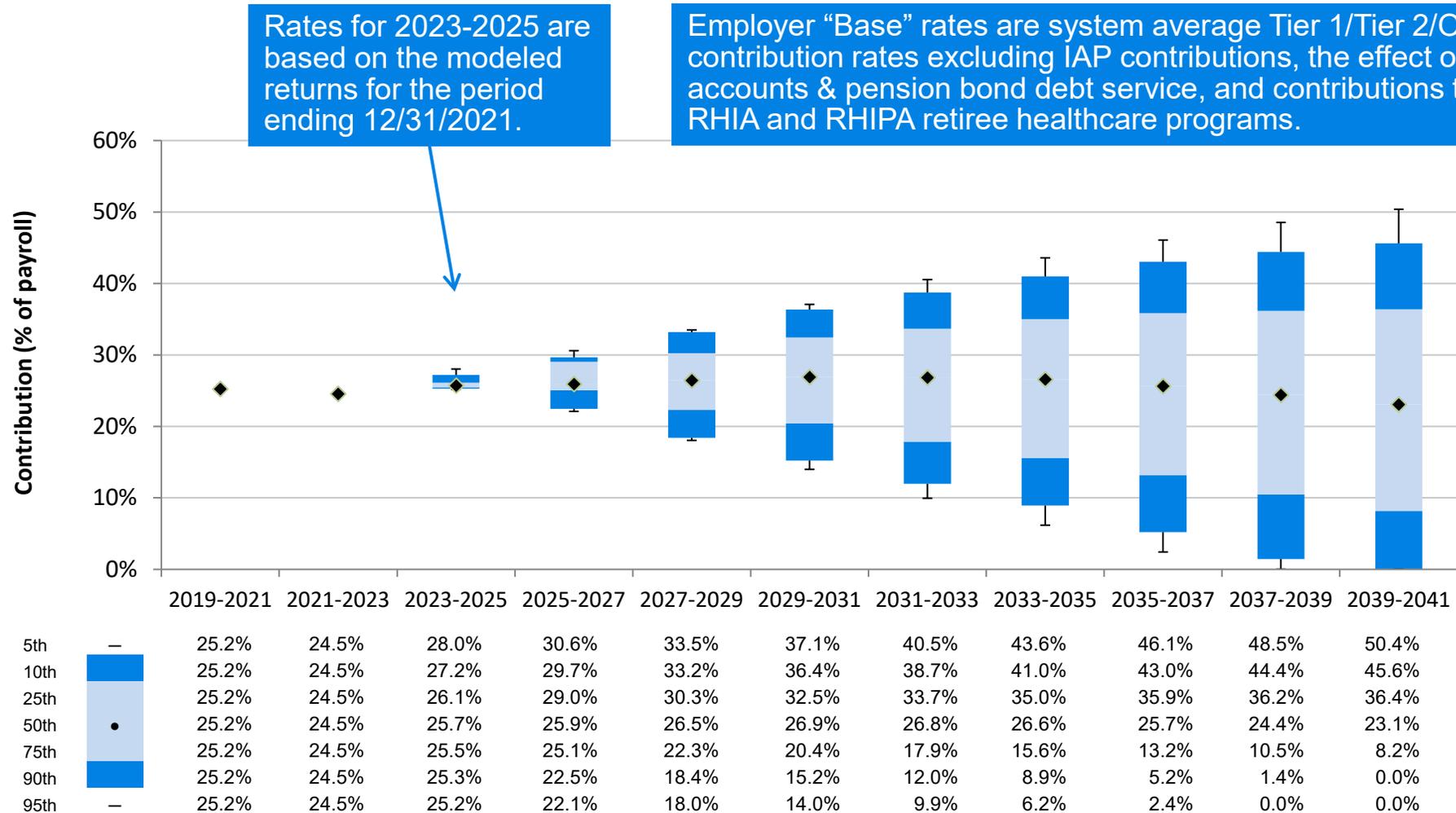
# Average Annualized Rate of Investment Return

## Post-2020 Modeled Returns (Geometric Average)



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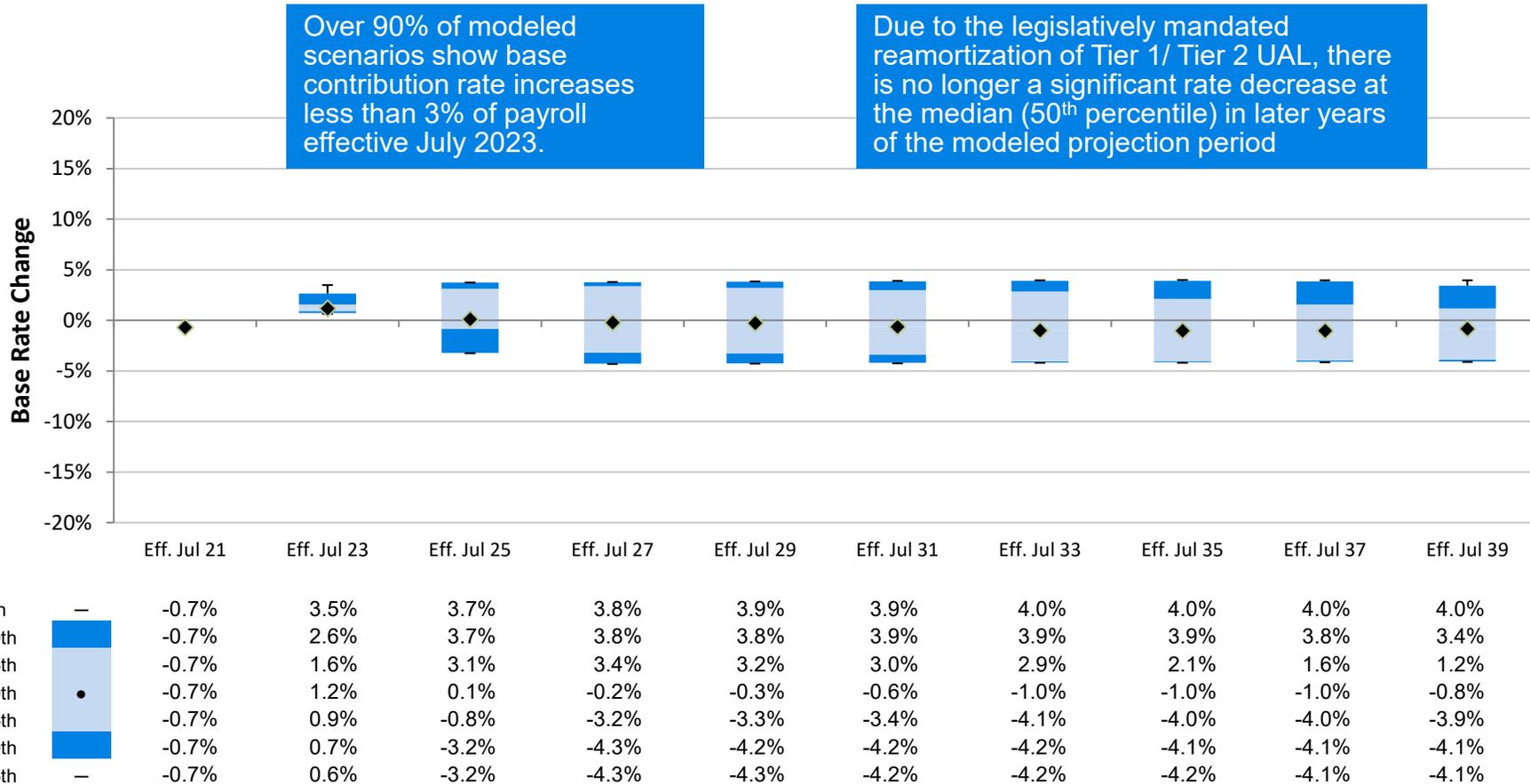
# Employer Collared Base Pension Rates (System Average)



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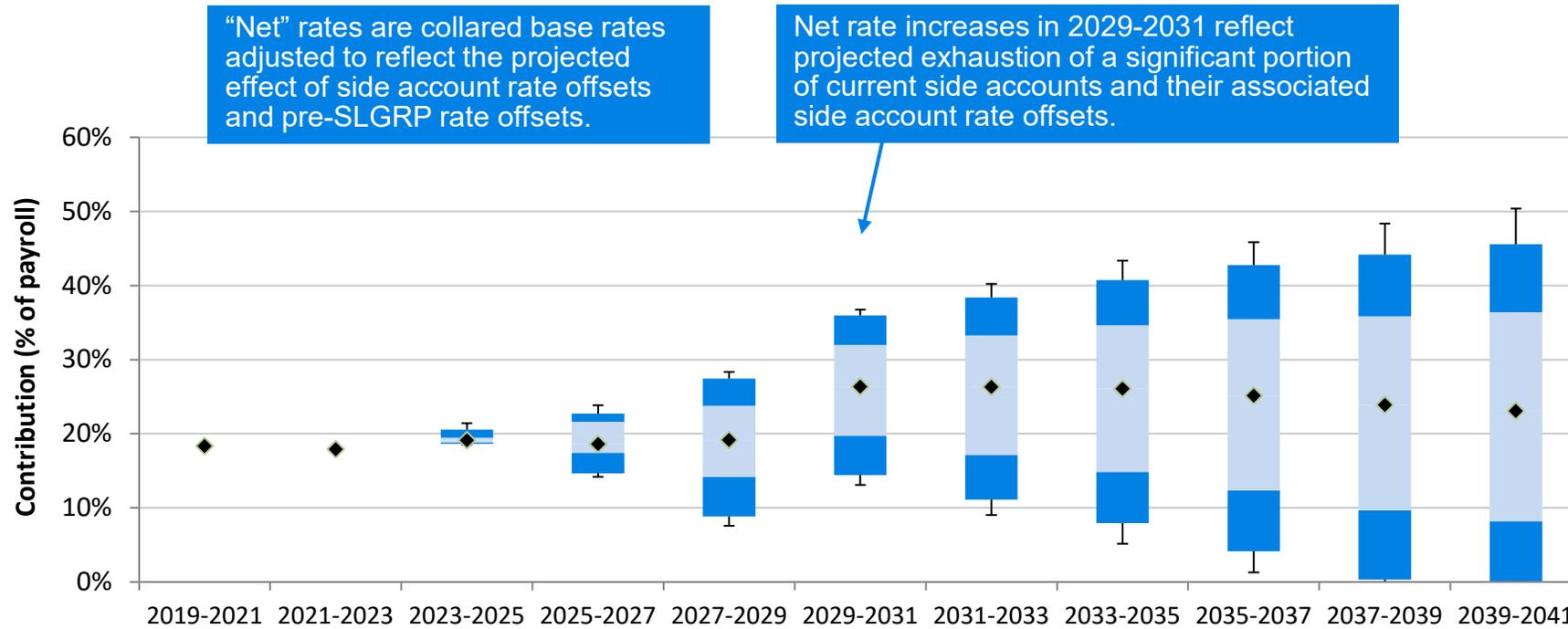
# Biennial Change in Employer Collared Base Pension Rate

## System Average Rates



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# Employer Collared Net Pension Rates (System Average)



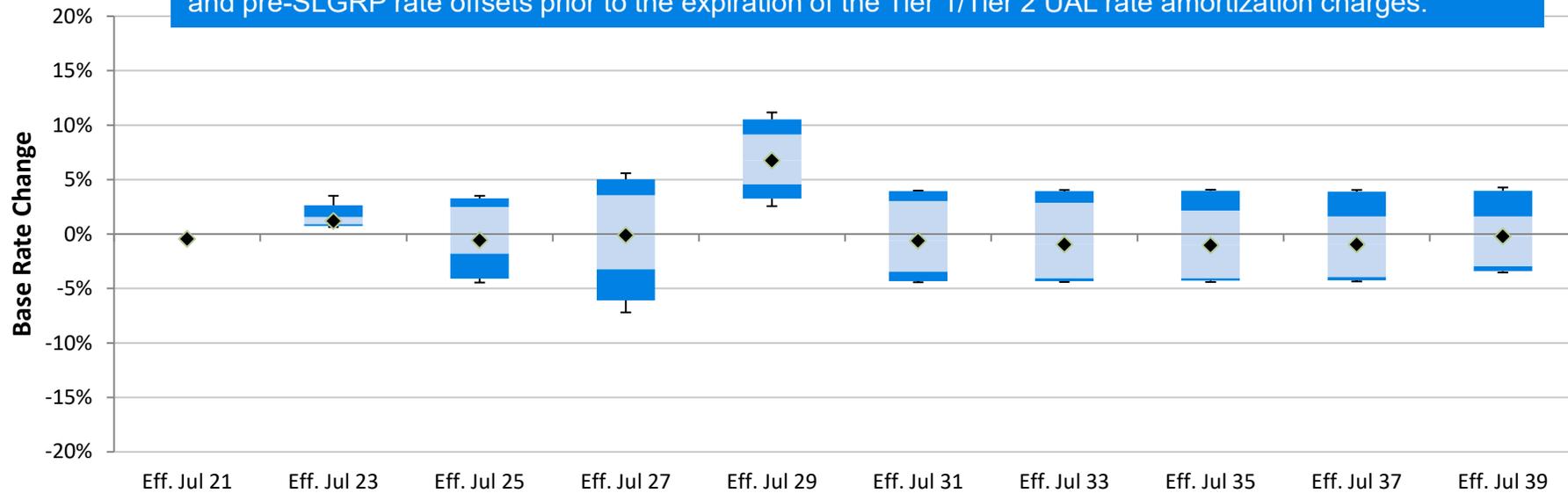
	2019-2021	2021-2023	2023-2025	2025-2027	2027-2029	2029-2031	2031-2033	2033-2035	2035-2037	2037-2039	2039-2041	
5th	—	18.3%	17.9%	21.4%	23.9%	28.3%	36.7%	40.2%	43.4%	45.9%	48.4%	50.4%
10th	—	18.3%	17.9%	20.6%	22.7%	27.5%	36.0%	38.4%	40.7%	42.8%	44.2%	45.6%
25th	—	18.3%	17.9%	19.5%	21.6%	23.8%	32.0%	33.3%	34.6%	35.5%	35.9%	36.4%
50th	•	18.3%	17.9%	19.1%	18.6%	19.1%	26.4%	26.3%	26.1%	25.1%	23.9%	23.1%
75th	—	18.3%	17.9%	18.8%	17.4%	14.2%	19.8%	17.2%	14.9%	12.3%	9.7%	8.2%
90th	—	18.3%	17.9%	18.6%	14.7%	8.8%	14.4%	11.1%	7.9%	4.1%	0.3%	0.0%
95th	—	18.3%	17.9%	18.5%	14.2%	7.6%	13.1%	9.0%	5.1%	1.3%	0.0%	0.0%

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# Biennial Change in Collared Net Pension Rate

## System Average Rates

The July 2029 increase is related to the projected exhaustion of a significant portion of current side accounts and pre-SLGRP rate offsets prior to the expiration of the Tier 1/Tier 2 UAL rate amortization charges.

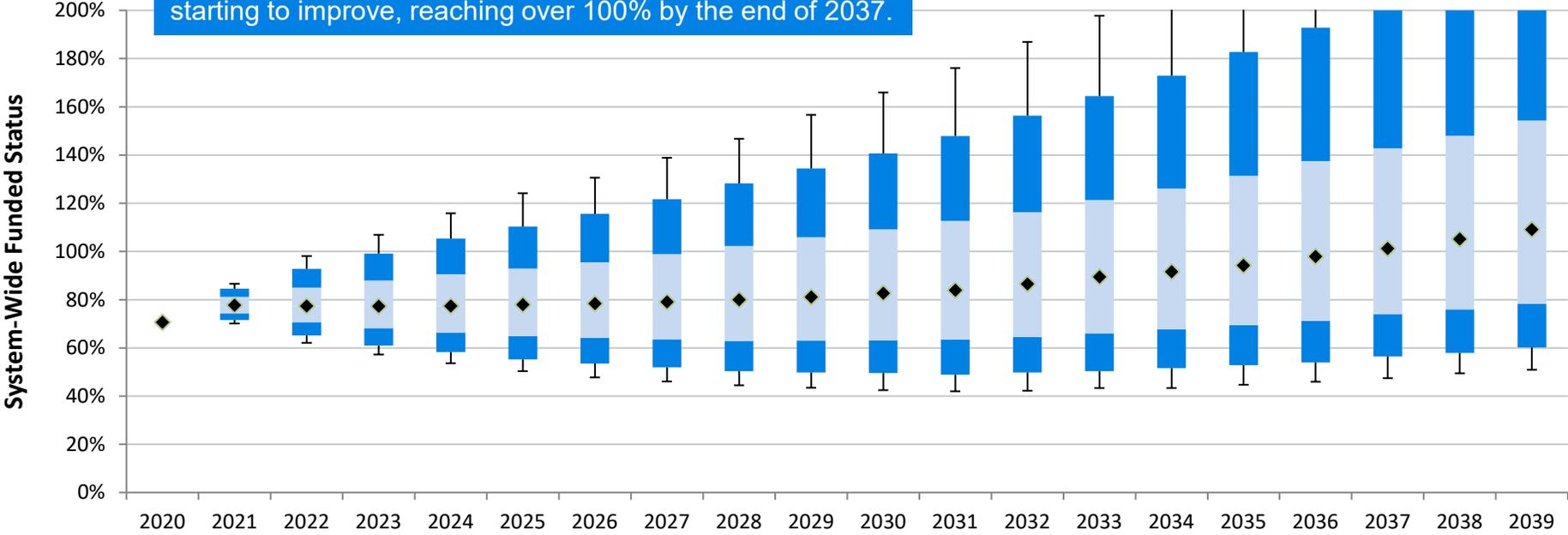


	Eff. Jul 21	Eff. Jul 23	Eff. Jul 25	Eff. Jul 27	Eff. Jul 29	Eff. Jul 31	Eff. Jul 33	Eff. Jul 35	Eff. Jul 37	Eff. Jul 39
5th	-	-0.4%	3.5%	3.5%	5.6%	11.2%	4.0%	4.0%	4.1%	4.3%
10th	-0.4%	2.7%	3.3%	5.0%	10.5%	3.9%	4.0%	4.0%	3.9%	4.0%
25th	-0.4%	1.6%	2.5%	3.6%	9.2%	3.0%	2.9%	2.2%	1.6%	1.6%
50th	-0.4%	1.2%	-0.6%	-0.1%	6.8%	-0.6%	-1.0%	-1.0%	-0.9%	-0.2%
75th	-0.4%	0.9%	-1.8%	-3.2%	4.6%	-3.5%	-4.1%	-4.0%	-3.9%	-2.9%
90th	-0.4%	0.7%	-4.1%	-6.1%	3.3%	-4.3%	-4.3%	-4.3%	-4.2%	-3.4%
95th	-	0.7%	-4.5%	-7.2%	2.6%	-4.4%	-4.4%	-4.4%	-4.4%	-3.5%

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# Funded Status (Excluding Side Accounts)

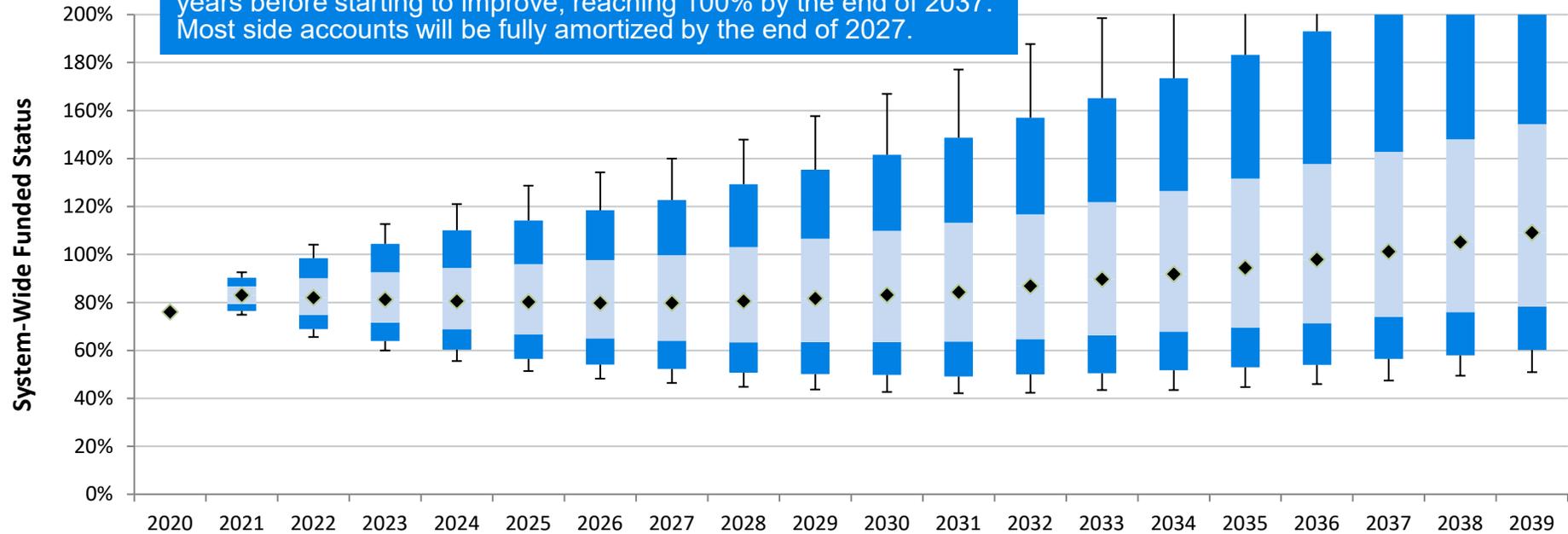
At the 50<sup>th</sup> percentile, funded status is 77.7% at year-end 2021, and decreases 0.4% over the next two years before starting to improve, reaching over 100% by the end of 2037.



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	
95th	—	70.6%	86.6%	98.1%	107.0%	115.8%	124.2%	130.6%	138.8%	146.7%	156.6%	165.9%	176.1%	186.9%	197.8%	209.7%	225.3%	237.6%	252.2%	267.9%	283.1%
90th	70.6%	84.6%	92.8%	99.2%	105.4%	110.3%	115.6%	121.7%	128.3%	134.4%	140.7%	147.9%	156.3%	164.4%	173.0%	182.7%	192.8%	203.1%	215.9%	224.3%	
75th	70.6%	81.2%	85.0%	88.0%	90.6%	93.0%	95.5%	98.9%	102.3%	105.9%	109.2%	112.7%	116.3%	121.3%	126.1%	131.4%	137.5%	142.8%	148.0%	154.3%	
50th	70.6%	77.7%	77.4%	77.3%	77.4%	77.9%	78.3%	79.1%	79.9%	81.1%	82.6%	83.9%	86.5%	89.4%	91.6%	94.2%	97.9%	101.2%	105.1%	109.0%	
25th	70.6%	74.4%	70.7%	68.2%	66.4%	65.0%	64.1%	63.5%	62.9%	63.0%	63.1%	63.4%	64.4%	66.1%	67.7%	69.5%	71.3%	74.0%	76.0%	78.3%	
10th	70.6%	71.6%	65.1%	61.0%	58.3%	55.3%	53.5%	51.9%	50.4%	49.9%	49.6%	48.9%	49.9%	50.4%	51.6%	52.9%	54.0%	56.4%	57.9%	60.2%	
5th	70.6%	70.1%	62.1%	57.3%	53.7%	50.4%	47.8%	46.1%	44.6%	43.5%	42.5%	42.0%	42.2%	43.4%	43.4%	44.7%	45.9%	47.4%	49.4%	51.0%	

# Funded Status (Including Side Accounts)

At the 50<sup>th</sup> percentile, funded status including side accounts is 83.0% at year-end 2021 and decreases by 3.3% over the next five years before starting to improve, reaching 100% by the end of 2037. Most side accounts will be fully amortized by the end of 2027.

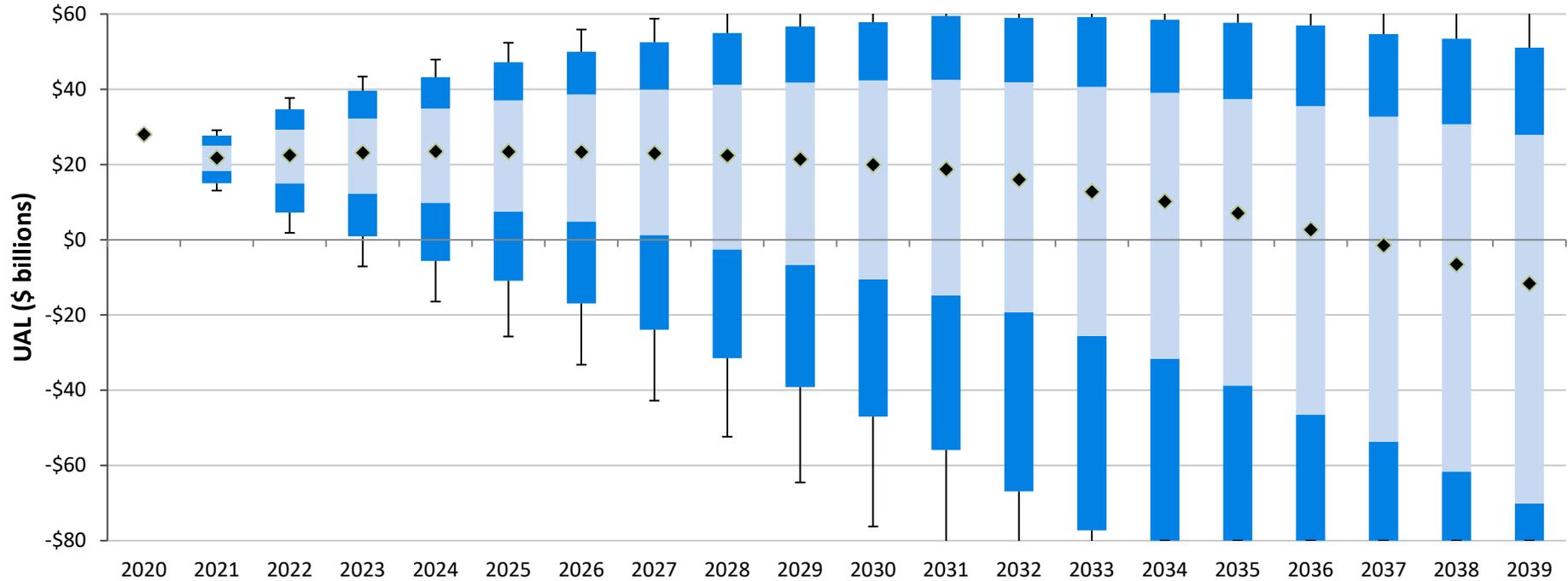


	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	
95th	—	76.0%	92.6%	104.1%	112.7%	121.1%	128.8%	134.2%	140.0%	147.8%	157.8%	167.0%	177.1%	187.8%	198.5%	210.4%	225.9%	237.9%	252.2%	267.9%	283.1%
90th	—	76.0%	90.4%	98.4%	104.5%	110.1%	114.1%	118.5%	122.8%	129.2%	135.4%	141.6%	148.7%	157.1%	165.1%	173.5%	183.2%	193.0%	203.1%	215.9%	224.3%
75th	—	76.0%	86.7%	90.1%	92.5%	94.4%	95.9%	97.7%	99.7%	103.1%	106.6%	109.8%	113.3%	116.8%	121.8%	126.5%	131.6%	137.7%	142.8%	148.0%	154.3%
50th	●	76.0%	83.0%	82.0%	81.2%	80.5%	80.2%	79.7%	79.7%	80.5%	81.6%	83.1%	84.3%	86.8%	89.7%	91.8%	94.4%	97.9%	101.2%	105.1%	109.0%
25th	—	76.0%	79.4%	74.8%	71.6%	68.9%	66.7%	65.0%	64.0%	63.4%	63.4%	63.4%	63.7%	64.7%	66.3%	67.9%	69.6%	71.3%	74.0%	76.0%	78.3%
10th	—	76.0%	76.4%	68.9%	63.9%	60.3%	56.5%	54.1%	52.3%	50.8%	50.2%	49.8%	49.1%	50.0%	50.5%	51.7%	53.0%	54.0%	56.4%	57.9%	60.2%
5th	—	76.0%	74.8%	65.7%	60.0%	55.6%	51.5%	48.2%	46.4%	44.9%	43.7%	42.7%	42.2%	42.4%	43.5%	43.5%	44.7%	45.9%	47.4%	49.4%	51.0%

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# UAL (Excluding Side Accounts)

At the 50<sup>th</sup> percentile, the UAL excluding side accounts is \$21.8 billion at year-end 2021, grows to \$23.5 billion at the end of 2024, then declines to less than \$0 by the end of 2037.

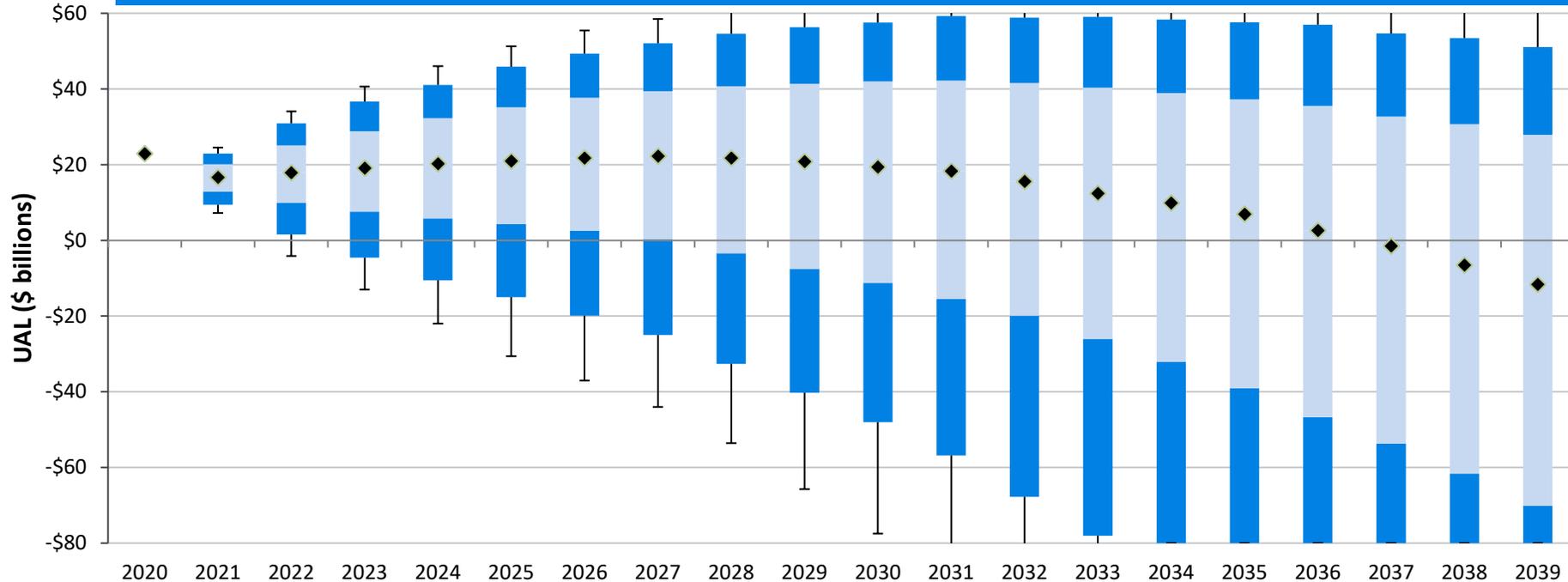


	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	
5th	—	28.0	29.1	37.7	43.4	47.9	52.4	55.9	58.8	61.7	63.7	65.6	67.2	67.8	67.8	68.3	67.6	66.9	65.9	64.5	62.9
10th	—	28.0	27.7	34.7	39.6	43.2	47.2	50.0	52.5	55.0	56.7	57.8	59.5	59.0	59.2	58.5	57.7	57.0	54.7	53.5	51.1
25th	—	28.0	25.0	29.2	32.3	34.9	37.0	38.7	39.9	41.2	41.8	42.4	42.5	41.9	40.6	39.1	37.4	35.6	32.7	30.7	27.9
50th	•	28.0	21.8	22.5	23.1	23.5	23.4	23.3	23.0	22.4	21.4	20.0	18.8	16.0	12.8	10.2	7.1	2.7	-1.5	-6.5	-11.6
75th	—	28.0	18.4	15.0	12.3	9.8	7.5	4.9	1.2	-2.6	-6.7	-10.6	-14.8	-19.3	-25.6	-31.6	-38.8	-46.5	-53.7	-61.7	-70.2
90th	—	28.0	15.0	7.2	0.9	-5.6	-10.9	-17.0	-23.9	-31.5	-39.2	-47.1	-55.9	-66.9	-77.3	-89.3	-102.1	-116.8	-129.8	-148.5	-161.1
95th	—	28.0	13.0	1.9	-7.1	-16.5	-25.7	-33.2	-42.8	-52.4	-64.5	-76.3	-89.4	-103.2	-117.8	-133.2	-154.9	-171.5	-193.3	-214.7	-238.2

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# UAL (Including Side Accounts)

At the 50<sup>th</sup> percentile, the UAL including side accounts is \$16.6 billion at year-end 2021, grows to \$22.3 billion at the end of 2027, then declines to less than \$0 by the end of 2037. Most side accounts will be fully amortized by the end of 2027.



	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	
5th	—	22.9	24.5	34.1	40.7	46.0	51.3	55.5	58.5	61.4	63.5	65.4	66.9	67.7	67.7	68.2	67.6	66.9	65.9	64.5	62.9
10th	—	22.9	23.0	30.9	36.7	41.1	45.9	49.4	52.1	54.6	56.4	57.5	59.3	58.8	59.1	58.4	57.7	57.0	54.7	53.5	51.1
25th	—	22.9	20.1	25.1	28.8	32.3	35.2	37.7	39.4	40.7	41.4	42.0	42.2	41.6	40.4	38.9	37.3	35.5	32.7	30.7	27.9
50th	—	22.9	16.6	17.9	19.1	20.3	21.0	21.8	22.3	21.8	20.9	19.4	18.3	15.6	12.4	9.9	6.9	2.6	-1.5	-6.5	-11.6
75th	—	22.9	13.0	9.9	7.6	5.8	4.3	2.5	0.3	-3.4	-7.5	-11.3	-15.5	-19.9	-26.1	-32.1	-39.0	-46.8	-53.7	-61.7	-70.2
90th	—	22.9	9.4	1.6	-4.5	-10.5	-15.0	-19.9	-25.0	-32.6	-40.2	-48.1	-56.9	-67.8	-78.0	-90.0	-102.6	-117.1	-129.8	-148.5	-161.1
95th	—	22.9	7.3	-4.1	-13.0	-22.0	-30.6	-37.1	-44.0	-53.6	-65.8	-77.5	-90.6	-104.2	-118.9	-134.0	-155.5	-172.1	-193.3	-214.7	-238.2

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# Variable Return Model Stress Test

- As in recent years, we also used the variable return model to do a “stress test” of the likelihood of certain events in the 10,000 scenarios modeled
  - Testing is done at a system-average level; results for individual rate pools or employers may vary
- The percentage of modeled scenarios with funded status above a specified threshold at the end of the projection period is shown below
  - Median funded status excluding side accounts at year-end 2020 was 70.6%

Likelihood of Funded Status Level as of 12/31/2039	
Funded Status (Excluding Side Accounts) > 100%	57%
Funded Status (Excluding Side Accounts) > 90%	65%
Funded Status (Excluding Side Accounts) > 80%	74%
Funded Status (Excluding Side Accounts) > 70%	82%
Funded Status (Excluding Side Accounts) > 60%	90%

# Variable Return Model Stress Test

- Median funded status excluding side accounts at year-end 2020 was 70.6%
- The likelihood of specified events occurring at some valuation date during the 20-year projection period is shown below

Likelihood of Event Occurring at Some Valuation Date in Next 20 Years	
Funded Status (Excluding Side Accounts) > 100%	72%
Funded Status (Excluding Side Accounts) < 60%	44%
Funded Status (Excluding Side Accounts) < 40%	9%

# Variable Return Model Stress Test

- The likelihood of specified events occurring at some valuation date during the 20-year projection period is shown below

Likelihood of Event Occurring at Some Valuation Date in Next 20 Years	
Employer Collared Base Rate (Excluding Retiree Healthcare) < 10% of Pay	30%
Employer Collared Base Rate (Excluding Retiree Healthcare) > 30% of Pay	51%
Employer Collared Base Rate (Excluding Retiree Healthcare) > 40% of Pay	21%

- The system-average employer base rate for the 2021-2023 biennium is about 24.5%, per the December 31, 2019 valuation

# Variable Return Model Stress Test

- As shown earlier, less than 10% of modeled scenarios show an increase in the collared rate above 3% of payroll at July 2023
- Table shows likelihood in the model of a collared rate increase exceeding a selected threshold at the July 2023 rate change

Likelihood of the July 2023 Collared Rate Increase Exceeding Threshold		
<u>Threshold Increase</u>	<u>Base Rate</u>	<u>Net Rate</u>
2% of Pay	15%	15%
3% of Pay	8%	8%
4% of Pay	3%	3%
5% of Pay	<1%	<1%

# Variable Return Model Stress Test

- Table shows likelihood in the model of a collared rate increase exceeding a selected threshold at the July 2025 rate change

Likelihood of the July 2025 Collared Rate Increase Exceeding Threshold		
<u>Threshold Increase</u>	<u>Base Rate</u>	<u>Net Rate</u>
2% of Pay	31%	28%
3% of Pay	26%	17%
4% of Pay	<1%	<1%
5% of Pay	<1%	<1%

## Wrap Up / Next Steps

- At the February 1, 2022 meeting, preliminary year-end 2021 investment results will be available
  - We can then comment as warranted on estimated impact on the 12/31/2021 actuarial valuation results, which will develop 2023 – 2025 contribution rates



# Appendix

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# Certification

This presentation summarizes deterministic and stochastic modeling for the Oregon Public Employees Retirement System (“PERS” or “the System”) over a 20-year period beginning December 31, 2020 under a wide range of potential economic scenarios. The results are based upon the same assumptions, methods, and plan provisions as described in the 2020 Experience Study and the forthcoming December 31, 2020 System-Wide Actuarial Valuation Report, except where noted otherwise.

In preparing this report, we relied, without audit, on information (some oral and some in writing) supplied by the System’s staff. This information includes, but is not limited to, statutory provisions, employee data, and financial information. We found this information to be reasonably consistent and comparable with information used for other purposes. The valuation results depend on the integrity of this information. If any of this information is inaccurate or incomplete our results may be different and our calculations may need to be revised.

All costs, liabilities, rates of interest, and other factors for the System have been determined on the basis of actuarial assumptions and methods which are individually reasonable (taking into account the experience of the System and reasonable expectations); and which, in combination, offer our best estimate of anticipated experience affecting the System. The valuation results were developed using models intended for valuations that use standard actuarial techniques.

Future actuarial measurements may differ significantly from the current measurements presented in this report due to such factors as the following: plan experience differing from that anticipated by the economic or demographic assumptions; changes in economic or demographic assumptions; increases or decreases expected as part of the natural operation of the methodology used for these measurements (such as the end of an amortization period or additional cost or contribution requirements based on the plan’s funded status); and changes in plan provisions or applicable law. Due to the limited scope of our assignment, we did not perform an analysis of the potential range of future measurements. Our forthcoming December 31, 2020 Actuarial Valuation Report will provide additional discussion of the System’s risks. The PERS Board has the final decision regarding the appropriateness of the assumptions.

Actuarial computations presented in this report are for purposes of determining the recommended funding amounts for the System. The computations prepared for other purposes may differ as disclosed in our report. The calculations in the enclosed report have been made on a basis consistent with our understanding of the System’s funding requirements and goals. The calculations in this report have been made on a basis consistent with our understanding of the plan provisions described in the appendix of this report. Determinations for purposes other than meeting these requirements may be significantly different from the results contained in this report. Accordingly, additional determinations may be needed for other purposes.

This work product was prepared for discussion purposes only and may not be appropriate to use for other purposes. Milliman does not intend to benefit and assumes no duty or liability to other parties who receive this work. Any recipient of this work product who desires professional guidance should engage qualified professionals for advice appropriate to its own specific needs.

# Certification

Milliman's work is prepared solely for the internal business use of the Oregon Public Employees Retirement System. To the extent that Milliman's work is not subject to disclosure under applicable public records laws, Milliman's work may not be provided to third parties without Milliman's prior written consent. Milliman does not intend to benefit or create a legal duty to any third-party recipient of its work product. Milliman's consent to release its work product to any third party may be conditioned on the third party signing a Release, subject to the following exception(s):

- (a) The System may provide a copy of Milliman's work, in its entirety, to the System's professional service advisors who are subject to a duty of confidentiality and who agree to not use Milliman's work for any purpose other than to benefit the System.
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The consultants who worked on this assignment are retirement actuaries. Milliman's advice is not intended to be a substitute for qualified legal or accounting counsel.

The signing actuaries are independent of the System. We are not aware of any relationship that would impair the objectivity of our work.

On the basis of the foregoing, we hereby certify that, to the best of our knowledge and belief, this report is complete and accurate and has been prepared in accordance with generally recognized and accepted actuarial principles and practices which are consistent with the principles prescribed by the Actuarial Standards Board and the *Code of Professional Conduct and Qualification Standards for Actuaries Issuing Statements of Actuarial Opinion in the United States* published by the American Academy of Actuaries. We are members of the American Academy of Actuaries and meet the Qualification Standards to render the actuarial opinion contained herein.

# Appendix

## Actuarial Basis

### Data

We have based our calculation of the liabilities on the data supplied by the Oregon Public Employees Retirement System and summarized in the Valuation Report.

Assets as of December 31, 2020, were based on values provided by Oregon PERS reflecting the Board's earnings crediting decisions for 2020, as shown in the Valuation Report. Financial model projections reflect September 30, 2021 investment results for regular and variable accounts as published by Oregon State Treasury.

### Methods / Policies

*Actuarial Cost Method:* Entry Age Normal, adopted effective December 31, 2012.

*UAL Amortization:* The UAL for OPSRP and Retiree Health Care as of December 31, 2007 were amortized as a level percentage of combined valuation payroll over a closed 16-year period for OPSRP and a closed 10-year period for Retiree Health Care. For the Tier 1/Tier 2 UAL, the amortization period was reset at 20 years as of December 31, 2013. Senate Bill 1049 was signed into law in June 2019 and requires a one-time re-amortization of Tier 1/Tier 2 UAL over a closed 22-year period at the December 31, 2019 rate-setting valuation which will set actuarially determined contribution rates for the 2021-2023 biennium. Gains and losses between subsequent odd-year valuations are amortized as a level percentage of combined valuation payroll over the amortization period (20 years for Tier 1/Tier 2, 16 years for OPSRP, 10 years for Retiree Health Care) from the odd-year valuation in which they are first recognized.

For the Retiree Health Care programs (RHIA and RHIPA), beginning with the December 31, 2021 rate-setting valuation the amortization policy when a program is over 100% funded status will be to amortize the actuarial surplus over Tier 1/Tier 2 payroll using a rolling 20-year amortization basis. The resulting negative UAL Rate will offset the normal cost rate for the program, but not below 0.0%. If either program subsequently fell below 100%, the UAL would be amortized over combined payroll following the 10-year closed, layered amortization policy.

# Appendix

## Actuarial Basis

### Methods / Policies (cont'd)

**Contribution rate stabilization method:** The UAL Rate contribution rate component for a rate pool (e.g. Tier 1/Tier 2 SLGRP, Tier 1/Tier 2 School Districts, OPSRP) is confined to a collared range based on the prior biennium's collared UAL Rate contribution rate component (prior to consideration of side account offsets, SLGRP transition liability or surplus rates, or pre-SLGRP liability rate charges or offsets).

**Collar Width:** the rate pool's new UAL Rate contribution rate component will generally not increase or decrease from the prior biennium's collared UAL Rate contribution rate component by more than the following amount:

- Tier 1/Tier 2 SLGRP and Tier 1/Tier 2 School District Pool: 3% of payroll
- OPSRP: 1% of payroll
- Tier 1/Tier 2 rates for independent employers: greater of 4% of payroll or one-third of the difference between the collared and uncollared UAL Rate at the prior rate-setting valuation. In addition, the UAL Rate will not be allowed to be less than 0.00% of payroll for any Tier 1/Tier 2 independent employer with a funded status (excluding side accounts) less than 100%.

**UAL Rate decrease restrictions:** the UAL Rate for any rate pool will not be allowed to decrease if the pool's funded status is 87% (excluding side accounts) or lower; the allowable decrease will phase into the full collar width from 87% funded to 90% funded.

**Expenses:** System-wide administration expenses are assumed to be equal to \$59.0M. The assumed expenses are allocated between Tier 1/Tier 2 and OPSRP based on projected payroll and are added to the respective normal costs.

**Actuarial Value of Assets:** Equal to Market Value of Assets excluding Contingency and Tier 1 Rate Guarantee Reserves. The Tier 1 Rate Guarantee Reserve is not excluded from assets if it is negative (i.e. in deficit status). The Actuarial Value of Assets includes the value of Employee Pension Stability Accounts (EPSA).

### Assumptions

Assumptions for valuation calculations are as described in the 2020 Experience Study Report.

### Provisions

Provisions valued are as detailed in the forthcoming December 31, 2020 System-Wide Actuarial Valuation Report.

# Appendix

## Rate Projection Basis

### Assumptions

In general, all assumptions are as described in the 2020 Experience Study Report.

The major actuarial valuation assumptions used in our projections are shown below. They are aggregate average assumptions that apply to the whole population and were held constant throughout the projection period. The economic experience adjustments were allowed to vary in future years given the conditions defined in each economic scenario.

- Valuation interest rate – 6.90%
- Tier 1 Regular account growth – 6.90%
- Actual fund investment return – Varies by scenario according to capital market assumptions
- Variable account growth – Equal to investment return on public equity portion of the fund
- Inflation assumption – 2.40%
- Inflation experience – Varies by scenario according to capital market assumptions
- Wage growth assumption – 3.40%
- Wage growth experience – 1.00% greater than inflation experience
- Demographic experience – as described in 2020 Experience Study Report
- New entrant experience – New members are assumed to be hired at the rate necessary to keep the total number of members in each job class (General Service, School District, Police & Fire, and Judges) constant over the duration of the projection. All new entrants other than judges are assumed to join as OPSRP members. New entrant pay is assumed to grow at the rate necessary for overall system payroll to increase with wage growth experience, as described above.

# Appendix

## Rate Projection Basis

### Reserve Projection

Contingency Reserve as of 12/31/2020 was \$50.0M. No future increases or decreases to this reserve were assumed.

The Tier 1 Rate Guarantee Reserve (“RGR”) was \$526.8 M as of 12/31/2020. The RGR was assumed to grow with excess returns above the 6.90% target growth on Tier 1 Member Accounts. When modeled aggregate returns were below 6.90%, applicable amounts from the RGR were assumed to transfer to Tier 1 Member Accounts to maintain the 6.90% target growth rate. The RGR is allowed to be negative, but the reserve is not excluded from valuation assets when it is negative. We did not include in rates any potential additional employer levy that could be required to eliminate a persistent negative RGR.

### Offset for Member Redirect Contributions

Under Senate Bill 1049, a portion of the 6% of pay member contribution previously made to the IAP was redirected to fund Tier 1/Tier 2 and OPSRP defined benefits beginning July 1, 2020. For Tier 1/Tier 2 members, the redirected amount will be 2.50% of pay, and for OPSRP it will be 0.75% of pay. Members with less than \$2,500 in monthly pay (indexed in future years) will be exempt from the redirection.

For the rate projection, member redirect contributions are assumed to offset the contribution rates paid by employers beginning with the July 2021 – June 2023 biennium. The offset is assumed to be 2.40% of total payroll for Tier 1/Tier 2 and 0.65% of total payroll for OPSRP.

Redirected member contributions are assumed to cease in a biennium following a rate-setting valuation where the funded status, including side accounts, is 90% or greater.

### Work After Retirement Contributions

Under Senate Bill 1049, starting in 2020 and ending December 31, 2024, employers are required to pay PERS contribution rates on rehired retiree payroll. For 2021, rehired retiree payroll was assumed to be approximately \$177.8 for Tier 1/Tier 2 members and \$5.6 million for OPSRP members. After 2021, rehired retiree payroll was assumed to increase with the wage growth assumption.

# Appendix

## Rate Projection Basis

### Capital Market Model

For each 20-year projection, we ran 10,000 stochastic scenarios for inflation and asset class rates of return. The scenarios were calibrated to represent Milliman's capital market assumptions in terms of expected average real returns, the expected year-to-year volatility of the returns, and the expected correlation between the returns of different asset classes. Annual rates of return for each of the asset classes and inflation are generated from a multivariate lognormal probability distribution. Rates of return are independent from year to year.

The variable return model includes 10,000 projected scenarios for possible future year-by-year system investment returns and levels of inflation. In developing that model, per Actuarial Standards of Practice we disclose reliance upon a Milliman colleague who is a credentialed actuary and also a credentialed investment professional with expertise in preparing capital outlook modeling. We reviewed overall model results for reasonability while, as part of his work, our investment professional colleague reviewed the investment projections for internal consistency.

For this purpose, we considered the Oregon PERS Fund to be allocated among the model's asset classes as shown on the following slide. This allocation is based on input provided by Meketa (OIC's primary consultant) and reflects changes to the OIC's target allocation for the Oregon PERS fund adopted in June 2021.

# Appendix

## Rate Projection Basis

### Capital Market Model

Reflects Milliman's capital market assumptions as of July 1, 2021.

	<b>Annual Arithmetic Mean</b>	<b>20-Year Annualized Geometric Mean</b>	<b>Annual Standard Deviation</b>	<b>Policy Allocation</b>
Global Equity	7.94%	6.57%	17.81%	30.625%
Private Equity	12.39%	8.77%	30.00%	25.500%
Real Estate	6.76%	5.87%	14.24%	12.250%
US Core Fixed Income	3.41%	3.34%	3.96%	23.750%
Hedge Fund – Macro	4.48%	4.16%	8.51%	5.625%
Hedge Fund – Equity Hedge	6.54%	5.88%	12.29%	0.625%
Hedge Fund – Multistrategy	5.91%	5.53%	9.25%	1.250%
Infrastructure	7.57%	6.28%	17.24%	1.500%
Commodities	4.18%	2.95%	16.54%	0.625%
Master Limited Partnerships	8.72%	5.76%	26.58%	0.750%
US 3-Month T-Bills	1.93%	1.92%	1.13%	(2.50%)
US Inflation (CPI-U)	2.41%	2.40%	1.16%	<b>N/A</b>
<b>Fund Total (reflecting asset class correlations)</b>	<b>7.75%</b>	<b>6.95%*</b>	<b>13.50%</b>	<b>100.00%</b>

\* The model's 20-year annualized geometric median is **6.91%**.

# Retirement System Risks

- Oregon PERS, like all defined benefit systems, is subject to various risks that will affect future system liabilities and contribution requirements, including:
  - **Investment risk:** the potential that investment returns will be different than assumed
  - **Demographic risks:** the potential that mortality experience, retirement behavior, or other demographic experience for the system membership will be different than assumed
  - **Contribution risk:** the potential that actual future contributions will be materially different than expected, for example if there are material changes in the system's covered payroll
- The results of an actuarial valuation are based on one set of reasonable assumptions, but it is almost certain that future experience will not exactly match the assumptions.
- Further discussion of system risks and historical information regarding system experience are shown in our annual actuarial valuations. In addition, our annual financial modeling presentation to the PERS Board illustrates future outcomes under a wide range of future scenarios reflecting variation in key risk factors.