

March 28, 2011

## **Oregon PERS Financial Modeling** Contribution Projections and Impact of Side Accounts

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## Introduction

- Mercer conducts actuarial valuations of the PERS program annually
  - Valuations are used to develop recommended contribution rates and assess system funded status
  - Valuation calculations are based on outcomes if all actuarial assumptions are met
    - A key assumption is annual investment return, currently at 8%
- Of course, assumptions are never met precisely and in some years actual experience will vary widely from assumption
- Given this, periodically Mercer conducts financial modeling studies
  - In these studies, contribution rates and funded status levels are calculated under a variety of possible investment return scenarios
  - While the scenarios shown are not all inclusive, the study results convey the system's sensitivity to investment results

## Overview of Employer Rate Setting

- Actuarial valuations are conducted annually each year-end
  - Rates are set biennially based on “odd year” actuarial valuations
  - “Even year” valuations are strictly advisory
- The rates determined by the actuarial valuation are adopted by the Board and go into effect 18 months subsequent to the valuation date

Valuation Date	Employer Contribution Rates
12/31/2009	July 2011 – June 2013
12/31/2011	July 2013 – June 2015

## Overview of Employer Rate Setting

- *Two types of employer contribution rates calculated in each valuation*
- **Base Rate**
  - A base rate is calculated for each employer or employer rate pool, and base rates vary from employer to employer and pool to pool
  - The base rate has two components:
    - Normal cost rate – economic value of benefits earned during the current year
    - UAL (unfunded actuarial liability) rate – projected cost to eliminate funding shortfalls for benefits already earned over a period of time approved by the PERS Board and assuming actuarial assumptions are met
  - The change in base rate from period to period is restricted by the “rate collar” mechanism

## Overview of Employer Rate Setting

- *Two types of employer contribution rates calculated in each valuation*
- **Net Rate**
  - Employers pay the net rate
  - For employers without a side account, the net rate is the same as the base rate
  - For side account employers, the net rate is lower than the base rate
    - In the valuation, the employer's side account asset and payroll levels are used to develop a "side account rate offset"
    - The rate offset level is calculated to provide a steady level of contribution rate relief until the end of 2027 if assumptions are met
  - Side account employers pay their calculated net rate
    - The difference between an employer's base rate and its net rate is funded by a transfer from the employer's side account to general PERS assets at the calculated rate offset level

# Overview of Employer Rate Setting

## Structure of Employer Pension Contribution Rates

Employer Contribution Rates* July 2011 – June 2013				
Payroll	Tier 1/Tier 2	OPSRP GS	OPSRP P&F	Combined
Normal Cost	8.6%	6.1%	8.8%	7.8%
T1/T2 UAL	7.7%	7.7%	7.7%	7.7%
OPSRP UAL	0.1%	0.1%	0.1%	0.1%
<b>Base Rate*</b>	<b>16.4%</b>	<b>13.9%</b>	<b>16.6%</b>	<b>15.6%</b>
Average Adjustment**	(5.5%)	(5.5%)	(5.5%)	(5.5%)
<b>Net Rate*</b>	<b>10.8%</b>	<b>8.4%</b>	<b>11.1%</b>	<b>10.1%</b>

\* Base and net rates excluding retiree healthcare component

\*\* Adjustments are for side accounts and Pre-SLGRP liabilities and are shown on a system-wide basis

- Employer pension contribution rates have two key components: Normal Cost and UAL
- Rates shown here and throughout the rest of this presentation are calculated on a systemwide basis
  - Rates for any single employer will vary from the systemwide rate
- IAP and retiree healthcare rates, as well as any repayment on pension obligation bonds (POBs) are charged in addition to the pension rate

# Overview of Employer Rate Setting

## The Rate Collar

- From one biennium to the next, employer base rate changes for Tier 1/Tier 2 and OPSRP are restricted to stay inside of a “rate collar”
  - The rate collar is defined as the greater of:
    - 20% of the base rate currently in effect, or
    - 3% of payroll
- If the plan’s funded status goes above 120% or below 80%, the width of the rate collar increases on a graded schedule such that above 130% or below 70% the size of the collar is doubled
- The rate collar will limit base rates for the 2011-2013 contribution period
  - The 12/31/2009 valuation established 2011-2013 employer rates
  - Without the collar, the average system-wide base rate of 15.6% would have been approximately 19.6%
  - This deferred increase means the rates for the 2013-2015 biennium are expected to rise if assumptions are met during 2010 and 2011

# Baseline Financial Modeling



# Baseline Financial Modeling

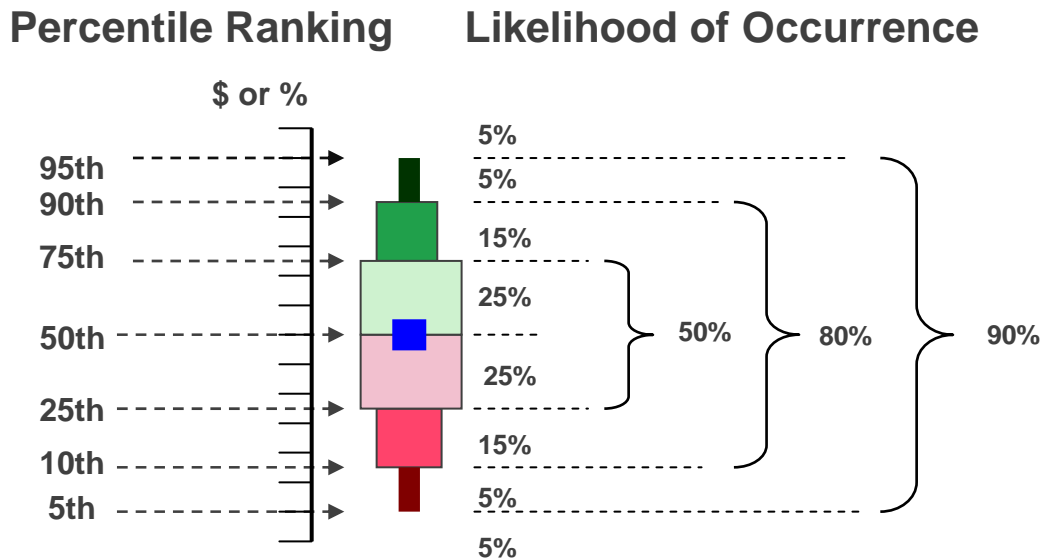
## Overview of Modeling

- Basis for modeling is most recently available year-end asset and liability information
  - **12/31/2009 liabilities and assumptions** for Tier 1/Tier 2/OSPRP
    - Modeling assumes 8% annual investment return assumption remains in place for duration of modeling period
  - Does not include retiree healthcare or IAP contributions
  - **12/31/2010 assets** based on preliminary board crediting decisions
  - Investment policy as selected by Oregon Investment Council (OIC)
- In the 12/31/2009 valuation, the Contingency Reserve and Tier 1 Rate Guarantee Reserve were each excluded from valuation assets
  - The Tier 1 Rate Guarantee Reserve (RGR) is currently negative
    - Excluding a negative reserve increases valuation assets
    - If the RGR remains negative for 5 years, action must be taken to address the deficit, per statute
  - Our model treats a negative reserve as part of the unfunded actuarial liability (UAL)

# Baseline Financial Modeling

## Introduction

- We used a stochastic model to create 1,000 trials of projected future experience for the system
  - Uses Mercer Investment Consulting’s capital market assumptions
  - Detail on model and market assumptions included in the appendix
- The model outputs key system measures such as contribution rates and funded status, with results displayed graphically in percentiles



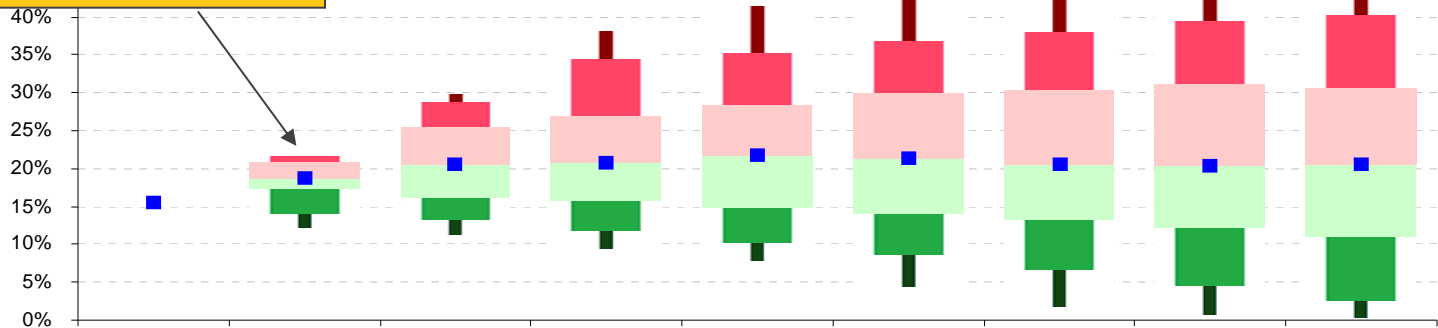
Darkening shades of green indicate progressively more favorable outcomes. Red is used in the same way to show progressively more unfavorable results. The graphics are supplemented with numerical tables.

# Baseline Financial Modeling

## Combined (Tier 1/Tier 2, OPSRP) Base\* Contribution Rate

In over 75 percent of scenarios, base rates increase at 2013. The 50<sup>th</sup> percentile increase is 3.1% of payroll. The rate collar prevents rates in worst scenarios from rising above 21.6%.

For 2015 and beyond, over half of all scenarios have base rates in excess of 20% of payroll, but significant volatility exists



Biennium	2011 - 2013	2013 - 2015	2015 - 2017	2017 - 2019	2019 - 2021	2021 - 2023	2023 - 2025	2025 - 2027	2027 - 2029
5th	15.6%	21.6%	29.9%	38.1%	41.3%	42.4%	43.8%	44.3%	46.2%
10th	15.6%	21.6%	28.9%	34.4%	35.3%	37.0%	38.1%	39.6%	40.4%
25th	15.6%	21.0%	25.6%	27.0%	28.5%	30.0%	30.3%	31.2%	30.7%
50th	15.6%	18.7%	20.5%	20.7%	21.8%	21.3%	20.6%	20.4%	20.5%
75th	15.6%	17.4%	16.0%	15.8%	14.9%	14.2%	13.3%	12.3%	11.0%
90th	15.6%	14.2%	13.2%	11.9%	10.2%	8.7%	6.6%	4.7%	2.7%
95th	15.6%	12.3%	11.3%	9.6%	7.8%	4.5%	1.8%	0.9%	0.5%
5th - 95th	0.0%	9.3%	18.6%	28.5%	33.5%	37.9%	41.9%	43.5%	45.8%

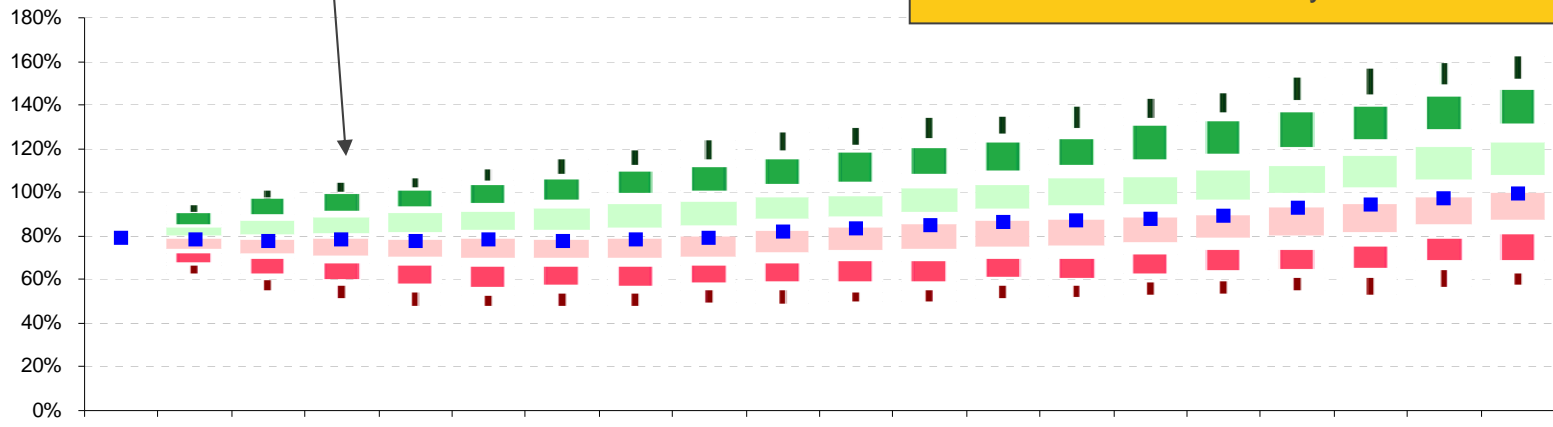
*\*Base rates do not reflect the effects of side account rate offsets and Pre-SLGRP liabilities, and do not include contribution rates for the IAP or retiree healthcare programs, or debt service on pension obligation bonds. The Tier 1 Rate Guarantee Reserve is not excluded from assets for years where the reserve is negative.*

# Baseline Financial Modeling

## Combined (Tier 1/Tier 2, OPSRP) Funded Status (Excluding Side Accounts)

Investment sensitivity is high enough that by the 2013 rate-setting valuation, funded status is greater than 100% in more than 5% of scenarios and less than 50% in more than 5% of scenarios

The large Tier 1/Tier 2 shortfall created by the 2008 market downturn is scheduled to be amortized over 20 years if assumptions are met. At the 50<sup>th</sup> percentile, the amortization pattern is that funded status stabilizes over the first ten years and then improves over the second ten years.



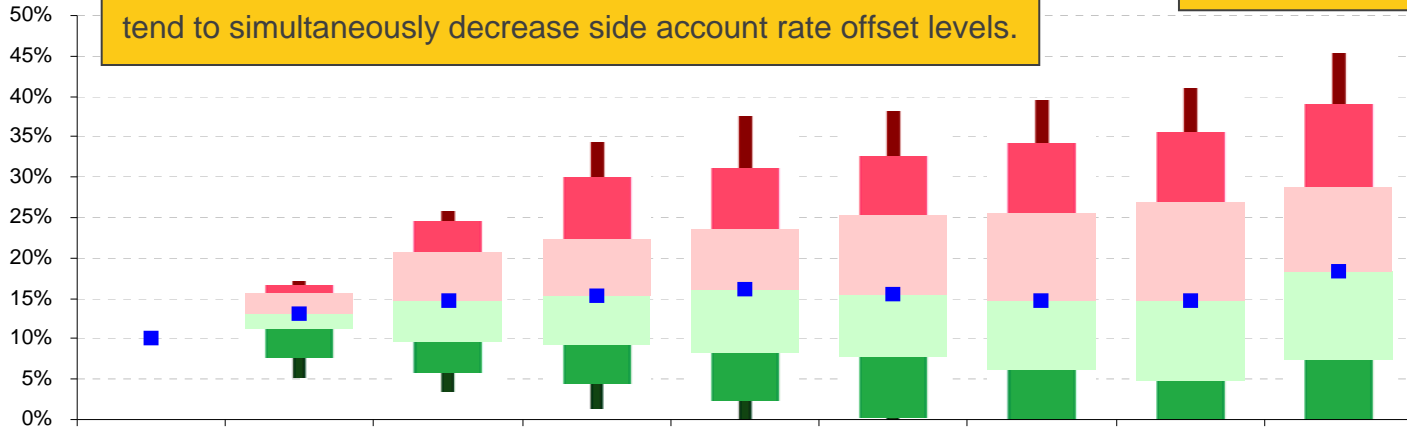
PY Ending 12/31	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
95th	79%	94%	100%	104%	106%	110%	114%	119%	123%	127%	129%	133%	134%	138%	142%	145%	152%	156%	159%	162%
90th	79%	90%	96%	98%	100%	103%	105%	109%	111%	115%	118%	120%	122%	124%	130%	132%	137%	139%	143%	147%
75th	79%	84%	86%	88%	90%	91%	92%	94%	95%	97%	98%	102%	103%	106%	107%	109%	112%	116%	120%	123%
50th	79%	79%	78%	78%	78%	78%	78%	78%	79%	82%	83%	85%	87%	87%	88%	90%	93%	95%	97%	99%
25th	79%	72%	69%	67%	66%	65%	65%	65%	66%	66%	68%	68%	69%	69%	71%	73%	73%	75%	78%	81%
10th	79%	66%	60%	56%	54%	52%	53%	53%	54%	54%	54%	55%	56%	57%	58%	59%	60%	60%	64%	63%
5th	79%	62%	53%	49%	45%	46%	46%	45%	46%	46%	48%	48%	49%	50%	50%	50%	52%	49%	52%	55%
95th - 5th	0%	32%	48%	55%	61%	65%	69%	74%	77%	81%	82%	86%	85%	88%	92%	95%	100%	107%	107%	106%

# Baseline Financial Modeling

## Combined (Tier 1/Tier 2, OPSRP) Net\* Contribution Rate

Net rates increase at 2027-2029 with the expiration of side account rate offsets, but this increase coincides with the expiration of debt payments on pension obligation bonds

Net rates exhibit even higher volatility than base rates. This is because investment return scenarios that increase base rates tend to simultaneously decrease side account rate offset levels.



Biennium	2011 - 2013	2013 - 2015	2015 - 2017	2017 - 2019	2019 - 2021	2021 - 2023	2023 - 2025	2025 - 2027	2027 - 2029
5th	10.0%	17.1%	25.8%	34.2%	37.6%	38.1%	39.6%	41.0%	45.4%
10th	10.0%	16.8%	24.6%	30.0%	31.3%	32.7%	34.4%	35.7%	39.0%
25th	10.0%	15.8%	20.8%	22.3%	23.7%	25.4%	25.6%	26.9%	28.9%
50th	10.0%	13.1%	14.7%	15.2%	16.2%	15.6%	14.8%	14.7%	18.4%
75th	10.0%	11.3%	9.6%	9.3%	8.4%	7.8%	6.3%	4.8%	7.4%
90th	10.0%	7.6%	5.8%	4.4%	2.4%	0.2%	0.0%	0.0%	0.0%
95th	10.0%	5.3%	3.4%	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%
5th - 95th	0.0%	11.8%	22.4%	32.9%	37.6%	38.1%	39.6%	41.0%	45.4%

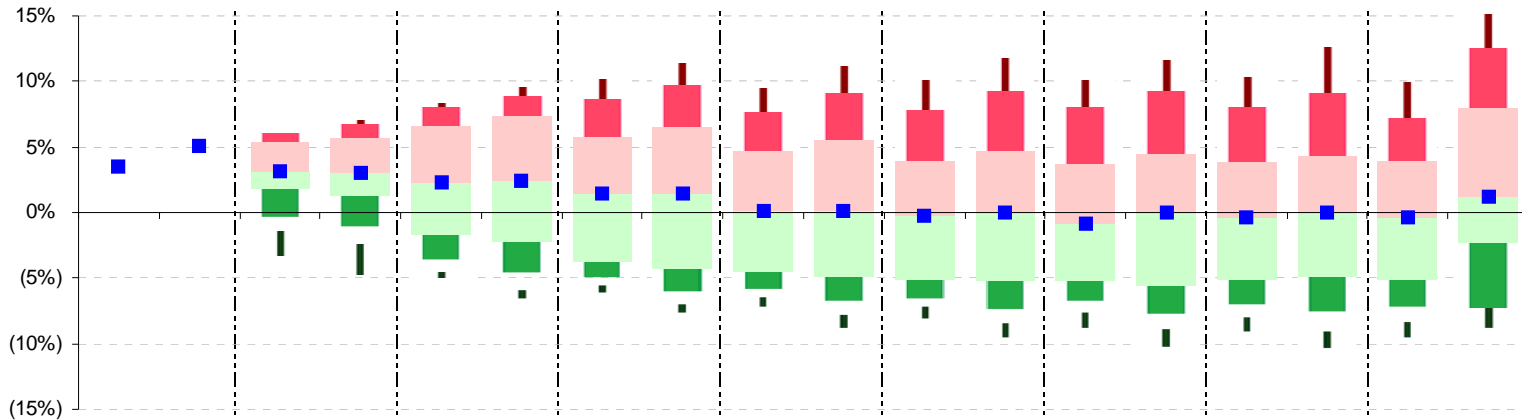
*\*Net rates do reflect the effects of side account rate offsets and Pre-SLGRP liabilities, but do not include contribution rates for the IAP or retiree healthcare programs, or debt service on pension obligation bonds. The Tier 1 Rate Guarantee Reserve is not excluded from assets for years where the reserve is negative.*

# Baseline Financial Modeling

## Biennium to Biennium Change to Contribution Rates

This chart compares period-to-period changes in base and net rates. Change levels tend to be similar around the 50<sup>th</sup> percentile, which are for investment returns close to assumption. In scenarios with both good and poor deviation from assumption, net rate changes exhibit higher volatility.

About 1/3<sup>rd</sup> of PERS payroll is for employers without side accounts, for whom base rates and net rates are identical. This means that employers with side accounts will have somewhat higher volatility than that displayed in this “system-wide average” chart.



Biennium	2009 - 2011 to 2011 - 2013		2011 - 2013 to 2013 - 2015		2013 - 2015 to 2015 - 2017		2015 - 2017 to 2017 - 2019		2017 - 2019 to 2019 - 2021		2019 - 2021 to 2021 - 2023		2021 - 2023 to 2023 - 2025		2023 - 2025 to 2025 - 2027		2025 - 2027 to 2027 - 2029	
	Base	Net	Base	Net	Base	Net	Base	Net	Base	Net	Base	Net	Base	Net	Base	Net	Base	Net
	5th	3.5%	5.1%	6.0%	7.1%	8.4%	9.6%	10.2%	11.3%	9.4%	11.1%	10.0%	11.7%	10.1%	11.6%	10.3%	12.6%	10.0%
10th	3.5%	5.1%	6.0%	6.7%	8.1%	9.0%	8.8%	9.9%	7.7%	9.2%	7.9%	9.3%	8.1%	9.3%	8.1%	9.2%	7.2%	12.6%
25th	3.5%	5.1%	5.4%	5.7%	6.7%	7.3%	5.8%	6.5%	4.7%	5.6%	4.0%	4.7%	3.7%	4.5%	3.9%	4.4%	4.0%	8.0%
50th	3.5%	5.1%	3.1%	3.0%	2.3%	2.4%	1.4%	1.5%	0.2%	0.1%	(0.2%)	0.0%	(0.8%)	0.0%	(0.4%)	0.0%	(0.4%)	1.2%
75th	3.5%	5.1%	1.8%	1.3%	(1.6%)	(2.2%)	(3.8%)	(4.2%)	(4.5%)	(4.9%)	(5.0%)	(5.2%)	(5.3%)	(5.5%)	(5.1%)	(4.9%)	(5.0%)	(2.3%)
90th	3.5%	5.1%	(1.4%)	(2.5%)	(4.6%)	(5.9%)	(5.6%)	(7.0%)	(6.5%)	(7.8%)	(7.3%)	(8.5%)	(7.6%)	(9.0%)	(7.9%)	(9.1%)	(8.3%)	(7.2%)
95th	3.5%	5.1%	(3.3%)	(4.7%)	(5.0%)	(6.7%)	(6.3%)	(7.8%)	(7.6%)	(9.1%)	(8.4%)	(10.0%)	(9.3%)	(10.9%)	(9.5%)	(11.0%)	(10.1%)	(9.7%)
5th - 95th	0.0%	0.0%	9.3%	11.8%	13.3%	16.3%	16.5%	19.2%	17.0%	20.3%	18.4%	21.7%	19.4%	22.5%	19.8%	23.7%	20.1%	24.8%

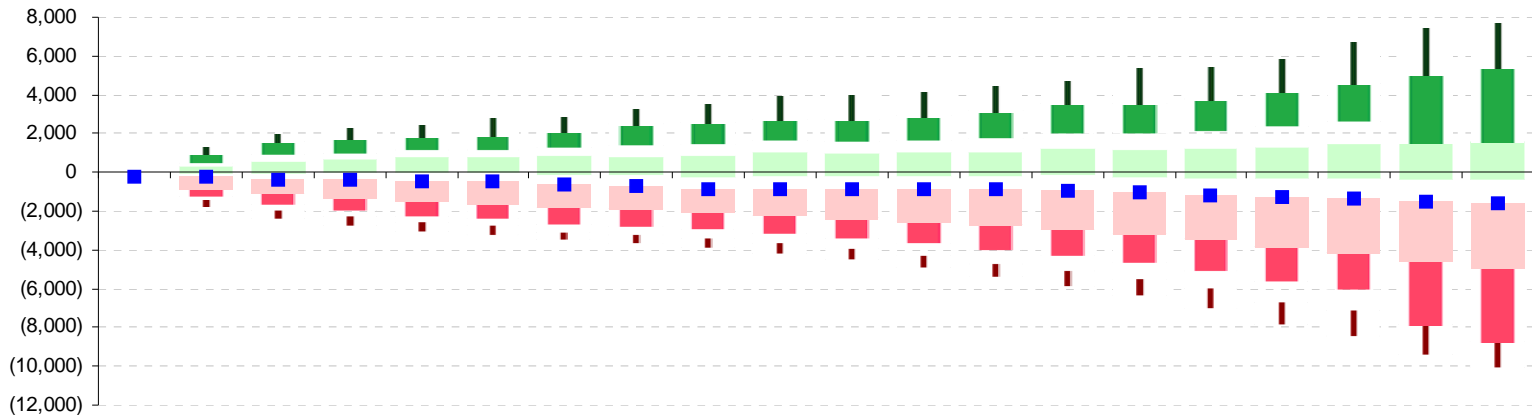
# Baseline Financial Modeling

## Tier 1 Rate Guarantee Reserve

Since the end of 2008, the reserve has been in a deficit situation. Our understanding is that the deficit cannot persist beyond five years.

In over 50 percent of scenarios, the Rate Guarantee Reserve remains negative for the duration of the projection period.

In later years, results away from the 50<sup>th</sup> percentile become very spread out as the size of the reserve becomes large compared to the value of underlying active member account balances.



(\$millions)

PY Ending 12/31	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
95th	(208)	1,305	1,989	2,302	2,467	2,748	2,811	3,213	3,471	3,854	3,981	4,095	4,433	4,669	5,317	5,451	5,852	6,680	7,424	7,681
90th	(208)	914	1,542	1,673	1,750	1,881	2,038	2,406	2,518	2,639	2,674	2,808	3,120	3,457	3,515	3,756	4,158	4,569	4,995	5,352
75th	(208)	236	490	560	726	742	791	760	814	951	939	1,016	991	1,117	1,103	1,153	1,250	1,385	1,485	1,561
50th	(208)	(250)	(364)	(384)	(497)	(494)	(639)	(726)	(833)	(832)	(850)	(865)	(896)	(969)	(1,044)	(1,165)	(1,273)	(1,371)	(1,488)	(1,599)
25th	(208)	(854)	(1,113)	(1,385)	(1,554)	(1,680)	(1,824)	(1,959)	(2,068)	(2,218)	(2,389)	(2,534)	(2,686)	(2,939)	(3,200)	(3,482)	(3,827)	(4,141)	(4,569)	(4,944)
10th	(208)	(1,405)	(1,968)	(2,331)	(2,617)	(2,840)	(3,109)	(3,277)	(3,462)	(3,730)	(4,049)	(4,334)	(4,729)	(5,130)	(5,584)	(6,049)	(6,734)	(7,185)	(7,859)	(8,738)
5th	(208)	(1,757)	(2,559)	(2,965)	(3,327)	(3,439)	(3,629)	(3,819)	(4,066)	(4,429)	(4,772)	(5,200)	(5,692)	(6,272)	(6,855)	(7,596)	(8,474)	(9,181)	(10,309)	(10,762)
95th - 5th	0	3,062	4,548	5,267	5,793	6,187	6,440	7,032	7,536	8,283	8,753	9,295	10,124	10,941	12,173	13,047	14,326	15,861	17,733	18,443

Negative Rate Guarantee Reserves are reflected in our model via decreased asset levels and increased UAL rates. This effectively reduces the valuation assets in those years to reflect the presence of a deficit reserve.

## Baseline Financial Modeling

### Observations

- Base rate and net rates for 2013-2015, which will be based on 12/31/2011 valuation results, increase in over 75 percent of scenarios, despite good 2010 investment results
  - At the 50<sup>th</sup> percentile, the increase is just over 3% of payroll
  - Increases are due to the rate collar spreading the base rate impact of 2008 investment losses over more than one rate-setting period
- The spread in projected outcomes is greater for the net rates than for base rates, due to the additional volatility of side accounts
- At the 50<sup>th</sup> percentile, projected funded status does not begin to increase significantly until about ten years out
- For scenarios that deviate from assumption, system volatility is increasing as the system continues to mature
  - For the 12/31/2013 rate-setting valuation, more than 5% of scenarios show funded status (excluding side accounts) greater than 100% and more than 5% of scenarios show funded status (excluding side accounts) under 50%



# **Modeling Hypothetical Side Account Including Debt Service Costs**

# Modeling Hypothetical Side Account Including Debt Service Costs

## Introduction

- In our baseline financial modeling, net rates are lower than base rates due to the effect of side account rate offsets
  - The baseline modeling does not display the cost of debt service on pension obligation bonds (POBs) used to establish side accounts
    - POB debt payment schedules vary from employer to employer and are not collected as part of our valuation process
- In addition, since approximately 1/3<sup>rd</sup> of system payroll is for employers without side accounts the net rate volatility for side account employers is understated when it is blended at a system-wide level with the base/net rate volatility of non-side account employers
- To address these two issues and give side account employers a better understanding of the potential cost/benefit trade-offs and underlying volatility associated with side accounts, we extended our analysis by modeling a hypothetical single system-wide side account

# Modeling Hypothetical Side Account Including Debt Service Costs

## Structure of Hypothetical Side Account and POB

- *To address the two issues noted on slide 17 and make the analysis as useful as possible, the hypothetical side account was established in the following manner:*
  - The level of the side account was “scaled up” so that at a system-wide level the side account exposure would parallel the current exposure of the average employer that presently has a side account
    - It produces an \$8.3 billion hypothetical side account at 12/31/2010
      - For comparison, actual system side accounts at 12/31/2010 were \$5.6 billion
  - The side account level so modeled will allow system-wide results to be more consistent with expectations for current side account employers

# Modeling Hypothetical Side Account Including Debt Service Costs

## Structure of Hypothetical Side Account and POB

- *To address the two issues noted on slide 17 and make the analysis as useful as possible, the hypothetical side account was established in the following manner:*
  - A pension obligation bond (POB) debt service payment schedule was created for the hypothetical side account and incorporated into the employer cost model
    - The schedule was made assuming a borrowing rate of 5.75% per year and payments as a level percentage of payroll from POB issue date to 2027 assuming 3.75% annual payroll growth
      - While actual side account schedules and borrowing rates vary from employer to employer, we feel the hypothetical schedule provides an approximate guide to total cost dynamics for a side account employer
  - By incorporating POB debt service into the modeling, the overall cost of the side account/POB combination can be shown

# Modeling Hypothetical Side Account Including Debt Service Costs

## Decision-Making Process Regarding Establishment of Side Accounts

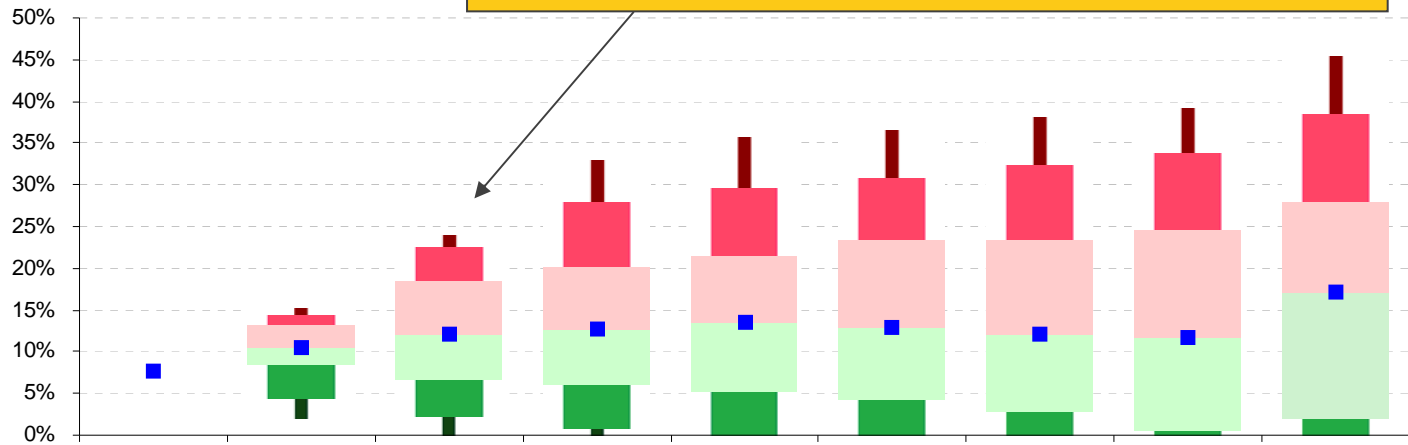
- The decision to issue a POB and establish a side account is an investment decision made individually by sponsoring employers, and one that includes significant risk
  - These decisions are made based on each employer's governance structure and in consultation with the employer's own advisors
  - By modeling such a situation, we are not counseling for or against the establishment of side accounts in general or any POB structure in particular
  - Our sole intent is to illustrate dynamics of choices that many employers have already made or may make in the future to help employers understand the possible outcomes of establishing a side account, based on the underlying assumptions in our financial model

# Modeling Hypothetical Side Account Including Debt Service Costs

## Combined (Tier 1/Tier 2, OPSRP) Net\* Contribution Rate

At the scaled up level of the hypothetical side account, a higher portion of the base rate is paid by side account rate offsets, which reduces the net rate shown. The 50<sup>th</sup> percentile net rates top out at 13.6% of payroll during the POB repayment period.

Rate volatility is significant in “deviation from assumption” scenarios. In over 10% of scenarios 2015-2017 net rates are less than 3% of payroll. Alternatively 2015-2017 net rates are greater than 22% of payroll in over 10% of scenarios.



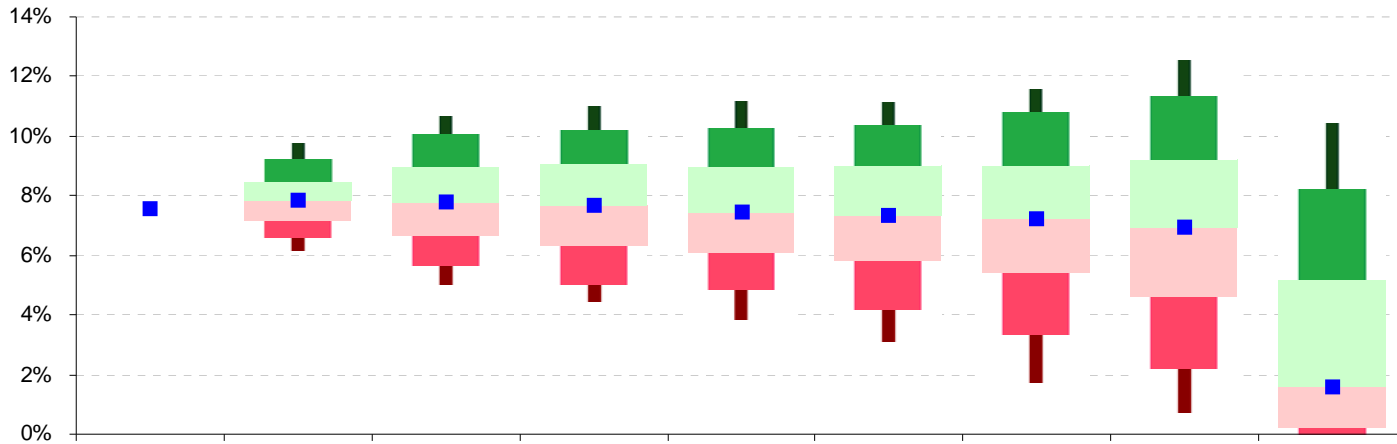
Biennium	2011 - 2013	2013 - 2015	2015 - 2017	2017 - 2019	2019 - 2021	2021 - 2023	2023 - 2025	2025 - 2027	2027 - 2029
5th	7.6%	15.0%	23.9%	32.8%	35.6%	36.6%	38.1%	39.2%	45.3%
10th	7.6%	14.5%	22.6%	28.0%	29.6%	30.9%	32.5%	33.9%	38.5%
25th	7.6%	13.4%	18.6%	20.2%	21.6%	23.3%	23.4%	24.7%	28.0%
50th	7.6%	10.5%	12.1%	12.7%	13.6%	12.8%	12.1%	11.6%	17.1%
75th	7.6%	8.5%	6.6%	6.1%	5.2%	4.3%	2.8%	0.7%	2.1%
90th	7.6%	4.5%	2.3%	0.8%	0.0%	0.0%	0.0%	0.0%	0.0%
95th	7.6%	2.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
5th - 95th	0.0%	13.0%	23.9%	32.8%	35.6%	36.6%	38.1%	39.2%	45.3%

\* Net rate excluding retiree healthcare component

# Modeling Hypothetical Side Account Including Debt Service Costs

## Projected Side Account Rate Offset

At the scaled up level of the hypothetical side account, the side account initially provides 7.6% of rate offset, with the offset level in future periods dependent on investment results and inflation-linked payroll growth levels. At the 50<sup>th</sup> percentile, the side account provides 7.0% to 7.9% of rate offset.

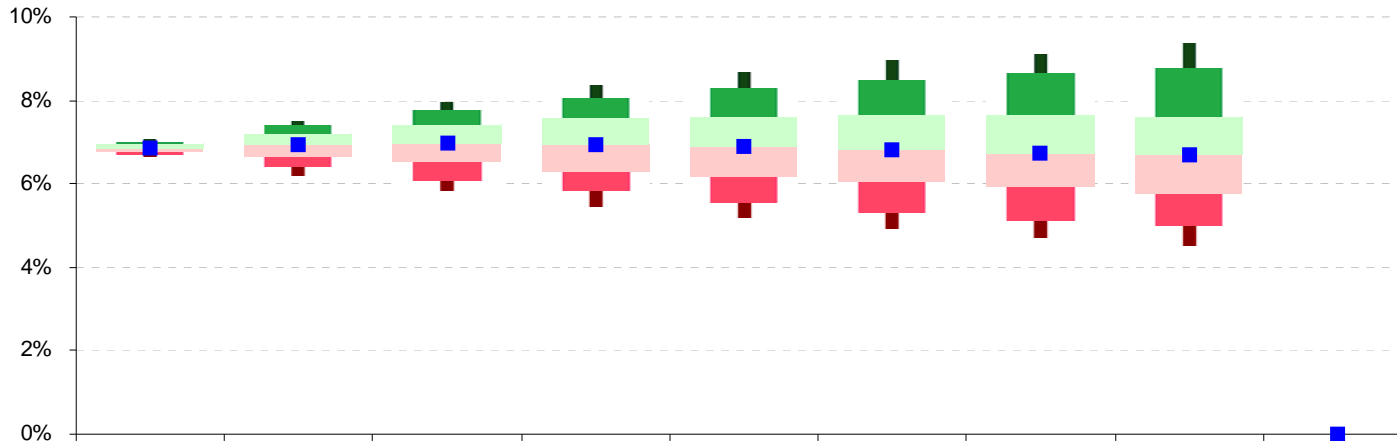


Biennium	2011 - 2013	2013 - 2015	2015 - 2017	2017 - 2019	2019 - 2021	2021 - 2023	2023 - 2025	2025 - 2027	2027 - 2029
95th	7.6%	9.8%	10.7%	11.0%	11.2%	11.1%	11.6%	12.6%	10.5%
90th	7.6%	9.2%	10.1%	10.2%	10.2%	10.4%	10.8%	11.3%	8.2%
75th	7.6%	8.5%	9.0%	9.1%	9.0%	9.0%	9.0%	9.2%	5.2%
50th	7.6%	7.9%	7.8%	7.7%	7.5%	7.3%	7.2%	7.0%	1.6%
25th	7.6%	7.2%	6.7%	6.3%	6.1%	5.8%	5.4%	4.6%	0.3%
10th	7.6%	6.6%	5.7%	5.0%	4.9%	4.2%	3.3%	2.2%	0.0%
5th	7.6%	6.2%	5.0%	4.4%	3.9%	3.1%	1.7%	0.7%	0.0%
95th - 5th	0.0%	3.6%	5.6%	6.6%	7.3%	8.0%	9.8%	11.8%	10.5%

# Modeling Hypothetical Side Account Including Debt Service Costs

## Projected Pension Obligation Bond (POB) Repayment

The POB repayment schedule is established as annual fixed-dollar amounts. In future periods, the repayment level as a percentage of payroll depends on inflation-linked payroll growth levels. At the 50<sup>th</sup> percentile, the repayment is 6.7% to 7.0% of annual pay.



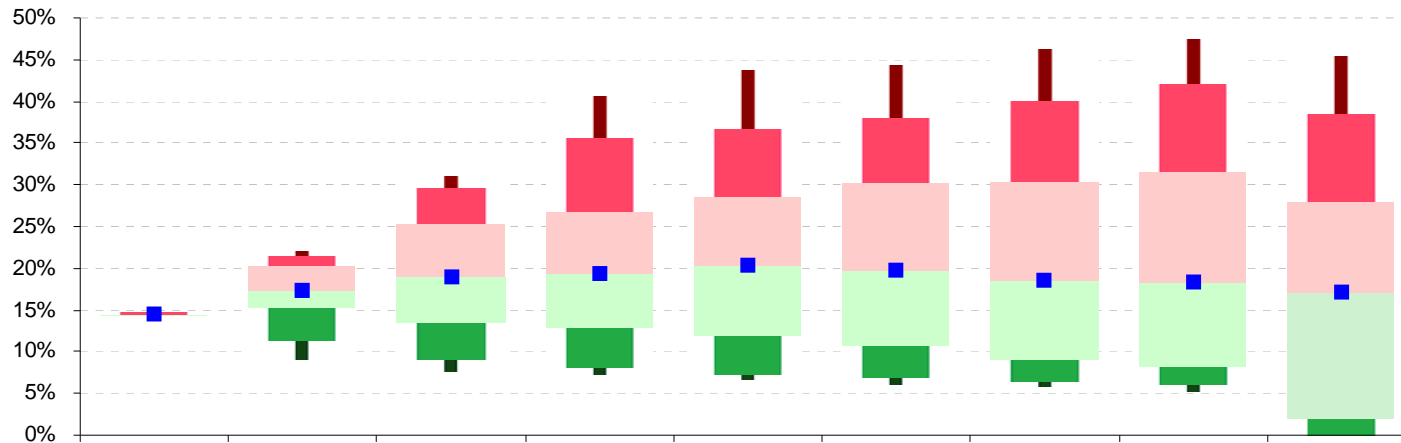
Biennium	2011 - 2013	2013 - 2015	2015 - 2017	2017 - 2019	2019 - 2021	2021 - 2023	2023 - 2025	2025 - 2027	2027 - 2029
95th	7.1%	7.5%	8.0%	8.3%	8.7%	9.0%	9.1%	9.3%	0.0%
90th	7.0%	7.4%	7.8%	8.1%	8.3%	8.5%	8.7%	8.8%	0.0%
75th	7.0%	7.2%	7.4%	7.6%	7.6%	7.7%	7.7%	7.6%	0.0%
50th	6.9%	6.9%	7.0%	7.0%	6.9%	6.8%	6.7%	6.7%	0.0%
25th	6.8%	6.7%	6.5%	6.3%	6.2%	6.0%	5.9%	5.7%	0.0%
10th	6.7%	6.4%	6.1%	5.9%	5.6%	5.3%	5.1%	5.0%	0.0%
5th	6.6%	6.2%	5.8%	5.4%	5.2%	4.9%	4.7%	4.5%	0.0%
95th - 5th	0.4%	1.3%	2.1%	2.9%	3.5%	4.1%	4.4%	4.8%	0.0%



# Modeling Hypothetical Side Account Including Debt Service Costs

## Net\* Rate + Pension Obligation Bond Repayment

Combining the net rate with the POB repayment schedule is an estimate of overall cost for employers with POBs



Biennium	2011 - 2013	2013 - 2015	2015 - 2017	2017 - 2019	2019 - 2021	2021 - 2023	2023 - 2025	2025 - 2027	2027 - 2029
5th	14.7%	22.0%	31.1%	40.4%	43.7%	44.4%	46.1%	47.4%	45.3%
10th	14.6%	21.6%	29.7%	35.7%	36.8%	38.2%	40.1%	42.2%	38.5%
25th	14.6%	20.3%	25.5%	26.9%	28.6%	30.3%	30.4%	31.6%	28.0%
50th	14.5%	17.3%	18.9%	19.4%	20.4%	19.7%	18.6%	18.3%	17.1%
75th	14.4%	15.4%	13.4%	12.8%	11.8%	10.8%	9.1%	8.2%	2.1%
90th	14.3%	11.3%	9.2%	8.1%	7.3%	6.9%	6.5%	6.0%	0.0%
95th	14.2%	9.1%	7.6%	7.2%	6.6%	6.0%	5.8%	5.3%	0.0%
5th - 95th	0.4%	13.0%	23.5%	33.3%	37.0%	38.4%	40.3%	42.1%	45.3%

\* Net rate excluding retiree healthcare component

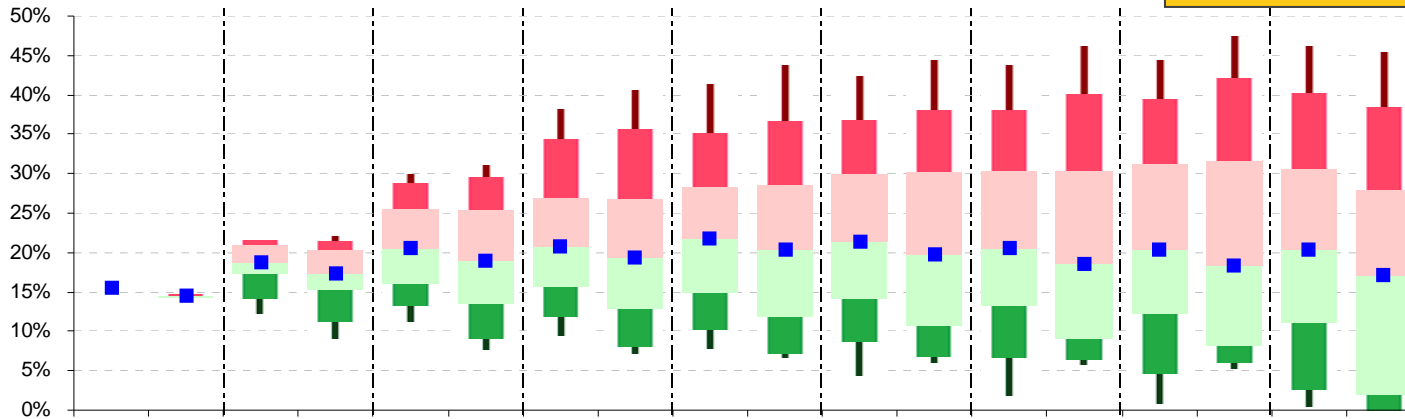
# Modeling Hypothetical Side Account Including Debt Service Costs

Compare Base\* Rate vs. Net\* Rate + Pension Obligation Bond Repayment

This slide compares the “net rate plus POB” cost for the hypothetical bond to the “base rate” cost of no side account and no POB

At the 50<sup>th</sup> and 75<sup>th</sup> percentiles, establishing a side account is forecast to save money as assumptions are met or exceeded

In the 5<sup>th</sup> and 10<sup>th</sup> percentiles, where assumptions are not met, establishing a side account is more expensive as side account assets lose value



For most scenarios, and especially poor outlier scenarios, the effect of the side account is to increase rate volatility

Biennium	2011 - 2013		2013 - 2015		2015 - 2017		2017 - 2019		2019 - 2021		2021 - 2023		2023 - 2025		2025 - 2027		2027 - 2029	
	Base	Net+ POB	Base	Net+ POB	Base	Net+ POB	Base	Net+ POB	Base	Net+ POB	Base	Net+ POB	Base	Net+ POB	Base	Net+ POB	Base	Net+ POB
5th	15.6%	14.7%	21.6%	22.0%	29.9%	31.1%	38.1%	40.4%	41.3%	43.7%	42.4%	44.4%	43.8%	46.1%	44.3%	47.4%	46.2%	45.3%
10th	15.6%	14.6%	21.6%	21.6%	28.9%	29.7%	34.4%	35.7%	35.3%	36.8%	37.0%	38.2%	38.2%	40.1%	39.6%	42.2%	40.4%	38.5%
25th	15.6%	14.6%	21.0%	20.3%	25.6%	25.5%	27.0%	26.9%	28.5%	28.6%	30.0%	30.3%	30.3%	30.4%	31.2%	31.6%	30.7%	28.0%
50th	15.6%	14.5%	18.7%	17.3%	20.5%	18.9%	20.7%	19.4%	21.8%	20.4%	21.3%	19.7%	20.6%	18.6%	20.3%	18.3%	20.4%	17.1%
75th	15.6%	14.4%	17.4%	15.4%	16.0%	13.4%	15.8%	12.8%	14.9%	11.8%	14.2%	10.8%	13.3%	9.1%	12.3%	8.2%	11.0%	2.1%
90th	15.6%	14.3%	14.2%	11.3%	13.2%	9.2%	11.9%	8.1%	10.2%	7.3%	8.7%	6.9%	6.6%	6.5%	4.7%	6.0%	2.7%	0.0%
95th	15.6%	14.2%	12.3%	9.1%	11.3%	7.6%	9.6%	7.2%	7.8%	6.6%	4.5%	6.0%	1.8%	5.8%	0.9%	5.3%	0.5%	0.0%
5th - 95th	0.0%	0.4%	9.3%	13.0%	18.6%	23.5%	28.5%	33.3%	33.5%	37.0%	37.9%	38.4%	41.9%	40.3%	43.5%	42.1%	45.7%	45.3%

\* Base rates and net rates excluding retiree healthcare component

# Modeling Hypothetical Side Account Including Debt Service Costs

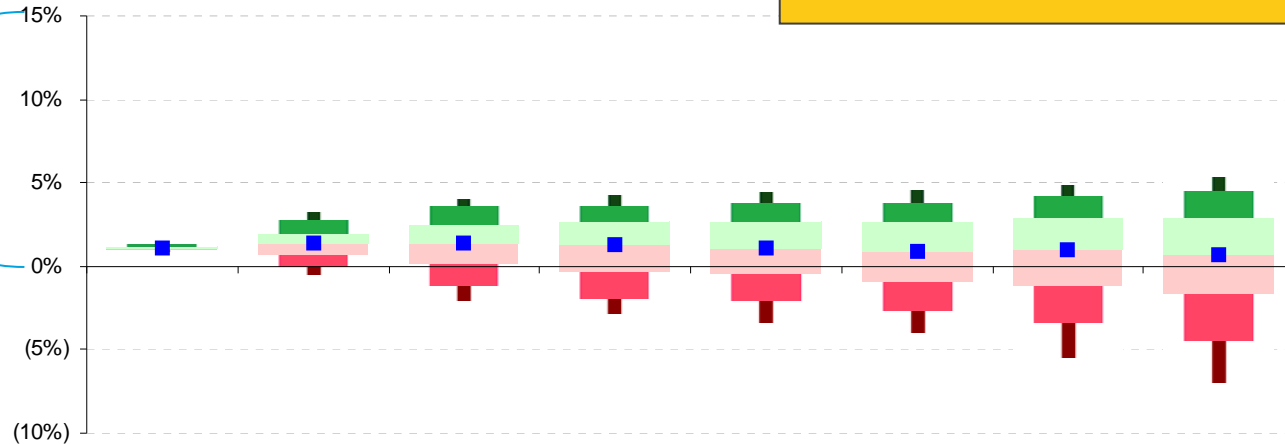
## Win/Lose Chart: Base Rate – (Net Rate + Pension Obligation Bond Repayment)

For each contribution period modeled, this slide indicates the difference between the “no side account” and “side account” costs

In the majority of scenarios, the net rate plus POB cost is less than the base rate

The asymmetrical risk profile (downside risk is greater than upside reward) is due to very good scenarios with base rates low enough that the maximum rate offset is limited

Net Rate +POB payments lower than Base Rates



Biennium	2011 - 2013	2013 - 2015	2015 - 2017	2017 - 2019	2019 - 2021	2021 - 2023	2023 - 2025	2025 - 2027
95th	1.3%	3.2%	4.0%	4.2%	4.4%	4.5%	4.8%	5.3%
90th	1.3%	2.8%	3.6%	3.7%	3.8%	3.9%	4.2%	4.5%
75th	1.2%	2.0%	2.5%	2.7%	2.7%	2.7%	2.9%	3.0%
50th	1.1%	1.4%	1.4%	1.3%	1.1%	0.9%	1.0%	0.7%
25th	1.0%	0.7%	0.2%	(0.3%)	(0.4%)	(0.9%)	(1.1%)	(1.6%)
10th	1.0%	(0.0%)	(1.1%)	(1.9%)	(2.1%)	(2.7%)	(3.4%)	(4.5%)
5th	0.9%	(0.5%)	(2.1%)	(2.9%)	(3.4%)	(4.0%)	(5.4%)	(7.0%)
95th - 5th	0.4%	3.7%	6.1%	7.1%	7.8%	8.5%	10.2%	12.3%

## Modeling Hypothetical Side Account Including Debt Service Costs Observations

- Despite establishing a fixed schedule to pay a variable cost, creating a side account does not appear to trade “variable for fixed”
  - Instead, due to bond proceeds being invested in the trust, rate volatility increases when a side account is created
- In the majority of scenarios modeled, overall costs decrease when a side account is established
  - Lower cost scenarios occur when investments meet or exceed assumption
- In scenarios where investment results are the most poor, costs increase as an outcome of establishing a side account
- Payment schedules or borrowing terms that differ significantly from the hypothetical POB could significantly affect analysis
  - For example, a “back loaded” debt payment schedule may lead to early savings followed by likely higher costs in later years

# Effect of Early-Year Returns on Cost Analysis

# Effect of Early Year Returns on Cost Analysis

## Introduction

- The prior section indicated that in over 50% of the scenarios the “side account plus pension obligation bond (POB)” approach had lower costs than the “pay the base rate” approach
  - This is unsurprising given the hypothetical POB’s cost structure and the model’s expected investment return level on side accounts
    - The hypothetical POB’s fixed rate interest cost is 5.75% per year
    - The side account’s 50<sup>th</sup> percentile geometric average annualized investment return is 8.1% for 2011 to 2027
- It would seem that if:
  - The side account’s average investment return over the POB’s debt payment period exceeds
  - The POB’s interest rate, then
  - The “side account plus POB” approach will have lower costs
    - *This is not always the case, however*

## Effect of Early Year Returns on Cost Analysis

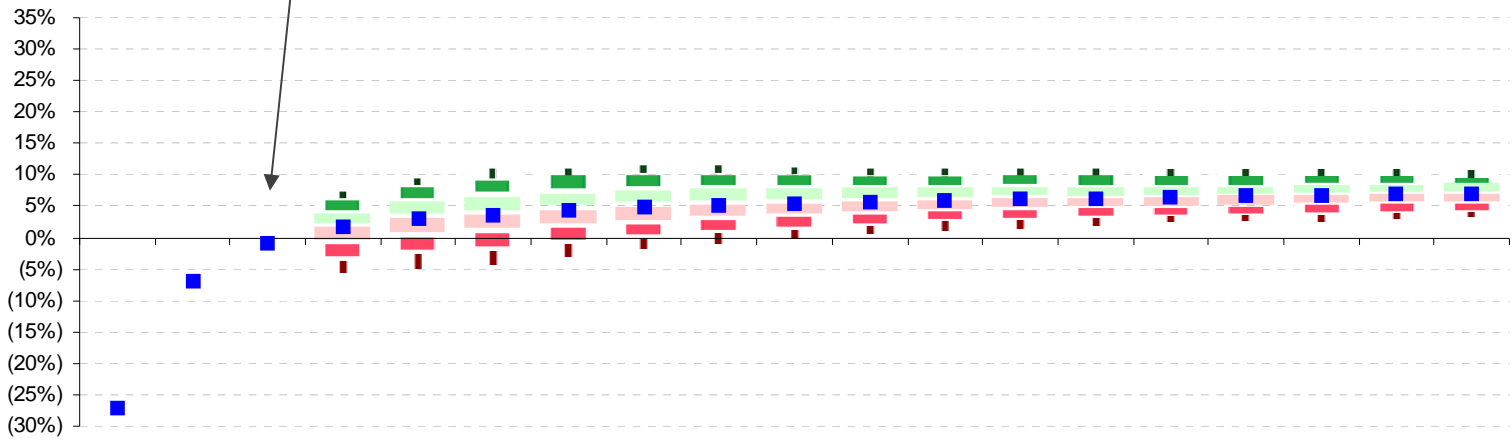
### Hypothetical Bond Model

- One reason for this is that early year side account investment returns carry greater weight than later year returns
  - Even if the side account's average investment return exceeds the bond's cost rate over the debt payment period, the “side account plus POB” approach can be more costly if early returns are poor
- To illustrate this phenomenon, we modeled the effect on the hypothetical bond from the prior section of side accounts underperforming compared to assumption during the initial three years of the bond (2011-2013)
  - We used asset returns approximately equal to those experienced by the PERS regular account for the period 2008-2010
    - The cumulative three year return of -2.5% during that period is between a 10<sup>th</sup> and 25<sup>th</sup> percentile event in our financial model

# Effect of Early Year Returns on Cost Analysis

## Assumed Regular Account Asset Returns – Geometric Average

The initial three years have a cumulative return of -2.5% and an average annualized return of -0.8%



For PYE 12/31	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
95th	(27.2%)	(6.9%)	(0.8%)	7.2%	9.4%	10.8%	11.0%	11.4%	11.4%	11.3%	10.8%	10.9%	11.0%	10.9%	10.8%	11.0%	10.8%	10.8%	10.7%
90th	(27.2%)	(6.9%)	(0.8%)	5.9%	7.9%	9.0%	9.7%	9.8%	9.7%	9.9%	9.7%	9.7%	9.8%	9.8%	9.8%	9.9%	9.8%	9.8%	9.7%
75th	(27.2%)	(6.9%)	(0.8%)	3.8%	5.6%	6.4%	7.0%	7.5%	7.6%	7.7%	7.9%	8.0%	7.9%	7.9%	8.0%	8.1%	8.3%	8.3%	8.4%
50th	(27.2%)	(6.9%)	(0.8%)	1.6%	3.0%	3.5%	4.2%	4.8%	5.1%	5.4%	5.7%	6.0%	6.1%	6.2%	6.4%	6.6%	6.8%	6.9%	6.9%
25th	(27.2%)	(6.9%)	(0.8%)	(1.2%)	(0.2%)	0.7%	1.6%	1.9%	2.7%	3.3%	3.7%	4.0%	4.3%	4.6%	4.7%	4.9%	5.0%	5.3%	5.4%
10th	(27.2%)	(6.9%)	(0.8%)	(3.9%)	(2.7%)	(2.2%)	(1.2%)	(0.1%)	0.6%	1.2%	1.7%	2.4%	2.7%	3.1%	3.2%	3.4%	3.6%	3.9%	4.2%
5th	(27.2%)	(6.9%)	(0.8%)	(5.6%)	(4.9%)	(4.2%)	(2.9%)	(1.7%)	(0.8%)	(0.1%)	0.5%	1.1%	1.5%	2.0%	2.4%	2.8%	2.6%	3.0%	3.2%
95th - 5th	0.0%	0.0%	0.0%	12.8%	14.3%	15.0%	13.9%	13.1%	12.3%	11.4%	10.2%	9.8%	9.5%	8.9%	8.3%	8.2%	8.2%	7.8%	7.6%

With the initial three years of side account returns set to parallel 2008-2010 returns, the average annualized investment return for the 2011-2027 debt repayment period is 6.8% at the 50<sup>th</sup> percentile, which is in excess of the 5.75% bond interest rate



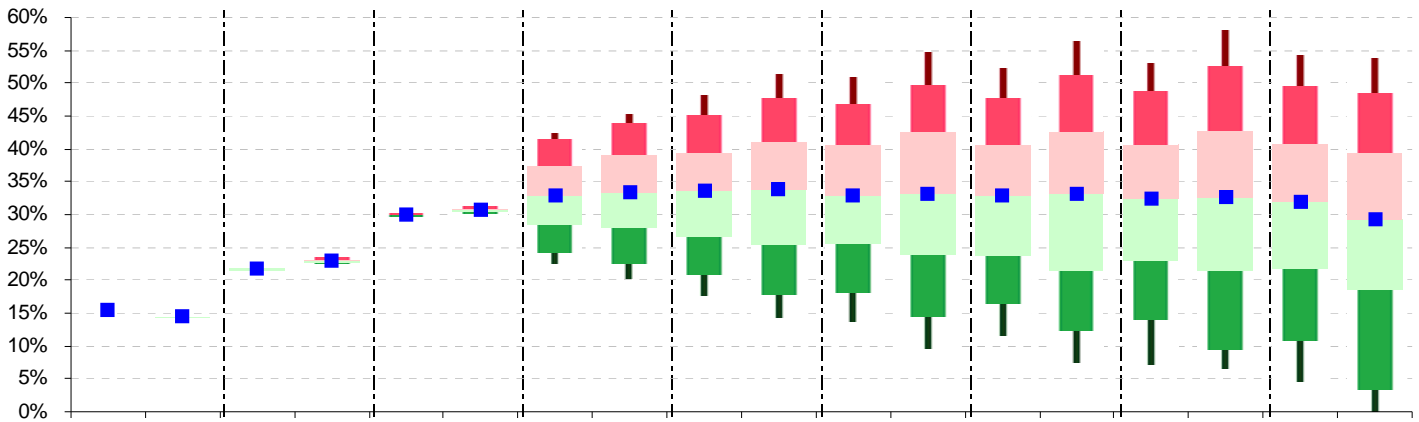
# Effect of Early Year Returns on Cost Analysis

Compare Base\* Rate vs. Net\* Rate + Pension Obligation Bond Repayment

Base rates shown here are higher than shown in prior sections because this scenario assumes a large asset loss in 2011

This slide compares the “net rate plus POB” cost for the hypothetical bond to the “base rate” cost of no side account and no POB

If the early side account returns are poor, the “net rate plus POB” cost is higher in the majority of scenarios



For most scenarios, and especially poor outlier scenarios, the effect of the side account is to increase rate volatility

Biennium	2011 - 2013		2013 - 2015		2015 - 2017		2017 - 2019		2019 - 2021		2021 - 2023		2023 - 2025		2025 - 2027		2027 - 2029	
	Base	Net+POB	Base	Net+POB	Base	Net+POB	Base	Net+POB	Base	Net+POB	Base	Net+POB	Base	Net+POB	Base	Net+POB	Base	Net+POB
5th	15.6%	14.7%	21.7%	23.5%	30.3%	31.2%	42.3%	45.3%	48.0%	51.3%	50.7%	54.6%	52.2%	56.5%	53.0%	58.2%	54.2%	53.6%
10th	15.6%	14.6%	21.7%	23.4%	30.2%	31.1%	41.7%	44.0%	45.2%	48.0%	46.8%	49.8%	47.9%	51.2%	48.9%	52.7%	49.7%	48.6%
25th	15.6%	14.6%	21.7%	23.2%	30.1%	31.0%	37.6%	39.1%	39.5%	41.2%	40.6%	42.7%	40.7%	42.6%	40.6%	42.9%	40.8%	39.6%
50th	15.6%	14.5%	21.7%	23.1%	30.0%	30.8%	32.8%	33.4%	33.5%	34.0%	32.9%	33.2%	33.0%	33.1%	32.5%	32.6%	31.9%	29.2%
75th	15.6%	14.4%	21.6%	22.8%	29.9%	30.6%	28.6%	28.1%	26.7%	25.4%	25.7%	24.0%	23.6%	21.4%	23.0%	21.6%	21.9%	18.7%
90th	15.6%	14.3%	21.6%	22.6%	29.8%	30.3%	24.1%	22.6%	20.8%	17.9%	18.2%	14.5%	16.4%	12.4%	14.0%	9.4%	11.0%	3.4%
95th	15.6%	14.2%	21.6%	22.5%	29.8%	30.1%	22.5%	20.4%	17.7%	14.2%	13.8%	9.7%	11.6%	7.6%	7.3%	6.4%	4.6%	0.0%
5th - 95th	0.0%	0.4%	0.1%	1.0%	0.5%	1.1%	19.8%	24.9%	30.4%	37.1%	36.9%	44.9%	40.7%	48.9%	45.8%	51.7%	49.6%	53.6%

\* Base rates and net rates excluding retiree healthcare component

# Effect of Early Year Returns on Cost Analysis

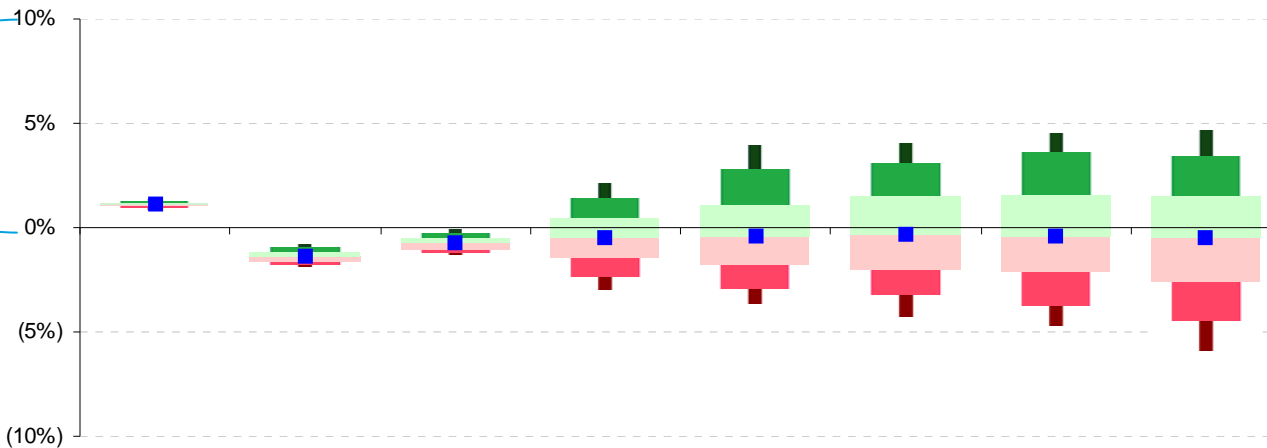
## Win/Lose Chart: Base Rate – (Net Rate + Pension Obligation Bond Repayment)

For each contribution period modeled, this slide indicates the difference between the “no side account” and “side account” costs

If investment returns are poor in the initial years, the “side account plus bond” approach is more expensive for 2013-2017 for all scenarios depicted on the chart

For 2017-2027, the “side account plus bond” approach is more expensive in over half of the scenarios, even though the 50<sup>th</sup> percentile investment return for 2011-2027 of 6.8% exceeds the 5.75% bond interest rate by over 1%

Net Rate + POB payments lower than Base Rates



Biennium	2011 - 2013	2013 - 2015	2015 - 2017	2017 - 2019	2019 - 2021	2021 - 2023	2023 - 2025	2025 - 2027
95th	1.3%	(0.8%)	(0.1%)	2.1%	3.9%	4.0%	4.5%	4.7%
90th	1.3%	(0.9%)	(0.3%)	1.4%	2.8%	3.2%	3.6%	3.5%
75th	1.2%	(1.1%)	(0.5%)	0.5%	1.2%	1.6%	1.6%	1.5%
50th	1.1%	(1.4%)	(0.8%)	(0.5%)	(0.4%)	(0.3%)	(0.4%)	(0.5%)
25th	1.0%	(1.6%)	(1.0%)	(1.4%)	(1.8%)	(2.0%)	(2.1%)	(2.6%)
10th	1.0%	(1.8%)	(1.2%)	(2.4%)	(2.9%)	(3.2%)	(3.7%)	(4.4%)
5th	0.9%	(1.8%)	(1.3%)	(3.0%)	(3.6%)	(4.3%)	(4.7%)	(5.9%)
95th - 5th	0.4%	1.1%	1.2%	5.1%	7.5%	8.3%	9.2%	10.5%

# Effect of Early Year Returns on Cost Analysis

## Observations

- Even if side account investment earnings average in excess of the bond interest rate, it is possible for the side account approach to be more expensive
  - This can occur if early year investment returns are poor
  - Because the side account is depleted steadily over time via rate offset transfers, strong later year returns may not be able to restore the side account approach to a net cost savings position
- The early year returns of side accounts determine the long-term win/lose profile of a side account
  - In essence, if market conditions deviate significantly from the assumption in early years the long-term win/lose prospects may become firmly established

## Wrap-Up/Forward Looking Calendar

- Questions or comments on today's presentation?
- Upcoming actuarial calendar
  - May Board meeting
    - Review of economic assumptions and actuarial methods
  - July Board meeting
    - Review of demographic assumptions
    - Board approval of all assumptions and methods
  - September Board meeting
    - Presentation of summary 12/31/2010 actuarial valuation results

# Appendix

# Appendix

## Important Notices

Mercer has prepared this report exclusively for the Oregon PERS Board; Mercer is not responsible for reliance upon this report by any other party. The only purposes of this report are to present Mercer's actuarial estimates of the system's contributions rates and funded status under a limited set of assumptions. This report may not be used for any other purpose; Mercer is not responsible for the consequences of any unauthorized use.

Decisions about benefit changes, granting new benefits, investment policy, funding policy, benefit security and/or benefit-related issues should not be made on the basis of this report, but only after careful consideration of alternative economic, financial, demographic and societal factors, including financial scenarios that assume future sustained investment losses.

The Oregon Investment Council (OIC) is solely responsible for selecting the plan's investment policies, asset allocations and individual investments of the Oregon PERS program. Mercer's actuaries have not provided any investment advice to Oregon PERS or OIC.

A valuation report is only a snapshot of a Plan's estimated financial condition at a particular point in time; it does not predict the Plan's future financial condition or its ability to pay benefits in the future and does not provide any guarantee of future financial soundness of the Plan. Over time, a plan's total cost will depend on a number of factors, including the amount of benefits the plan pays, the number of people paid benefits, the period of time over which benefits are paid, plan expenses and the amount earned on any assets invested to pay benefits. These amounts and other variables are uncertain and unknowable at the valuation date

Because modeling all aspects of a situation is not possible or practical, we may use summary information, estimates, or simplifications of calculations to facilitate the modeling of future events in an efficient and cost-effective manner. We may also exclude factors or data that are immaterial in our judgment. Use of such simplifying techniques does not, in our judgment, affect the reasonableness of valuation results for the plan.

To prepare the valuation report, actuarial assumptions, as described in the actuarial valuation report as of December 31, 2009, for Oregon PERS are used in a forward looking financial and demographic model to select a single scenario from a wide range of possibilities; the results based on that single scenario are included in the valuation. The future is uncertain and the plan's actual experience will differ from those assumptions; these differences may be significant or material because these results are very sensitive to the assumptions made and, in some cases, to the interaction between the assumptions.

# Appendix

## Important Notices

Different assumptions or scenarios within the range of possibilities may also be reasonable and results based on those assumptions would be different. As a result of the uncertainty inherent in a forward looking projection over a very long period of time, no one projection is uniquely “correct” and many alternative projections of the future could also be regarded as reasonable. Two different actuaries could, quite reasonably, arrive at different results based on the same data and different views of the future. A "sensitivity analysis" shows the degree to which results would be different if you substitute alternative assumptions within the range of possibilities for those utilized in this report. This report displays a limited-scope sensitivity analysis of alternate possible economic scenarios only, as detailed in this report. At Oregon PERS request, Mercer is available to perform additional sensitivity analyses.

Actuarial assumptions may also be changed from one valuation to the next because of changes in mandated requirements, plan experience, changes in expectations about the future and other factors. A change in assumptions is not an indication that prior assumptions were unreasonable when made.

The calculation of actuarial liabilities for valuation purposes is based on a current estimate of future benefit payments. The calculation includes a computation of the "present value" of those estimated future benefit payments using an assumed discount rate; the higher the discount rate assumption, the lower the estimated liability will be. For purposes of estimating the liabilities (future and accrued) in this report, Oregon PERS selected an assumption based on the expected long term rate of return on plan investments. Using a lower discount rate assumption, such as a rate based on long-term bond yields, could substantially increase the estimated present value of future and accrued liabilities.

Because valuations are a snapshot in time and are based on estimates and assumptions that are not precise and will differ from actual experience, contribution calculations are inherently imprecise. There is no uniquely “correct” level of contributions for the coming plan year.

Valuations do not affect the ultimate cost of the Plan. Plan funding occurs over time. Contributions not made this year, for whatever reason, including errors, remain the responsibility of the Plan sponsor and can be made in later years. If the contribution levels over a period of years are lower or higher than necessary, it is normal and expected practice for adjustments to be made to future contribution levels to take account of this with a view to funding the plan over time.

# Appendix

## Important Notices

Data, computer coding and mathematical errors are possible in the preparation of a valuation involving complex computer programming and thousands of calculations and data inputs. Errors in a valuation discovered after its preparation may be corrected by amendment to the valuation or in a subsequent year's valuation.

To prepare this report, Mercer has used and relied on member and financial data submitted by the Oregon Public Employees Retirement System as summarized in the December 31, 2009 actuarial valuation report and on investment return information as published by Oregon PERS and Oregon Investment Council (OIC). Oregon PERS is responsible for ensuring that such participant data provides an accurate description of all persons who are participants under the terms of the plan or otherwise entitled to benefits as of December 31, 2009, that is sufficiently comprehensive and accurate for the purposes of this report. Although Mercer has reviewed the data in accordance with Actuarial Standards of Practice No. 23, Mercer has not verified or audited any of the data or information provided.

Mercer has also used and relied on the plan provisions described in Oregon Revised Statutes Sections 238 and 238A and legislative amendments supplied by Oregon PERS. A summary of the plan provisions valued is presented in our report. Oregon PERS is solely responsible for the accuracy, validity and comprehensiveness of this information. If the data or plan provisions supplied are not accurate and complete the valuation results may differ significantly from the results that would be obtained with accurate and complete information; this may require a later revision of this report. Moreover, plan documents may be susceptible to different interpretations, each of which could be reasonable, and that the different interpretations could lead to different valuation results.

Assumptions used are based on the last experience study, as adopted by the Board on July 16, 2009. The Board is responsible for selecting the plan's funding policy, actuarial valuation methods, asset valuation methods and assumptions. This valuation is based on assumptions, plan provisions, methods and other parameters so prescribed and as summarized in this report. Oregon PERS is solely responsible for communicating to Mercer any changes required thereto.



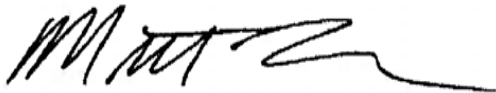
# Appendix

## Important Notices

### Professional Qualifications

We are available to answer any questions on the material in this report or to provide explanations or further details as appropriate. The undersigned credentialed actuaries meet the Qualification Standards of the American Academy of Actuaries to render the actuarial opinion contained in this report. We are not aware of any direct or material indirect financial interest or relationship, including investments or other services that could create a conflict of interest, that would impair the objectivity of our work.

We are available to answer any questions on the material contained in the report, or to provide explanations or further details as may be appropriate.



March 28, 2011

Matthew R. Larrabee, FSA, EA, MAAA  
Enrolled Actuary No. 08-6154

Date

Mercer (US), Inc.  
111 SW Columbia Street, Suite 500  
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503 273 5900



March 28, 2011

Scott D. Preppernau, FSA, EA, MAAA  
Enrolled Actuary No. 08-7360

Date

***The information contained in this document is not intended by Mercer to be used, and it cannot be used, for the purpose of avoiding penalties under the Internal Revenue Code that may be imposed on the taxpayer.***

# Appendix

## Actuarial Basis

### Data

We have based our projection of the liabilities on the data, methods, assumptions and plan provisions described in the December 31, 2009, Actuarial Valuation (“2009 Valuation Report”) for the Oregon Public Employees Retirement System.

Assets as of December 31, 2010, were based on values provided by Oregon PERS reflecting the Board’s preliminary earnings crediting decisions for 2010.

We have assumed that the active participant data reflected in the valuation of the Plan remains stable over the projection period (i.e. – participants leaving employment are replaced by new hires in such a way that the total counts, average age, and average service remain stable from year to year). No new members are assumed to be eligible for Tier 1 and Tier 2 benefits; all new entrants are assumed to become members under the OPSRP benefit formula.

### Methods / Policies

Liabilities are based on the Projected Unit Credit method and are rolled forward according to the following rules:

**Normal cost:** Normal cost increases with assumed wage growth adjusted for wage experience, demographic experience and asset return experience (if applicable). Demographic experience follows assumptions described in the Valuation Report.

**Accrued liability:** Liabilities increase with normal cost and decrease with benefit payments. Results are adjusted for wage, demographic and asset experience (if applicable).

**Contribution Rates:** The projected contribution rates are calculated on each odd valuation date in accordance with methodologies described in the Valuation Report. Rates are applied 18 months after the determination date.

**Expenses:** OPSRP administration expenses are assumed to be equal to \$6.6M and are added to the OPSRP normal cost.

**Actuarial Value of Assets:** Equal to Market Value of Assets excluding Contingency and Tier 1 Rate Guarantee Reserves, when such reserves are individually greater than zero

# Appendix

## Actuarial Basis

### *Investment Policy*

General Accounts were assumed to be invested as follows: 46% Global Equity; 11% Real Estate; 16% Private Equity; 27% Fixed Income, in accordance with the Oregon Investment Council “Statement of Investment Objectives and Policy Framework for the Oregon Public Employees Retirement Fund” dated December 1, 2010.

Variable Accounts were assumed to be invested in 100% Global Equity.

### *Assumptions*

In general, all assumptions are as described in the Valuation Report.

The major 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 — 8.00%
- General Accounts Growth — 8.00%
- Variable Account Growth — 8.50%
- Wage growth assumption — 3.75%
- Wage growth experience — inflation + 1.25%
- Demographic experience — reflects decrement assumptions as described in the Valuation Report.
- Actual Investment earnings are based on Mercer’s Capital Market Outlook reflecting actual market experience through January 1, 2011.

### *Reserve Projections*

Contingency Reserve as of 12/31/2010 was estimated to be \$734.4M. No future increases or decreases from this reserve were assumed.

Tier 1 Rate Guarantee Reserve (“T1RGR”) was estimated to be \$-207.8M as of 12/31/2010. The reserve was assumed to grow with returns in excess of 8% on Tier 1 Member Accounts plus T1RGR. When aggregate returns were below 8%, applicable amounts from the T1RGR were transferred to the Tier 1 Member Accounts to maintain the 8% target growth on the member accounts. The T1RGR reserve was allowed to go negative, but the reserve is not excluded from valuation assets when it is negative.

# Appendix

## Actuarial Basis

### Assumptions

Assumptions for valuation calculations are as described in the 2009 Valuation Report.

### Provisions

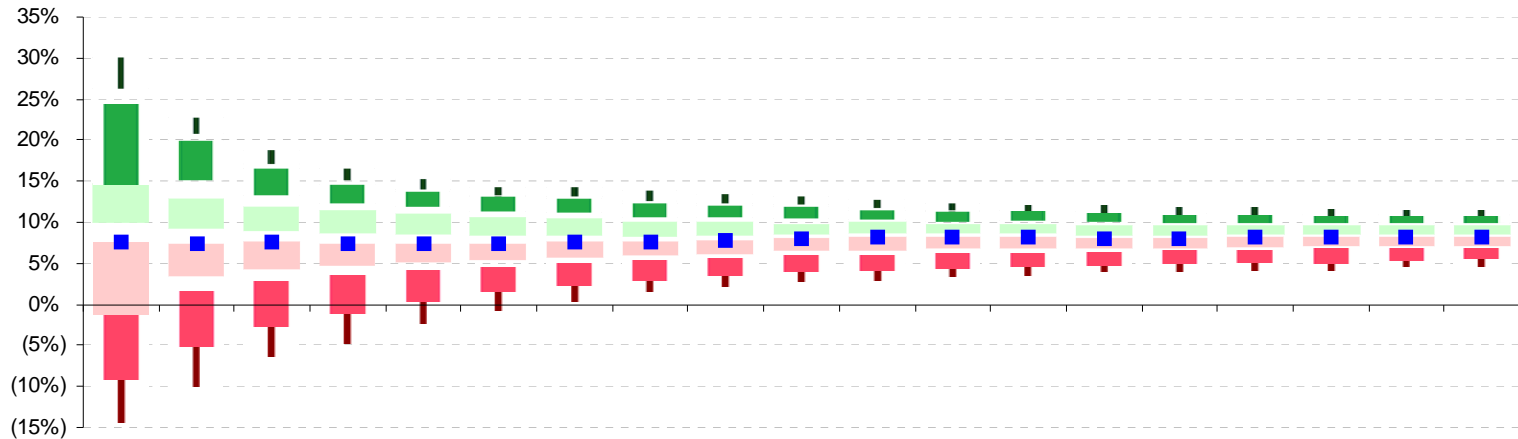
Provisions valued are as detailed in the 2009 Valuation Report.

### Arken and Robinson Litigation

We have made no adjustment to these valuation results to reflect any interpretation of Judge Kantor's rulings in the *Arken and Robinson* cases.

# Appendix

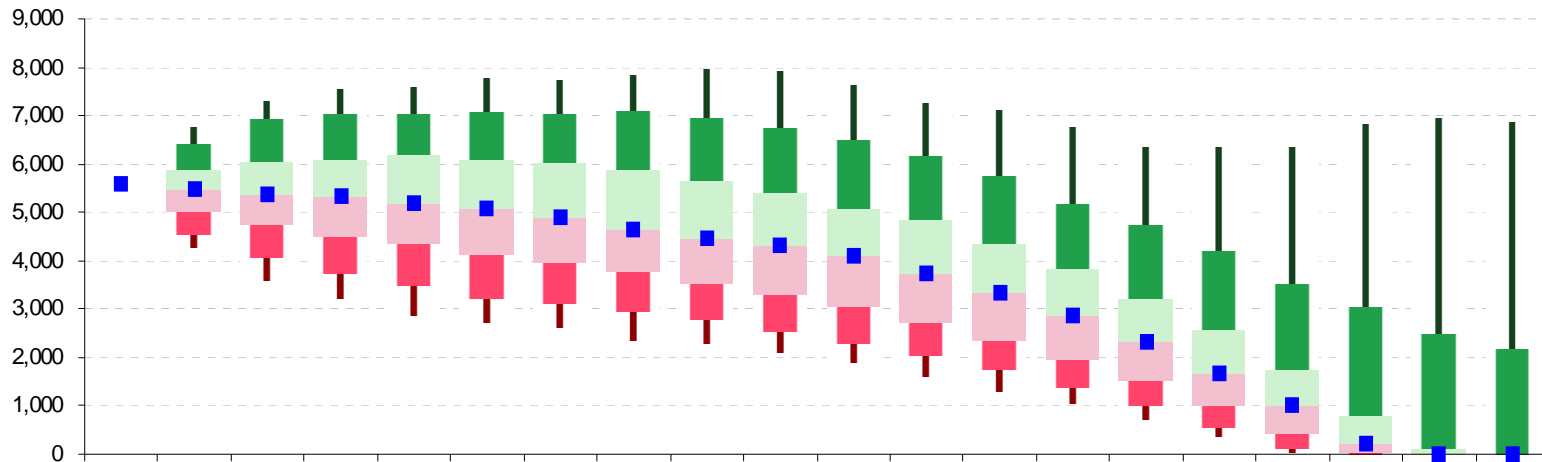
## Assumed Regular Account Asset Returns – Geometric Average



For PYE 12/31	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
95th	30.0%	22.8%	18.7%	16.5%	15.3%	14.3%	14.2%	13.8%	13.5%	13.0%	12.6%	12.2%	12.1%	12.0%	11.8%	11.8%	11.7%	11.5%	11.3%
90th	24.4%	19.9%	16.4%	14.4%	13.6%	13.0%	12.8%	12.3%	12.1%	11.7%	11.5%	11.3%	11.3%	11.2%	11.0%	10.9%	10.8%	10.8%	10.7%
75th	14.5%	12.9%	11.8%	11.3%	10.9%	10.6%	10.4%	10.1%	9.9%	9.8%	9.9%	9.8%	9.7%	9.7%	9.5%	9.5%	9.6%	9.5%	9.5%
50th	7.5%	7.4%	7.5%	7.3%	7.5%	7.4%	7.5%	7.6%	7.8%	8.0%	8.1%	8.2%	8.1%	8.0%	8.0%	8.1%	8.1%	8.2%	8.2%
25th	(1.2%)	1.4%	2.7%	3.5%	4.3%	4.6%	5.0%	5.3%	5.6%	5.9%	6.0%	6.1%	6.1%	6.4%	6.6%	6.6%	6.7%	6.8%	6.7%
10th	(9.2%)	(5.0%)	(2.7%)	(1.1%)	0.3%	1.5%	2.3%	3.0%	3.5%	3.9%	4.1%	4.4%	4.7%	4.9%	5.0%	5.2%	5.1%	5.5%	5.5%
5th	(14.3%)	(10.0%)	(6.3%)	(4.7%)	(2.4%)	(0.7%)	0.3%	1.5%	2.0%	2.7%	2.9%	3.4%	3.6%	3.9%	3.9%	4.2%	4.2%	4.6%	4.6%
95th - 5th	44.3%	32.8%	25.0%	21.2%	17.6%	15.0%	13.9%	12.3%	11.5%	10.2%	9.7%	8.8%	8.5%	8.1%	7.9%	7.7%	7.5%	6.9%	6.7%

# Appendix

## Baseline Projected Side Account Balance



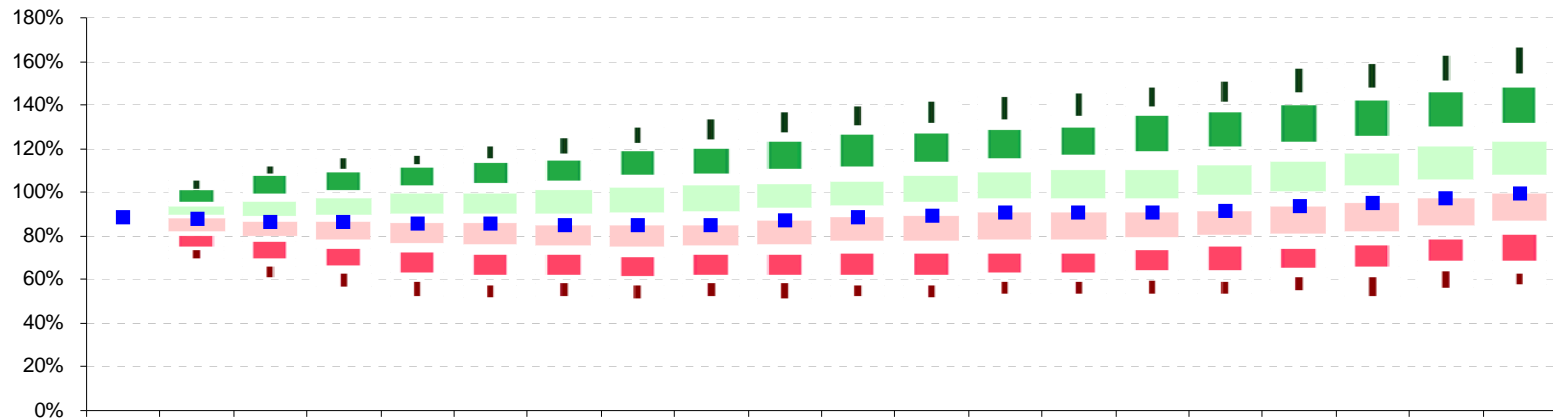
(\$millions)

PY Ending 12/31	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
95th	5,580	6,740	7,292	7,532	7,588	7,784	7,726	7,823	7,930	7,927	7,623	7,272	7,097	6,743	6,353	6,347	6,356	6,820	6,927	6,856
90th	5,580	6,423	6,949	7,037	7,055	7,071	7,054	7,128	6,953	6,766	6,493	6,176	5,773	5,205	4,744	4,214	3,513	3,032	2,492	2,186
75th	5,580	5,876	6,073	6,114	6,202	6,112	6,019	5,876	5,661	5,421	5,069	4,868	4,349	3,852	3,242	2,573	1,751	802	97	9
50th	5,580	5,483	5,384	5,334	5,199	5,083	4,889	4,647	4,475	4,313	4,083	3,746	3,324	2,879	2,332	1,685	999	216	13	0
25th	5,580	4,995	4,764	4,502	4,363	4,141	3,959	3,760	3,525	3,306	3,058	2,739	2,366	1,969	1,525	1,029	435	29	0	0
10th	5,580	4,549	4,056	3,746	3,472	3,215	3,125	2,922	2,804	2,551	2,282	2,032	1,726	1,385	1,024	551	124	0	0	0
5th	5,580	4,266	3,584	3,242	2,849	2,737	2,599	2,361	2,296	2,112	1,895	1,583	1,306	1,048	721	347	39	0	0	0
95th - 5th	0	2,474	3,708	4,290	4,739	5,047	5,126	5,462	5,634	5,815	5,728	5,689	5,791	5,694	5,632	5,999	6,317	6,820	6,927	6,856

Variable 122

# Appendix

## Baseline Combined (Tier 1/Tier 2, OPSRP) Funded Status (Including Side Accounts)



PY Ending 12/31	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
95th	88%	105%	112%	115%	117%	121%	125%	130%	133%	137%	139%	142%	144%	145%	148%	151%	157%	159%	163%	166%
90th	88%	101%	108%	109%	111%	113%	115%	119%	120%	123%	126%	127%	129%	130%	135%	136%	140%	142%	146%	148%
75th	88%	93%	96%	97%	100%	100%	101%	102%	103%	104%	104%	108%	109%	110%	111%	112%	114%	118%	122%	123%
50th	88%	88%	87%	86%	86%	86%	85%	85%	87%	89%	89%	91%	91%	91%	91%	92%	94%	95%	97%	100%
25th	88%	80%	77%	74%	73%	71%	71%	70%	71%	71%	72%	72%	72%	72%	73%	75%	74%	76%	78%	81%
10th	88%	73%	66%	62%	59%	57%	58%	58%	58%	58%	57%	57%	59%	59%	59%	59%	61%	61%	64%	63%
5th	88%	69%	59%	54%	49%	50%	50%	49%	50%	49%	51%	49%	51%	52%	51%	51%	53%	49%	52%	56%
95th - 5th	0%	36%	53%	61%	68%	71%	76%	81%	84%	88%	88%	92%	92%	94%	97%	100%	104%	110%	110%	111%

Variable 172

#### ▪ **Stochastic (Monte Carlo) Modeling**

- In order to understand the range of outcomes, we employ an economic model of capital markets in which we focus on the three fundamental factors – growth, inflation, and interest rates – that drive capital markets.
- Thus, if interest rates rise due to inflation, we utilize the same rise in inflation and interest rates in order to calculate returns on bonds and to determine if the discount rate is reasonable.
- Stochastic modeling is used to help assign probabilities to the various market environments.
- Our capital market assumptions represent general future expectations and significant volatility around those expectations.



## Appendix

### Capital Market Assumptions

- Mercer's Methodology:
  - Mercer's stochastic model is based on a 7 state regime-switching Monte Carlo simulation.
  - This technique generates 1,000 economic trials with each trial producing projected results for each year over the selected planning horizon.
  - Each state or regime has a defined set of means, volatilities, reversion coefficients and correlation assumptions.
  - We define a probability transition matrix for achieving each regime given the past state-of-the-world.
  - We adjust the Base Case state (described on next slide) so that the median results across all trials produce inflation and growth that correspond to our long run projections. Essentially, this becomes a recentering state because in the other six states there are more negative than positive states. Properly speaking, this state should be labeled "Optimistic Normal", since we generally have to lower inflation, raise growth, and lower credit spreads to more optimistic conditions (but not quite as high as Ideal Growth).

## Appendix

### Capital Market Assumptions

- Mercer's Methodology (*continued*):

- We define the seven possible states (or regimes) of the world as:
  - **Base Case:** Inflation, growth, and equity returns hover around their long term expected values. (Inflation is 2.8%, growth is 3.1%, and equity returns are in the low 8.0% range.) Bond yields adjust from their current conditions to their long run values over a period of three to five years. This path of interest rates then determines bond returns.
    - Since the Treasury curve in the US is quite steep with very low short rates, this Base Case scenario has low bond returns initially and then returns in the 5.0% to 5.5% range once the adjustment of interest rates is finished.
  - **Recession:** This is a “classical recession”, not a severe credit crunch or depression. In the recession scenario, inflation is quite low, but not negative, while growth dips below zero. Treasury yields decline sharply, but T-Bills do not approach zero. Credit spreads widen and the equity returns are low because of a decline in earnings and drop in the P/E level.
  - **Stagflation:** Inflation rises to around 6.0% and growth stalls to 1.0% (but is not necessarily negative). The Treasury yield curve flattens at about 7.0% to 7.5%. Equity returns are weak, because the P/E level drops. Credit spreads widen, but not to recession levels.
  - **Inflationary growth:** Inflation rises to 6.0% and economic growth is very strong at 4.5%. Treasury yields rise to the 8.0% level. The P/E level of the market rises slightly, producing returns consistently in the 10% range.
  - **Ideal Growth:** Inflation falls to 0.5%, economic growth booms at 6%. Treasury yields stay near our long run projected curve, producing very high real yields. P/E level soars, producing equity returns in the teens. If this regime persists for a few years, equity returns drop back down to the 8.0% level, which means that real returns are still quite high, in the 7.5% range.
  - **High Inflation:** Inflation rises to 10%, economic growth is below average at 2.5%. Treasury yields rise to 10% to 11%, credit spreads widen slightly. Equity returns are depressed as the P/E level falls.
  - **Credit Crunch/Depression:** This is modeled after the events of 2008. Inflation and economic growth are both negative (around -1.5% to -2.0%). Credit spreads soar, treasury yields decline sharply and T-Bill yields approach zero. The P/E level of the market declines sharply.

## Appendix

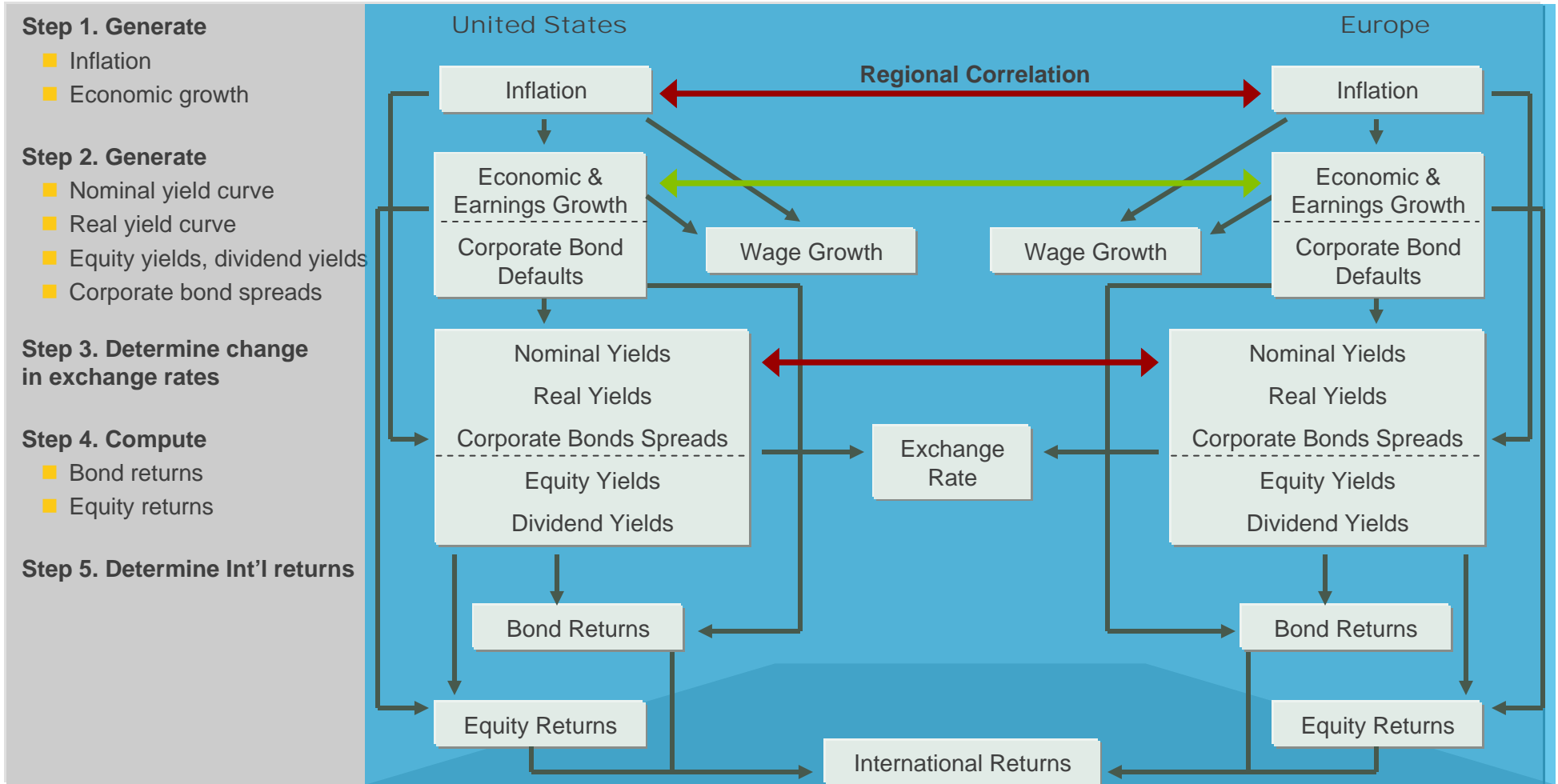
### Capital Market Assumptions - Base Case State Modeling Parameters

	Asset Class Name	Arithmetic Expected Annual Return	Geometric Annual Return Equivalent	Annual Standard Deviation	Correlation Matrix					
					1	2	3	4	5	
1	Global All Cap Unhedged	10.00%	8.33%	19.40%	1.00					
2	Fixed Income-Aggregate	4.70%	4.53%	6.00%	0.09	1.00				
3	Fixed Income-High Yield	6.40%	5.89%	10.50%	0.62	0.50	1.00			
4	Real Estate-Core	8.20%	7.11%	15.49%	0.40	0.25	0.35	1.00		
5	Private Equity-Total	13.40%	9.17%	31.86%	0.65	0.20	0.40	0.50	1.00	

Based on Mercer's December 2010 Capital Market Outlook

# Appendix

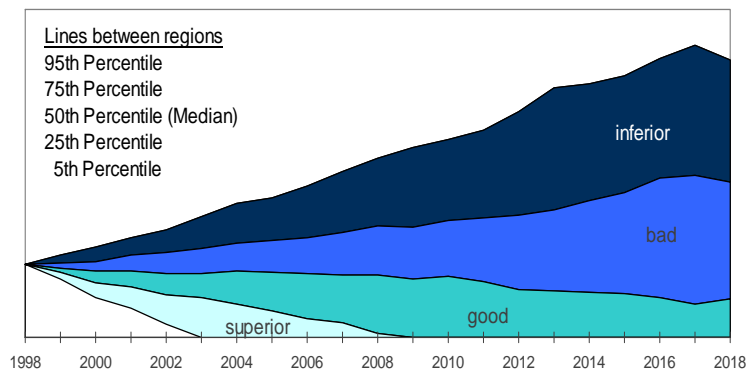
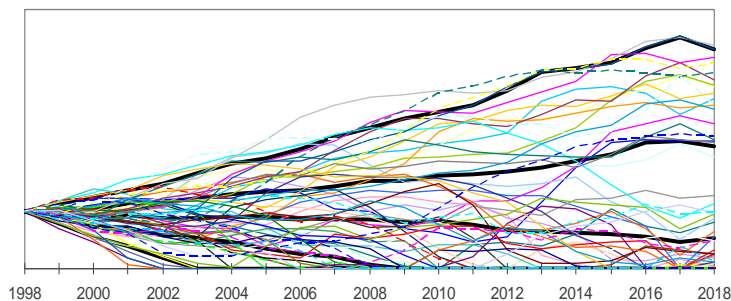
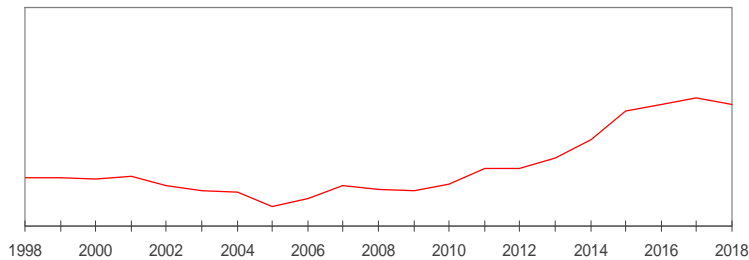
## Investment Strategy - Capital Market Simulator



# Appendix

## Modeling Parameters and Assumptions

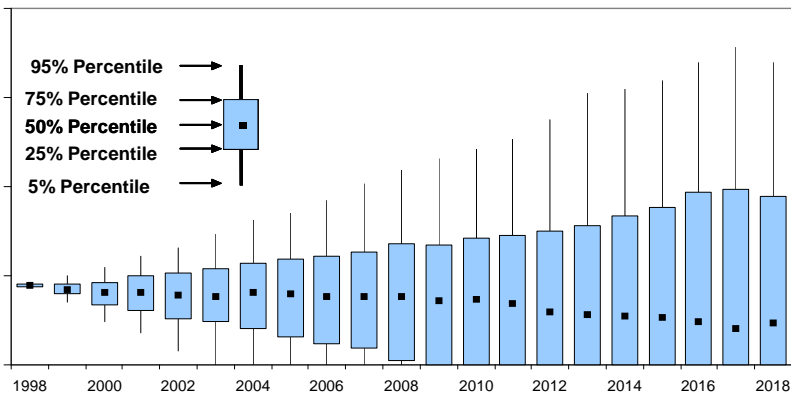
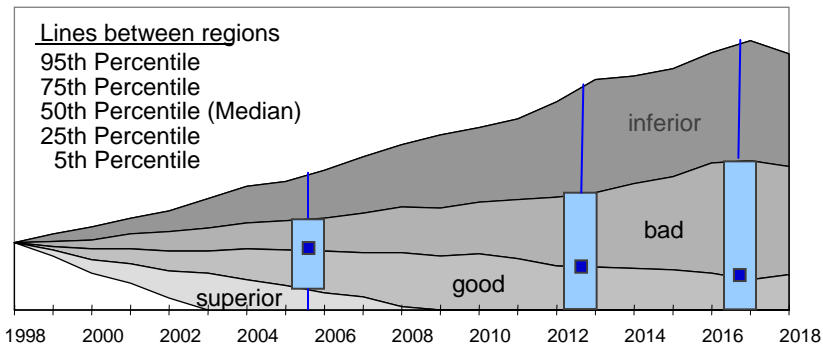
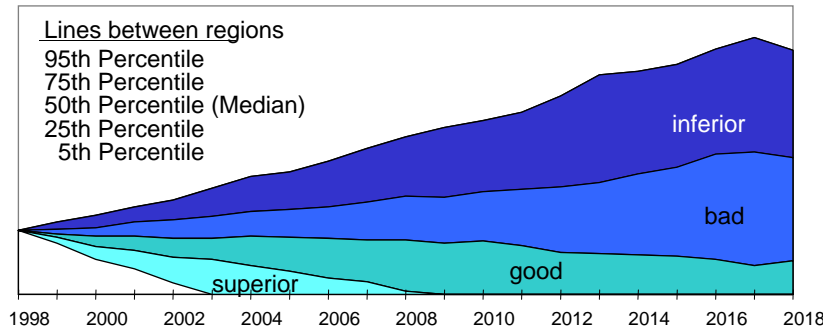
### Simulation Framework – Unfunded Liabilities Illustrated



- Results are calculated for one path of the stochastic model
- This is repeated 1000 times
- Each year is percentiled
- The percentiles group each years' results into regions
- The good and bad regions represent 25% variance from median results, or together what would be expected half of the time
- The superior and inferior regions add another 20% of upside and downside variance
- All the regions combined show 90% of simulated results

# Appendix

## Presenting Results - Stochastic percentiles



- The line chart is potentially confusing because it might appear that the 75th percentile (for example) is generated by the same simulated path over time.
- In fact, any given simulated path could vary between regions over time
- In any year, we can represent the key percentile values with “candlesticks”, which remove the implied connection between percentiles over time.

MERCER