Economic Assumptions

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Funding a Pension Plan

- A Retirement System is a financing arrangement where compensation for services is provided in the form of an annuity after employment for the member
- Each year there are benefit payments out, contributions in, and investment earnings on Trust assets (hopefully)
- The funding goal is for the arrangement to be sustainable indefinitely with intergenerational equity
- The annual valuation process measures the liability of the System, compares it to the current assets and projected contributions of the System, to determine if the arrangement is in balance or needs adjustments

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How assumptions factor in…

- Over time, the true cost of benefits will be borne out in actual experience
  - Cost of benefits NOT affected by actuarial assumptions
  - Determined by actual participant behavior (termination, retirement), plan provisions, and actual investment returns
- But if wrong can lead to poor decisions, poor outcomes
  - If objective is to fund levelly over active career, and assumptions suggest cost is 10% per year, but true cost is 14%
  - Losses and unfunded liabilities will develop
  - Can't outrun or "out-assume" the true cost
  - Important to update regularly and re-chart your course
- Assumptions help us anticipate and manage what each component of the equation will be
  - Assumptions dictate the timing of the contributions
  - Develop expectations for future contributions, investment returns and benefit payments
  - Important for decision making
- Same can be true to the positive side, as overly conservative assumptions would pull resources to the System and away from other alternatives or force unnecessary reductions in benefits

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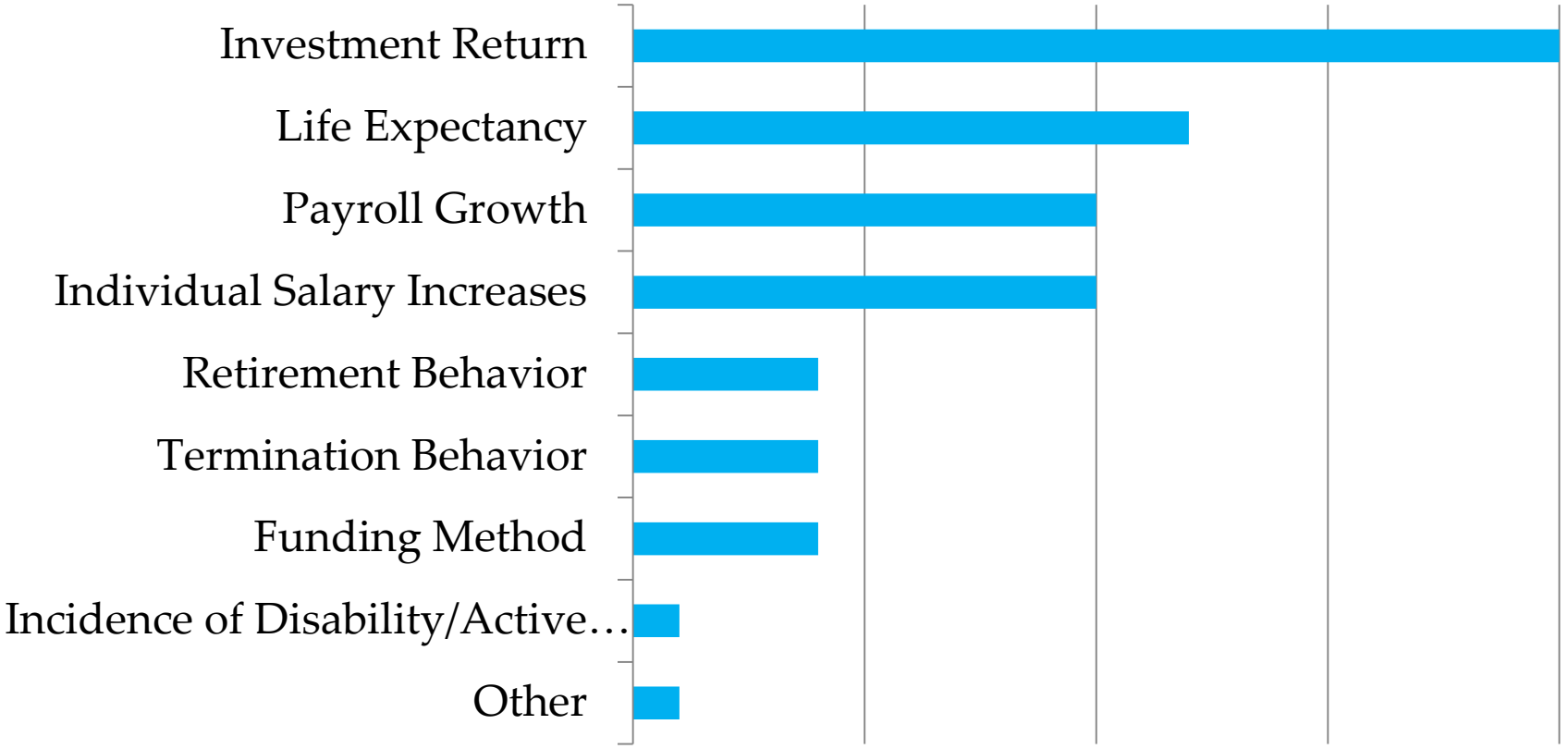
Magnitude of Individual Assumptions

Impact on Determination of Contribution Levels



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Per ASOP 27: Reasonable Assumptions

- What is the purpose of the measurement in the Annual Valuation?
  - Determine annual contribution rates for government budgeting
    - Plan Funding
  - These contribution rates are intended to stay level as a percent of payroll on average
    - Intergenerational Equity

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General Investing vs Funding Liabilities

- Investing against a liability may lead to different decisions than investing just to generate returns
- Several factors impact the overall risk tolerance and sustainability of the plan
- The size of the accumulated asset values (which will depend on benefit levels, retirement eligibilities, and funded levels) compared to the size of the budget of the plan sponsor will impact risk tolerance
- Cash flow needs may impact terminal cash value in volatile environments

Reaching the Goals

- It is always a trade off between cost today and risk of higher costs tomorrow
  - Also volatility of costs
- Balancing between the goals requires tradeoffs:
  - For example, between mitigating contribution volatility and recognizing gains and losses over a reasonable period
  - Lower investment returns (lower risk) increase costs (higher risk)
  - Investment risk to achieve returns (and ultimately lower costs) may increase volatility and thus put benefits at risk

Asset Liability Model

- As previously discussed, investing against a liability may lead to different decisions than investing just to generate returns
- The size of the accumulated asset values (which will depend on benefit levels, retirement eligibilities, and funded levels) compared to the size of the budget of the plan sponsor will impact risk tolerance
- The ALM will help move the decision making away from investment centric risks (standard deviation, downside deviation, etc) towards more global stakeholder risks (benefit security, contribution volatility, funded ratio volatility, contribution levels)
  - Puts the investment risks into context

Investment Risk

- Investment Risk shows in two ways:
  - Volatility
  - Uncertainty
- Volatility also shows up two ways:
  - Year to year changes in contribution rate
  - Impact on ultimate wealth accumulation when combined with negative cash flows
- Uncertainty is underperformance over the time horizon

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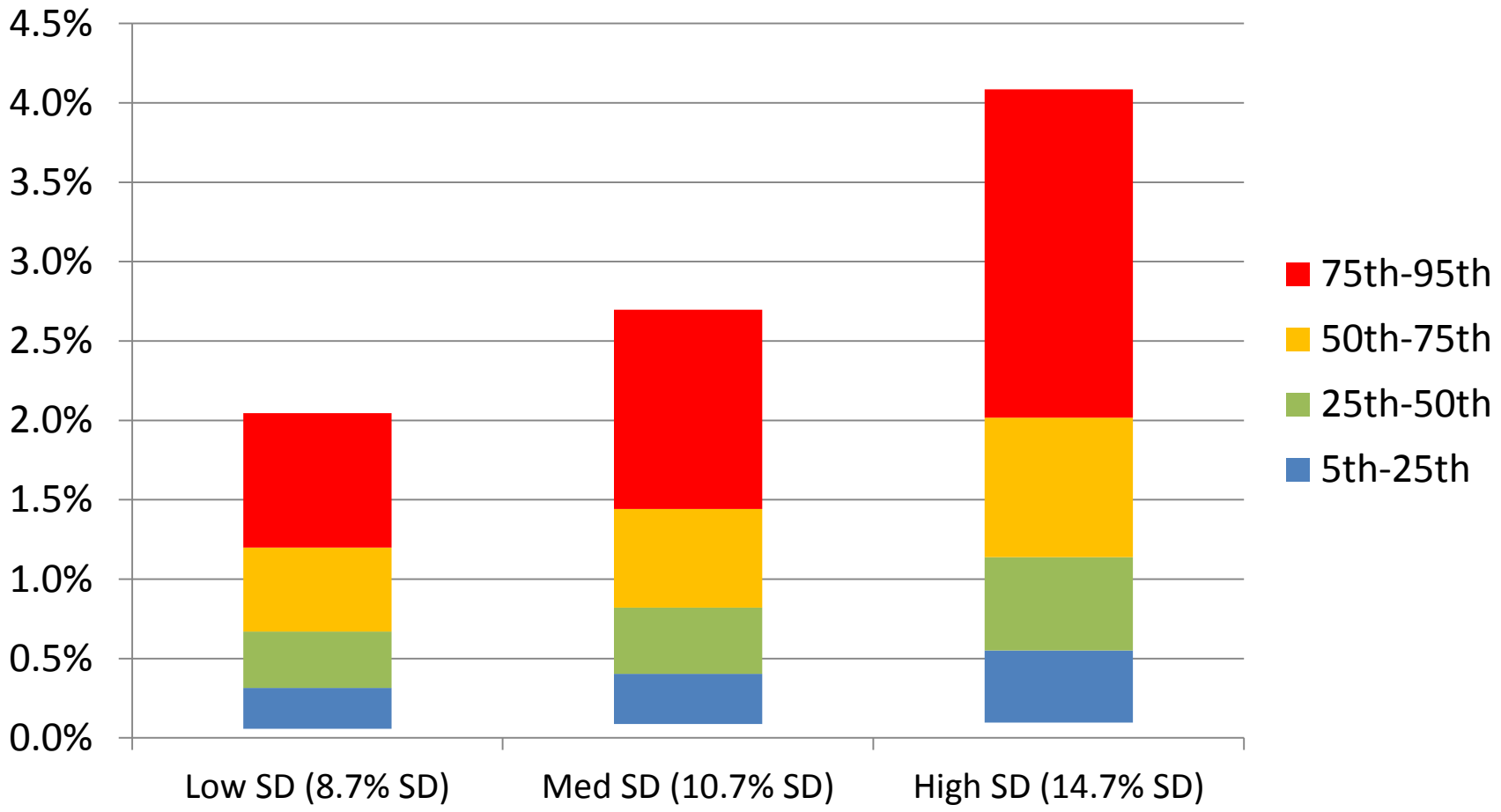
Annual Change in Contribution Rate



The above are illustrated portfolios based on hypothetical risk/return characteristics

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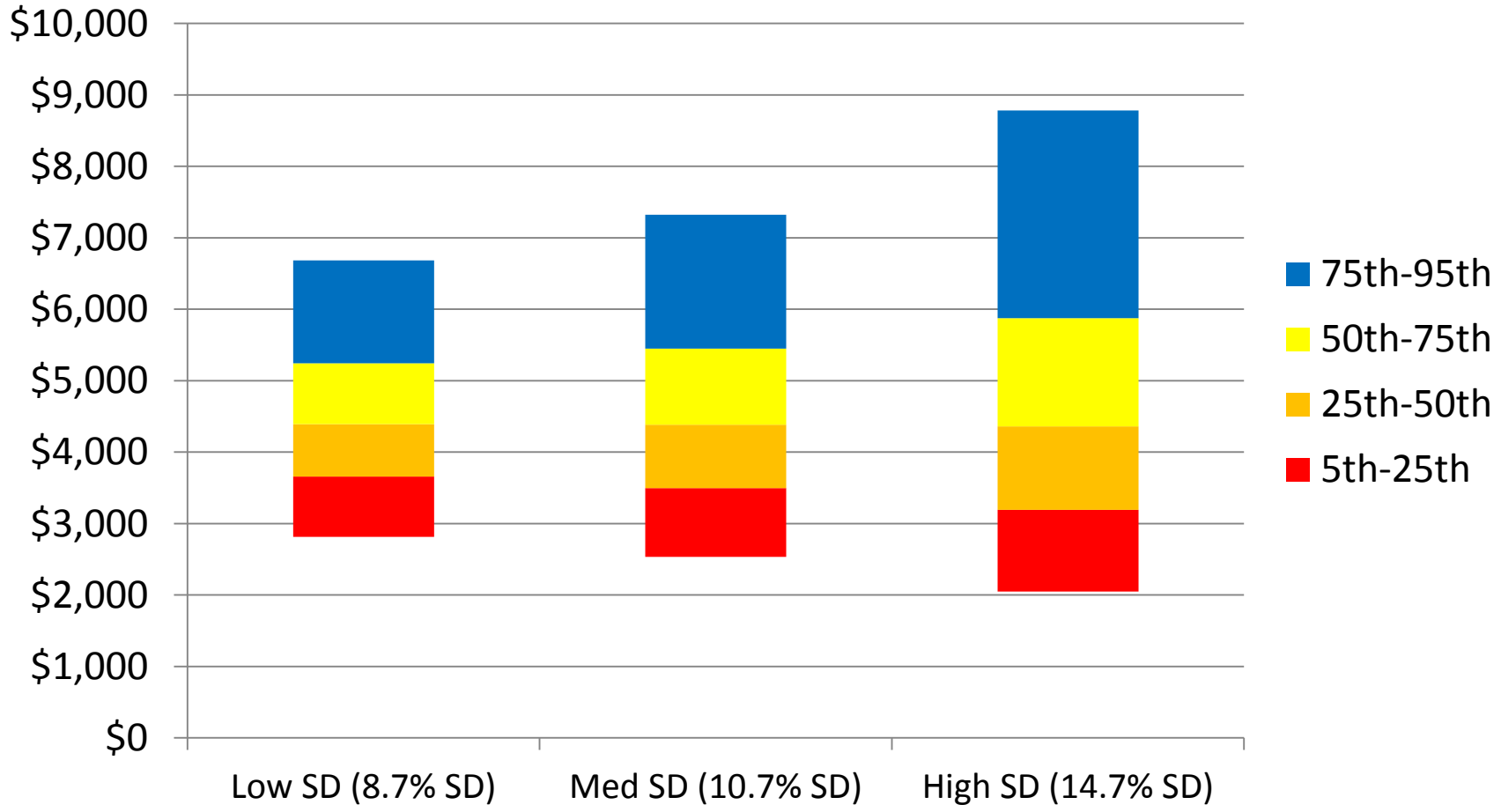
Market Asset Values Year + 10



The above are illustrated portfolios based on hypothetical risk/return characteristics
All three have approximately the same expected compound return

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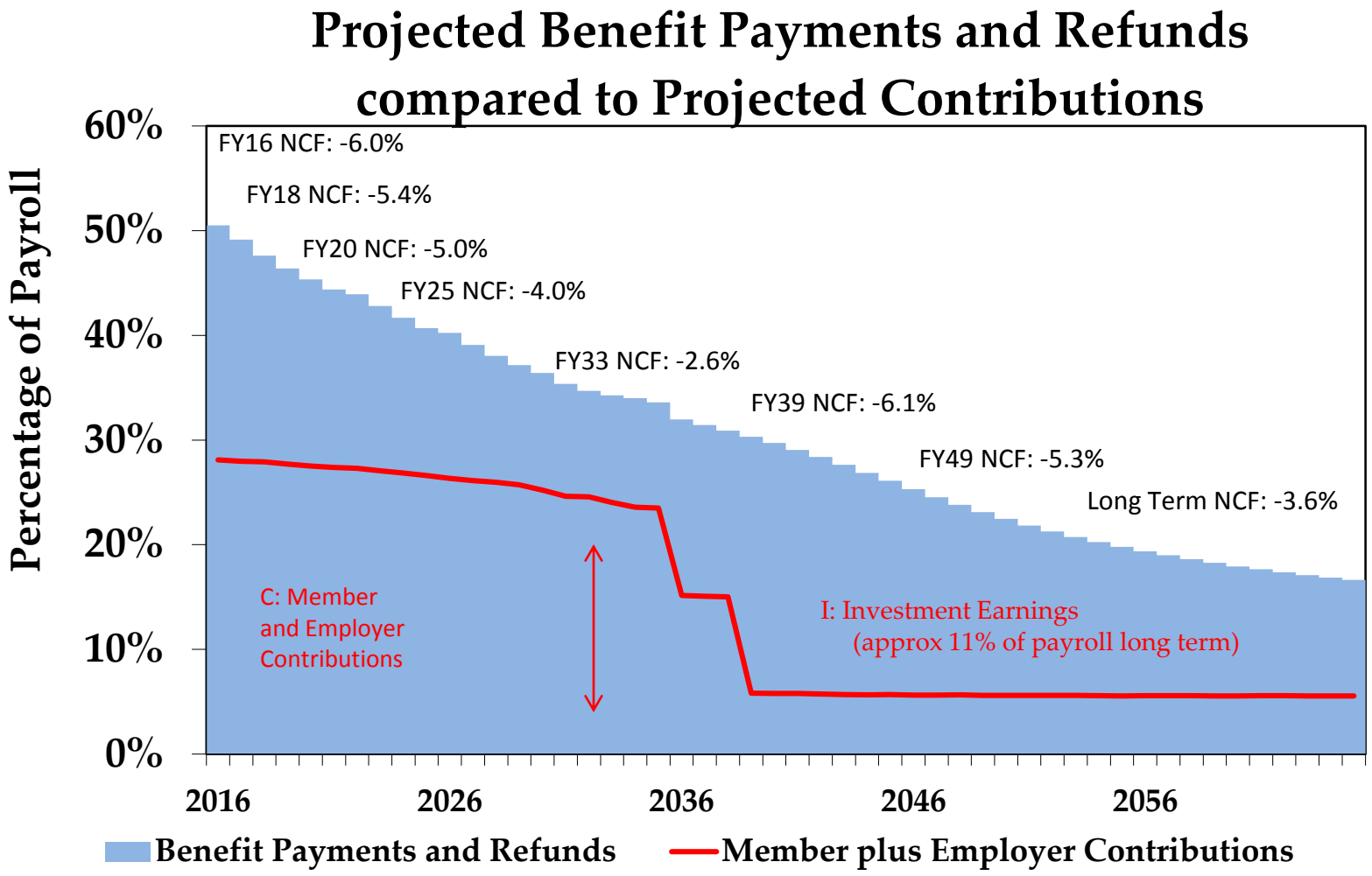
ERSRI Specifics

- In the ALM, the following ERSRI characteristics may produce a different answer than the typical PERS going through the same process
  - Current Funded Status
  - Closed amortization period of <=20 years
  - 1% prospective benefit multiplier
  - Flexible post-retirement benefit adjustments
  - High short term negative cash flows
  - Manageable longer term negative cash flows.
- Not all of these characteristics are the same across all Plans under the ERSRI umbrella

Cash Flow

Projected Negative Cash Flow (ERSRI Teachers)



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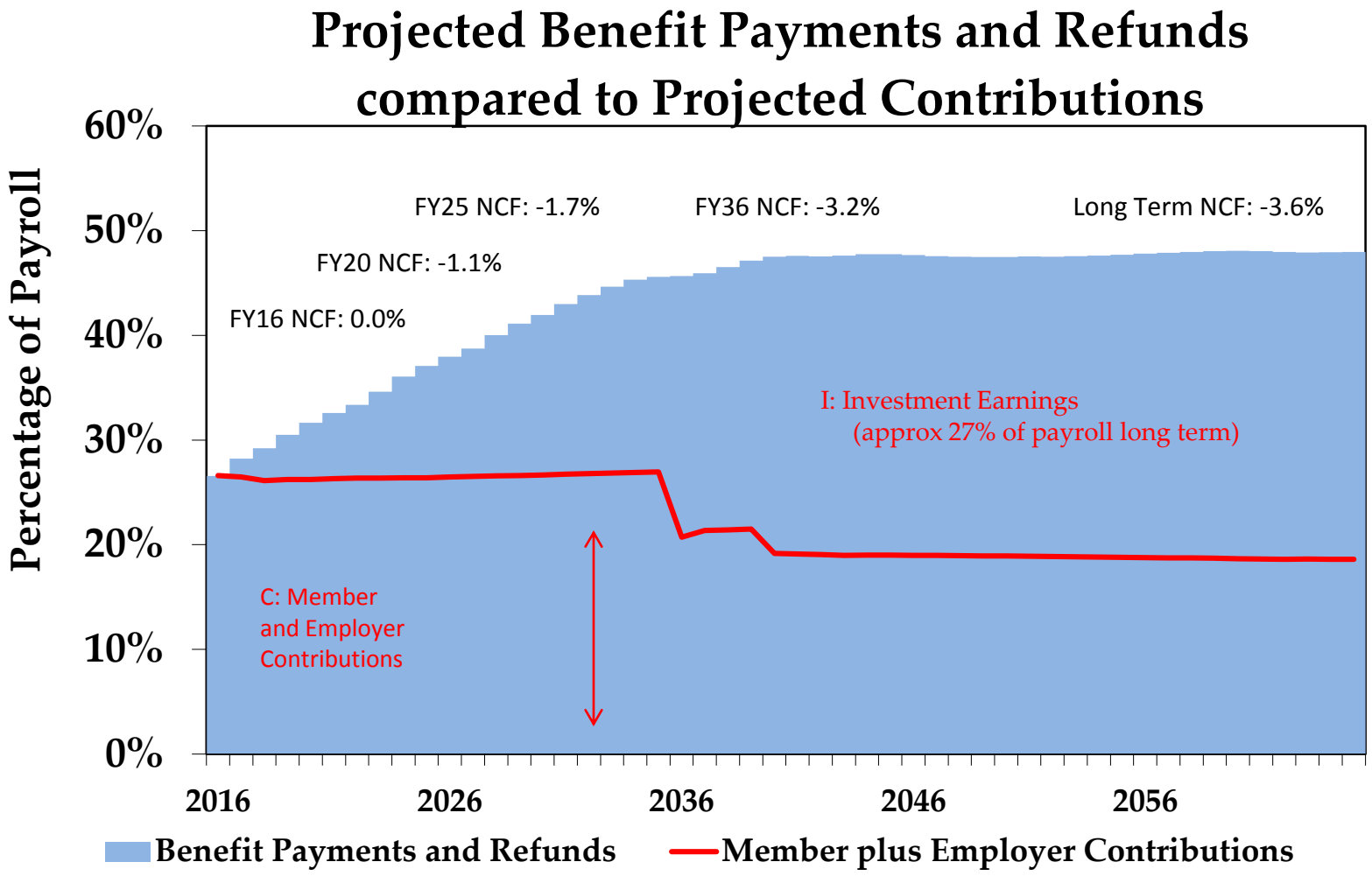
Cash Flow

Projected Negative Cash Flow (ERSRI MERS PF)



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Hypothetical Scenarios

- As an indication of PCA's process, Treasury staff created six hypothetical return scenarios
  - Return scenarios drew from recent market history
  - One "base" case and one "early recession" case
  - Portfolios of varying risk/return characteristics
    - Higher return/risk – 8.5% arithmetic average return, 21% volatility
    - Medium return/risk – 7.5% arithmetic average return, 15% volatility
    - Lower return/risk – 6.5% arithmetic average return, 8% volatility
- Required contributions and funded ratios calculated across the six scenarios

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Scenario Output: State Employees Plan

Contributions ($ millions)	High Risk Base Case	High Risk Early Recession	Med Risk Base Case	Med Risk Early Recession	Low Risk Base Case	Low Risk Early Recession
Total (25 years)	3,284	6,322	4,382	5,916	4,854	5,342
Maximum ARC	222	408	319	374	322	322
% payroll	26%	37%	27%	34%	26%	29%
Minimum ARC	29	33	30	33	33	33
% payroll	3%	2%	3%	2%	3%	3%
Funded Ratio Low	39%	32%	55%	39%	56%	53%

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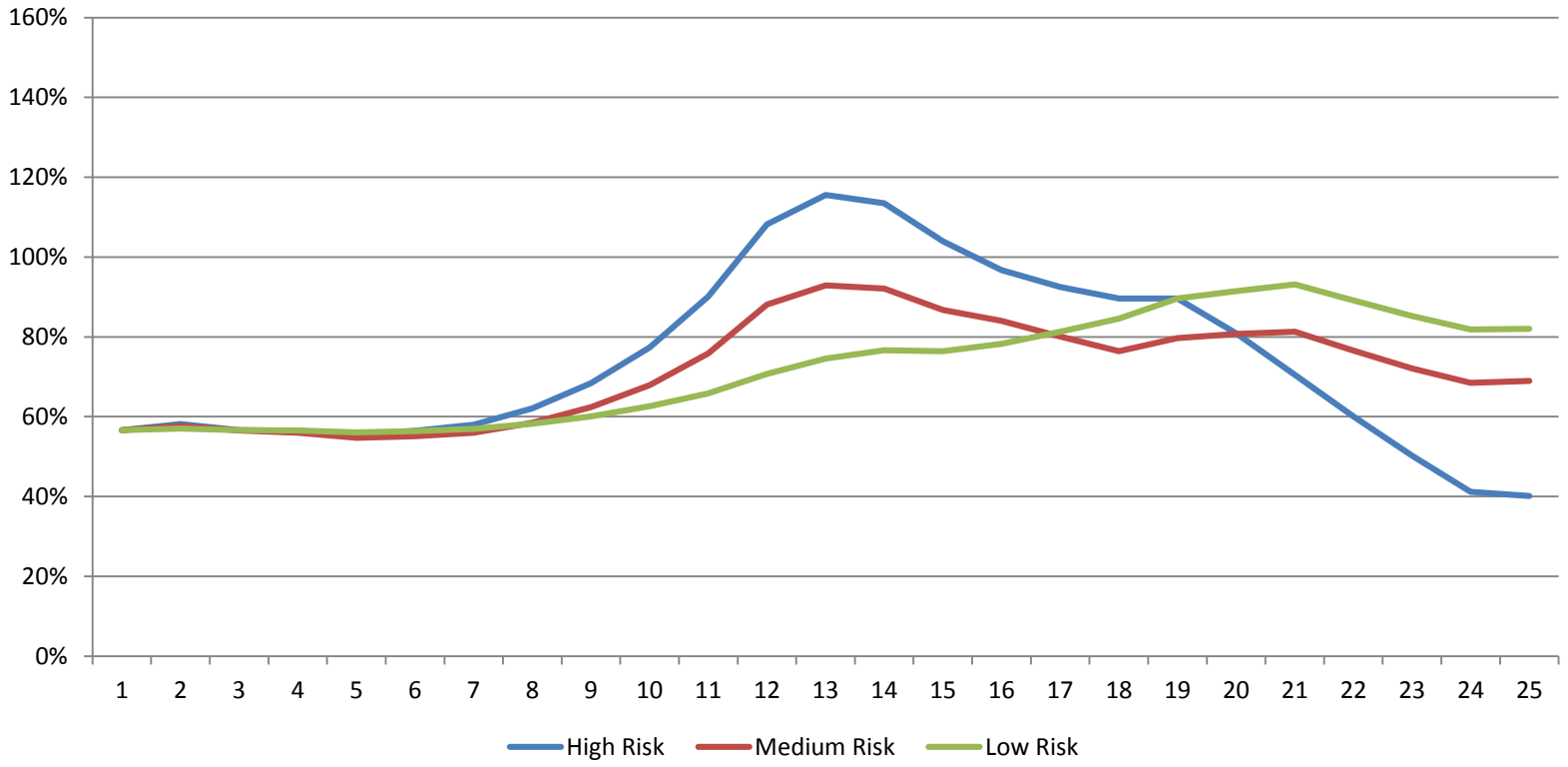
Scenario: Path of Funded Ratio

- State Employees – Base Case



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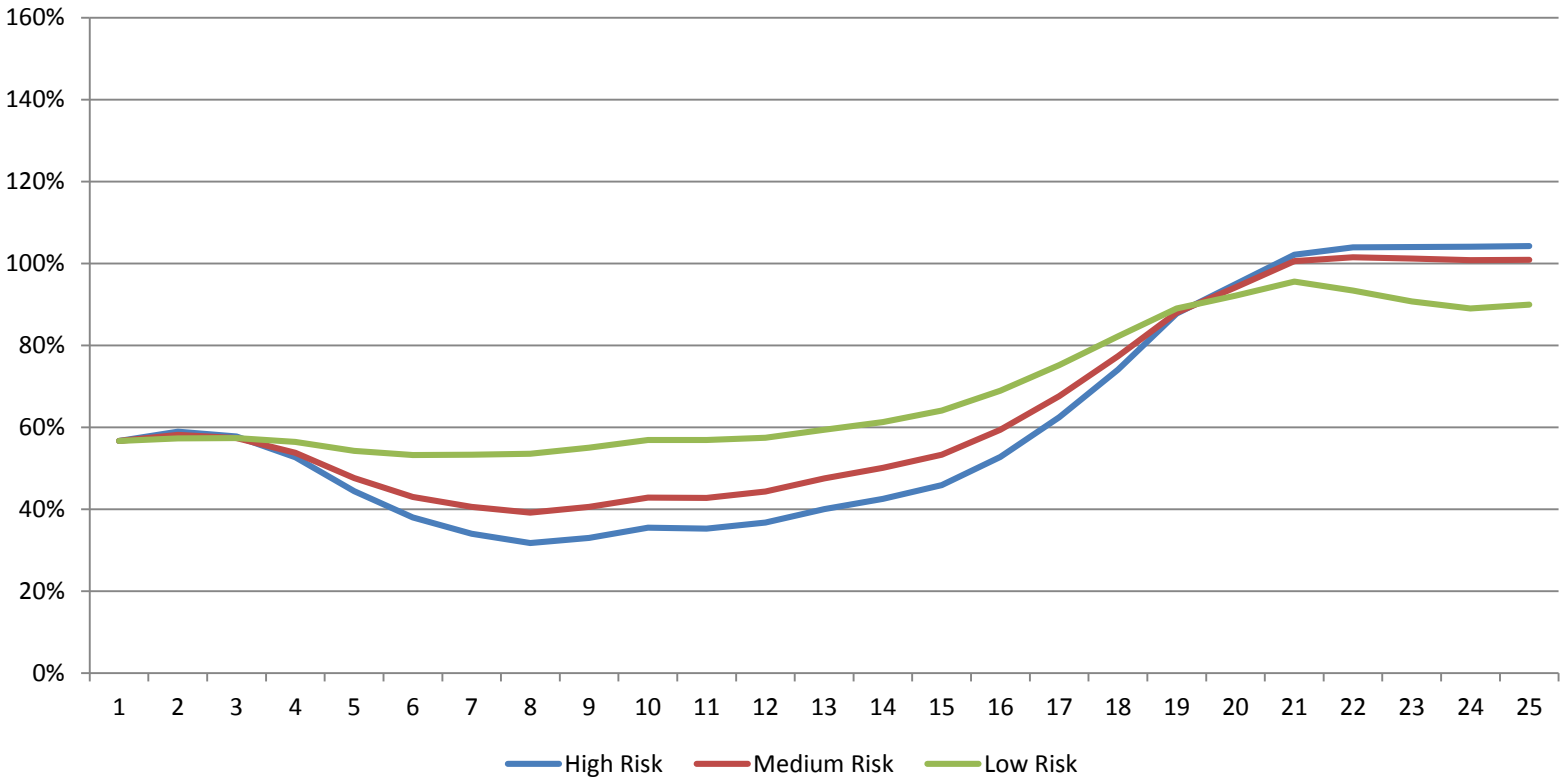
Scenario: Path of Funded Ratio

- State Employees – Early Recession Case



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Scenario Output: Well-Funded MERS Plan

Contributions ($ millions)	High Risk Base Case	High Risk Early Recession	Med Risk Base Case	Med Risk Early Recession	Low Risk Base Case	Low Risk Early Recession
Total (25 years)	553	776	492	705	626	694
Maximum ARC	27	50	39	44	41	39
% payroll	18%	32%	19%	28%	20%	23%
Minimum ARC	9	15	12	15	16	16
% payroll	7%	8%	8%	8%	13%	14%
Funded Ratio Low	68%	55%	74%	64%	79%	78%

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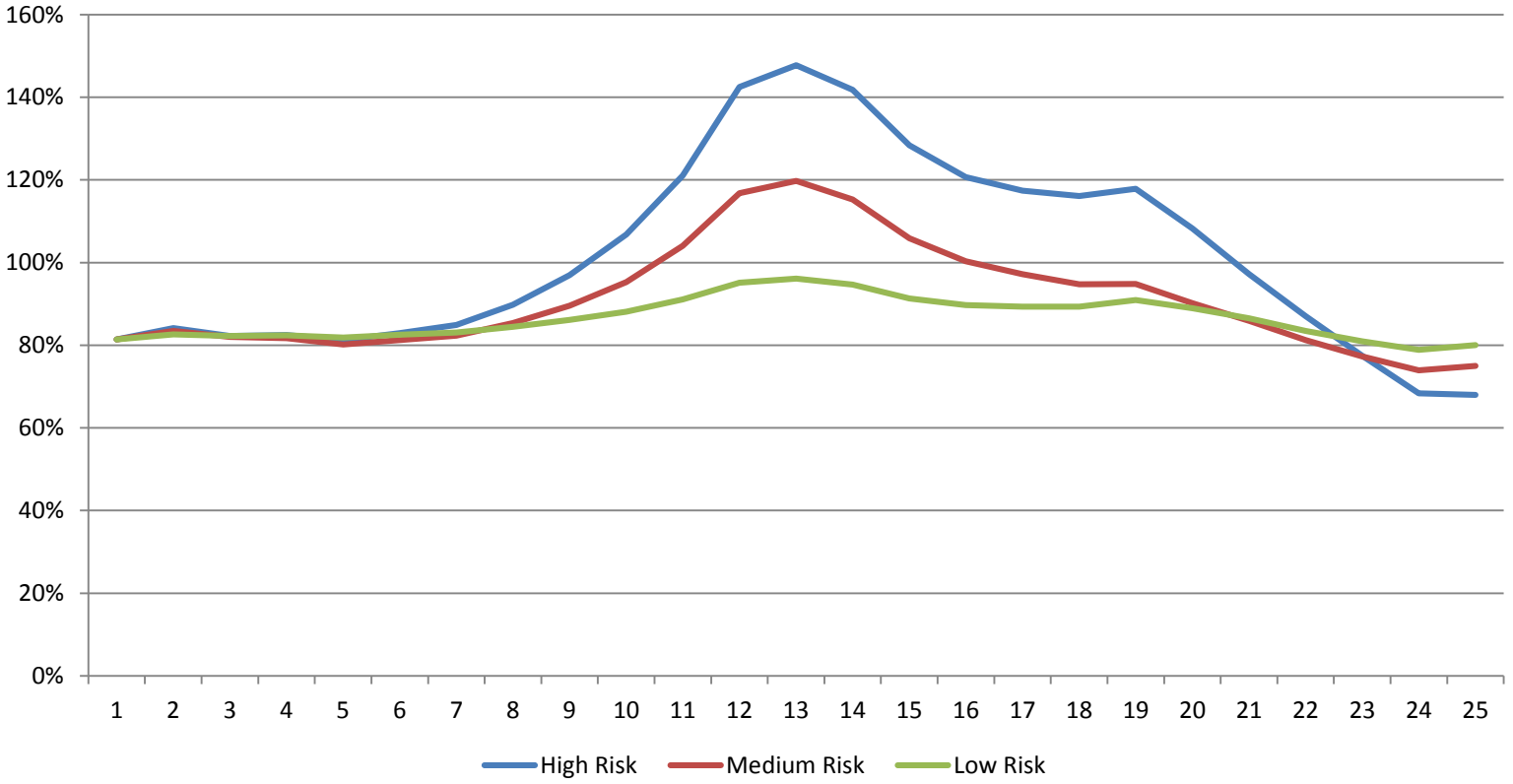
Scenario: Path of Funded Ratio

- Sample MERS Plan – Base Case



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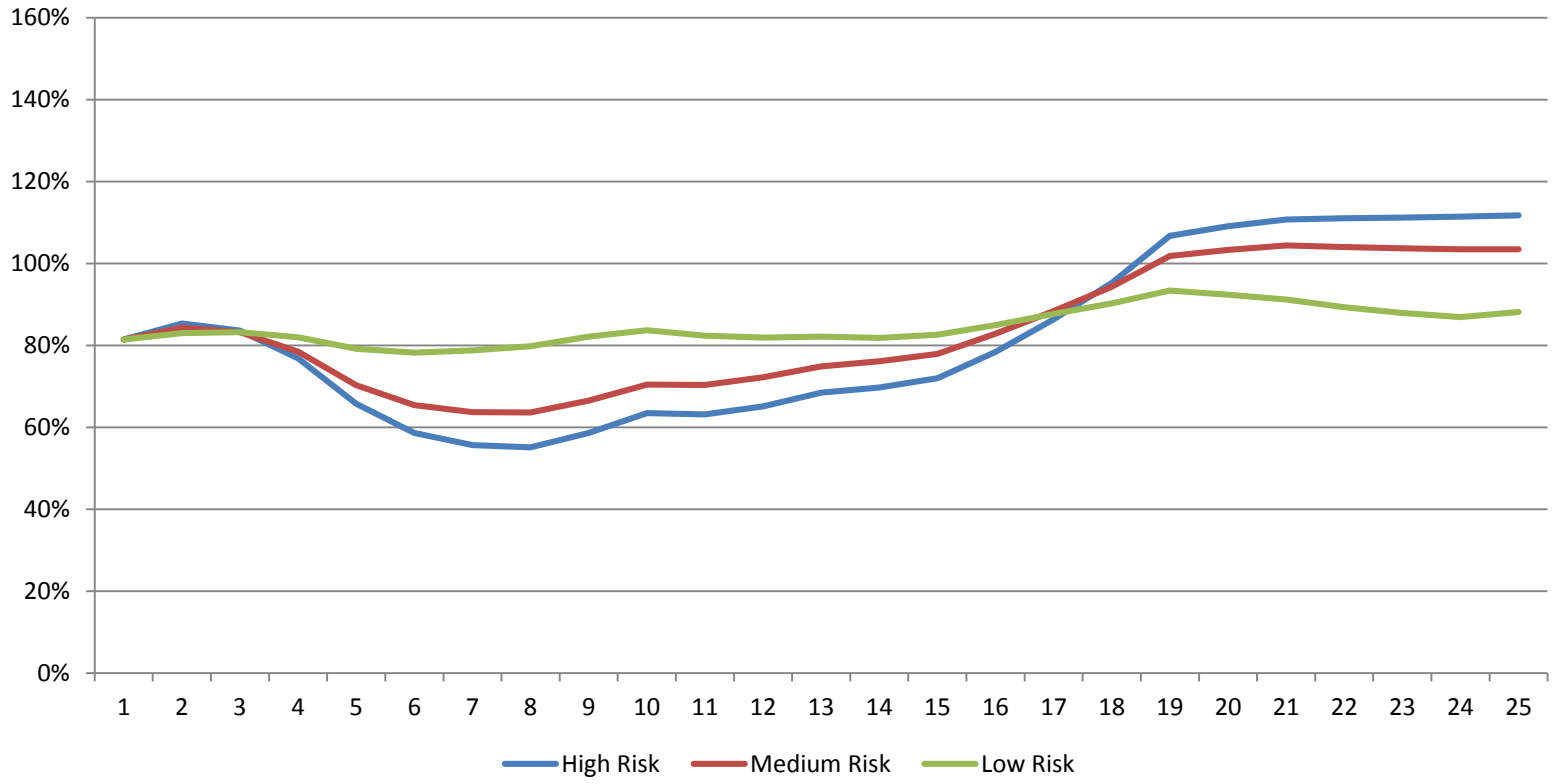
Scenario: Path of Funded Ratio

- Sample MERS Plan – Early Recession Case



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Questions

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Appendix

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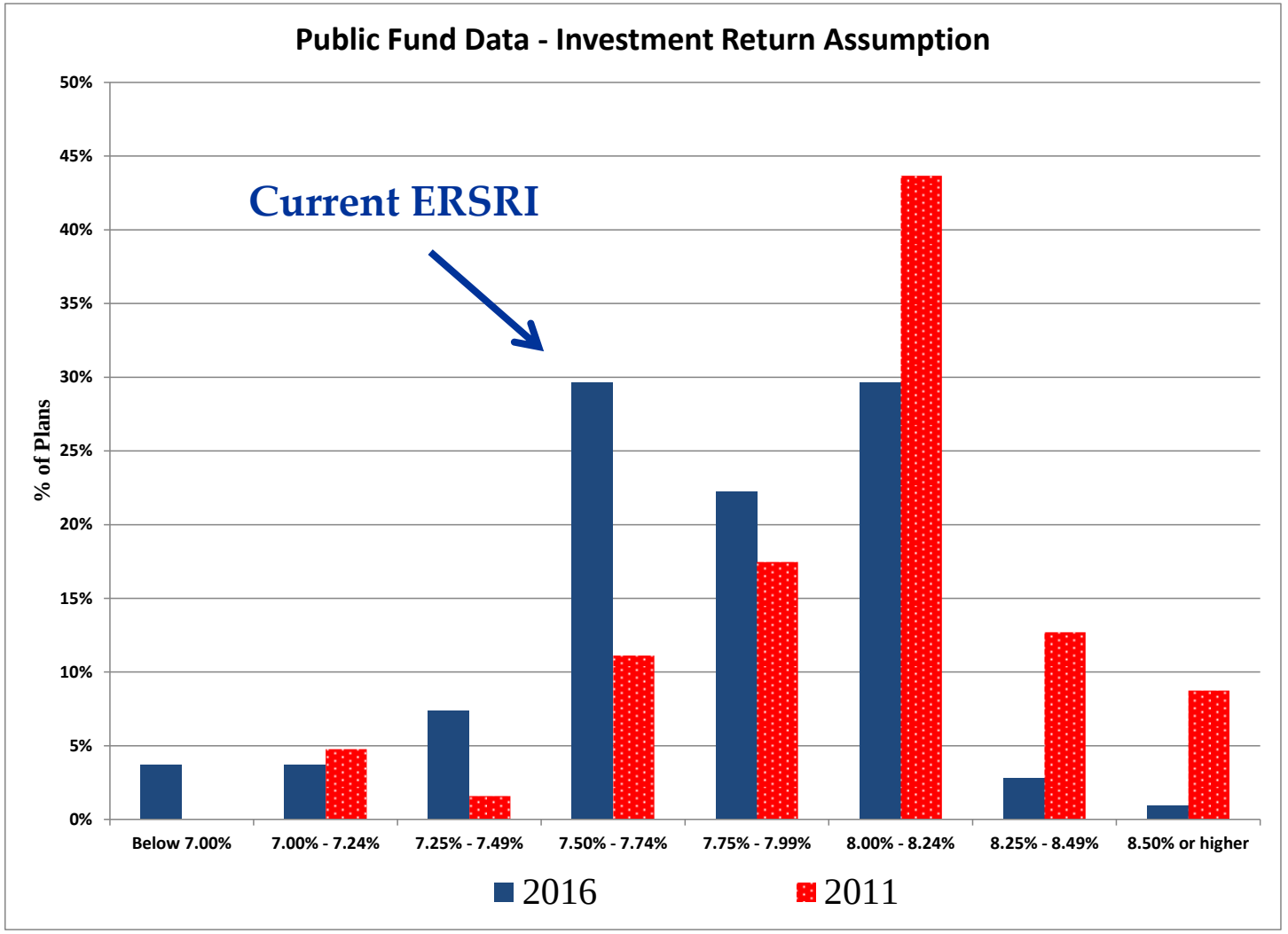
Investment Return Assumption

- The investment return assumption reflects the anticipated returns on the plan's current and, if appropriate for the measurement, future assets.
- This assumption is typically constructed by considering various factors including, but not limited to, the time value of money; **inflation** and **inflation** risk illiquidity; credit risk; macroeconomic conditions; and growth in earnings, dividends, and rents.
- By far the most important (and most subjective) assumption in the valuation/budgeting process
- There has been a heavy trend of decreasing this assumption
- In the experience study next summer, this will be one of the most impactful decisions for the Retirement Board

Investment Return Risk

Comparison to Peers



Source: Public Plans Database

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Capital Market Assumptions

- Our analysis will be based on the target asset allocation at the time of the experience study and a universe of capital market assumptions, with emphasis on PCA's expectations
  - The Asset Liability Study will provide most of the data for the analysis
- We will also compare to other sources, one specific source we use is a survey done by Horizon Actuarial Services which aggregates information from 23 independent sources, including longer term expectations

Scenarios: Hypothetical Returns

	base case				early recession	
Year	higher vol	med vol	lower vol	higher vol	med vol	lower vol
1	20.9%	16.4%	10.5%	28.5%	21.5%	12.9%
2	-18.5%	-13.0%	-2.2%	-22.3%	-14.1%	-0.1%
3	24.6%	17.0%	11.2%	-23.1%	-14.7%	-1.3%
4	-5.4%	-3.3%	1.7%	-26.7%	-17.2%	-2.4%
5	27.0%	21.7%	12.8%	33.2%	24.7%	15.8%
6	6.9%	5.8%	5.8%	19.1%	14.9%	9.4%
7	25.9%	20.2%	12.1%	10.9%	9.1%	7.7%
8	17.1%	13.5%	9.2%	25.1%	19.1%	11.3%
9	19.7%	15.5%	10.1%	10.3%	8.7%	7.5%
10	30.0%	23.2%	13.5%	-28.1%	-18.2%	-9.4%
11	30.6%	23.7%	13.7%	39.8%	29.4%	14.7%
12	-15.2%	-10.7%	-1.6%	14.0%	11.3%	8.5%
13	-19.5%	-14.0%	-3.0%	-11.8%	-6.7%	2.6%
14	-23.1%	-16.7%	-3.3%	19.5%	15.1%	9.9%
15	36.0%	27.7%	16.1%	33.2%	24.7%	15.8%
16	14.6%	11.7%	8.9%	16.4%	13.0%	9.4%
17	9.8%	8.1%	7.6%	12.2%	10.0%	7.7%
18	13.1%	10.5%	11.1%	22.4%	17.2%	11.3%
19	-40.0%	-17.4%	-12.1%	-13.2%	-7.8%	-9.4%
20	14.6%	9.5%	7.4%	11.6%	9.6%	7.5%
avg arithmetic return	8.5%	7.5%	6.5%	8.5%	7.5%	6.5%
standard deviation	21.4%	14.7%	7.4%	21.6%	15.1%	7.5%

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Scenarios: State Employees Contributions

Year	High Risk Base Case	Med Risk Base Case	Low Risk Base Case	High Risk Early Recession	Med Risk Early Recession	Low Risk Early Recession
1	$ 163	$ 163	$ 163	$ 163	$ 163	$ 163
2	181	181	181	181	181	181
3	183	183	183	183	183	183
4	183	185	187	180	183	186
5	194	193	192	190	191	190
6	197	199	197	212	208	198
7	210	213	207	248	237	214
8	215	220	216	279	262	226
9	222	228	225	304	281	237
10	217	230	230	325	299	247
11	206	227	235	334	306	253
12	185	220	238	342	314	260
13	153	205	241	364	334	275
14	99	174	237	376	344	287
15	29	177	240	383	351	296
16	30	30	248	396	362	307
17	30	30	266	408	373	316
18	31	251	276	408	374	319
19	31	287	287	403	372	321
20	32	319	299	394	368	322
21	32	56	34	109	92	55
22	49	73	33	33	33	33
23	98	90	61	34	34	76
24	136	113	81	35	35	92
25	178	133	95	36	36	106
Total	$ 3,284	$ 4,382	$ 4,854	$ 6,322	$ 5,916	$ 5,342

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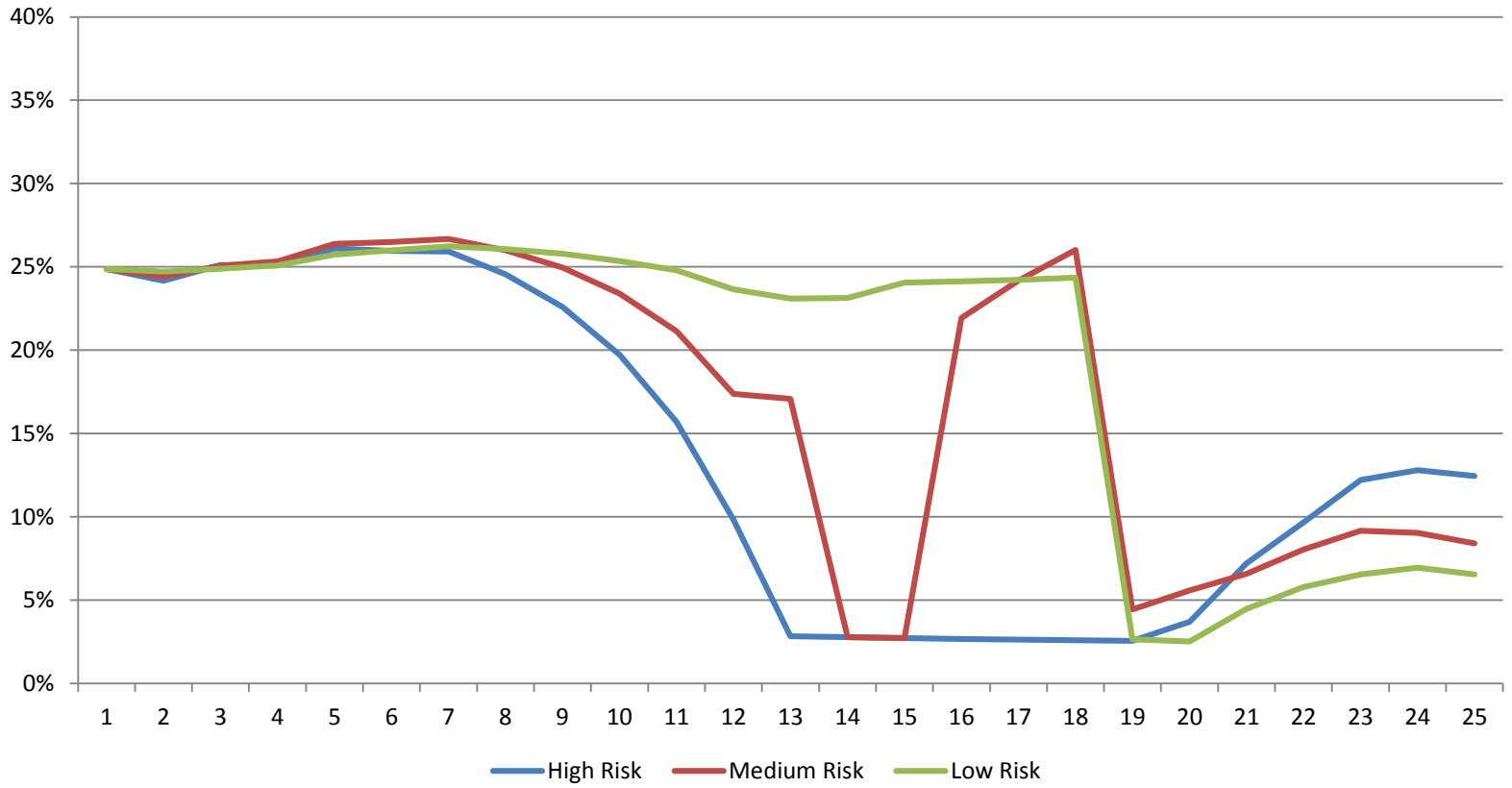
Scenario: Path of Contributions

- State Employees – Base Case



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Scenario: Path of Contributions

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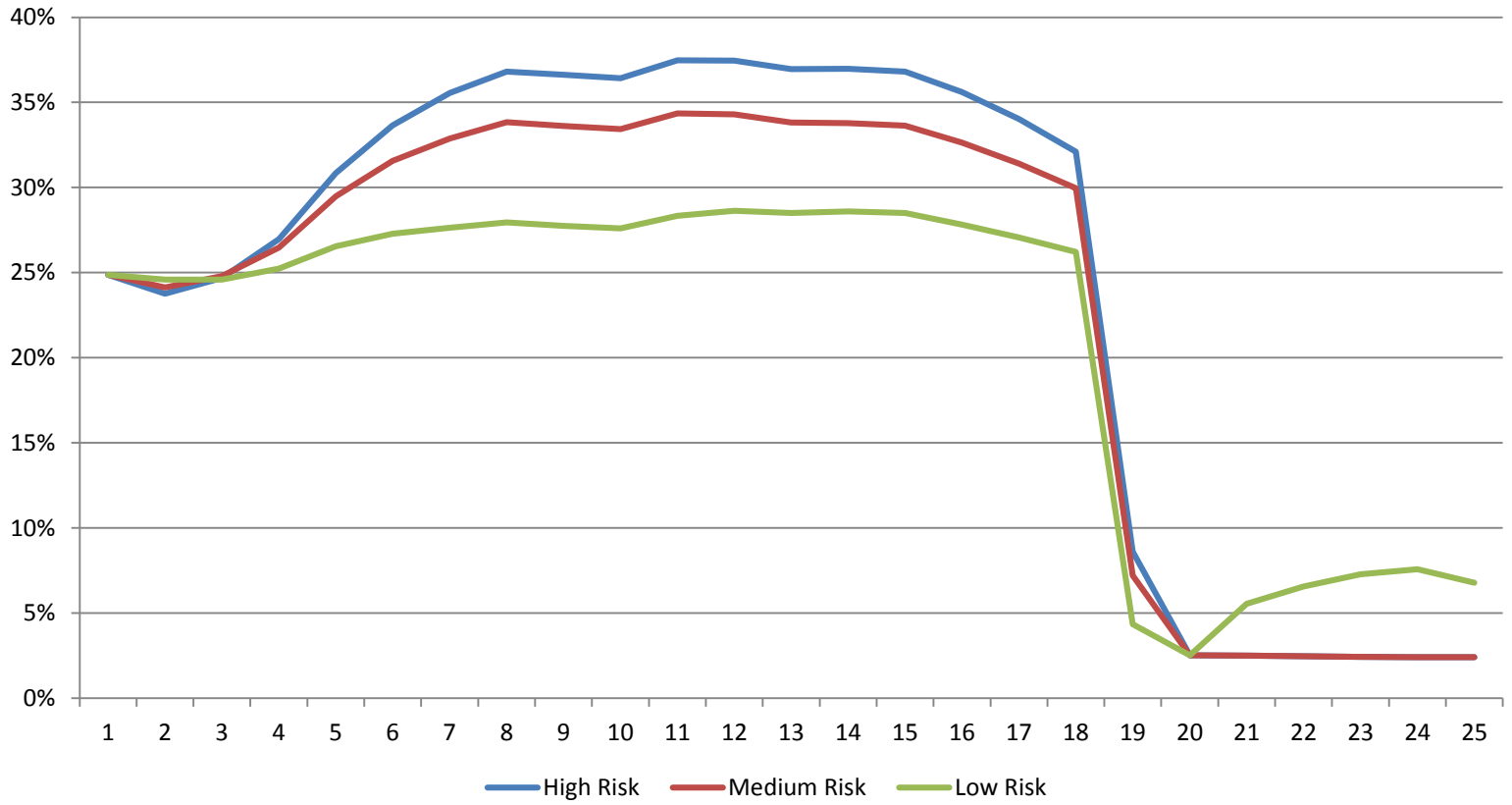

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Scenarios: Sample MERS Contributions

Year	High Risk Base Case	Med Risk Base Case	Low Risk Base Case	High Risk Early Recession	Med Risk Early Recession	Low Risk Early Recession
1	$ 16	$ 16	$ 16	$ 16	$ 16	$ 16
2	16	16	16	16	16	16
3	16	16	16	16	16	16
4	16	16	17	15	16	17
5	18	18	18	17	18	18
6	19	19	19	22	21	19
7	21	21	20	30	27	22
8	21	22	21	35	31	24
9	21	22	22	38	33	24
10	19	22	22	41	35	25
11	15	20	23	41	36	25
12	9	18	23	41	36	26
13	11	12	22	44	38	29
14	12	12	20	45	39	31
15	12	12	21	46	40	33
16	12	12	24	49	42	35
17	13	13	29	50	44	37
18	13	13	32	48	42	37
19	14	14	34	45	41	37
20	14	27	36	40	38	38
21	15	17	25	15	15	26
22	15	25	31	15	15	31
23	16	31	36	16	16	35
24	20	37	41	16	16	39
25	27	39	41	17	17	38
Total	$ 401	$ 492	$ 626	$ 776	$ 705	$ 694

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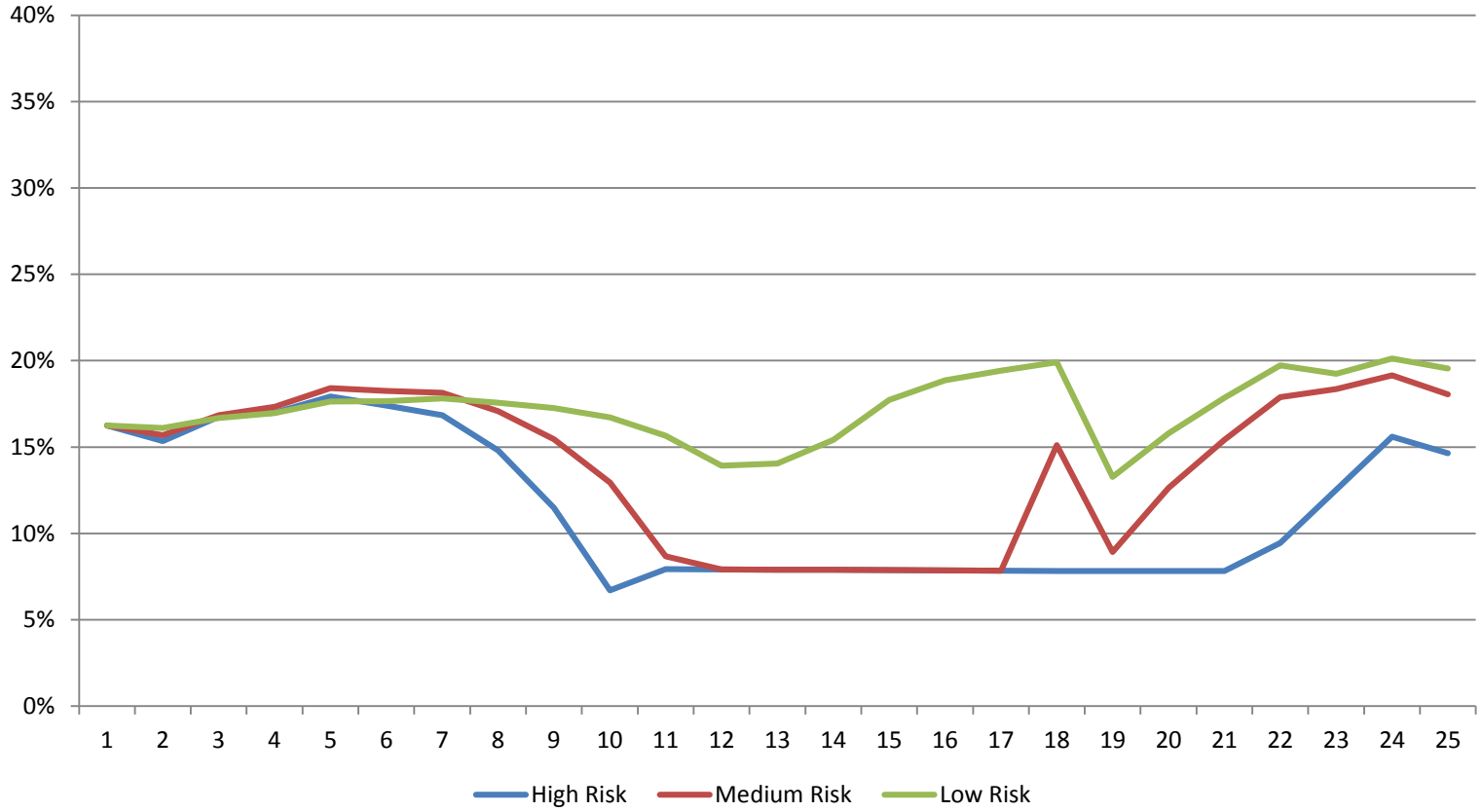
Scenario: Path of Contributions

- Sample MERS Plan – Base Case



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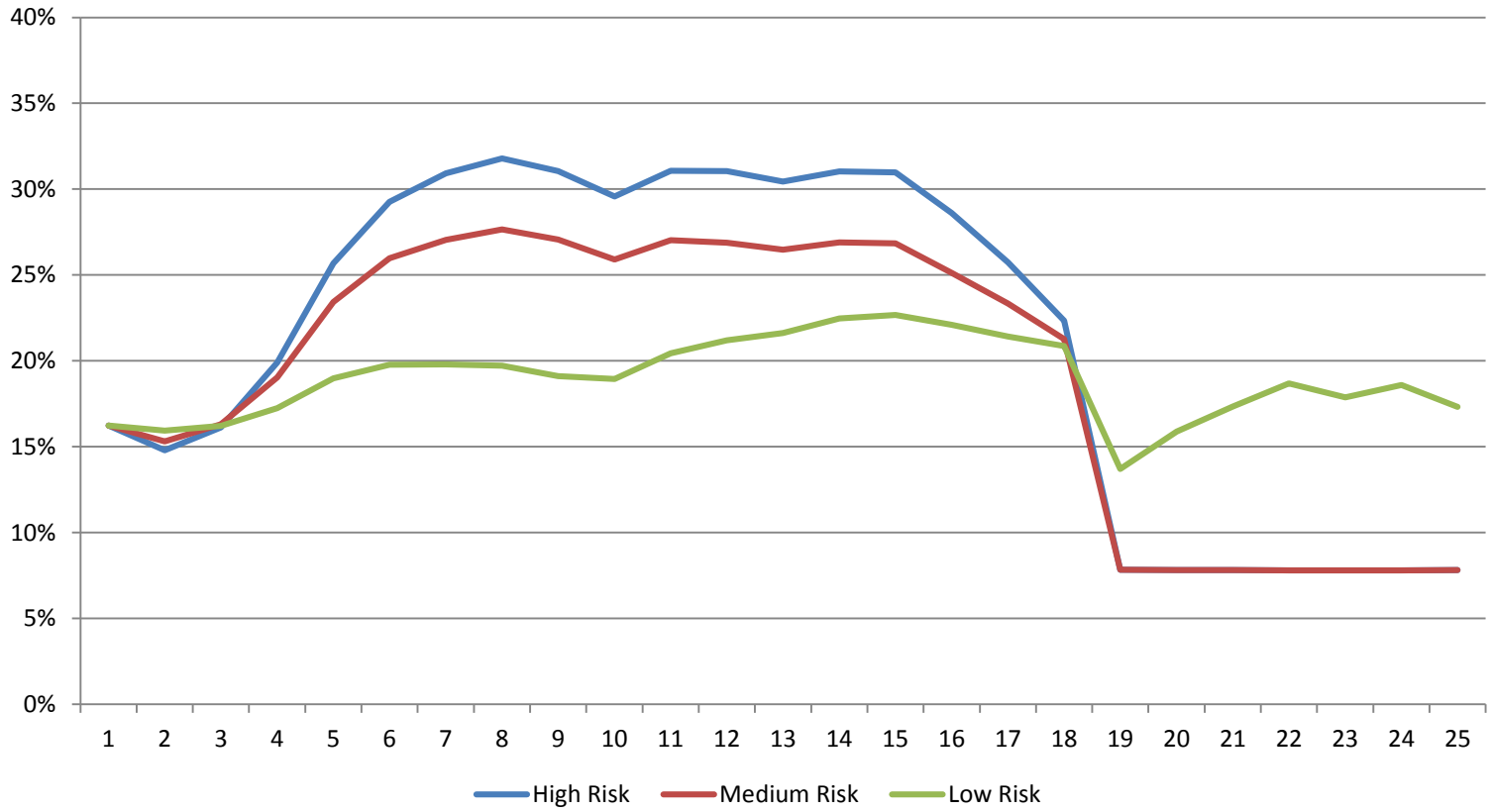
Scenario: Path of Contributions

- Sample MERS Plan – Early Recession Case



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