June 20, 2018

The Board of Trustees met on Wednesday, June 20, 2018 in the Board Room, 625 St. Joseph Street, New Orleans, LA. The meeting convened at about 11:00 A.M.

Present:

Dr. Tamika Duplessis, President Pro Tempore
Mr. Andrew Amacker
Mr. Christopher Bergeron
Ms. Eileen Gleason
Ms. Stacy Horn Koch
Mr. Ralph Johnson
Mr. Joseph Peychaud
Ms. Chante' Powell
Mr. Marvin Russell
Mr. Lynes Sloss
Mr. Lewis Sterling, III
Mr. John Wilson

Also in attendance: Ms. Jade Brown-Russell, Acting Executive Director of the Employees' Retirement System (ERS) and Sewerage and Water Board (S&WB); and the following S&WB staff – Ms. Marina Kahn, Interim Chief Financial Officer, Mr. James Thompson, Office of Special Counsel; and Dr. Tim Viezer, Chief Investment Officer.

ACTION ITEMS:

1. R-048-2018 Resolution to Assign Month-to-Month Investment Consulting Contract to FFC Investment Advisors of Raymond James

EXECUTIVE SESSION:

2. None.

PRESENTATION ITEMS:

3. Pension Committee Report

President Pro Tempore Dr. Tamika Duplessis began the meeting by reading the Employees' Retirement System mission statement into the record: "to prudently manage an actuarially sound pension fund solely in the interest of participants and beneficiaries in a cost-effective manner."

Dr. Duplessis then asked for a motion to approve the last meeting's minutes. Mr. Lynes Sloss moved to approve the minutes and Mr. Joseph Peychaud seconded the motion. The motion carried. Mr. Peychaud gave

the report of the Pension Committee by first noting that four sets of decisions will be made in the coming months: (1) deciding on the investment consultant, (2) decision rights within the Investment Policy Statement, (3) funding policy, and (4) asset allocation. Mr. Peychaud covered the three Pension Committee meetings since the Board of Trustees last met. In April the Pension Committee passed a resolution for Board of Trustee approval to assign on a month-to-month basis the investment consultant agreement to FFC Investment Advisors of Raymond James. In May the Committee discussed decision rights as codified in a "governance matrix." The process has sought to codify who offers input, who makes the decision, and who oversees tasks with respect to the pension. The Committee also reviewed the discussion draft professional services procurement policy for ERS which was distributed in April. In June the actuary presented the updated actuarial valuation and the Chief Investment Officer presented a recommended funding policy. Dr. Viezer commended the Pension Committee for its active engagement and Mr. Peychaud thanked the Committee for its prudence and commitment to the action plan.

Dr. Viezer noted the current investment consultant has been with ERS for almost a decade. The Pension Committee decided it was prudent to rebid the contract. Since the current consultant's contract expired in March, the Pension Committee wanted to have a month-to-month contract until the consultant search was completed. However, the consultant affiliated with Raymond James to strengthen his competitiveness. Therefore, the Committee passed a resolution for the Board of Trustees' approval assigning the contract to FFC Investment Advisors of Raymond James on a month-to-month basis. Ms. Gleason moved to approve R-048-2018, a resolution to assign a month-to-month investment consulting contract to FFC Investment Advisors of Raymond James. Mr. Sloss seconded the motion and the motion carried.

INFORMATION ITEMS:

Information item(s) a through g were received.

ANY OTHER MATTERS:

The following questions and requests were raised for follow-up:

1. Mr. Peychaud asked that the ERS Board of Trustees' meeting be conducted within the S&WB Board of Directors' meeting. Dr. Viezer added that this would need to be coordinated with the President of the Board of Trustees (Mayor Cantrell). Ms. Brown-Russell noted the request and said Board Relations would coordinate.

ADJOURNMENT:

There being no further business to come before the Board of Trustees, Dr. Duplessis called for a motion and Ms. Gleason made a motion to adjourn, which was seconded, and the motion carried. The meeting adjourned at approximately 11:07 A.M.

Respectfully submitted,

_____

Tamika Duplessis, PhD – President Pro Tempore

Callan

July 18, 2018

Sewerage & Water Board of New Orleans

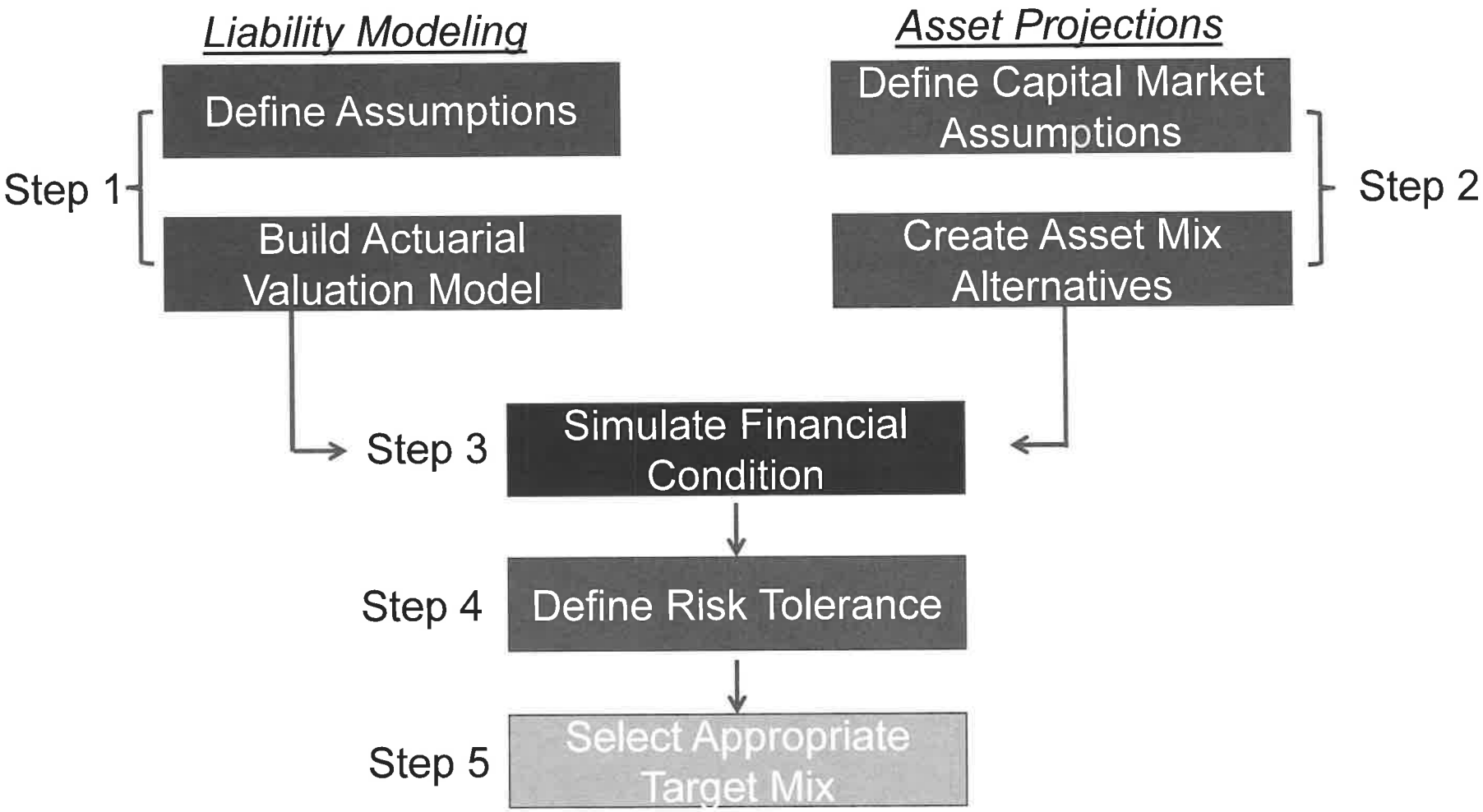
Asset Allocation and Liability Study: Results

Weston Lewis, CFA, CAIA
Atlanta Plan Sponsor Consulting

Cody Chapman, CFA, CAIA
Atlanta Plan Sponsor Consulting

Karen Harris, CFA, ASA
Capital Markets Research Group

Overview of the Asset-Liability Process



Callan's Asset Allocation and Liability Process

Description

Step 1: Liability Modeling

- Examine the characteristics of the pension plan liabilities that influence the investment strategy the most.

Step 2: Asset Projections

- Develop 10-year forward looking capital market expectations for return and risk.
- Create alternative asset mixes to test in the study using an asset-liability framework.

Step 3: Simulate Financial Condition

- Examine a range of capital market outcomes for each asset mix on the pension plan.
- Focus on the impact to pension surplus and contribution risk.

Step 4: Define Risk Tolerance

- Examine the return and risk trade-offs between the alternative asset mixes.
- Examine downside risk of each alternative asset mix.

Step 5: Select Appropriate Target Mix

- Define your primary goals and objectives for the pension plan investments and select an optimal asset mix.

GLOSSARY OF TERMS INCLUDED IN THE APPENDIX

Step 1 - Defining the Liability Assumptions

- January 1, 2018 data and valuation report, as provided by actuary Conefry & Company, LLC.
- Model excludes the current Drop Account Balances ($11.6M) because they are invested in cash.
- Investment risk associated with the asset allocation decisions is reflected in the size of Unfunded Liability as well as the Employer Contribution.
  - Contribution amounts shown use the 15-year closed amortization.

	With Drop	Exclude Drop
Present Value Future Benefits (PVFB)	$ 342.5M	$ 330.9M
less Present Value of Future Normal Costs	26.6	26.6
Actuarial Liability (AL)	315.9	304.3
Market Value of Assets (MVA)	$ 235.3M	$ 223.7M
Actuarial Value of Assets (AVA)	241.4	229.8
Surplus/(Unfunded Liability) = AVA-AL	$ (74.5)M	$ (74.5)M
Funded Ratio = AVA/AL	76.4%	75.5%
Normal Cost	$ 4.7M (11.25% pay)	11.25% pay
plus Amortization Payment (15 year Closed)	+7.9 (18.97% pay)	+18.97% pay
less Employee Contribution	-2.1 (5.00% pay)	-5.00% pay
Employer Contribution	$10.5M (25.22% pay)	25.22% pay

Step 1 - Defining the Liability Assumptions (Continued)

Funding Policy

- Funding Policy :
  - Entry Age Normal level % of pay used to determine normal cost
  - Asset smoothing reflects a full 7 years of gains / losses

  - Total Contribution equal to Normal Cost plus a "closed" 15-year Amortization payment for each year's actuarial gains and losses.
  - Total Contribution equal to the Normal cost plus an "open" 30-year amortization payment, which takes the entire unfunded liability at each valuation date and re-amortizes over a new 30 year period.

  - Employer Contribution equals the Total Contribution less the Employee Contribution, expressed as a % of Payroll.
  - Employee Contributions modeled as 5% of pay for this study in accordance with the 2018 actuarial report:
    - *Despite "Actual" contributions from employees currently at 6% of pay, or 1% higher.*
    - *The model therefore assumes the Total Contribution would remain the same as the actuarial projections, and the "actual" employer contribution rates could be 1% lower than the rates shown in this study.*

Step 1 - Defining the Liability Assumptions (Continued)

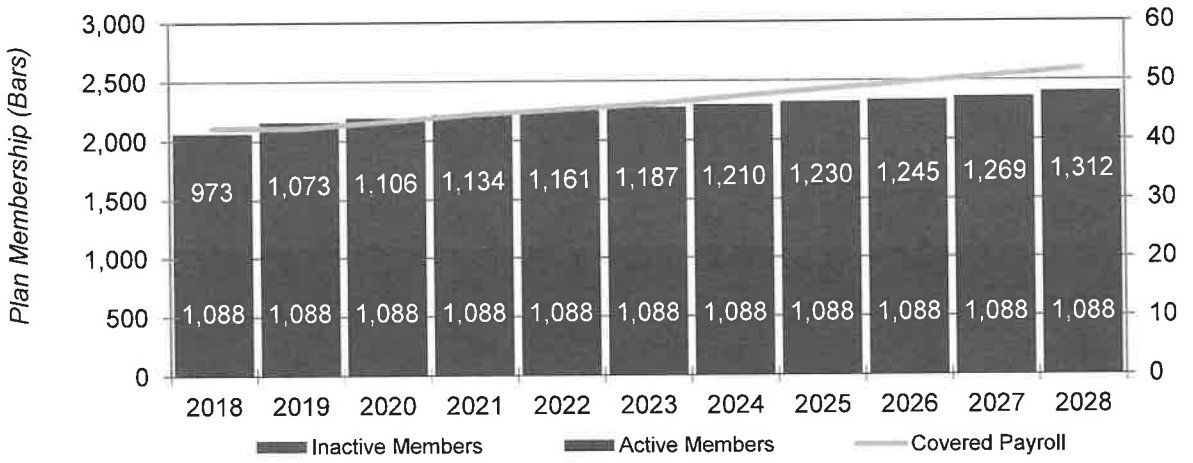
Workforce Projections

- Modeled and tested several future workforce projections:
  - 1. Level population of 1088 active employees.
    - *Which means maintaining the current workforce, and replacing those who leave with a new hire. The new hire is eligible to join the plan.*
  - 2. Increasing to 1500 active employees over 5 years.
  - 3. Assume everyone who can retire in the next 5 years will, with *level* population of 1088 active.
  - 4. Closing the plan to new hires.
- Other considerations in the liability model:
  - 5. Lowering the actuarial discount rate from 7% to 6% in 2019.
  - 6. Katrina-like scenario where employee and employer contributions stop.
  - 7. Scenario analysis such as another 2008-like market decline or 2001 tech bubble in the next 5 years.

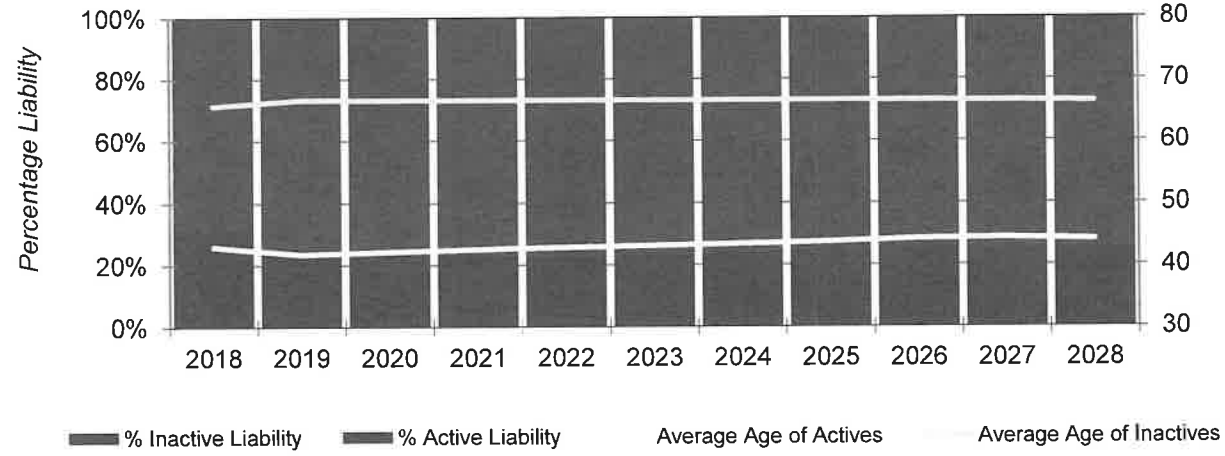
Step 1 - Building the Actuarial Valuation Model

1. Level Population Characteristics

Plan Membership



Plan Maturity

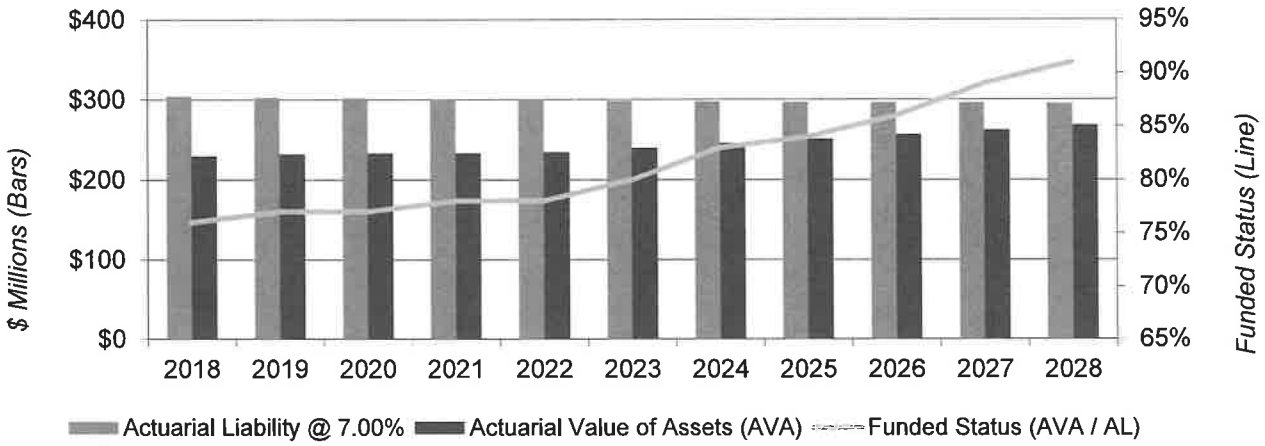


- Begin with a ***deterministic projection***, one scenario whereby the actuarial assumptions will be met (i.e. future experience will equal actuarial assumptions):
  - 7% investment return (i.e. discount rate)
  - 2% COLA
  - GAM 71 mortality
  - *One exception:*
    - *payroll projections assume 3% "actual" salary increase (versus 5% actuarial assumption)*
    - *lower payroll implies actuarial gains each year - consistent with the last 2 valuation reports.*
- Inactive includes retirees, beneficiaries, and deferred-terminated vested.
- Plan maturity indicates that active and inactive liabilities are fairly constant over next 10 years, with a large portion associated with inactive.
- Lower salary experience impacts the active portion of the liability.

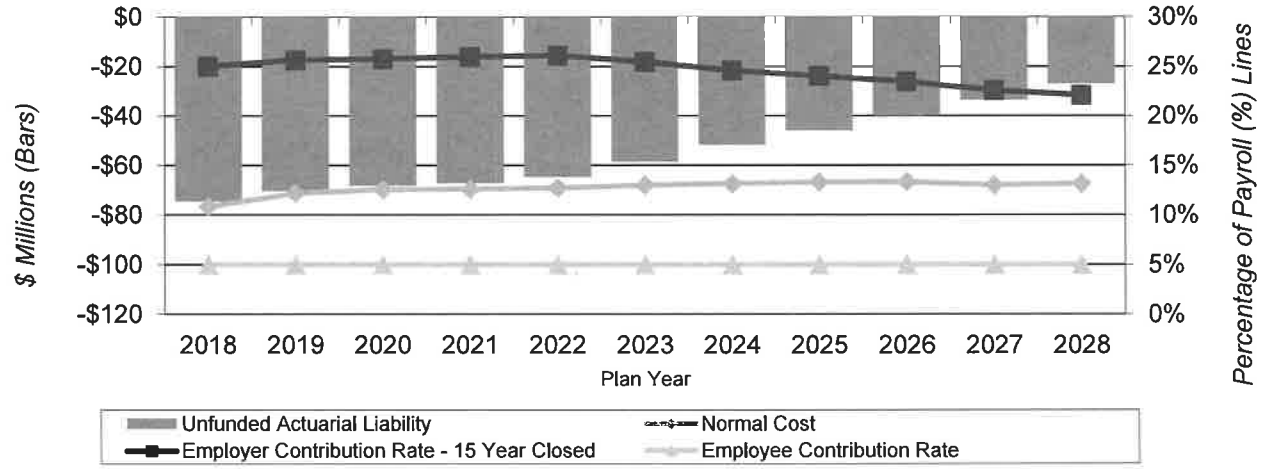
Step 1 - Building the Actuarial Valuation Model

1. Level Population Funding Progress – 15 Year Closed Amortization

AL Funded Status



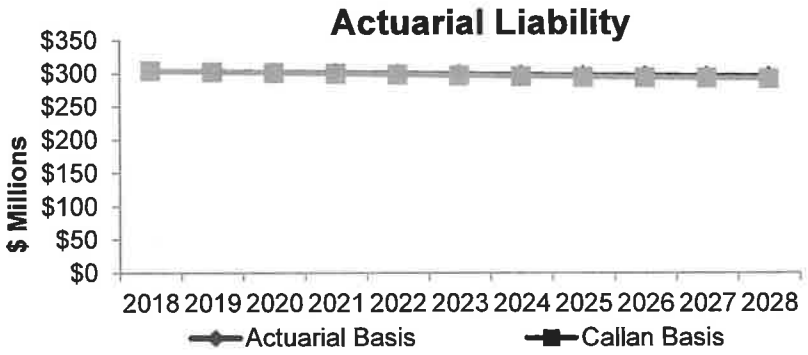
Contribution Rates

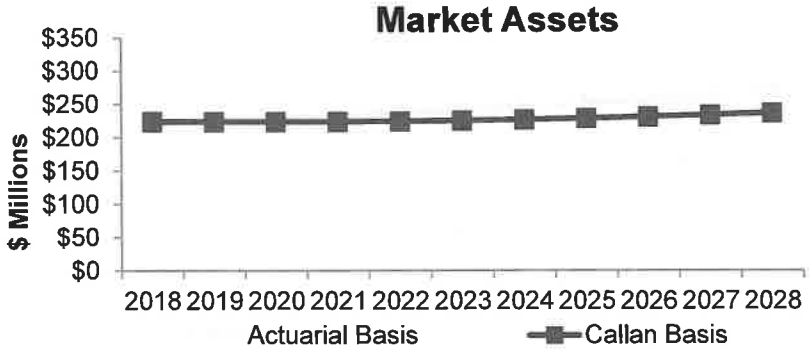


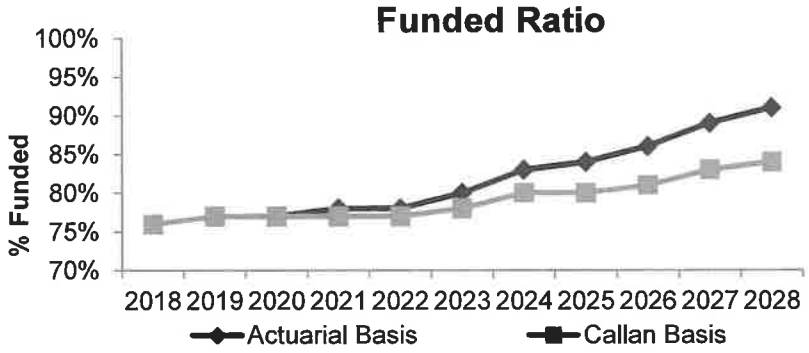
- Funded status and contribution projections reflect 7.00% return in each future year:
  - Stochastic modeling is necessary because a constant return assumption in each year is unlikely.
- Assets are expected to grow as the unfunded liability is paid down, but actuarial liabilities appear to have peaked.
- Total Normal Cost rate rises marginally in the next year but stays level thereafter.
- Under a closed 15-year amortization, the Employer Contribution rate will decline as actuarial gains from lower salary are amortized.

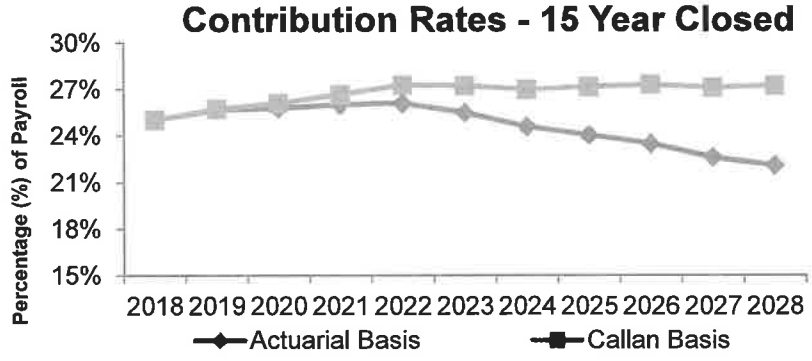
Step 1 - Building the Actuarial Valuation Model

1. Level Population – Closed 15 Year Amortization: Compare Assumptions







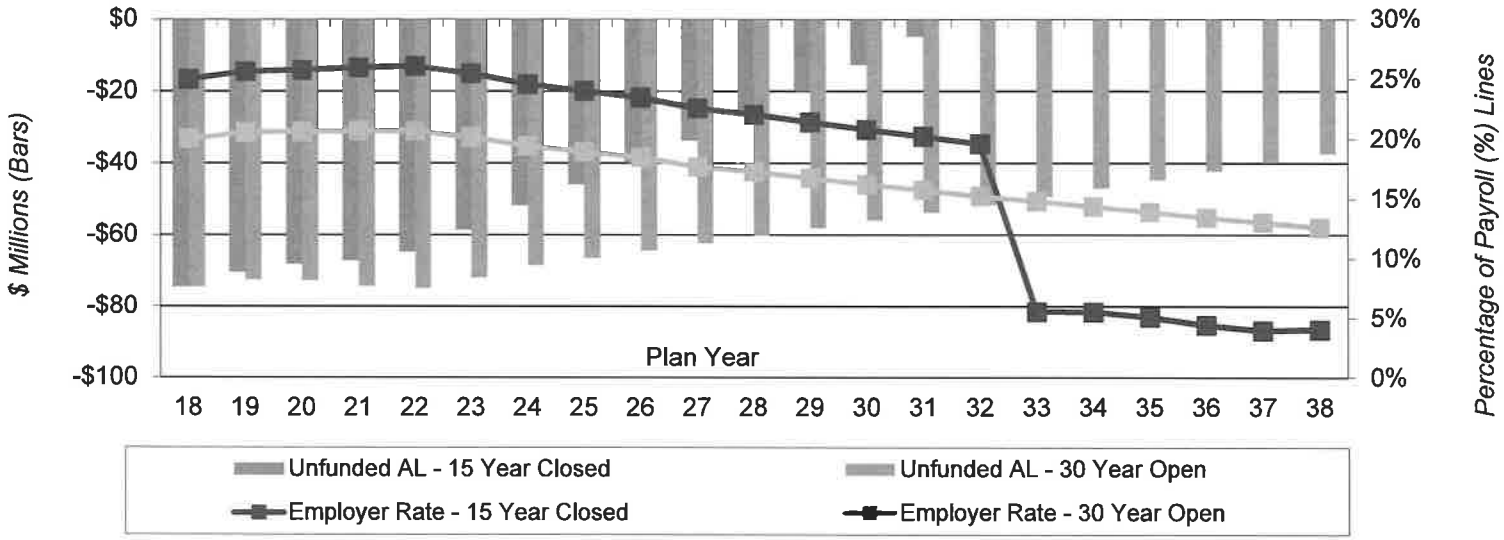


- Callan Basis projections are lower relative to the actuarial projections:
  - Callan returns for the next 10 Years = 5.65%, Actuarial assumption = 7.00%.
  - Return differences are due to Callan's 10Yr forecast horizon relative to the actuary's longer horizon of 40- 50 years.
- At the end of 10 years, Callan projects that liabilities will be roughly equal, but assets will be 8% lower and funded status will be 7% lower than the actuarial basis.
- Overall, investment losses will exceed gains from lower salary experience, resulting in net actuarial losses that are amortized into higher contribution rates.

Step 1 - Building the Actuarial Valuation Model

1. Level Population - Closed versus Open Amortization

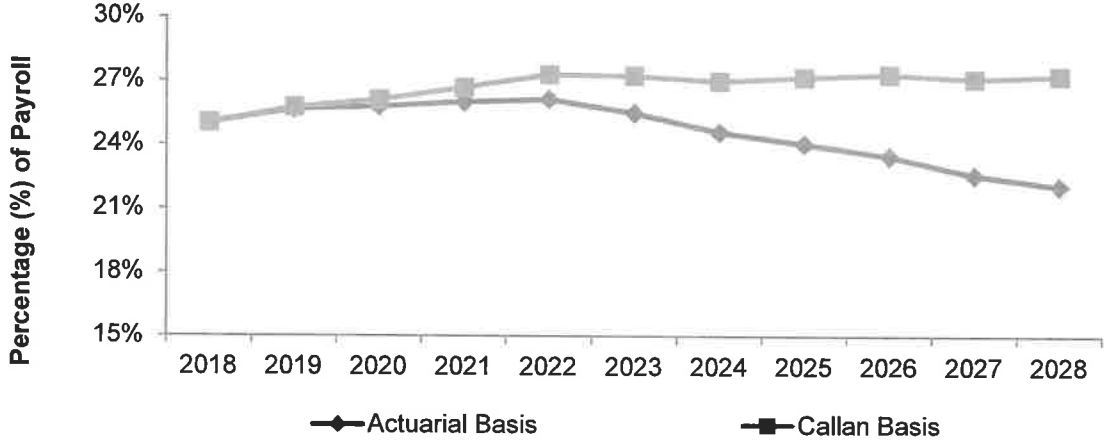
Impact of Open versus Closed Amortization

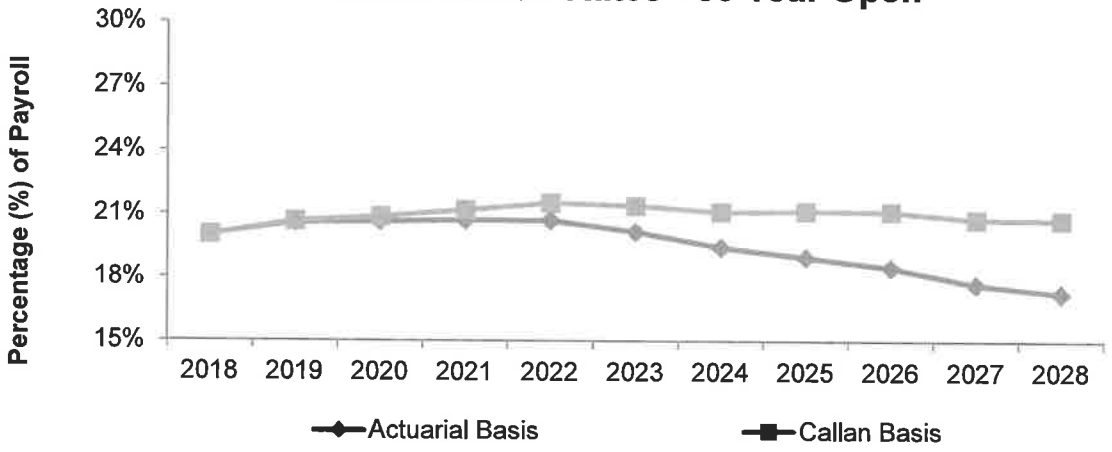


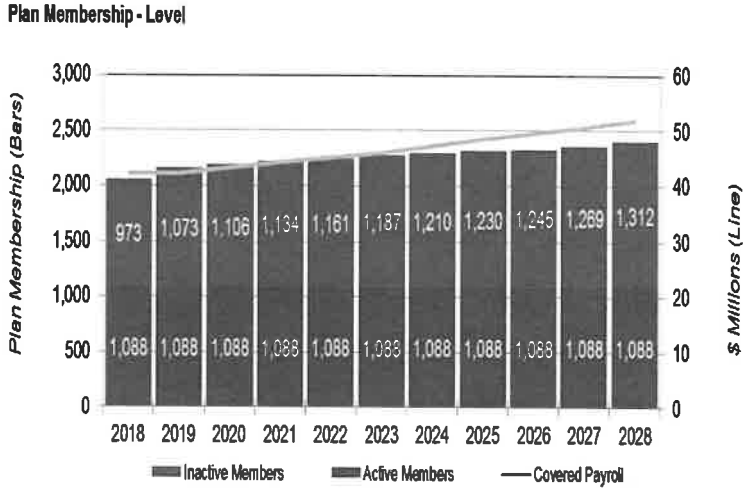
- Projection has been extended from 10 years to 20 years to show the impact of **15-year "closed"** versus **30-year "open"** amortizations.
- A 30-year "open" amortization policy results in less than half of the unfunded liability being paid down after 20 years:
  - Under this policy, the unfunded liability is never fully paid off.
  - Analogy is asking the bank every year to re-calculate your mortgage with a new 30-year lending period. You will never fully pay off the loan.
- An "open" amortization policy also results in an elevated contribution rate for a much longer period of time.

Step 1 - Building the Actuarial Valuation Model

1. Level Population - Closed versus Open Amortization



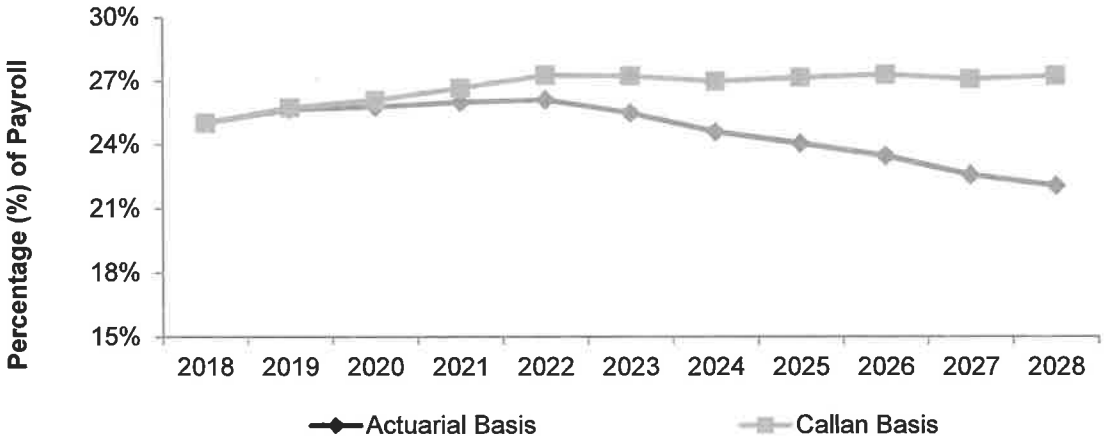


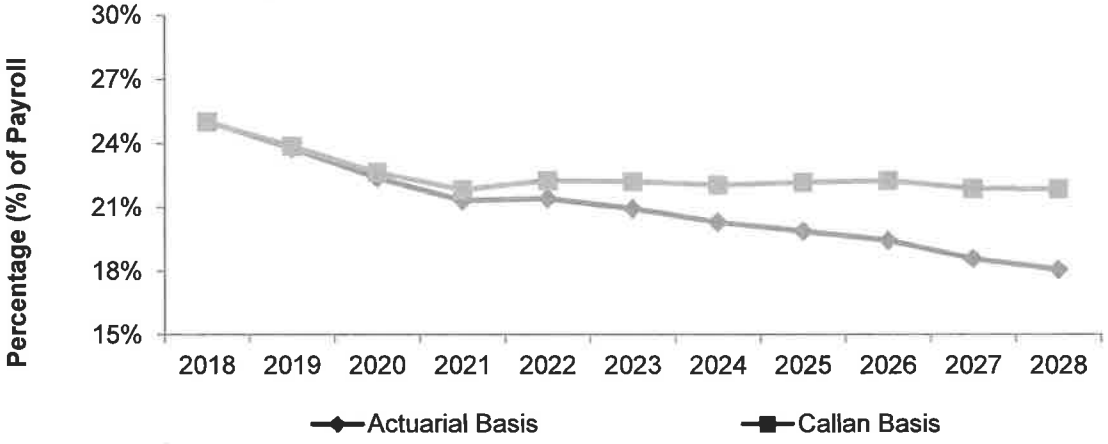


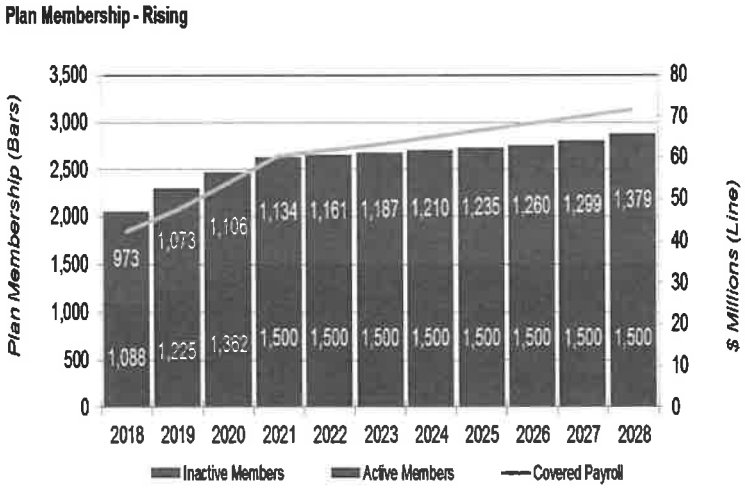
- Using the Callan Basis of lower expected returns, the charts compare the impact of closed versus open amortization on employer contribution rates for the level population.
- Charts indicate a range of employer contribution rate between 21 – 27% of payroll over the next 10 years in the expected case.

Step 1 - Building the Actuarial Valuation Model

2. Rising Population - Impact on Employer Contribution Rates



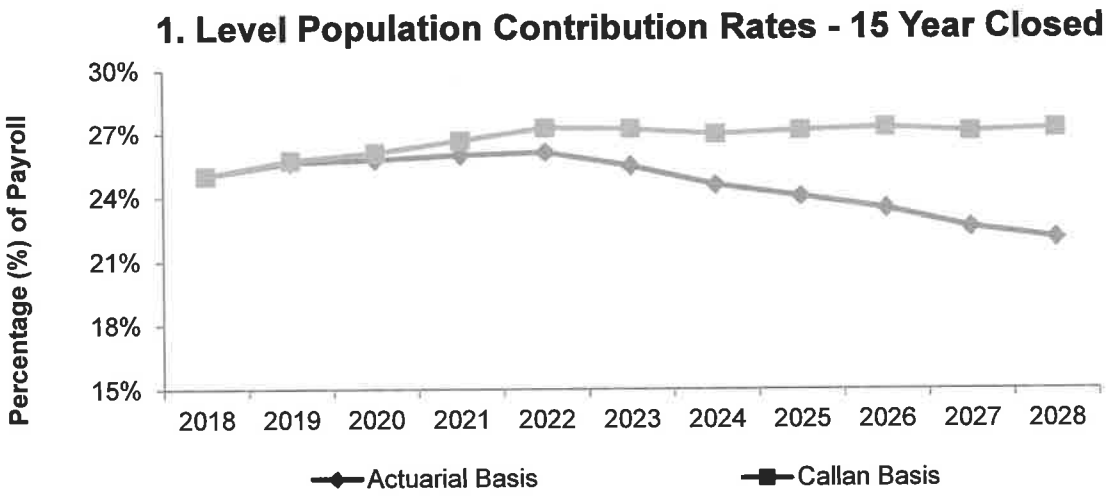


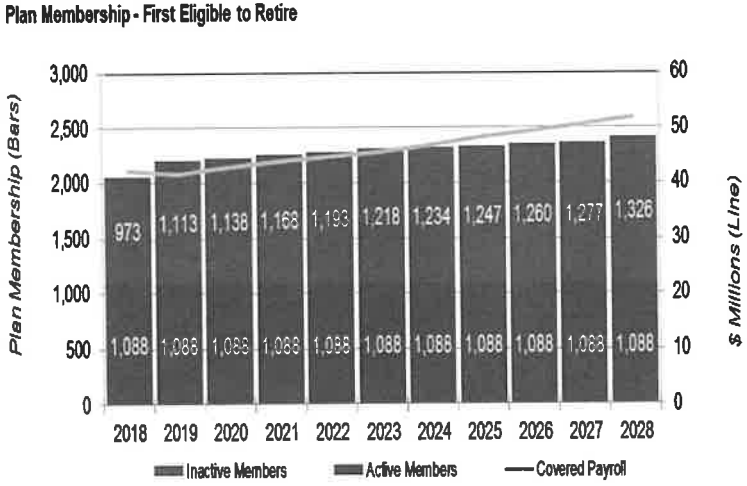


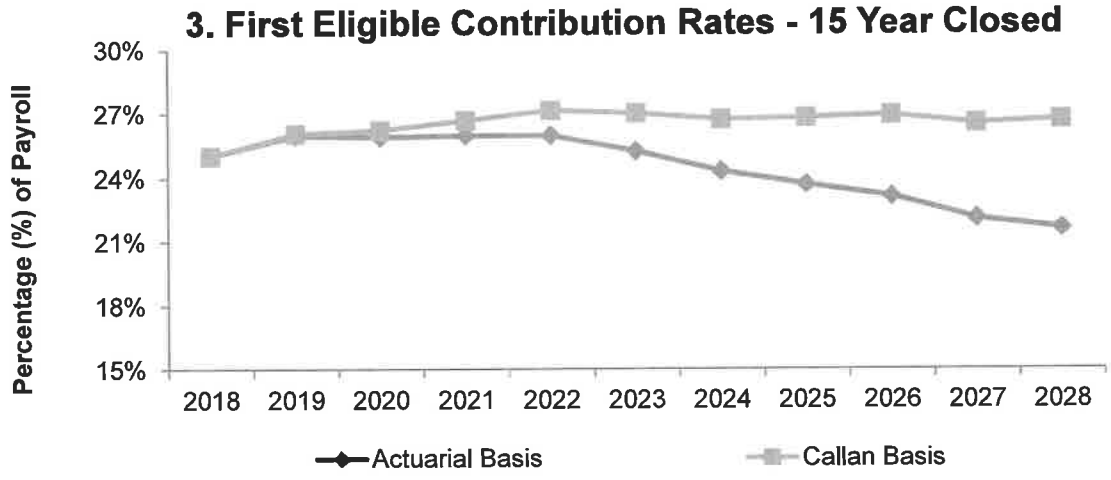
- Increasing the size of the active population results in a lower employer contribution rate:
  - Dollars of payroll increases and shown in the membership table above
  - Unfunded liability as a % of total payroll therefore declines
  - Normal cost as a % of total payroll stays the same.

Step 1 - Building the Actuarial Valuation Model

3. First Eligible for Retire - Impact on Employer Contribution Rates



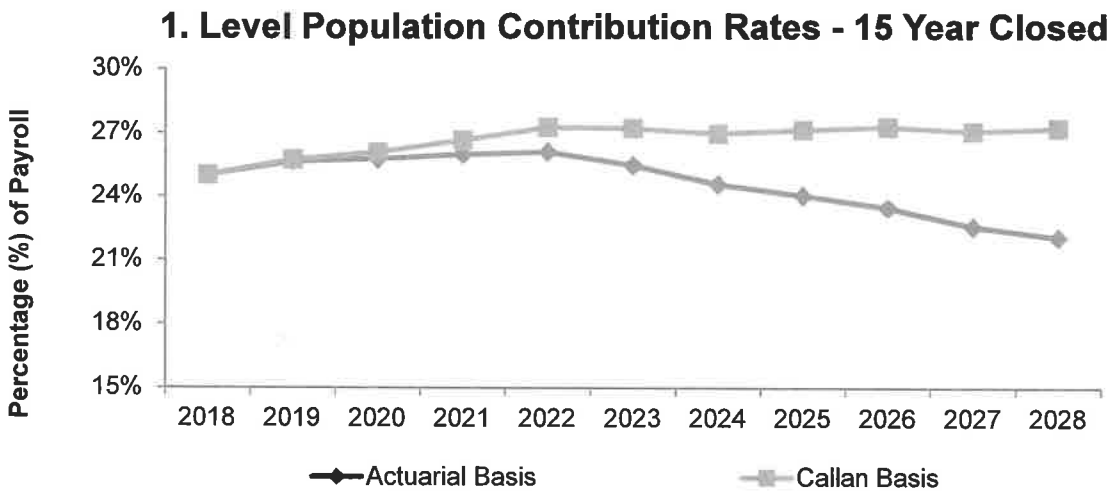


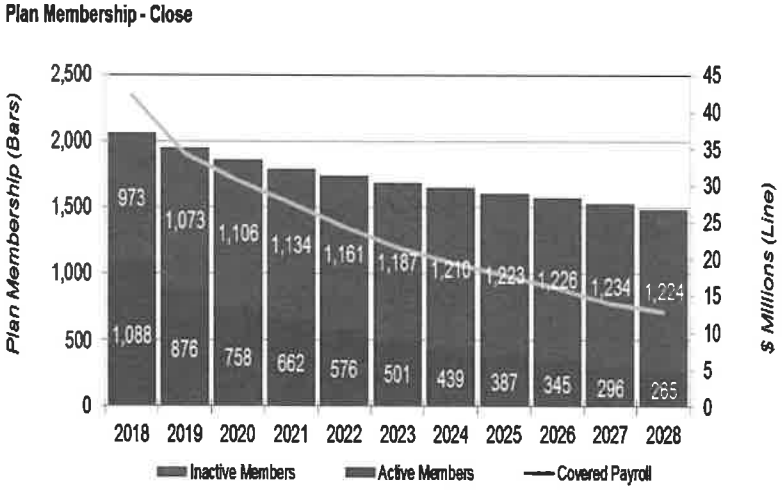


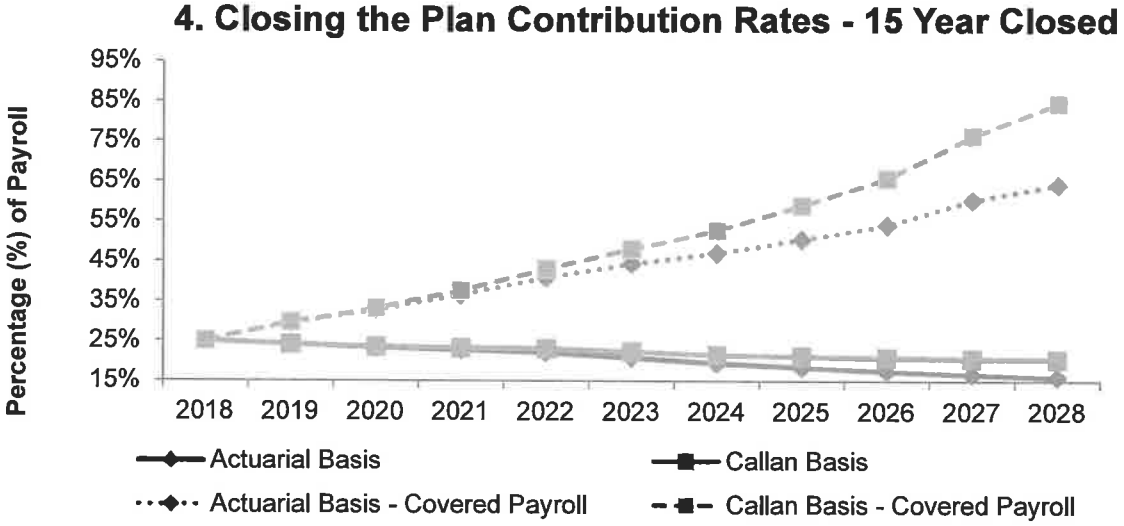
- Increased retirements over the next 5 years have no meaningful impact on employer contribution rates:
  - Actuary already assumes a high rate of retirement at first eligibility.

Step 1 - Building the Actuarial Valuation Model

4. Closing the Plan – Impact on Employer Contribution Rates





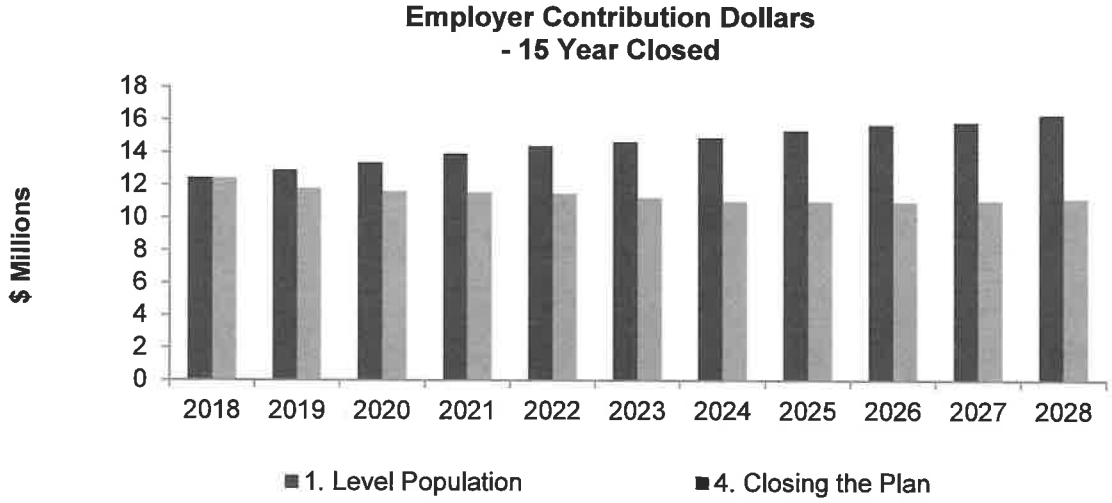


- Closing the Plan to new entrants has the impact of lowering the employer contribution rate:
  - A lower rate if the same total payroll as the level population projection (i.e. $42M rising to $50M).
  - A higher rate if covered payroll for those that remain in the plan, as shown in the membership chart above (i.e. $42M falling to $12M).

Step 1 - Building the Actuarial Valuation Model

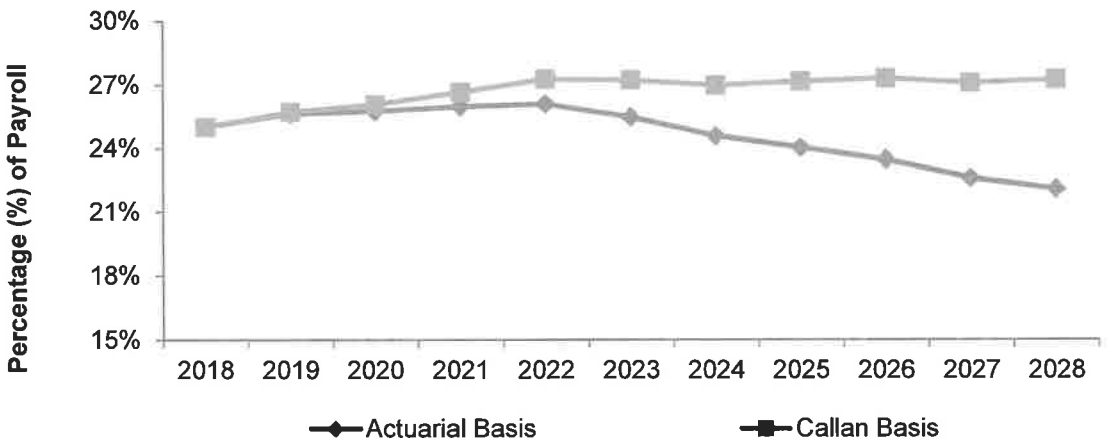
4. Closing the Plan – Impact on Employer Contribution Rates

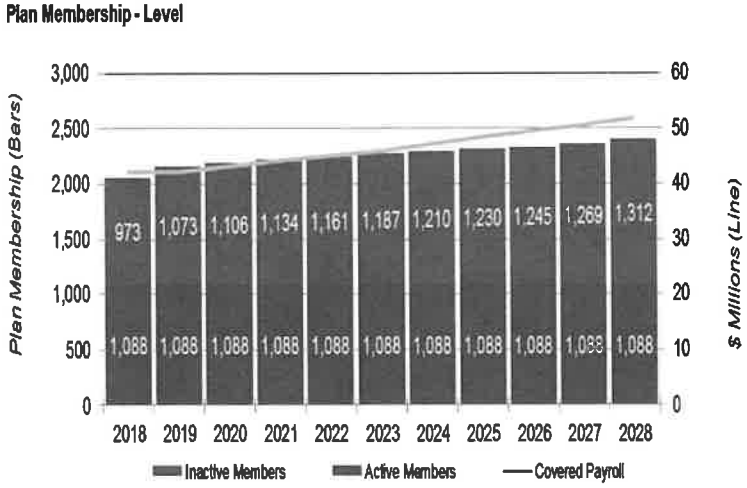
- Closing the Plan lowers the total dollars of contributions to fund the Unfunded Liability.
- In addition, these figures exclude any additional contribution to a defined contribution plan.

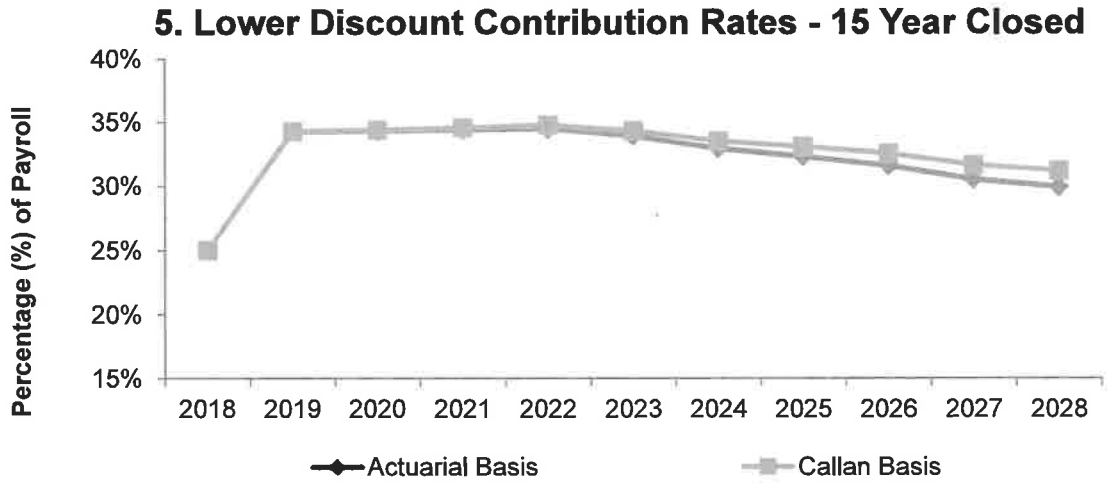


Step 1 - Building the Actuarial Valuation Model

5. Lowering the Discount Rate – Impact on Employer Contribution Rates





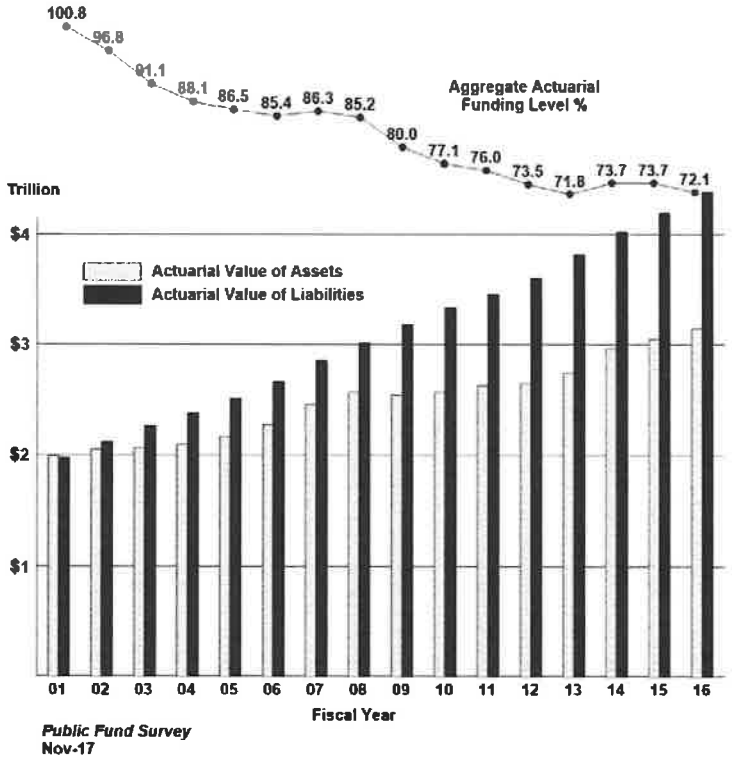


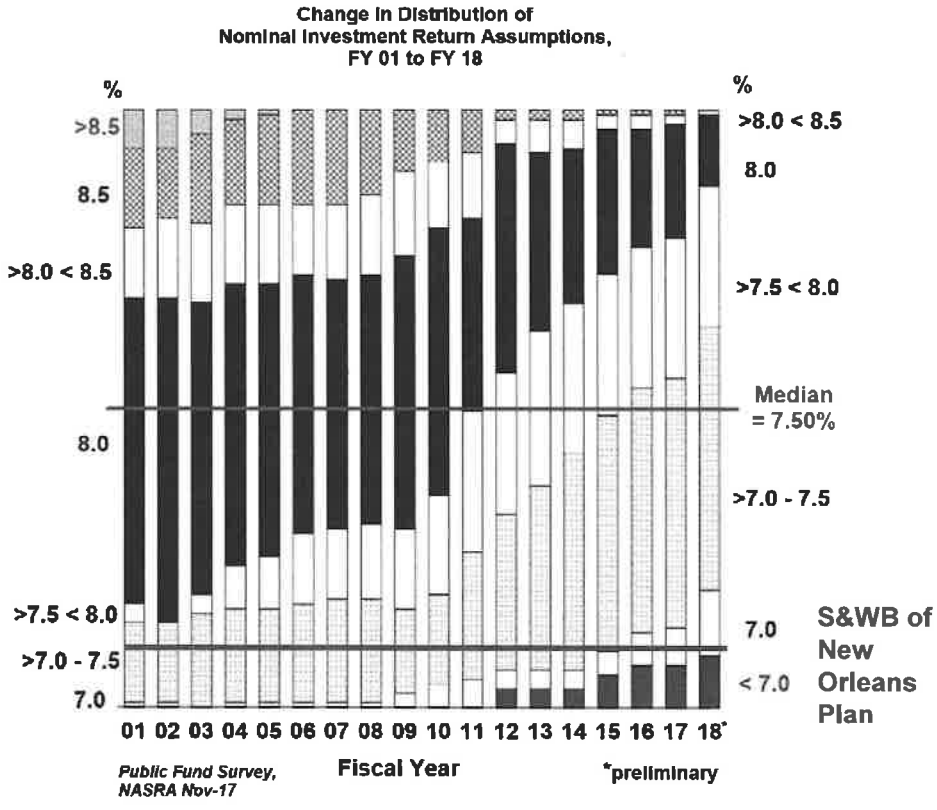
- Assuming a level population, lowering the discount rate in 2019 to 6% has the immediate impact of increasing the contribution rate by 8% of total payroll.
  - However, the contribution rate declines over time because the return hurdle rate is lower.
  - The gap between the actuarial basis and the Callan basis closes.

Step 1 - Building the Actuarial Valuation Model

5. Lowering the Discount Rate

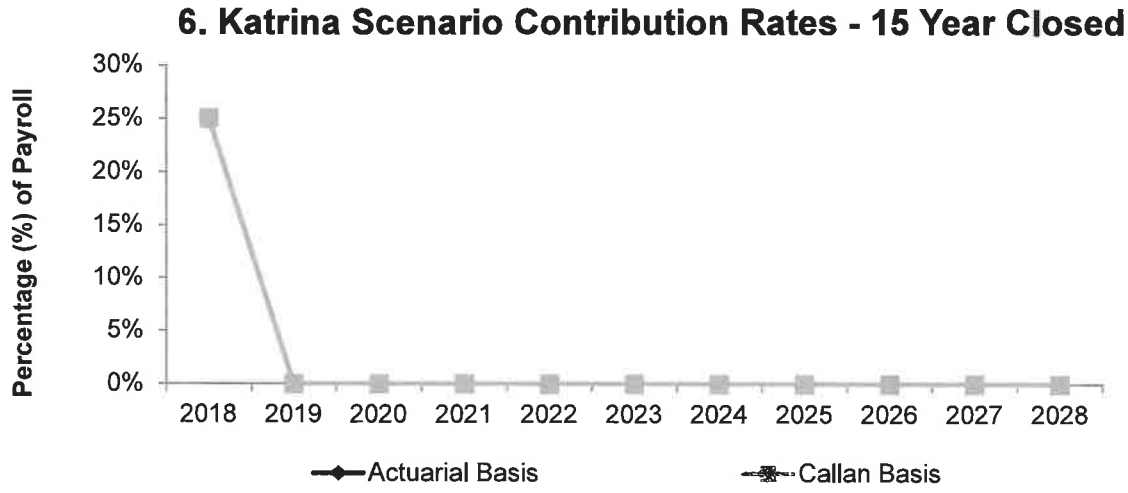
- S&WB of New Orleans Plan is well positioned relative to other public funds recently surveyed by the National Association of State Retirement Administrators (NASRA):
  - Plan's funded ratio at 1/1/2017 was 81% and Discount Rate = 7.00%.
  - Median Funded Ratio of peer group was 73.8% (aggregate 72.1%) and Discount Rate = 7.50%.

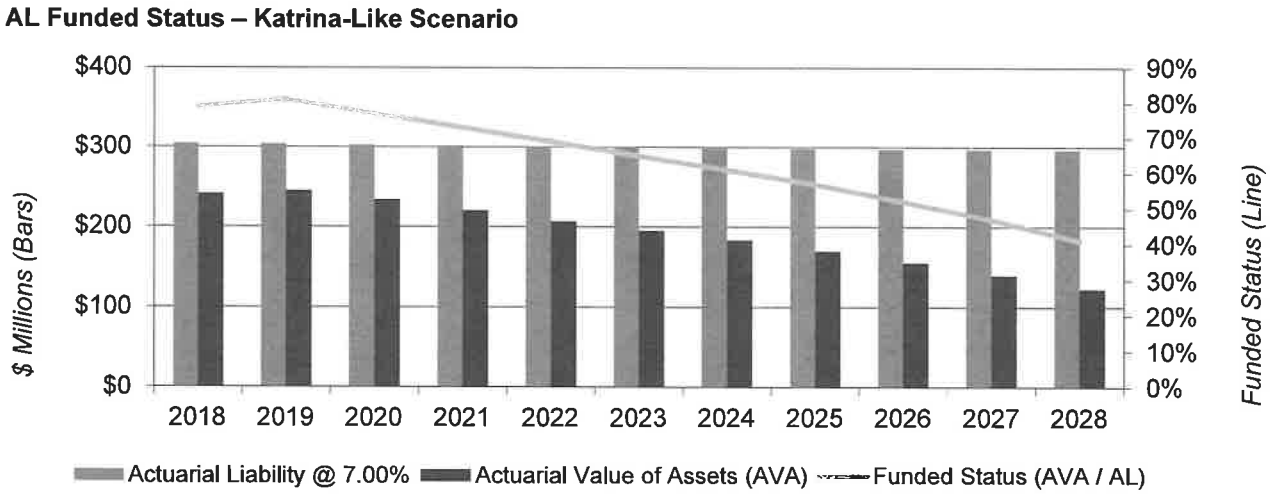




Step 1 - Building the Actuarial Valuation Model

6. Katrina-Like Scenario



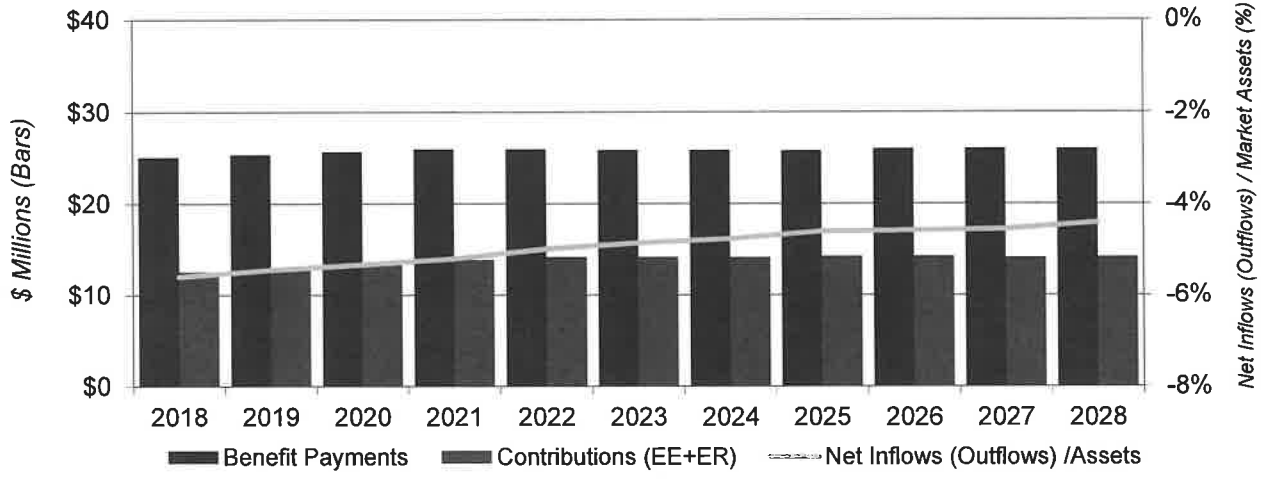


- A Katrina-like scenario assumes no further employee or employer contributions, beginning in 2019.
- The impact to the plan would be a declining asset base and rising liquidity needs.
  - For example, 2019 benefit payments as a percentage of the current market value of assets is ~11%
  - Ensuring a source for liquidity in the asset allocation should be an important element.
- If contributions stop indefinitely, the Fund is expected to be exhausted by the end of 14th year.

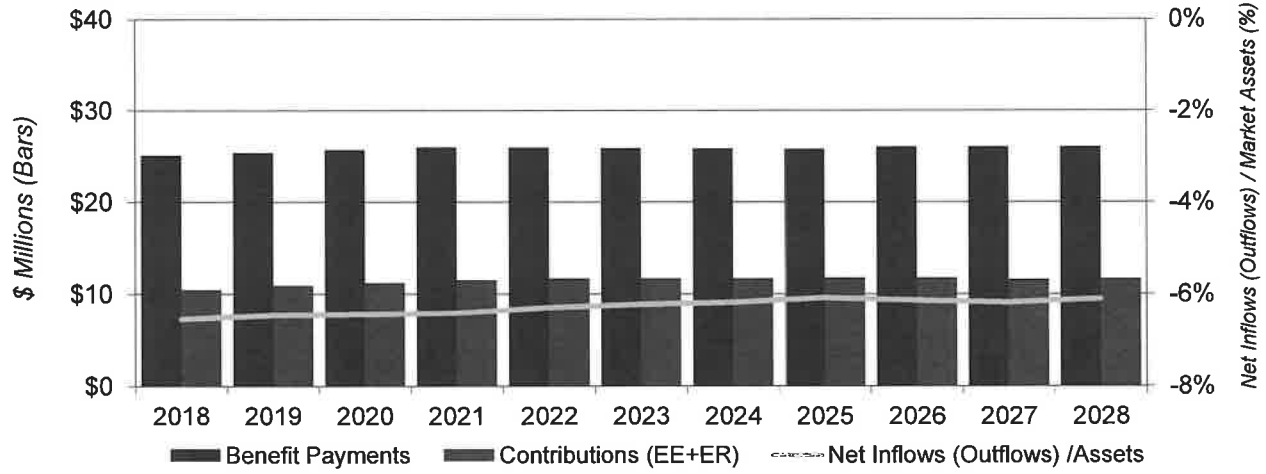
Step 1 - Building the Actuarial Valuation Model

Net Cash Flow – 1. Level Population

Cash Flow Analysis - 15 Year Closed Amortization



Cash Flow Analysis - 30 Year Open Amortization



- Net Cash Flow = Total Contributions – Benefit Payments:
  - taken as a percentage of the market assets as of the beginning of the year.
- Liquidity needs help define the appropriate time horizon for investments and shape the ability of the Plan to commit to illiquid asset classes.
- Liquidity needs depend on the funding policy, and are in the range of 4-7% of assets each year, which are manageable with only a small allocation to cash:
  - 2 to 3 months of benefit payments with no contributions equal 1.8-2.8% cash.

Step 2 - Defining the Capital Market Expectations

2018-2027 Capital Market Expectations

Asset Class	Index	Projected Return*	Projected Risk
Equities			
Broad Domestic Equity	Russell 3000	6.85%	18.25%
Large Cap	S&P 500	6.75%	17.40%
Small/Mid Cap	Russell 2500	7.00%	22.60%
Global ex-US Equity	MSCI ACWI ex USA	7.00%	21.00%
International Equity	MSCI World ex USA	6.75%	19.70%
Emerging Markets Equity	MSCI Emerging Markets	7.00%	27.45%
Fixed Income			
Short Duration	Bloomberg Barclays 1-3 Yr G/C	2.60%	2.10%
Domestic Fixed	Bloomberg Barclays Aggregate	3.00%	3.75%
Long Duration	Bloomberg Barclays Long G/C	3.00%	10.95%
TIPS	Bloomberg Barclays TIPS	3.00%	5.25%
High Yield	Bloomberg Barclays High Yield	4.75%	10.35%
Non-US Fixed	Bloomberg Barclays Glbl Agg xUSD	1.40%	9.20%
Emerging Market Debt	EMBI Global Diversified	4.50%	9.60%
Other			
Real Estate	Callan Real Estate Database	5.75%	16.35%
Private Equity	TR Post Venture Capital	7.35%	32.90%
Hedge Funds	Callan Hedge FoF Database	5.05%	9.15%
Commodities	Bloomberg Commodity	2.65%	18.30%
Cash Equivalents	90-Day T-Bill	2.25%	0.90%
Inflation	CPI-U	2.25%	1.50%

** Geometric returns are derived from arithmetic returns and the associated risk (standard deviation).*

Step 2 - Create Alternative Asset Mixes

Portfolio Optimization Mixes

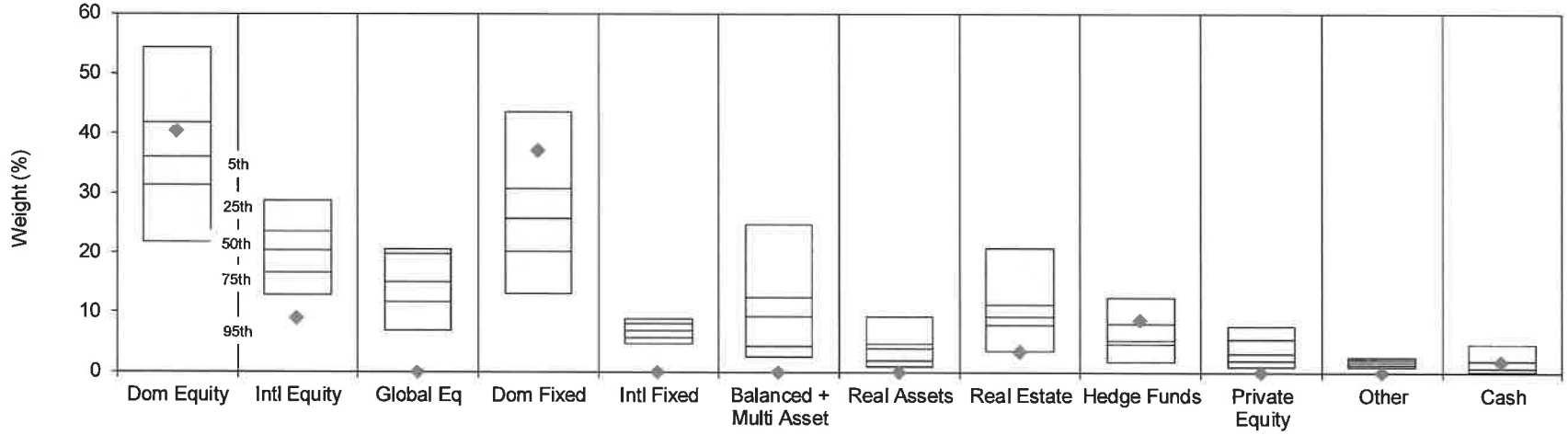
Component	Target	Min	Max	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
Broad US Equity	40.25%	0%	100%	25%	27%	29%	32%	34%
Global ex US Equity	9%	0%	100%	18%	20%	22%	23%	25%
Real Estate	3.25%	0%	100%	8%	8%	9%	10%	11%
Hedge Funds	8.75%	0%	100%	8%	9%	9%	9%	9%
Domestic Fixed	37%	0%	100%	40%	35%	30%	25%	20%
Cash Equivalents	1.75%	1%	1%	1%	1%	1%	1%	1%
Total	**100%**			**100%**	**100%**	**100%**	**100%**	**100%**
Total Fixed Income+Cash	**38.75%**			**41%**	**36%**	**31%**	**26%**	**21%**
Asset-Only								
Expected Return	5.64%			5.57%	5.76%	5.93%	6.10%	6.26%
Standard Deviation	10.05%			9.60%	10.46%	11.33%	12.21%	13.09%
Sharpe Ratio	0.329			0.337	0.327	0.317	0.308	0.299

- Analysis uses the current asset classes, with a small constraint on cash to account for the drag on returns from net negative cash flow needs:
  - Liquidity needs can be managed with the fixed income allocation, or alternatively through an overlay program.
- Mixes optimized in return and risk; Mix 1 is closest to the current target allocation:
  - Favors slightly higher non-US equity and real estate and much lower US equity allocations.
- Mix 5 is the most aggressive asset mix considered, with only 20% allocated to domestic fixed income.
- See appendix for asset class education material.

Step 2 - Create Alternative Asset Mixes

Peer Group Comparisons - What are Others Doing?

Callan Public Fund DB Plan Sponsor Database
Market Assets between $100M and $1B
Actual Allocation as of December 31, 2017, Count =75

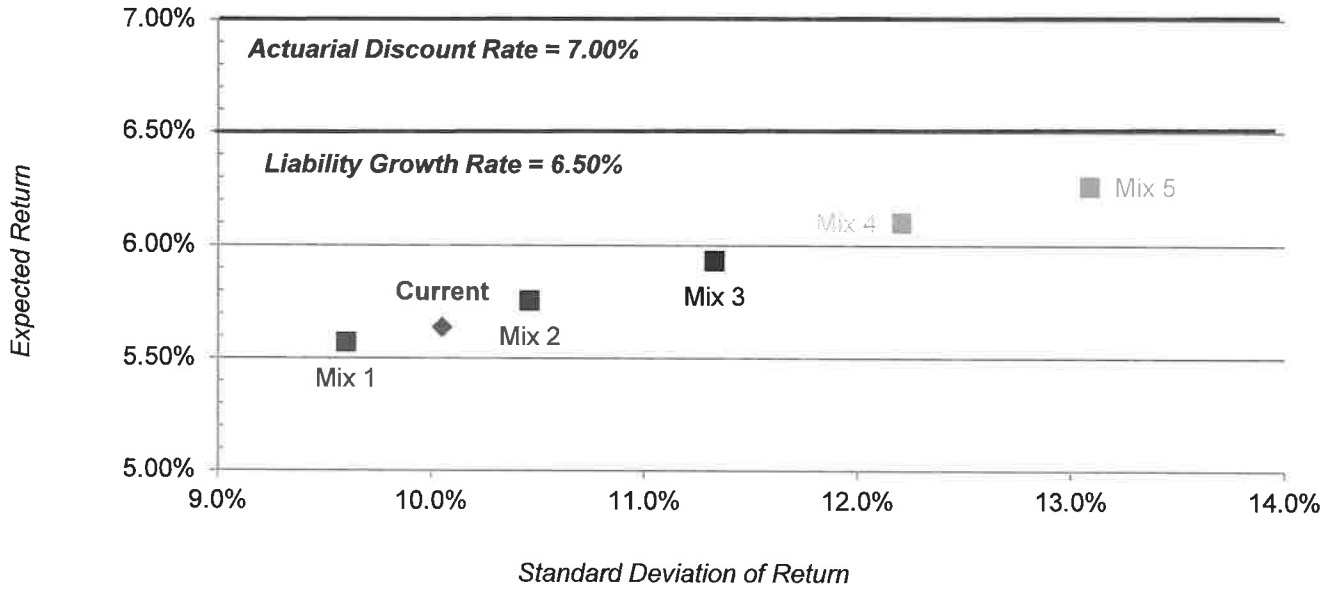


	Dom Equity	Intl Equity	Global Eq	Dom Fixed	Intl Fixed	Balanced + Multi Asset	Real Assets	Real Estate	Hedge Funds	Private Equity	Other	Cash
5th Percentile	54%	29%	21%	44%	9%	25%	9%	21%	12%	8%	3%	5%
25th Percentile	42%	24%	20%	31%	8%	12%	5%	11%	8%	6%	2%	2%
Median	**36%**	**20%**	**15%**	**26%**	**7%**	**9%**	**4%**	**9%**	**5%**	**3%**	**2%**	**1%**
75th Percentile	31%	17%	12%	20%	6%	4%	2%	8%	5%	2%	1%	0%
95th Percentile	22%	13%	7%	13%	5%	3%	1%	3%	2%	1%	1%	0%
% of Companies Invested	97%	88%	9%	100%	3%	28%	25%	73%	48%	40%	3%	61%
Plan Target ◆	40.25%	9%	0%	37%	0%	0%	0%	3.25%	8.75%	0%	0%	1.75%

- The graph above shows the actual asset allocation for a peer group of public funds of similar asset size:
  - Median domestic fixed income allocation is 26%.

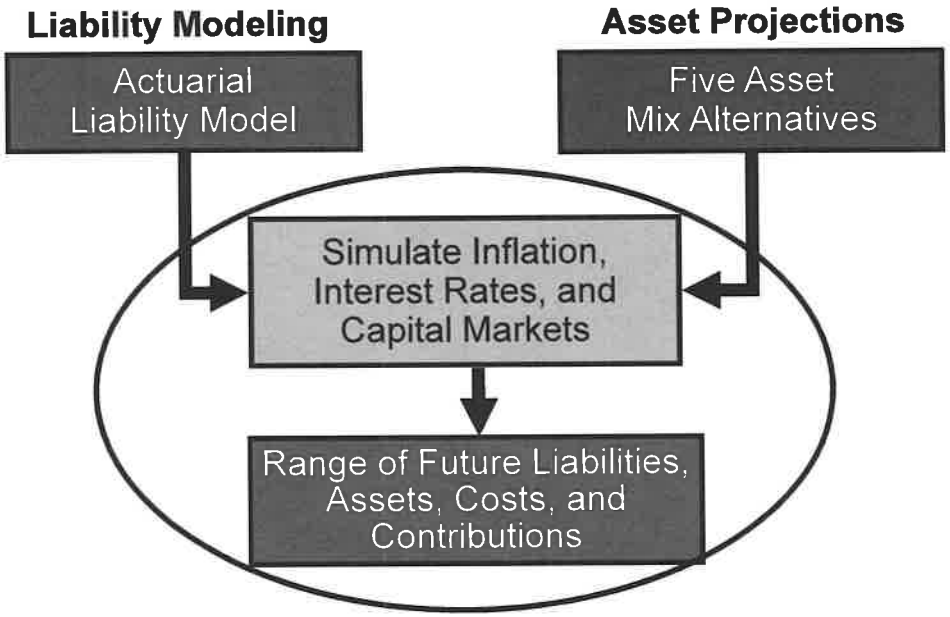
Step 2 - Create Alternative Asset Mixes

Efficient Frontier



- Graph plots the return and risk characteristics of Current policy, and Mixes 1 through 5.
- The Liability Growth Rate of 6.5% represents the targeted return, and is lower than the actuarial discount rate:
  - The actuary assumes a 5% overall salary increase while the actual payroll growth is expected to be equal to 3%, resulting in actuarial gains that lower the overall return target.
- Efficient frontier demonstrates that Callan doesn't expect the markets to deliver the liability growth rate over the next 10 years period (without positive alpha contribution from active managers) for the asset mixes considered:
  - A reasonable contribution to return from active management (alpha) is 0.25-0.50%, and is consistent with the Plan's actual fund performance (see Since Inception Fund Returns vs. Benchmark/Policy Returns)

Step 3 - Simulating the Financial Condition

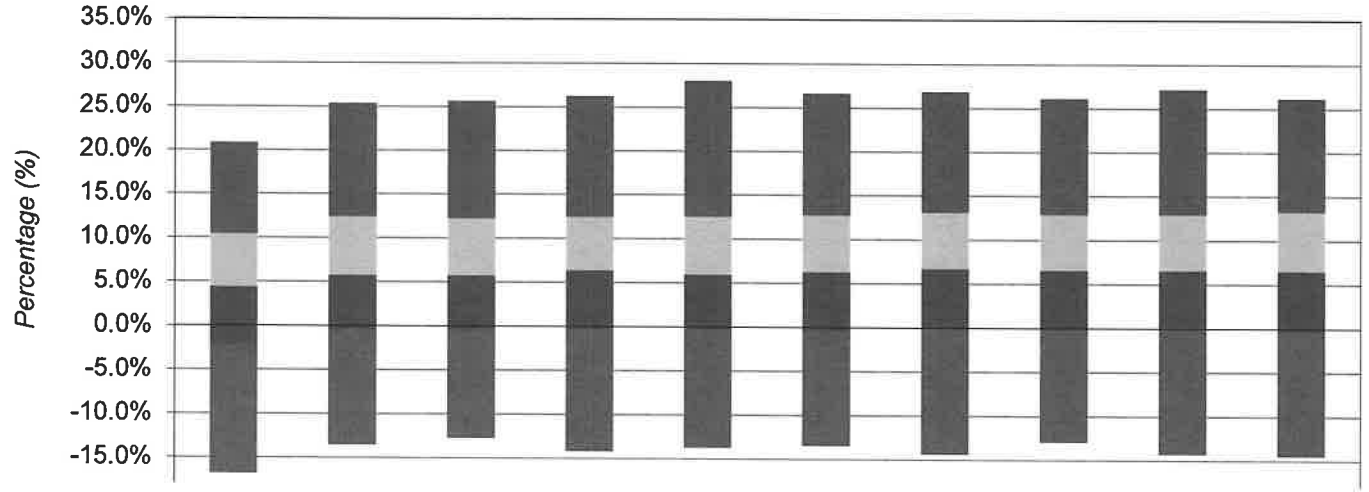


- This section demonstrates a ***stochastic forecast***: the modeling of uncertainty associated with the capital markets.
  - Simulate three (3) key variables: inflation rate, interest rate, asset class returns.
  - Assume annual rebalancing of portfolio mixes.
  - Generate 2,000 simulations per year, per asset mix to capture possible future economic scenarios and their effect on the pension plan.
  - Rank the results from highest to lowest to develop probability distributions.
- Test workforce scenarios: 1. Level; 2. Increasing; 4. Close the Plan under the two funding policies.

Step 3 - Range of Simulated Total Returns – Current Policy

What is Simulation Analysis? Annual Returns vs. 10 Year Compound Returns

- *Simulation begins by generating a range of annual returns for each asset mix.*

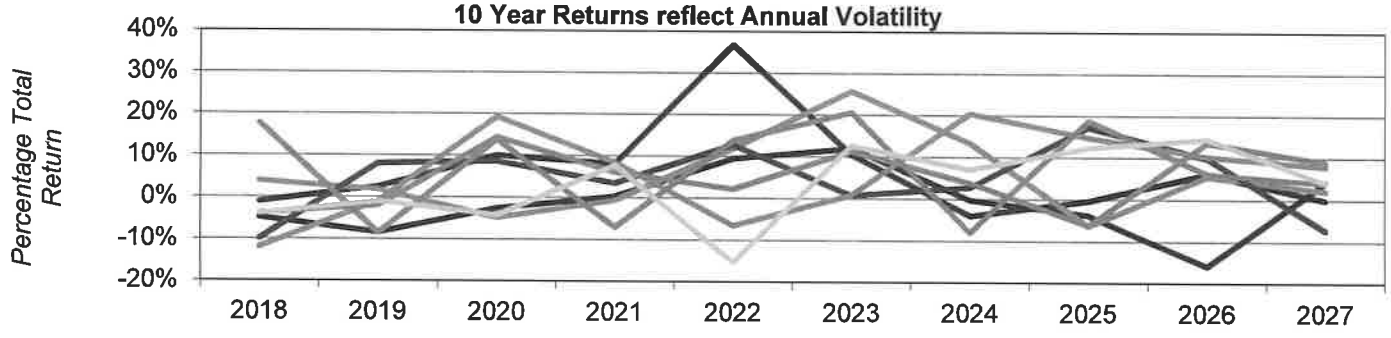


← **2.5th percentile (Best-case)**

← **50th percentile (Expected)**

← **97.5th percentile (Worse-case that suggests a 2.5% probability of occurring**

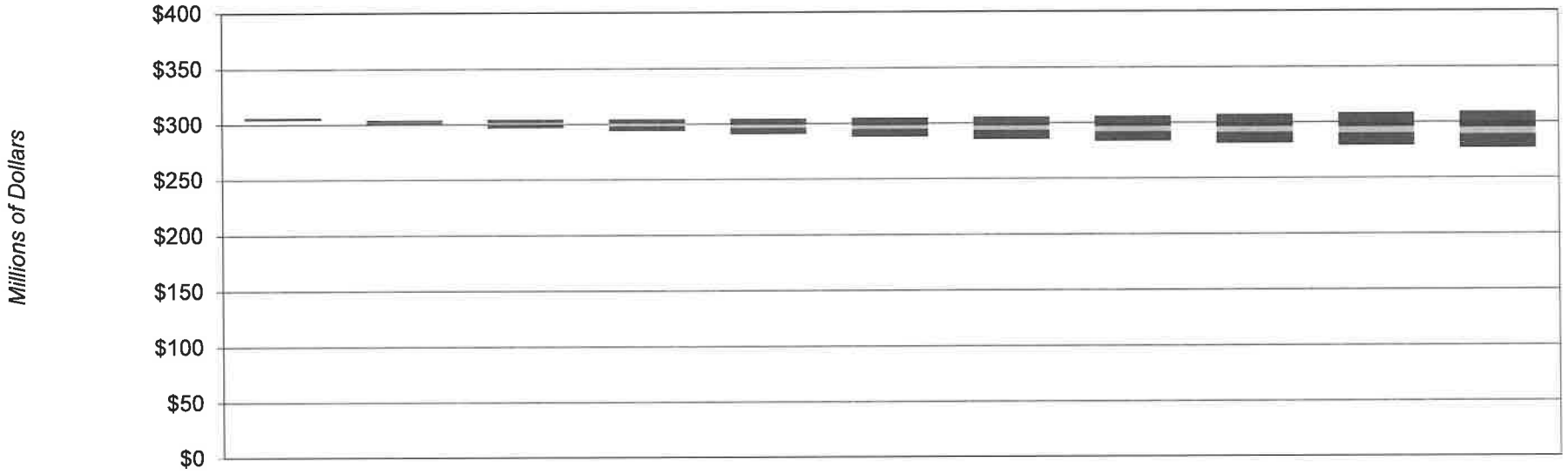
Percentile	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	10-Year Return
2.5th	20.8%	25.4%	25.7%	26.2%	28.0%	26.6%	26.9%	26.1%	27.2%	26.2%	10.6%
25th	10.4	12.4	12.2	12.4	12.5	12.7	13.1	12.9	12.9	13.3	7.3
50th	**4.4**	**5.8**	**5.7**	**6.4**	**5.9**	**6.2**	**6.7**	**6.5**	**6.6**	**6.5**	**5.6**
75th	-2.1	-0.4	-0.4	-0.3	-0.3	-0.3	-0.1	0.0	0.2	-0.4	4.0
97.5th	**-16.8**	**-13.5**	**-12.7**	**-14.2**	**-13.7**	**-13.4**	**-14.4**	**-12.9**	**-14.3**	**-14.5**	**0.9**
VAR	**21.2**	**19.3**	**18.5**	**20.6**	**19.7**	**19.7**	**21.0**	**19.5**	**20.8**	**21.0**	**4.7**



- *10 Year Compound returns are generated from a path of annual returns and demonstrate the volatility.*

Step 3 - Range of Actuarial Liability – Current Policy

1. Level Population

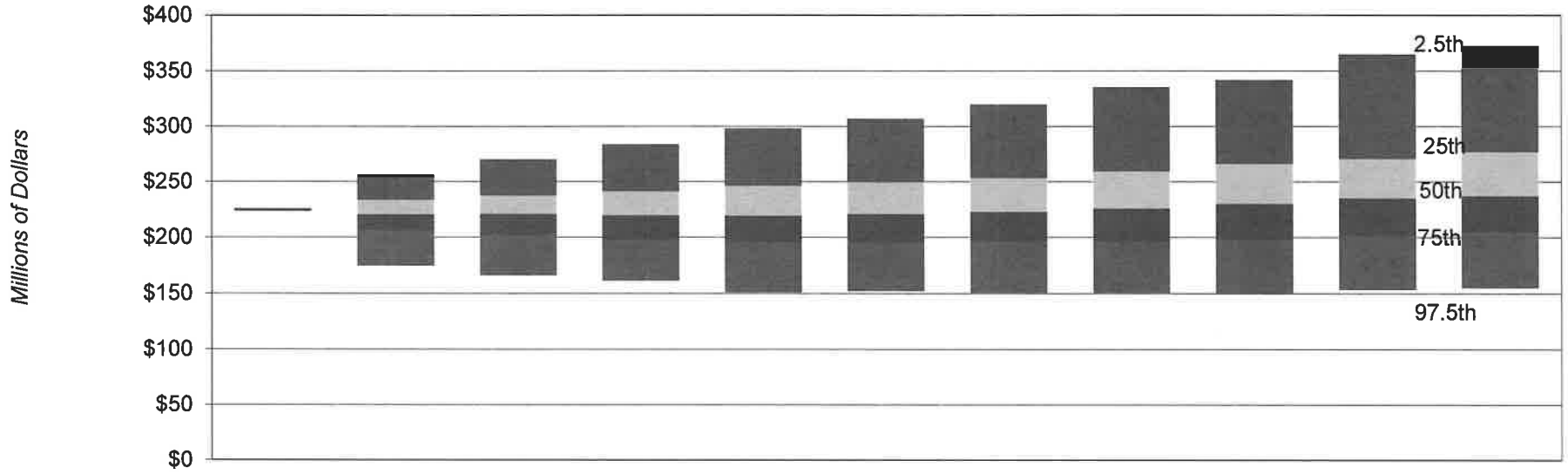


Percentile	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
97.5th	**$304**	**$304**	**$304**	$305	**$305**	**$305**	**$306**	**$306**	$307	**$308**	**$309**
75th	304	303	303	302	301	301	300	300	300	300	300
50th	**304**	**303**	**302**	**301**	**299**	**298**	**297**	**297**	**296**	**296**	**295**
25th	304	302	300	298	296	295	293	292	291	290	289
2.5th	304	300	297	294	291	288	286	283	281	279	277
VAR	**0**	**1**	**3**	**4**	**5**	**7**	**8**	**9**	**11**	**13**	**14**

- Actuarial liabilities have much less capital market risk, since they are not marked to market using current interest rates. Chart above assumes discount rate of 7.00% remains constant.
- Current variability reflects the uncertainty of inflation, as it impact participant's salary:
  - COLA variability only if actual inflation is below 2% - capped at 2% maximum annual increase.
- Chart also demonstrates why a duration-matching bond strategy may not be appropriate: while duration is long, liabilities have no market-based interest rate sensitivity.

Step 3 - Range of Market Values – Current Policy

1. Level Population – 15 Year Closed

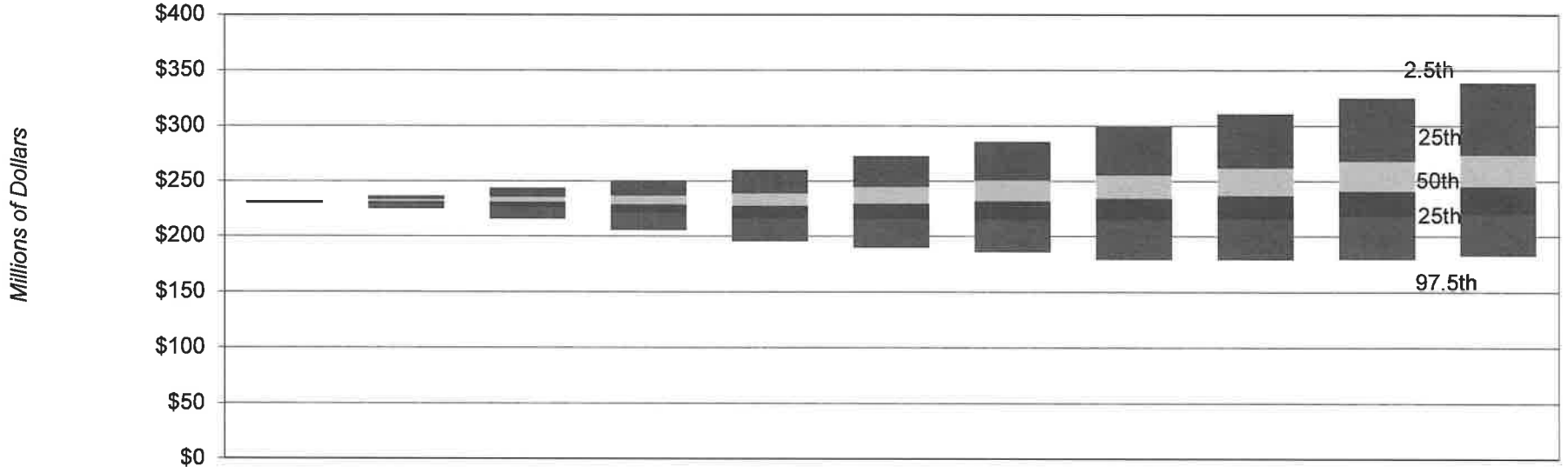


Percentile	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
2.5th	$224	$256	$270	$284	$298	$307	$320	$335	$342	$365	$373
25th	224	234	238	241	246	250	253	259	266	271	277
50th	**224**	**221**	**221**	**220**	**219**	**221**	**223**	**226**	**230**	**235**	**237**
75th	224	207	202	198	196	195	196	197	198	201	205
97.5th	**224**	**175**	**166**	**161**	**151**	**152**	**151**	**150**	**150**	**154**	**155**
VAR	**0**	**46**	**55**	**58**	**68**	**69**	**72**	**76**	**80**	**82**	**82**

- Market assets are impacted by both asset returns and cash flows, and shows significantly more volatility than the liabilities.
- Range of outcomes widens as time horizon lengthens, and distribution of asset values shows non-symmetry (skew).
- VAR (or value at risk) measures downside risk, or the difference between the expected (50th percentile) and worse-case (97.5th percentile) results, in this case how much the assets could fall.

Step 3 - Range of Actuarial Asset Values – Current Policy

1. Level Population – 15 Year Closed

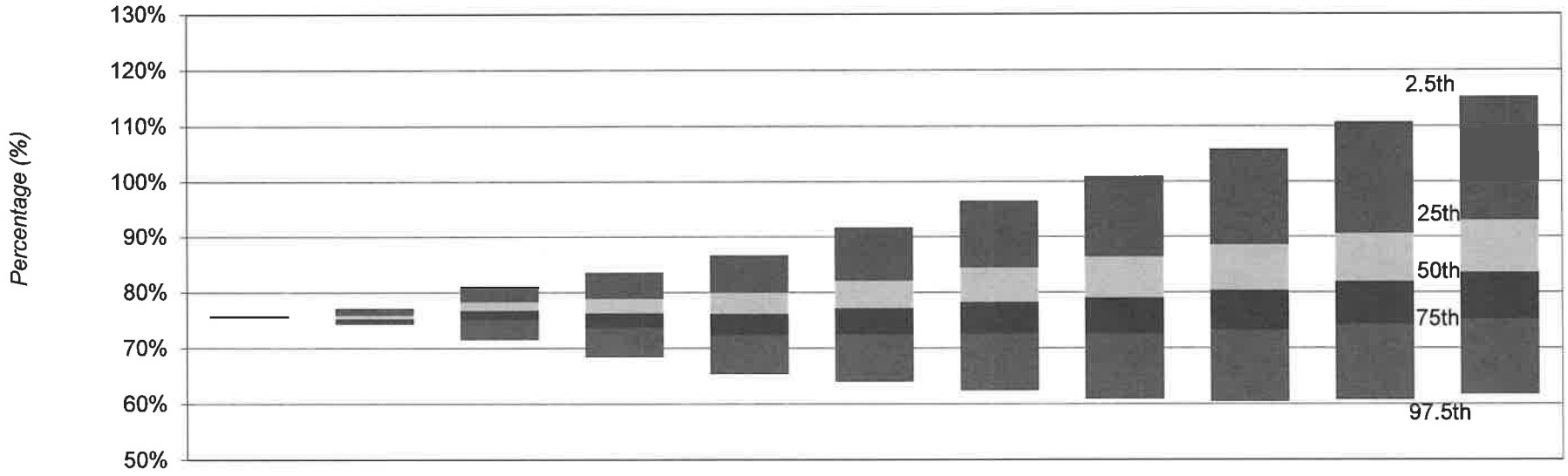


Percentile	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
2.5th	$230	$237	$244	$250	$260	$273	$286	$299	$311	$325	$339
25th	230	233	236	237	239	245	251	256	262	268	274
50th	**230**	**232**	**231**	**229**	**228**	**230**	**232**	**234**	**237**	**241**	**245**
75th	230	230	226	221	216	215	215	215	216	218	220
97.5th	**230**	**225**	**216**	**205**	**195**	**190**	**186**	**179**	**179**	**180**	**183**
VAR	**0**	**7**	**15**	**24**	**32**	**40**	**46**	**55**	**58**	**62**	**63**

- Asset performance is smoothed over a 7-year period.
- VAR (or value at risk) measures downside risk, or the difference between the expected (50th percentile) and worse-case (97.5th percentile) results.
- Smoothing marginally reduces volatility and downside risk (VAR) when measuring funded ratio performance.

Step 3 - Range of Funded Ratio (AVA/AL) – Current Policy

1. Level Population – 15 Year Closed

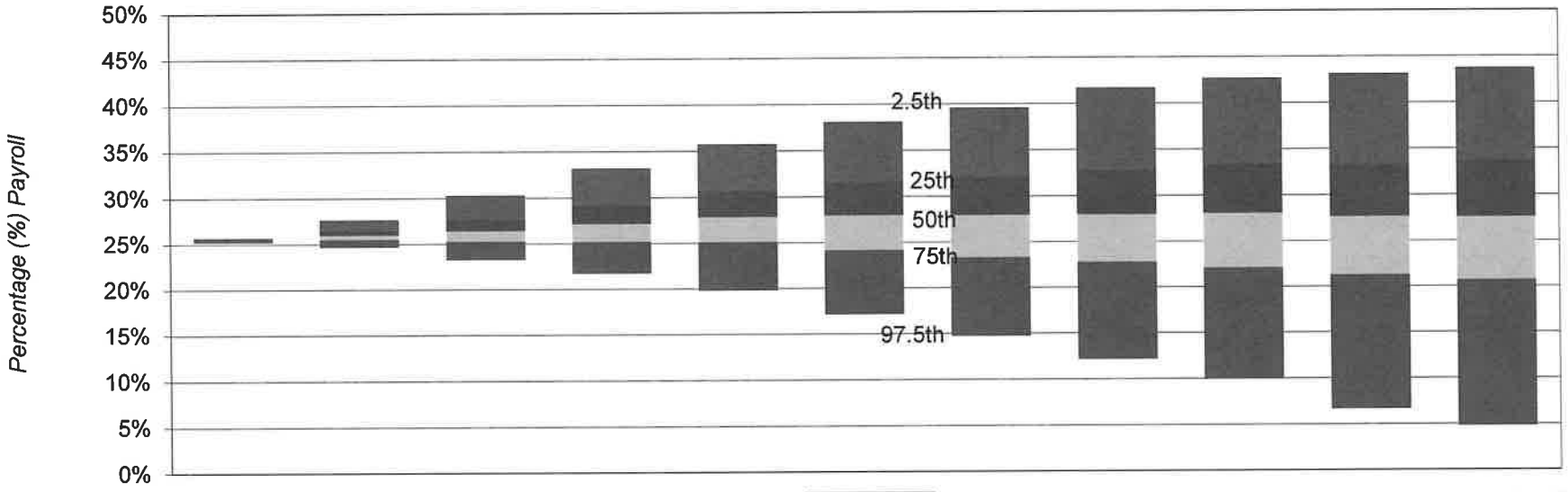


Percentile	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
2.5th	75.5%	78.4%	81.0%	83.6%	86.7%	91.7%	96.5%	101.0%	105.9%	110.7%	115.2%
25th	75.5	77.2	78.3	78.9	79.9	82.1	84.4	86.4	88.6	90.6	93.0
50th	**75.5**	**76.6**	**76.8**	**76.3**	**76.2**	**77.2**	**78.2**	**79.0**	**80.4**	**81.9**	**83.5**
75th	75.5	75.9	75.1	73.7	72.4	72.5	72.7	72.6	73.2	74.3	75.2
97.5th	**75.5**	**74.3**	**71.5**	**68.4**	**65.4**	**64.1**	**62.4**	**60.9**	**60.4**	**60.7**	**61.7**
VAR	**0.0**	**2.2**	**5.2**	**7.9**	**10.8**	**13.1**	**15.8**	**18.1**	**19.9**	**21.2**	**21.8**

- The funded ratio combines assets and liabilities and captures one dimension of investment risk: how much larger can the unfunded liability grow as the funded ratio falls.
  - A larger unfunded liability will increase the annual contribution requirement.
- Funded ratio volatility is largely driven by asset volatility, highlighting the importance of the asset mix decision.

Step 3 - Range of Employer Contribution Rate – Current Policy

1. Level Population – 15 Year Closed

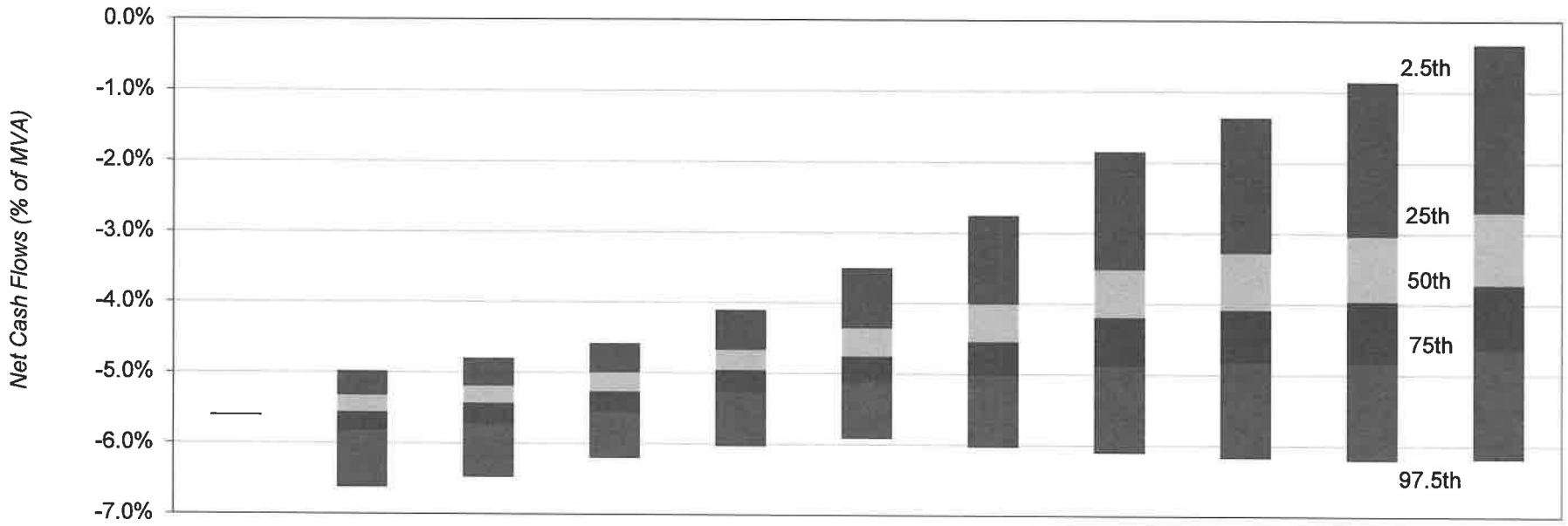


Percentile	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
97.5th	**25.22%**	**27.66%**	**30.31%**	**33.19%**	**35.77%**	**38.07%**	**39.57%**	**41.70%**	**42.69%**	**43.14%**	**43.72%**
75th	25.22	26.52	27.66	29.12	30.66	31.56	32.01	32.78	33.39	33.31	33.71
50th	**25.22**	**25.99**	**26.42**	**27.17**	**27.85**	**27.99**	**27.93**	**27.97**	**28.09**	**27.66**	**27.61**
25th	25.22	25.52	25.26	25.19	25.12	24.17	23.32	22.76	22.08	21.24	20.65
2.5th	**25.22**	**24.69**	**23.24**	**21.71**	**19.79**	**17.13**	**14.71**	**12.14**	**9.96**	**6.66**	**4.81**
VAR	**0.0**	**1.7**	**3.9**	**6.0**	**7.9**	**10.1**	**11.6**	**13.7**	**14.6**	**15.5**	**16.1**

- The potential range of outcomes for employer contributions is another important measure of investment risk. The range of contribution in any one year is an important measure of risk.
- Note that a worse-case scenario is unlikely to occur in every year, so the study will focus on contributions over multiple periods like a 5 and 10-year time horizons.
- Cumulative analysis focuses on contributions starting in 2019, since investment risk taken this year will impact next years contribution amount.

Step 3 - Range of Net Outflows for Current Policy

1. Level Population – 15 Year Closed



Percentile	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
2.5th	-5.6%	-5.0%	-4.8%	-4.6%	-4.1%	-3.5%	-2.8%	-1.8%	-1.4%	-0.9%	-0.3%
25th	-5.6	-5.3	-5.2	-5.0	-4.7	-4.4	-4.0	-3.5	-3.3	-3.0	-2.7
50th	**-5.6**	**-5.6**	**-5.4**	**-5.3**	**-5.0**	**-4.8**	**-4.5**	**-4.2**	**-4.1**	**-4.0**	**-3.7**
75th	-5.6	-5.8	-5.7	-5.6	-5.3	-5.1	-5.0	-4.9	-4.8	-4.8	-4.6
97.5th	**-5.6**	**-6.6**	**-6.5**	**-6.2**	**-6.0**	**-5.9**	**-6.0**	**-6.1**	**-6.2**	**-6.2**	**-6.2**
VAR	**0.0**	**1.1**	**1.0**	**0.9**	**1.1**	**1.2**	**1.5**	**1.9**	**2.1**	**2.2**	**2.5**

- Liquidity needs show some potential for higher outflows in worse case scenarios, but in all cases are forecast to remain very manageable.
- As a general rule of thumb, Callan uses a threshold of -10% in any one year as an indicator that there are liquidity concerns impacting the asset allocation decision.

Step 3 - Liquidity Analysis

1. Level Population – 15 Year Closed

Net Cashflow in Year 3

Percentile	100%	90%	80%	70%	60%
2.5th	-4.7%	-5.2%	-5.9%	-6.7%	-7.9%
25th	-5.1	-5.7	-6.4	-7.3	-8.5
50th	**-5.4**	**-6.0**	**-6.7**	**-7.7**	**-8.9**
75th	-5.7	-6.3	-7.1	-8.1	-9.4
97.5th	**-6.4**	**-7.1**	**-8.0**	**-9.1**	**-10.6**
VAR	**1.0**	**1.1**	**1.3**	**1.4**	**1.7**

Net Cashflow in Year 5

Percentile	100%	90%	80%	70%	60%
2.5th	-4.3%	-4.8%	-5.4%	-6.2%	-7.2%
25th	-5.1	-5.7	-6.4	-7.3	-8.5
50th	**-5.5**	**-6.1**	**-6.9**	**-7.8**	**-9.2**
75th	-5.9	-6.5	-7.4	-8.4	-9.8
97.5th	**-6.9**	**-7.6**	**-8.6**	**-9.8**	**-11.4**
VAR	**1.4**	**1.5**	**1.7**	**2.0**	**2.3**

Net Cashflow in Year 8

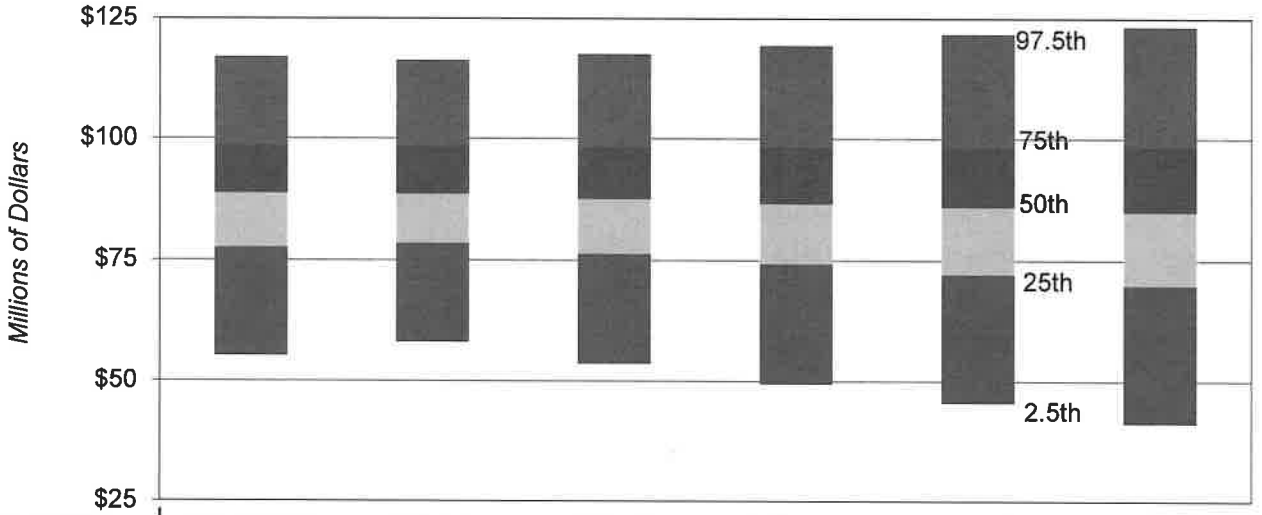
Percentile	100%	90%	80%	70%	60%
2.5th	-3.3%	-3.6%	-4.1%	-4.7%	-5.5%
25th	-5.0	-5.5	-6.2	-7.1	-8.3
50th	**-5.7**	**-6.3**	**-7.1**	**-8.1**	**-9.5**
75th	-6.4	-7.1	-8.0	-9.2	-10.7
97.5th	**-7.9**	**-8.8**	**-9.9**	**-11.3**	**-13.2**
VAR	**2.2**	**2.5**	**2.8**	**3.2**	**3.7**

- Using net cash flow analysis, the purpose is to ascertain how much of the asset allocation could be devoted to less liquid alternative asset classes or private market investment strategies.
- Each column represents the portion of the portfolio that is publically traded:
  - For example, 100% means all of the asset classes are publicly traded
  - As highlighted, 80% implies only a portion of the portfolio is traded, while the other 20% is in private investments.
- Focusing on worse-case outcomes and a threshold of -10% in any one year, the analysis supports up to 20% of the portfolio in less liquid strategies as are considered in Mix 1 through Mix 5.

Step 3 - Range of PV Cumulative Contributions over 10 Years

1. Level Population – 15 Year Closed: Compare Asset Mixes

- The chart below seeks to demonstrate the risk and reward tradeoffs between different asset allocation strategies in contribution space over multiple time horizons:
  - Accumulate dollars of employer contribution over a 10 year period and discount by the 7% actuarial return.
- **Blue** highlights the median case (50th percentile) and measures the **reward** for taking on investment risk.
  - The higher the return target, the lower the total contributions to the plan. Mix 5 has a lower contribution than Mix 1.
- **Red** highlights the downside scenarios (97.5th percentile) and demonstrate the **risk**.
  - The higher the return target, the greater the volatility. Mix 5 could have a higher contribution than Mix 1 in worse-cases.

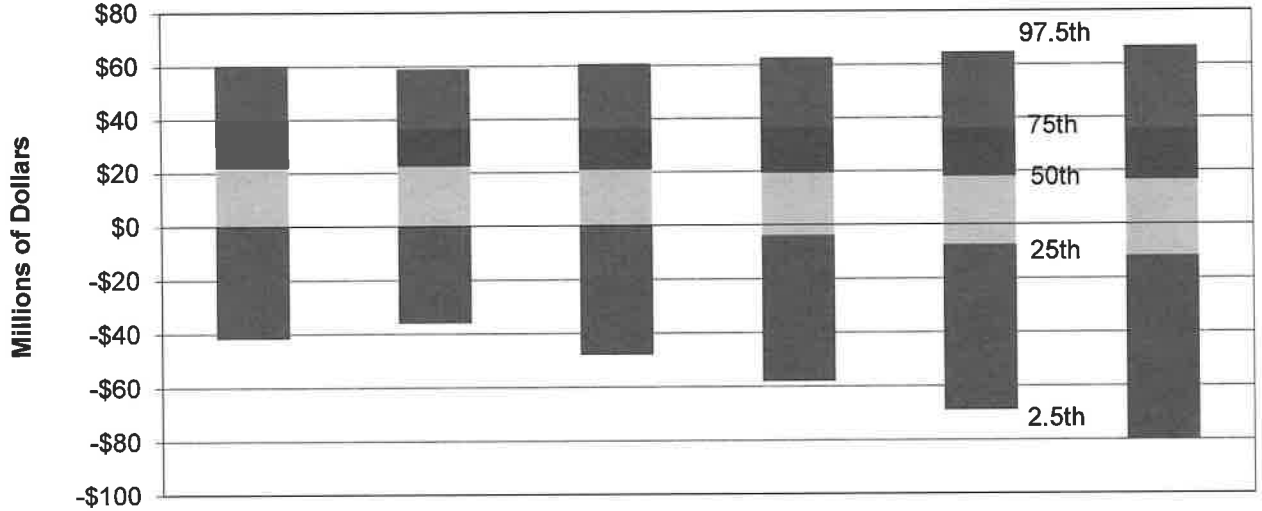


	Percentile	Current	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
Risk	**97.5th**	**$117**	**$116**	**$118**	**$119**	**$122**	**$123**
	75th	99	98	98	98	98	98
Reward	**50th**	**89**	**89**	**88**	**87**	**86**	**85**
	25th	78	78	76	74	72	70
	2.5th	55	58	54	49	45	41
	VAR	**28**	**28**	**30**	**33**	**36**	**38**

Step 3 - Range of PV Unfunded Liability(MVA) the End of 10 Years

1. Level Population – 15 Year Closed: Compare Asset Mixes

- Charts compare the remaining unfunded liability at the end of 10 years (January 1, 2028) across the different asset mixes, and is another source for evaluating the risk and return tradeoffs of an asset allocation strategy.
  - Market Value measurement with no asset smoothing
  - Discounted on a present value basis using the 7% discount rate.



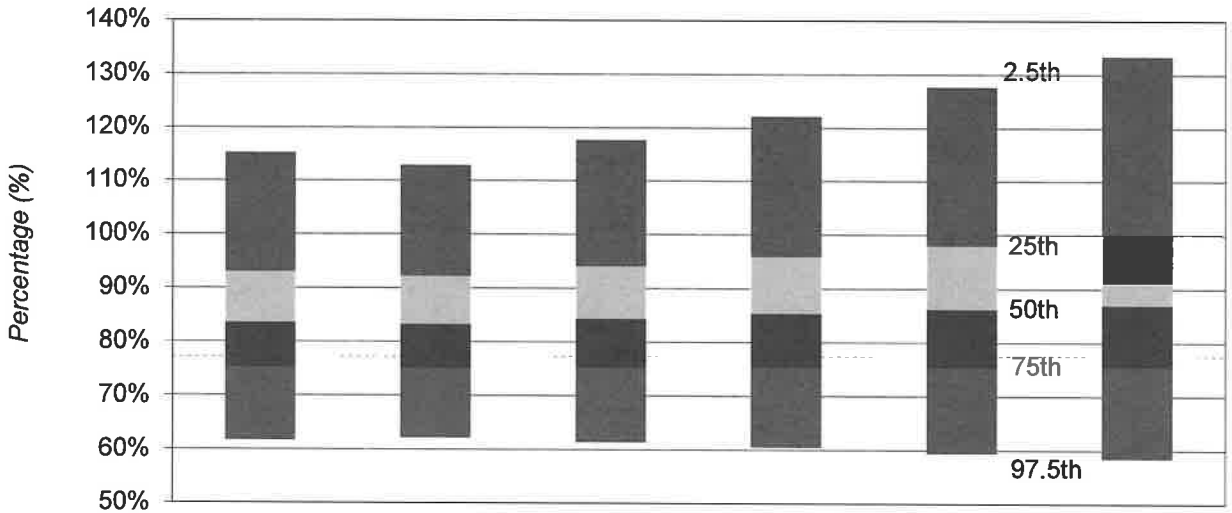
	Percentile	Current	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
Risk	**97.5th**	**$60**	**$59**	**$61**	**$63**	**$65**	**$67**
	75th	37	37	37	36	36	36
Reward	**50th**	**22**	**22**	**21**	**19**	**18**	**16**
	25th	3	4	0	-4	-8	-12
	2.5th	-42	-36	-48	-58	-69	-80
	VAR	**39**	**37**	**40**	**43**	**47**	**50**

** Negative number implies surplus.*

Step 3 - Range of Funded Ratio (AVA/AL) the End of 10 Years

1. Level Population – 15 Year Closed: Compare Asset Mixes

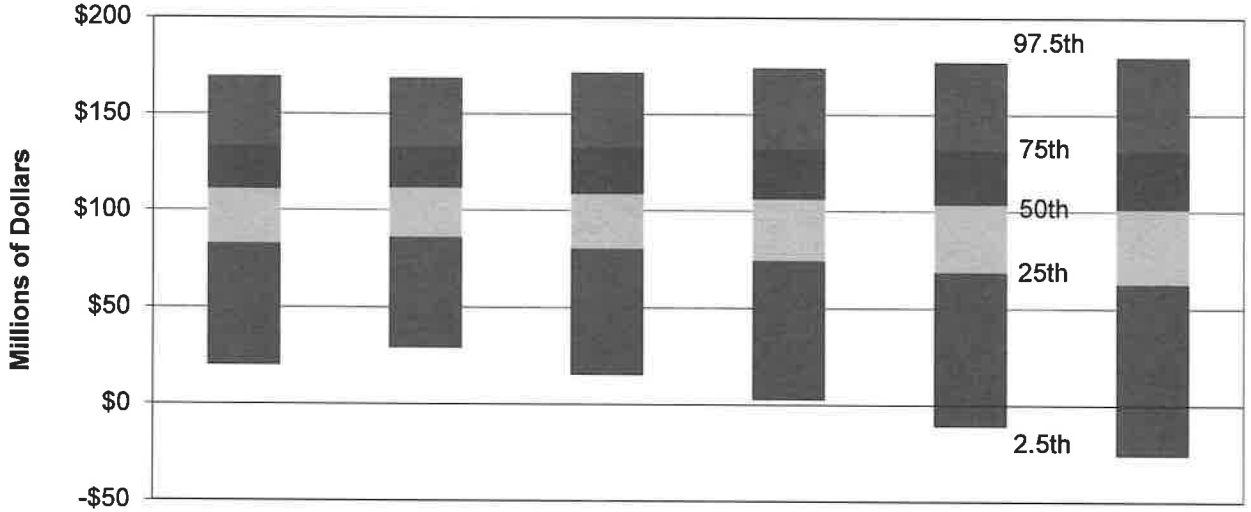
- Charts show the funded ratio at the end of 10 years using the smoothing of assets measurement without any discounting.
  - Black line indicates the Plan's current funded ratio of 76% as of January 1, 2018.
- Risk appears at the bottom of the table for this analysis because it is worse-case scenario where the funded ratio falls because the unfunded liability increased.



	Percentile	Current	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
	2.5th	115%	113%	118%	122%	128%	133%
	25th	93	92	94	96	98	100
Reward	**50th**	**84**	**83**	**84**	**85**	**86**	**87**
	75th	75	75	75	75	75	76
Risk	**97.5th**	**62**	**62**	**61**	**60**	**59**	**58**
	VAR	**-22**	**-21**	**-23**	**-25**	**-27**	**-28**

Step 3 - Range of Ultimate Net Cost over 10 Years

1. Level Population – 15 Year Closed: Compare Asset Mixes



	Percentile	Current	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
Risk	**97.5th**	**$169.7**	**$168.8**	**$171.8**	**$174.2**	**$177.3**	**$180.0**
	75th	133.3	132.9	132.7	132.2	131.9	131.4
Reward	**50th**	**110.9**	**111.6**	**108.6**	**106.1**	**103.5**	**101.1**
	25th	82.9	86.0	80.4	74.5	68.7	62.6
	2.5th	19.9	29.1	15.2	2.6	-10.9	-25.8
	VAR	**58.8**	**57.3**	**63.1**	**68.1**	**73.8**	**78.9**

* *Negative number implies surplus.*

Tradeoff Current to Mix 3

Up $4.5M

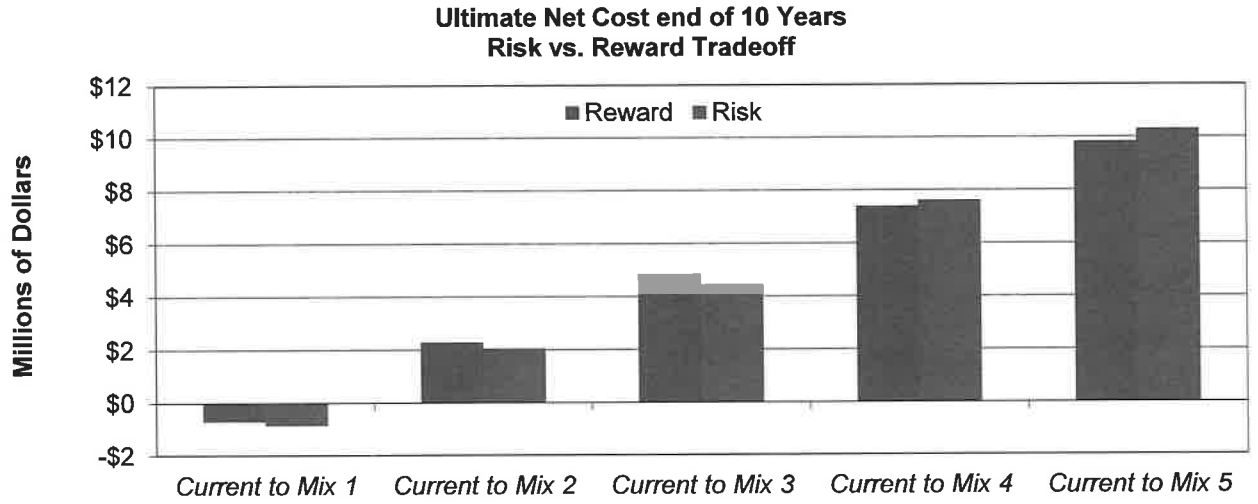
Down $4.7M

The potential reward is more than the increase in risk

- Ultimate Net Cost quantifies the total cost of operating the Plan and can demonstrate the tradeoff between minimizing contributions relative to a goal of improving the funded status
- Ultimate Net Cost = PV of Cumulative Contributions + PV Unfunded Liability (MVA) over 10 years.
- To compare the alternative asset allocation strategies, we employ a risk and reward analysis:
  - Reward measures the difference in the median case (50th percentile) over a 10 year horizon.
  - Risk measures the difference in the worse-case outcomes (97.5th percentile) over a 10 year horizon.

Step 4 - Defining Risk Tolerance

1. Level Population – 15 Year Closed: Compare Asset Mixes

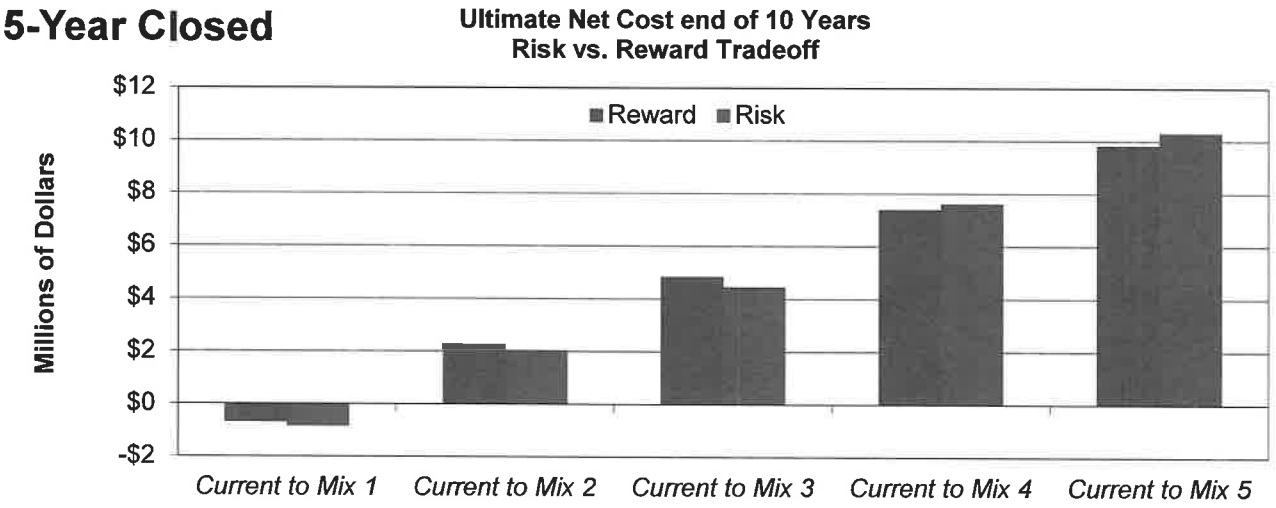


- Chart above graph the differences between the reward and risk numbers shown on the prior slide.
  - Each alternative mix is compared to the current target policy of 37% fixed income.
- The analysis supports moving to the indicated asset mix if the green bars are higher than the red bars, or the reward is greater than the increase in risk.
- This type of analysis supports Mix 2 and Mix 3 as reasonable options, showing that the increase in reward overcomes the increase in risk:
  - More aggressive options like Mix 4 and Mix 5 are less favorable as red bars are higher than the green bars.
- If the same analysis were applied to a shorter time horizon like 5 Years, Mix 2 would be favored.
- Conclude that a lower fixed income target, in the range of 30-35%, is favored.

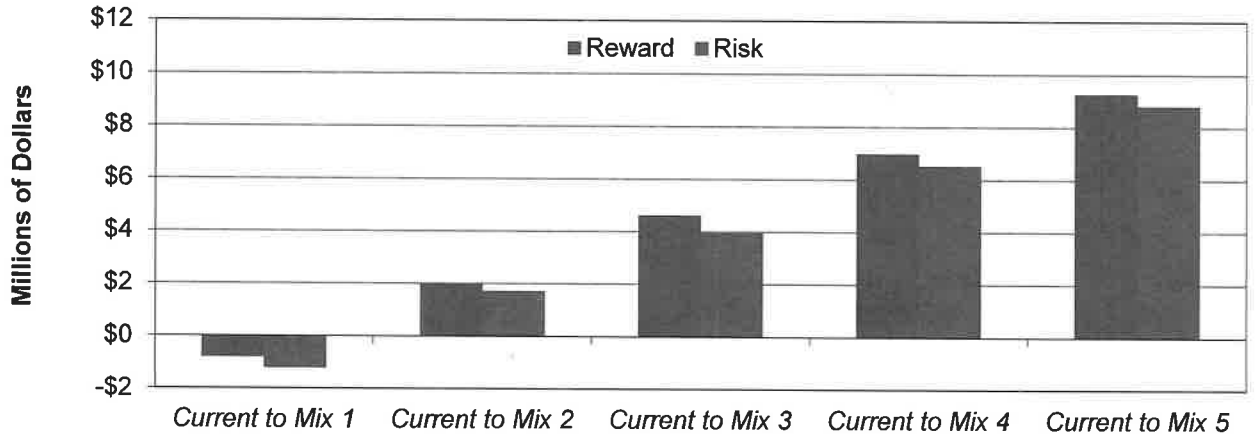
Step 4 - Defining Risk Tolerance

Impact of Funding Policy

15-Year Closed



30-Year Open

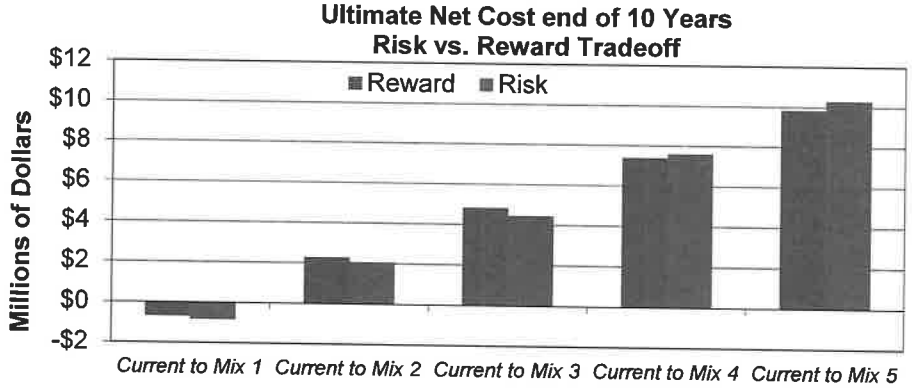


- The risk and reward tradeoff analysis changes with the funding policy.
- A closed amortization funding policy suggests Mix 2 or Mix 3, as more contribution dollars are exposed to risk.
- Open amortization suggests a more aggressive mix like Mix 4 or Mix 5, because a lower amount of contribution dollars are exposed to risk.

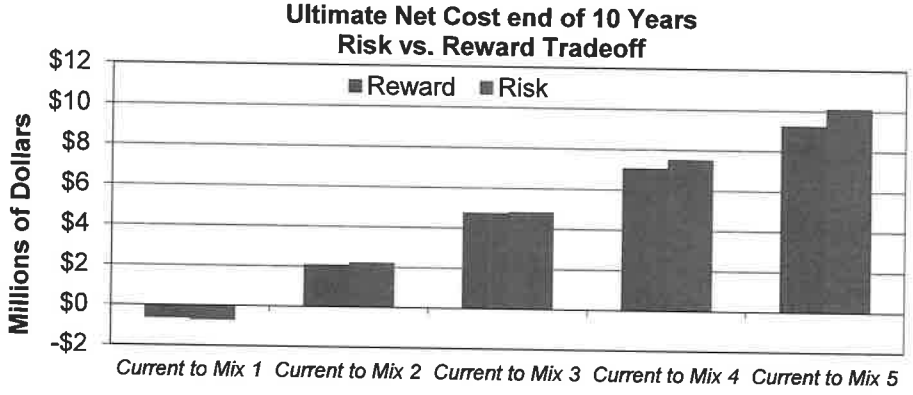
Step 4 - Defining Risk Tolerance

Impact of Different Workforce Scenarios

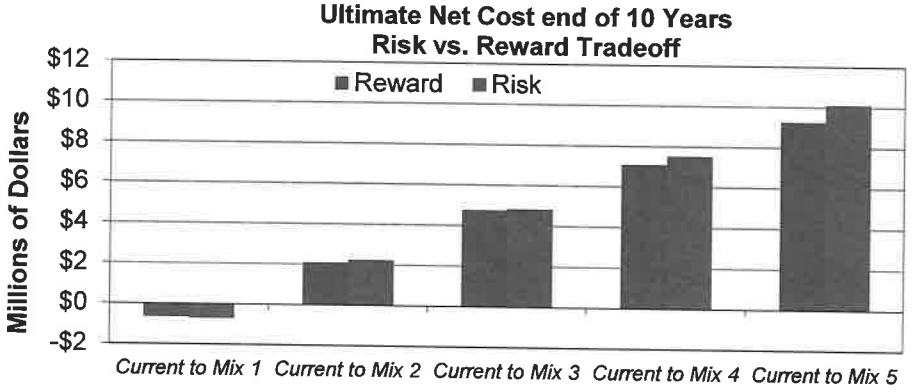
1. Level Population: 15-Year Closed



2. Increasing Population: 15-Year Closed



4. Close the Plan: 15-Year Closed



- Increasing the active employee population supports Mix 3, similar to the level population results.
- Closing the plan to new hires seems to support a less aggressive investment policy like the current policy or Mix 1.

Step 4 - Defining Risk Tolerance

7. Scenario Analysis

- Within the stochastic results, we examine specific downside scenarios included in the stochastic range
  - Each scenario has a path of inflation, interest rates, US bond and equity returns (shown year by year, and cumulative over 5 years)
  - Tech Bubble had 3 years of negative equity years in succession
  - Great Recession had a large equity drawdown, -35-40% return, in any one year
  - 1974 market scenario of rising yields and very low bond returns.

	Inflation				
	Year 1	Year 2	Year 3	Year 4	Year 5
Stagflation	1.5%	2.1%	4.9%	4.6%	3.0%
Tech Bubble	2.3%	1.1%	-0.4%	0.3%	2.0%
Great Recession 1	1.2%	1.5%	2.1%	1.2%	-1.9%
Great Recession 2	3.4%	3.3%	3.2%	4.1%	2.9%
Great Recession 3	2.8%	2.1%	3.0%	3.6%	3.9%
Bond Market 1	1.8%	0.9%	2.6%	2.8%	2.5%
Bond Market 2	2.3%	0.6%	-0.3%	0.7%	0.7%

	High Quality Corporate Yields					
	Year 1	Year 2	Year 3	Year 4	Year 5	Cumulative Returns US Bonds
Stagflation	3.6%	3.7%	4.5%	4.6%	3.6%	3.6%
Tech Bubble	3.9%	3.1%	2.1%	2.4%	2.1%	4.4%
Great Recession 1	3.3%	4.5%	4.4%	4.0%	3.1%	3.7%
Great Recession 2	3.8%	4.0%	3.8%	4.4%	3.4%	4.3%
Great Recession 3	4.1%	4.6%	3.9%	5.2%	5.2%	2.1%
Bond Market 1	4.1%	4.7%	5.5%	6.1%	6.8%	(1.1%)
Bond Market 2	3.6%	3.4%	4.0%	5.8%	5.9%	(0.0%)

	US Equity Returns					
	Year 1	Year 2	Year 3	Year 4	Year 5	Cumulative Returns US Equity
Stagflation	(6.1%)	(2.5%)	(4.7%)	14.6%	10.1%	1.9%
Tech Bubble	(2.9%)	(8.8%)	(1.0%)	(35.0%)	25.2%	(6.5%)
Great Recession 1	(5.6%)	(43.4%)	11.7%	11.3%	31.4%	(2.7%)
Great Recession 2	2.2%	17.7%	(35.9%)	5.8%	12.5%	(1.7%)
Great Recession 3	3.9%	(1.4%)	(1.4%)	(33.2%)	12.4%	(5.3%)
Bond Market 1	10.5%	(43.2%)	47.7%	34.3%	2.8%	5.1%
Bond Market 2	23.1%	(6.3%)	(14.2%)	(31.0%)	(3.0%)	(7.9%)

- The scenario analysis shows the downside risk associated with weak capital markets and demonstrates the benefits to having a less risky asset allocation, like Mix 1 and Mix 2.

	Cumulative Contributions over 5 Years (2019-2023)					
	Current	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
Stagflation	55	55	55	56	56	56
Tech Bubble	54	55	56	56	57	57
Great Recession 1	57	57	58	58	59	60
Great Recession 2	52	52	52	52	52	52
Great Recession 3	55	55	55	55	56	56
Bond Market 1	53	53	54	54	54	54
Bond Market 2	49	49	48	48	48	48

	Funded Status End of 5 Years					
	Target	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
Stagflation	64%	64%	63%	63%	62%	62%
Tech Bubble	52%	51%	50%	48%	46%	44%
Great Recession 1	61%	61%	60%	59%	58%	56%
Great Recession 2	63%	66%	65%	65%	64%	63%
Great Recession 3	51%	51%	49%	48%	47%	46%
Bond Market 1	72%	71%	71%	71%	72%	72%
Bond Market 2	48%	50%	50%	49%	48%	47%

	Ultimate Net Cost (UNC) over 5 Years (2023)					
	Target	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
Stagflation	121	122	123	124	125	126
Tech Bubble	143	144	148	153	156	160
Great Recession 1	127	125	128	131	134	137
Great Recession 2	121	115	116	118	119	121
Great Recession 3	149	149	152	154	156	159
Bond Market 1	102	105	104	104	104	104
Bond Market 2	147	141	143	144	145	146

Step 5 – Select an Appropriate Target Mix

Summary and Conclusions

- Sewage & Water Board of New Orleans Plan is well positioned relative to other public funds recently surveyed by NASRA.
  - Funded ratio is 80% (1/1/2017), Discount Rate = 7.00%.
- The liability and demographic profiles suggest the Plan has a sufficiently long time horizon in which to assume investment risk.
- Liquidity needs are manageable but negative, and depend on the funding policy:
  - For a 15-year closed amortization funding policy, net outflows are between 4% and 5% of Plan assets each year for the next 10 years.
  - For a 30-year open amortization funding policy, net outflows increase to 6% and 7% of Plan assets.
  - Despite net negative cash flows, the analysis suggests the Plan can take on some illiquidity risk in investments, up to 20% of the total asset allocation.
  - Sufficient liquidity can be provided within fixed income allocation, or through an overlay strategy.
- The total value of the Actuarial Liability is not expected to rise materially in each of the workforce scenario tested, unless there is significant growth in the active population.
- Liability volatility is overshadowed by asset volatility, which drives funded status volatility.
  - Liability volatility stems from inflation uncertainty and its impact on future salary growth (not COLA)
  - Asset volatility can be managed by exposure to beta (stocks, bonds) and by implementation strategies.

Step 5 – Select an Appropriate Target Mix (Continued)

Summary and Conclusions

- The current discount rate target is 7.0%, however our model shows the liability growth rate to be closer to 6.5% due to lower salary increase expectations.
  - The current target mix has a large gap in return expectations over the next 10 years relative to the liability growth rate.
  - A more aggressive asset mix with less fixed income would serve to close the return gap
- The conclusions of the study support a slightly more aggressive asset allocation similar to Mix 2 or Mix 3. Mix 3 is Callan's preferred choice using the risk and reward tradeoff analysis, however Mix 2 is a reasonable option if the Board is concerned about downside risk.
  - One exception is the conclusions lend support for an asset mix with slightly more fixed income, like Mix 1, if the S&WB of New Orleans decides to close the Plan to new hires.
  - For all of the other workforce scenarios and funding policies tested, the risk and reward tradeoff analysis supports a slightly more aggressive asset mix with marginally less fixed income.
- Mix 3 offers a refinement to the current target that includes meaningful exposure to market beta, to alpha seeking strategies, and to alternative asset classes like private real estate and hedge funds to meet the Plan's return target:
  - Maintains a fixed income allocation that is slightly above the median allocation for other public plans in the peer group.
  - Relative to the peer group, Mix 3 moves the overall asset allocation in the direction of the median allocations for the other asset classes.
- Education slides for private Real Estate and Multi-Asset Class strategies (a hedge fund substitute) are provided in the next section.

Step 5 – Select an Appropriate Target Mix (Continued)

Summary and Conclusions

Component	Target	Mix 2	Change	Mix 3	Change
Broad US Equity	40.25%	27%	-13.25%	29%	-11.25%
Global ex US Equity	9%	20%	11%	22%	13%
Real Estate	3.25%	8%	4.75%	9%	5.75%
Hedge Funds	8.75%	9%	0.25%	9%	0.25%
Domestic Fixed	37%	35%	-2%	30%	-7%
Cash Equivalents	1.75%	1%	-0.75%	1%	-0.75%
Total	**100%**	**100%**		**100%**	
Total Fixed Income+Cash	**38.75%**	**36%**		**31%**	
Asset-Only					
Expected Return	5.64%	5.76%		5.93%	
Standard Deviation	10.05%	10.46%		11.33%	
Sharpe Ratio	0.329	0.327		0.317	

- The table above highlights the change to the asset allocation strategy associated with moving to Mix 2 or Mix 3.
- The Board will want to consider a formal transition plan for the assets for the purposes of managing the transaction costs and potential market impacts, particularly with respect the recommended changes to the equity allocations.

Education Material

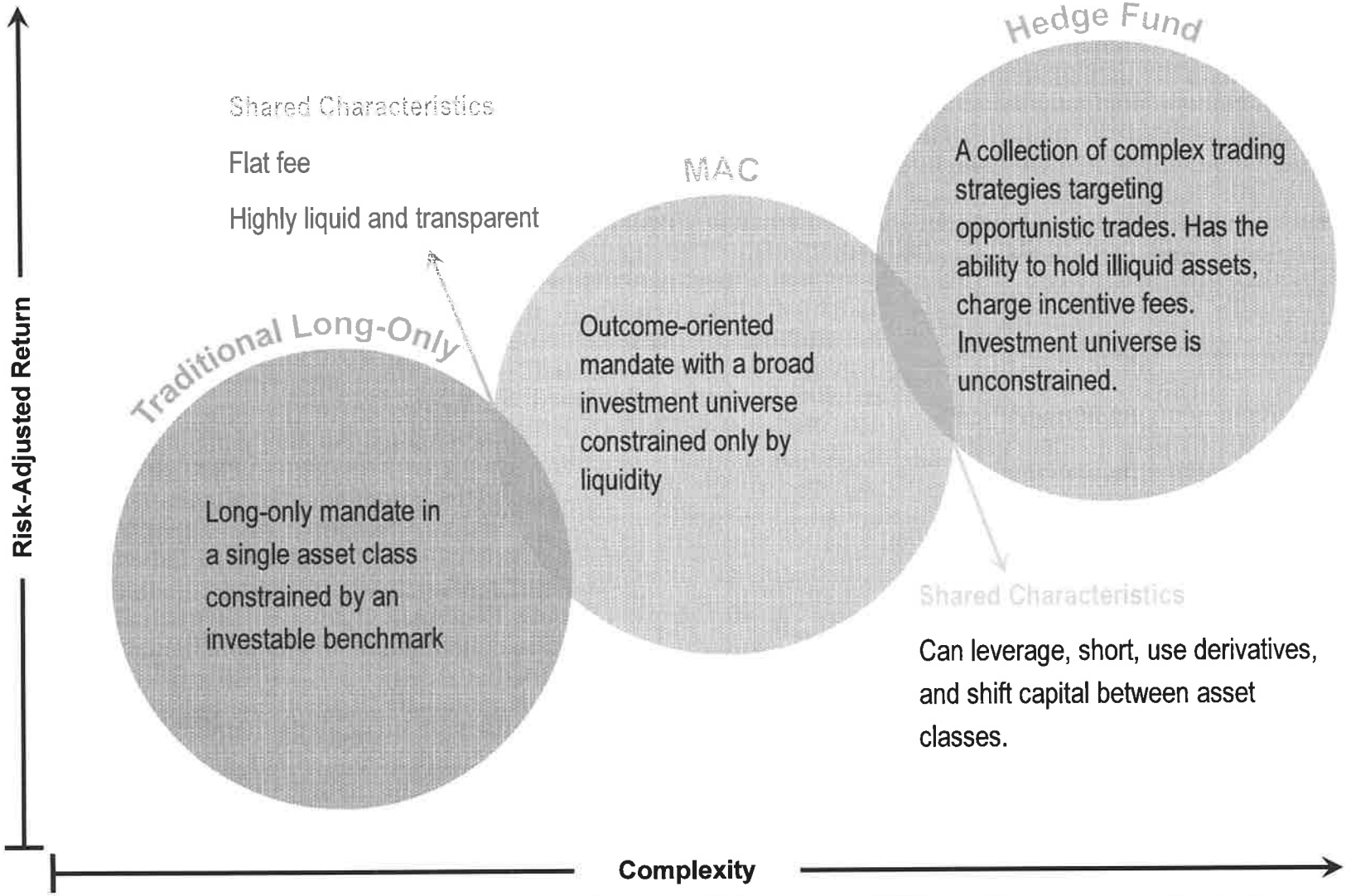
Private Real Estate

Multi-Asset Class Strategies

Multi-Asset Class (MAC)

- Multi-asset class products are outcome-oriented solutions (no benchmark) that invest across multiple asset classes.
- Leverage may be employed to target overall volatility, a specific return, or to achieve a desired risk factor weighting
- MACs have many appealing features that make them attractive:
  - Diversification
  - Dynamic risk management
  - Focus on drawdown protection (risk management)
  - Ability to use derivatives and invest in most asset classes (constrained only by liquidity)
  - Liquid, transparent, with static fees (ranging from 0.50% – 1.40%)
- MAC strategies are more complex than traditional long only strategies
- Implementation risk is high - MAC strategies are unconstrained and highly dependent on manager skill
- They typically take a "multi-horizon" approach that considers short, intermediate and long-term time horizons and may employ a non-traditional asset allocation framework
- Performance evaluation requires greater patience as the strategies are benchmark agnostic and typically designed to deliver higher risk-adjusted returns over a time period measured in years not quarters (typically 5+ years)

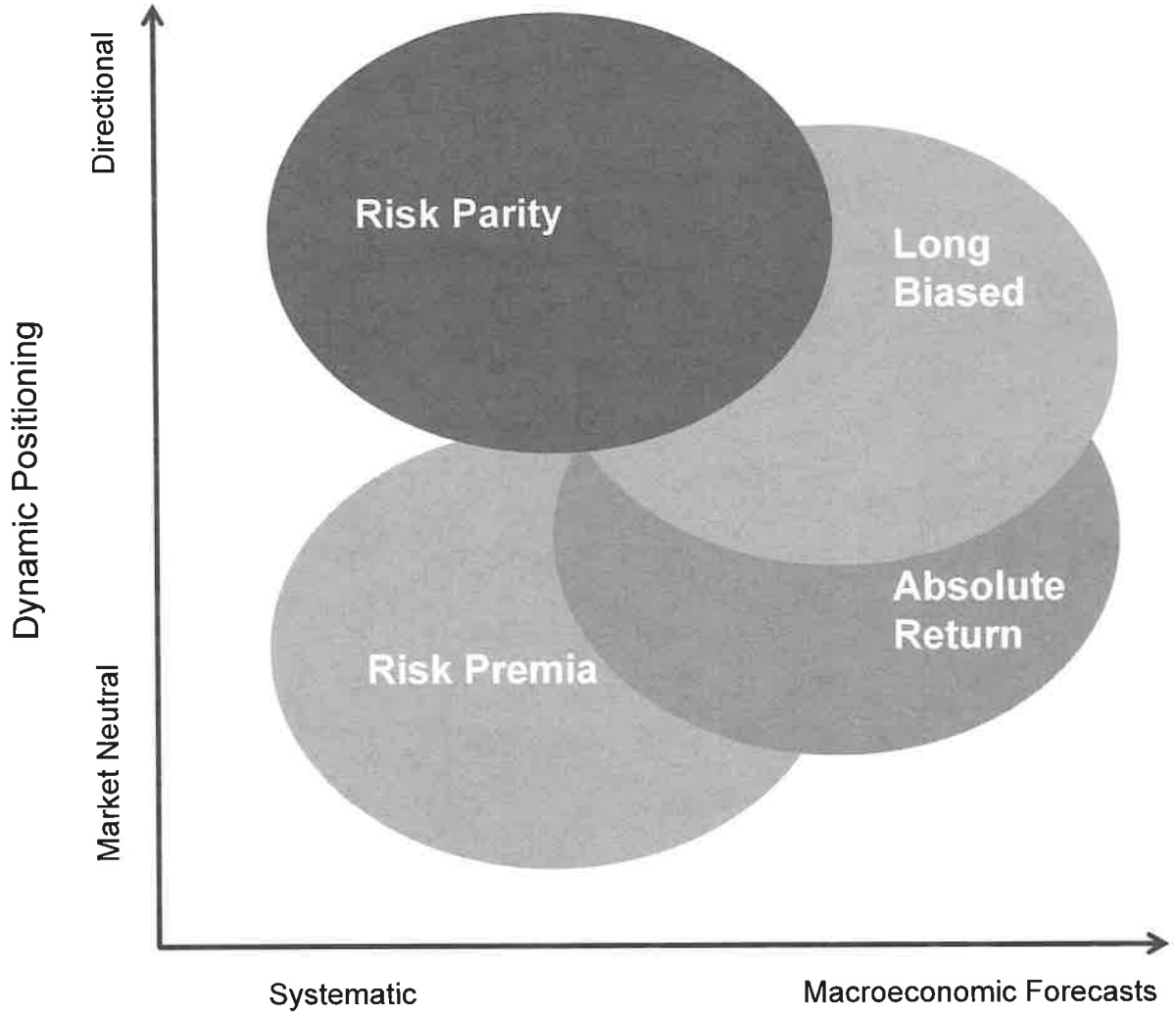
Bridging The Gap



Categorizing the Multi-Asset Class Universe

Qualitative Questions

- Portfolio Structure
  - Relative Value
  - Directional
  - Long Only
- Investment Structure
  - Systematic
  - Fundamental
  - Dynamic risk management



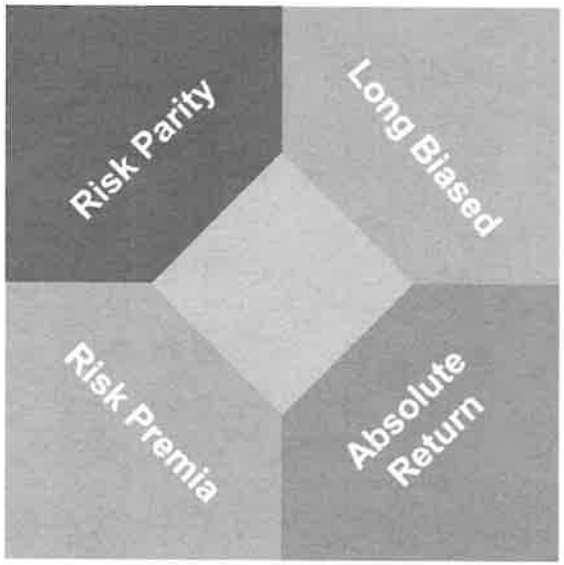
Callan Categorization of Multi-Asset Class Strategies

Risk Parity

- Equal risk-weighted (or close to) exposure to major asset classes/risk factors/economic regimes
- Exposure implemented through long positions with lower volatility holdings levered to meet desired risk target
- Common Benchmarks: T-bills + 5-8%

Long Biased

- Bias to directional asset class exposure
- Higher volatility than absolute return
- Shorting and derivatives may be employed but to a lesser extent
- Macroeconomic forecasting central to idea generation and portfolio positioning
- Dynamic risk management
- Common benchmarks: T-bills + 5-8%; CPI + 4-6%



Risk Premia

- Exposure to academic and behavioral risk factors
- Often with risk balancing between factors
- Implemented through market neutral positions with leverage applied to reach volatility target between 5-15%.
- Common Benchmarks: T-bills + 6-10%

Absolute Return

- Bias to relative value exposures
- Emphasis on downside protection via derivatives and diversifying positions
- Macroeconomic forecasting central to idea generation and portfolio positioning
- Common benchmarks: T-bills + 3-7%; CPI + 3-5%

Real Estate: A Definition

	Privately Traded	Publicly Traded
Equity	**Equity Ownership in Commercial Real Estate** Includes: office, industrial, retail, multifamily, hotel, and other specialty property types	**Real Estate Securities** Includes: Real Estate Investment Trusts (REITs), Real Estate Operating Companies, and Real Estate Development Companies
Debt	**Mortgage Loans** Includes: Senior mortgages, mezzanine debt, among others	**Mortgage-Backed Securities** Includes: CMBS and CDOs (Typically held in bond portfolios)

All strategies exist domestically and internationally

The Case For Investing in Real Estate

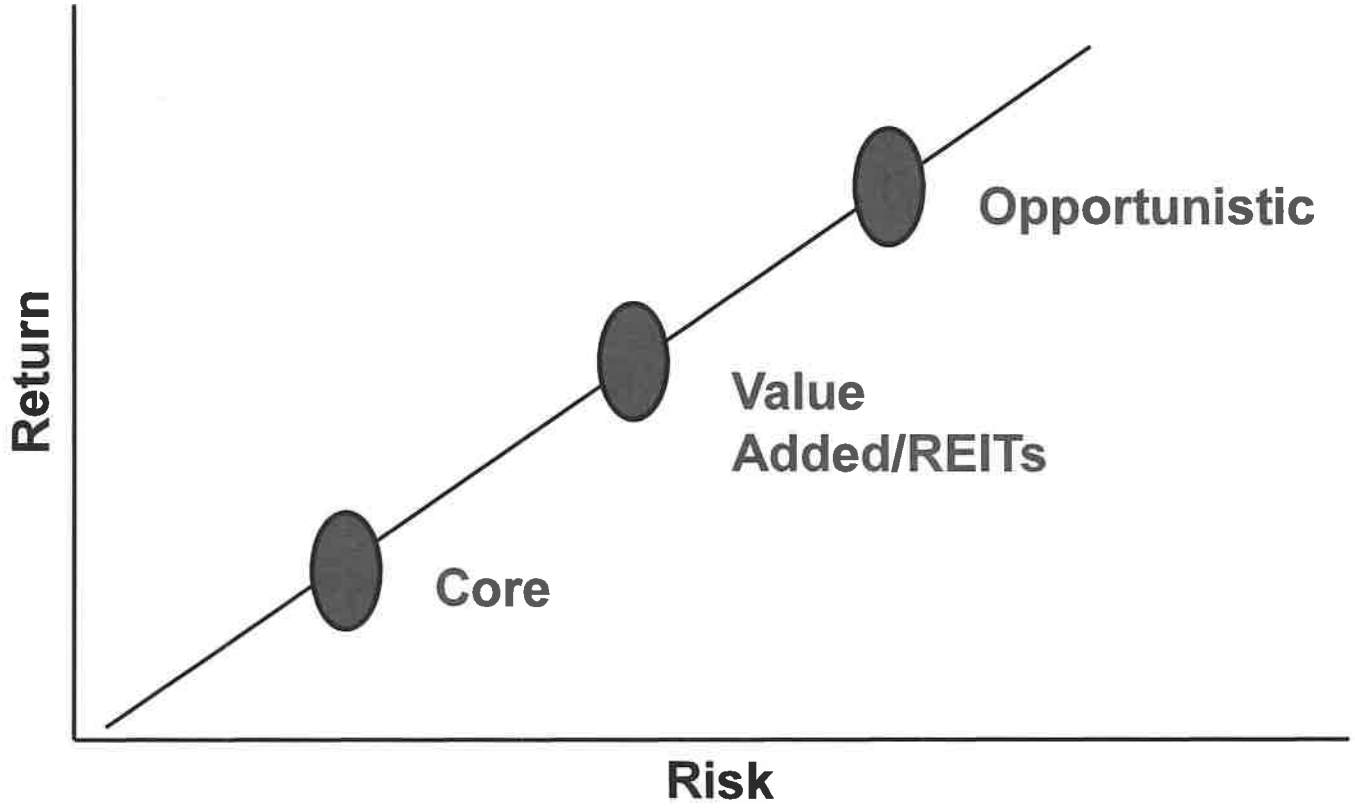
- Competitive returns
- Diversification benefits when added to portfolios of stocks and bonds
- Low correlations with stocks and bonds
- Strong income component
- Inefficiency creates return opportunities
- Inflation protection characteristics
- Diversification benefits of combining public and private real estate

The Case Against Investing in Real Estate

- All real estate is cyclical
- Private real estate is:
  - Not valued daily
  - Illiquid
  - Management intensive/implementation risks
  - High fees compared to mainstream asset classes
  - Lack of investable indices; benchmarking issues
- Public real estate
  - Volatility
  - Lower diversification benefits than private real estate; positively correlated with small/mid-cap equity
  - Small share of the real estate investable universe (<10%)

Implementation – Real Estate Strategies

Risk and Return By Strategy



Core Private Real Estate Strategies

- Most conservative equity real estate approach and most prevalent in institutional portfolios.
- Existing properties with quality construction and design features, quality tenants and staggered lease schedules.
- At least 80% leased upon purchase.
- Located in economically diversified metropolitan areas.
- Investment structures using all cash or limited leverage (less than 40%).
- Predictable income and cash flows. Two-thirds of the anticipated total return will be from income.
- Investment vehicles include core open-end funds and separate accounts (large investors only).

Open-end Core Funds

- U.S. Core Open-end Funds
  - 24 core open-end funds in the NCREIF ODCE universe
  - Funds invest in the U.S only; diversified by region
  - Most diversified by property type across office, retail, industrial, and apartments; additional core funds outside of the ODCE universe that invest in only one property type. Some include specialty property types (hotel, self storage, student housing)
  - Infinite-life
  - Quarterly appraisal based valuations
  - Quarterly liquidity; however, not guaranteed
  - Total universe size: $173 billion
  - Gross Asset Values: $705 million - $42 billion
  - Leverage: 15% - 30%
  - Dynamic universe; funds with 40+ years of history and newly formed funds
  - Entry queues for some funds, but not all
    - *Can present implementation problems, but likely to call capital in one to two quarters*
  - Easy to benchmark using NFI-ODCE, a leveraged fund level benchmark

Non-Core Private Real Estate Strategies

- Non-Core strategies take advantage of dislocations of capital, growth opportunities, and emerging strategies, emerging markets, and emerging managers which may not be "institutional."
- Both value added and opportunistic are considered Non Core.
- Non-Core strategies extend a wider net across the real estate investment opportunity set than Core strategies alone.
- Return enhancement is a primary objective of Non-Core strategies.
- Manager expertise, investor controls, and vintage year diversification are key in implementing Non-Core strategies.
- Non-core strategies and vehicles have many parallels with private equity.

Value Added Real Estate Strategies

- Value Added
  - Seeks a competitive income return with potential for capital appreciation
  - Acquires properties and incorporates re-leasing, repositioning, and re-development strategies
  - Once value has been created, the property is targeted for sale
  - Leverage ranges from 40% to 75%
  - Anticipated one half of the total return will be from income and one half from appreciation
- Investment Vehicles
  - Closed End funds
  - Separate Accounts (for larger investors)
  - Open End Funds

APPENDIX and GLOSSARY OF TERMS

Step 3 –Ranges of Outcomes

1. Level Population – 15 Year Closed: Compare Asset Mixes

7% Present Value

Cumulative Contributions

Percentile	Current	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
97.5th	**$117**	**$116**	**$118**	**$119**	**$122**	**$123**
75th	99	98	98	98	98	98
50th	**89**	**89**	**88**	**87**	**86**	**85**
25th	78	78	76	74	72	70
2.5th	55	58	54	49	45	41
VAR	**28**	**28**	**30**	**33**	**36**	**38**

Unfunded Liability (MVA)

Percentile	Current	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
97.5th	**$60**	**$59**	**$61**	**$63**	**$65**	**$67**
75th	37	37	37	36	36	36
50th	**22**	**22**	**21**	**19**	**18**	**16**
25th	3	4	0	-4	-8	-12
2.5th	-42	-36	-48	-58	-69	-80
VAR	**39**	**37**	**40**	**43**	**47**	**50**

** Negative number implies surplus.*

Ultimate Net Cost

Percentile	Current	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
97.5th	**$169.7**	**$168.8**	**$171.8**	**$174.2**	**$177.3**	**$180.0**
75th	133.3	132.9	132.7	132.2	131.9	131.4
50th	**110.9**	**111.6**	**108.6**	**106.1**	**103.5**	**101.1**
25th	82.9	86.0	80.4	74.5	68.7	62.6
2.5th	19.9	29.1	15.2	2.6	-10.9	-25.8
VAR	**58.8**	**57.3**	**63.1**	**68.1**	**73.8**	**78.9**

** Negative number implies surplus.*

No Discount

Percentile	Current	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
97.5th	**$173**	**$173**	**$175**	**$177**	**$180**	**$183**
75th	144	144	144	144	144	144
50th	**128**	**128**	**126**	**125**	**124**	**122**
25th	110	112	108	105	102	98
2.5th	73	78	71	64	58	53
VAR	**45**	**44**	**48**	**52**	**57**	**61**

Percentile	Current	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
97.5th	**$119**	**$116**	**$119**	**$123**	**$127**	**$131**
75th	72	72	72	71	71	70
50th	**43**	**44**	**41**	**38**	**35**	**32**
25th	6	8	1	-8	-15	-23
2.5th	-82	-71	-94	-114	-135	-157
VAR	**76**	**72**	**78**	**85**	**92**	**99**

** Negative number implies surplus.*

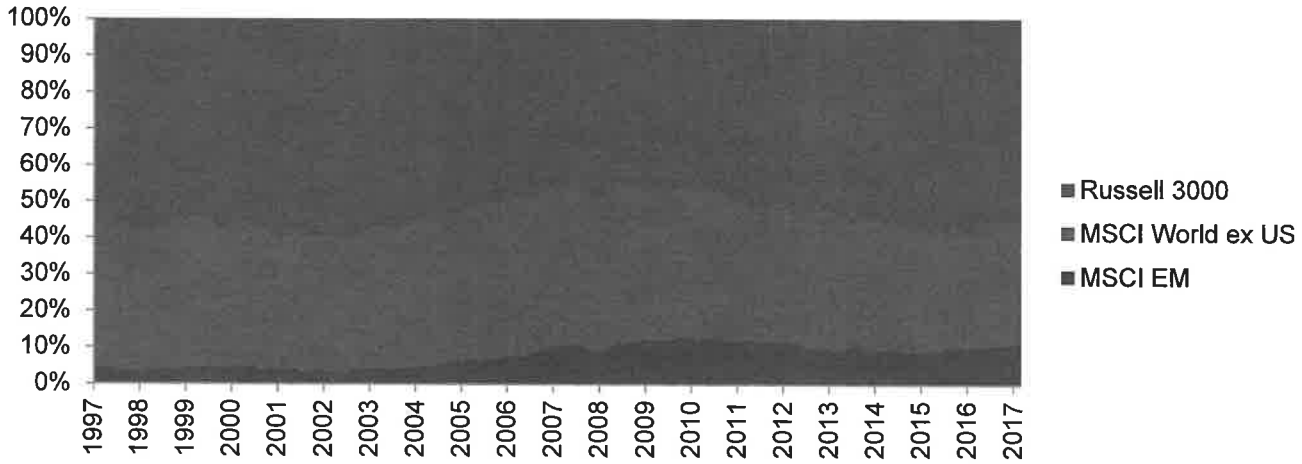
Percentile	Current	Mix 1	Mix 2	Mix 3	Mix 4	Mix 5
97.5th	**$278.5**	**$279.6**	**$284.3**	**$289.0**	**$293.3**	**$297.8**
75th	213.7	212.0	210.8	209.5	208.7	207.9
50th	**171.5**	**173.4**	**168.5**	**163.6**	**159.4**	**155.1**
25th	119.8	125.1	114.6	103.4	93.1	82.0
2.5th	3.9	16.2	-8.2	-33.5	-60.0	-89.7
VAR	**107.0**	**106.2**	**115.9**	**125.4**	**133.8**	**142.7**

** Negative number implies surplus.*

Why More Non-US Equity?

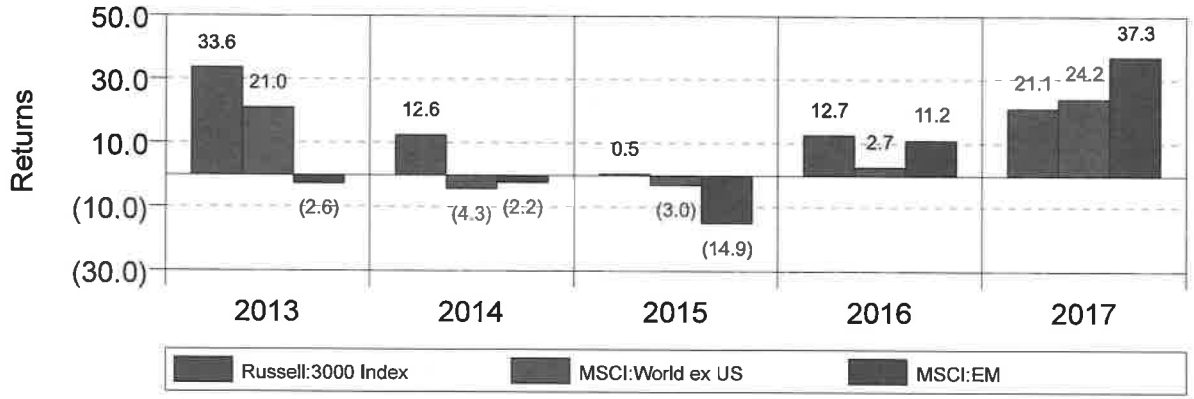
Developed and Emerging Market Exposures

Relative sizes of world stock markets (1997-Present)



- Non-US equity is approximately 50% of total global equity
- Emerging markets now represent roughly 10% of global markets

Annual Returns
for 5 Years Ended December 31, 2017



- Performance and economic outlook for Non-US equity (including emerging markets) have dramatically improved
- Over 93% of corporate plan sponsors in Callan's database have exposure to international equity
- The median allocation was 17.5% at 12/31/17

Defining the Capital Market Expectations

Key to Constructing Efficient Portfolios

		Broad	Lg Cap	Sm/Mid	Global/US	Int'l Eq	Emerge	Sht Dur	Dom Fix	Long D	TIPS	Hi Yield	NUS Fix	EMD	Real Est	Pvt Eqt	Hedge Fd	Comm	Cash Eq	Inflation
1	Broad Domestic Equity	1.000																		
2	Large Cap	0.996	1.000																	
3	Small/Mid Cap	0.966	0.940	1.000																
4	Global ex-US Equity	0.874	0.872	0.839	1.000															
5	International Equity	0.840	0.840	0.800	0.987	1.000														
6	Emerging Markets Equity	0.866	0.860	0.845	0.936	0.865	1.000													
7	Short Duration	-0.250	-0.240	-0.270	-0.271	-0.250	-0.290	1.000												
8	Domestic Fixed	-0.110	-0.100	-0.135	-0.130	-0.110	-0.160	0.870	1.000											
9	Long Duration	0.109	0.112	0.096	0.080	0.094	0.043	0.739	0.930	1.000										
10	TIPS	-0.054	-0.045	-0.080	-0.049	-0.030	-0.085	0.525	0.600	0.532	1.000									
11	High Yield	0.636	0.635	0.610	0.627	0.605	0.615	-0.140	0.020	0.190	0.060	1.000								
12	Non-US Fixed	0.013	0.050	-0.100	0.013	0.060	-0.090	0.480	0.510	0.539	0.340	0.120	1.000							
13	EMD	0.573	0.570	0.555	0.577	0.550	0.580	-0.040	0.100	0.143	0.180	0.600	0.010	1.000						
14	Real Estate	0.732	0.730	0.705	0.677	0.660	0.650	-0.165	-0.030	0.168	0.000	0.560	-0.050	0.440	1.000					
15	Private Equity	0.948	0.945	0.915	0.927	0.895	0.910	-0.260	-0.200	-0.005	-0.110	0.640	-0.060	0.570	0.715	1.000				
16	Hedge Funds	0.802	0.800	0.770	0.761	0.730	0.755	-0.130	0.080	0.287	0.075	0.570	-0.080	0.540	0.605	0.780	1.000			
17	Commodities	0.152	0.150	0.150	0.161	0.155	0.160	-0.220	-0.100	-0.041	0.120	0.100	0.050	0.190	0.200	0.180	0.210	1.000		
18	Cash Equivalents	-0.043	-0.030	-0.080	-0.040	-0.010	-0.100	0.300	0.100	-0.041	0.070	-0.110	-0.090	-0.070	-0.060	0.000	-0.070	0.070	1.000	
19	Inflation	-0.010	-0.020	0.020	0.010	0.000	0.030	-0.200	-0.280	-0.288	0.180	0.070	-0.150	0.000	0.100	0.060	0.200	0.400	0.000	1.000

- Relationships between asset classes is vitally important
- To determine portfolio mixes, we use mean-variance optimization
- Return, standard deviation and correlation determine the composition of efficient asset mixes

Glossary of Terms

Actuary

A specialist in the application of mathematics, probability, statistics and risk theory to financial problems involving future uncertainty. These uncertainties are usually associated with life insurance, property and casualty insurance, annuities, pension or other employee benefit plans and investments.

Actuarial (Accrued) Liability (AL)

The actuarial present value of all benefits accrued or earned under the Plan as of the beginning of the year, based on the anticipated salary increases for pay-related plans. Under the entry age normal cost method, the actuarial liability is the difference between the actuarial present value of future benefits and the actuarial present value of future normal cost.

Actuarial Value of Assets (AVA)

The value of cash, investments and other property belonging to a pension plan, as used by the actuary for the purpose of an actuarial valuation.

Alternative Investments

Refers broadly to non-traditional investment strategies such as hedge funds, private equity, distressed debt, commodities and futures.

Glossary of Terms (Continued)

Bond

A bond is a debt instrument issued by entities such as corporations, municipalities, federal, state and local government agencies for the purpose of raising capital through borrowing. Bonds typically pay interest periodically while repaying the principal, or par value, at maturity. Bonds with maturities of five years or less are often called notes.

Cost-of-Living Adjustment (COLA)

An increase (or decrease) in pension benefits according to the rise (or fall) in the cost of living as measured by an index, often the Consumer Price Index (CPI).

Deterministic Forecast

An outcome that is precisely determined in advance, using single estimates and without variation.

Diversification

The allocation of funds across different asset classes or securities within a portfolio.

Equity

The ownership interest of common and preferred stockholders in a company.

Glossary of Terms (Continued)

Funded Status

The status of a pension plan that has accumulated and set aside assets for the payment of retirement benefits to employees. Funded status is measured as the ratio of the Actuarial Value of Assets / Actuarial Liability.

Government Accounting Standards Board (GASB)

The designated organization for establishing standards of financial accounting and reporting in the public sector.

Inflation

A period in which the general level of prices for goods and services is increasing, and, thus, purchasing power is decreasing.

Liquidity

In general, liquidity refers to the ease by which a financial asset can be converted into cash. Liquidity is often more narrowly defined as the ability to sell an asset quickly without having to make a substantial price concession.

Liquidity Risk

Liquidity risk is the risk stemming from a lack of marketability of an investment, which makes it difficult to sell when desired.

Glossary of Terms (Continued)

Market Value of Assets (MVA)

An asset valuation that is based on the price for which an asset could be sold on the valuation date (also known as fair market or actual value).

Normal Cost (NC)

The annual accrual cost attributable to the upcoming plan year.

Present Value

Present value is the value on a given date of a future payment/receipt or series of future payments/receipts, discounted to reflect the time value of money, usually by the current relevant market interest rate.

Present Value of Benefits (PVB)

The actuarial present value all benefits (accrued service plus future service) under the Plan as of the beginning of the year, based on the anticipated salary increases for pay-related plans.

Purchasing Power Risk

Purchasing power risk is the risk that a portfolio or investment will earn a return less than the rate of inflation.

Glossary of Terms (Continued)

Sharpe Ratio

The Sharpe ratio is a commonly used measure of risk-adjusted return. It is calculated by subtracting the risk-free return (usually the 3 month Treasury bill) from a portfolio's return and then dividing this excess return by the portfolio's total standard deviation (a measure of portfolio volatility, or risk). The ratio thus represents the return gained per unit of risk taken.

Standard Deviation

Standard deviation is a statistical measure of portfolio risk. It reflects the average deviation of returns from their mean. Standard deviation is used as an estimate of risk since it measures how wide the range of returns has been.

Stochastic Forecast

An outcome based on variability or a range of values, and expressed in the form of a probability distribution.

Strategic Asset Allocation

Strategic asset allocation requires rebalancing back to a pre-determined policy allocation at specified time intervals or when established tolerance bands are violated.

Glossary of Terms (Continued)

Tactical Asset Allocation

Tactical Asset Allocation involves actively altering allocation among broad asset classes in an attempt to capture the highest returns. It is also referred to as "market timing."

Unfunded Liability

The difference between the actuarial (accrued) liability and the actuarial value of assets. A surplus exists if assets exceed liabilities.

VAR (Value at Risk)

The difference between the Downside Scenario (97.5th) and the Expected Case (50th): How much could be lost in a downside scenario relative to where you expected to be.

Volatility

The degree to which an investment's market value goes up and down over time.

Disclaimers

This report is for informational purposes only and should not be construed as legal or tax advice on any matter. Any decision you make on the basis of this content is your sole responsibility. You should consult with legal and tax advisers before applying any of this information to your particular situation.

This report may consist of statements of opinion, which are made as of the date they are expressed and are not statements of fact.

Reference to or inclusion in this report of any product, service or entity should not be construed as a recommendation, approval, affiliation or endorsement of such product, service or entity by Callan.

Past performance is no guarantee of future results.

The statements made herein may include forward-looking statements regarding future results. The forward-looking statements herein: (i) are best estimations consistent with the information available as of the date hereof and (ii) involve known and unknown risks and uncertainties such that actual results may differ materially from these statements. There is no obligation to update or alter any forward-looking statement, whether as a result of new information, future events or otherwise. Undue reliance should not be placed on forward-looking statements.

FFC Investment Advisors of Raymond James
Octave J. Francis III, CIMA®
Managing Director
Senior Vice President, Investments
400 Poydras Street, Suite 2430
New Orleans, LA 70130
www.ffcinvestmentadvisors.com

ASSET ALLOCATION

A Guide to the Fundamentals of Portfolio Construction

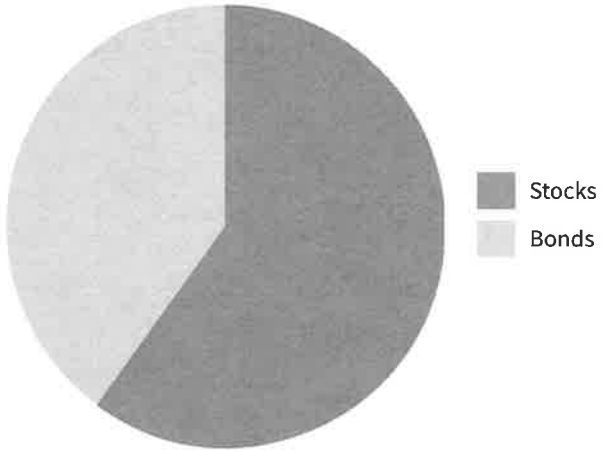
What is Asset Allocation?	2
Risk Premium & Correlation	3
Diversification	4
Determining Allocations	5
Time Horizon	6
Risk Tolerance	7
Investment Goals	8

RAYMOND JAMES

WHAT IS ASSET ALLOCATION?

As its name suggests, asset allocation is the collective percentage of investable capital 'allocated' to each 'asset' class. The conventional '60/40' stock and bond portfolio showcases a traditional asset allocation model. Namely, 60% of investable capital is allocated to stocks while the remaining 40% of investable capital is allocated to bonds (see chart).

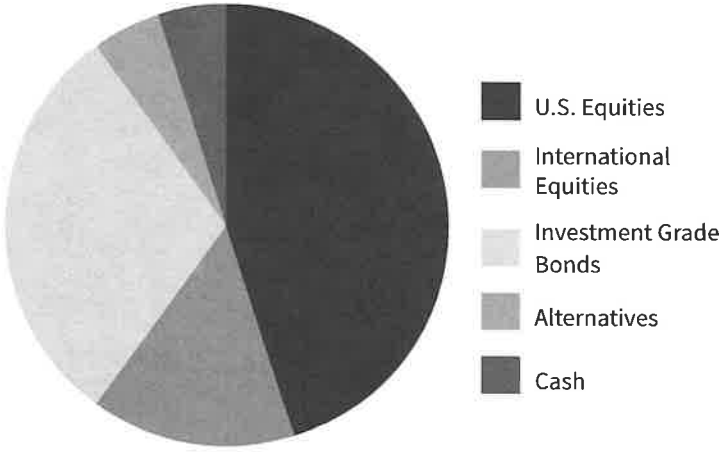
60/40 PORTFOLIO



ASSET CLASSES

Traditional asset classes fall into two broad categories: **equities** (stocks) and **non-equities** (bonds and cash). **Alternative investments** represent a non-traditional category in modern portfolios. These broad asset classes consist of multiple 'sub' asset classes (see chart). For example, large-capitalization U.S. equities and international equities are sub asset classes within the broad equity asset class. U.S. Treasury notes and investment grade bonds are sub asset classes within the broad non-equity asset class. Managed futures and long/short strategies are sub asset classes within the broad alternative asset class.

ASSET CLASSES

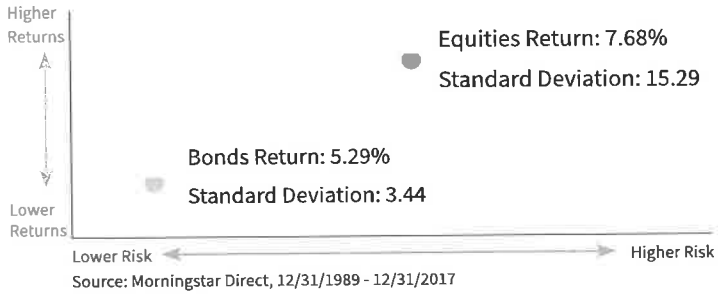


THE IMPORTANCE OF ASSET ALLOCATION

Asset allocation is the most predominant component of portfolio performance. Studies have shown that asset allocation accounts for approximately 86% of portfolio returns. In short, the percentage of assets allocated to equities vs. non-equities is the principal determinant of portfolio performance over time.

RISK PREMIUM

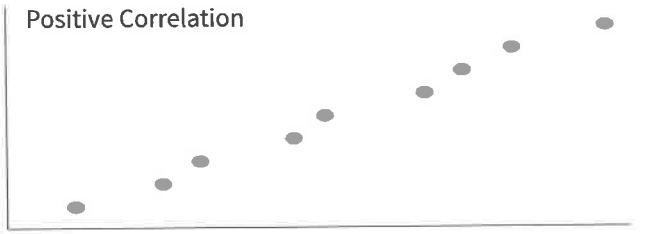
Given that asset allocation determines a preponderance of portfolio returns, an investor may be tempted to allocate all of his assets to the asset class with the most upside potential. Generally speaking, asset classes with the greatest upside potential also have the greatest downside potential. Conversely, asset classes with the least upside potential also have the least downside potential. This is known as **risk premium**. Over time, an investor should be rewarded relative to the risk he assumes.

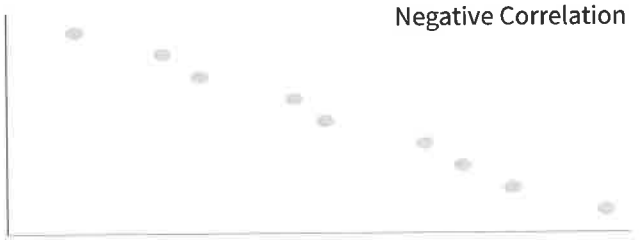


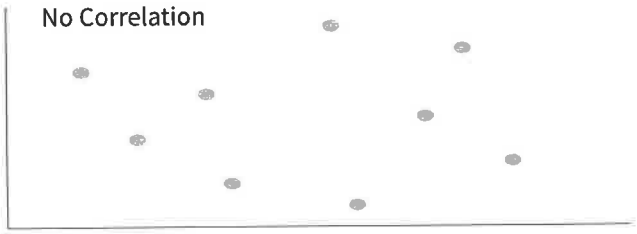
Source: Morningstar Direct, 12/31/1989 - 12/31/2017

CORRELATION

Effective asset allocation can also insulate portfolio returns from excess volatility. This can be achieved by allocating capital with respect to the **correlation** of each asset to other assets within the portfolio. Correlation measures the degree to which assets move in the same or opposite directions. This measure ranges from +1 to -1. Assets which are positively correlated (+1) move in the same direction, while assets which are negatively correlated (-1) move in opposite directions. Assets which have no correlation (0) do not move in relation to each other (see charts). By allocating a percentage of capital to negatively or non-correlated assets, portfolio returns can be insulated from market volatility.







DIVERSIFICATION

The performance of different asset classes varies year to year. The best performing asset class in one year can easily be the worst performing asset class next year (see below). Past results are not indicative of future performance. The ability to consistently and reliably pick the best performing asset class each year has proven to be a nearly impossible task. A balanced, well-diversified portfolio has proven to be one of the best ways to capture consistent returns over time. A balanced portfolio offers exposure to the upside potential of multiple asset classes while attempting to limit downside risk (see chart below).

2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Non-U.S. Equity 16.7%	Fixed Income 5.2%	Non-U.S. Equity 41.5%	Real Estate 19.3%	Fixed Income 7.8%	Real Estate 29.0%	U.S. Equity 33.6%	Real Estate 13.9%	Fixed Income 0.6%	U.S Equity 12.7%	Non-U.S. Equity 27.2%
Commodities 16.2%	Cash & Cash Alternatives 1.8%	Real Estate 40.2%	U.S. Equity 16.9%	Blended Portfolio 2.1%	Non-U.S. Equity 16.8%	Non-U.S. Equity 15.3%	U.S. Equity 12.6%	U.S. Equity 0.5%	Commodities 11.8%	U.S Equity 21.1%
Blended Portfolio 7.8%	Blended Portfolio -21.7%	U.S. Equity 28.3%	Commodities 16.8%	U.S. Equity 1.0%	U.S. Equity 16.4%	Blended Portfolio 13.9%	Blended Portfolio 7.1%	Cash & Cash Alternatives 0.0%	Blended Portfolio 7.1%	Real Estate 14.0%
Fixed Income 7.0%	Commodities -35.7%	Blended Portfolio 20.2%	Blended Portfolio 11.9%	Cash & Cash Alternatives 0.1%	Blended Portfolio 11.0%	Real Estate 1.6%	Fixed Income 6.0%	Blended Portfolio -0.2%	Non-U.S. Equity 4.5%	Blended Portfolio 13.8%
U.S. Equity 5.1%	U.S. Equity -37.3%	Commodities 18.9%	Non-U.S. Equity 11.2%	Real Estate -8.7%	Fixed Income 4.2%	Cash & Cash Alternatives 0.1%	Cash & Cash Alternatives 0.0%	Real Estate -1.2%	Real Estate 3.8%	Fixed Income 3.5%
Cash & Cash Alternatives 4.7%	Non-U.S. Equity -45.5%	Fixed Income 5.9%	Fixed Income 6.5%	Commodities -13.3%	Cash & Cash Alternatives 0.1%	Fixed Income -2.0%	Non-U.S. Equity -3.9%	Non-U.S. Equity -5.7%	Fixed Income 2.7%	Commodities 1.7%
Real Estate -5.0%	Real Estate -50.2%	Cash & Cash Alternatives 0.2%	Cash & Cash Alternatives 0.1%	Non-U.S. Equity -13.7%	Commodities -1.1%	Commodities -9.5%	Commodities -17.0%	Commodities -24.7%	Cash & Cash Alternatives 0.3%	Cash & Cash Alternatives 0.8%

Best

Worst

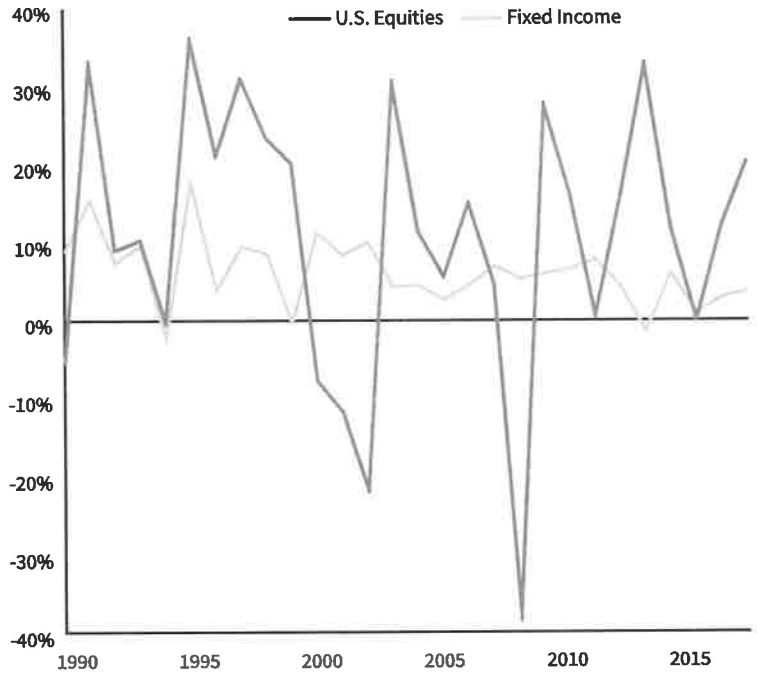
Blended Portfolio Allocation: 45% U.S. Equity / 15% Non-U.S. Equity / 40% Fixed Income; Source: Morningstar Direct, as of 12/31/2017

DETERMINING PROPER ALLOCATIONS

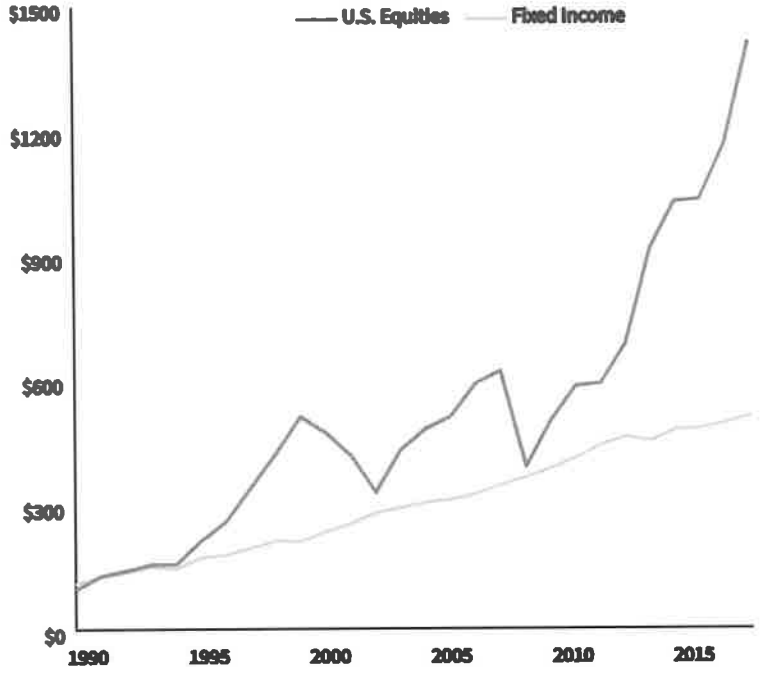
As previously indicated, the most crucial determinant of portfolio performance lies in the percentage of assets allocated to equities vs. non-equities. So how should an investor determine his allocations to each asset class?

While equities may offer the best potential for growth over an extended period of time, their returns are often more volatile than bonds. Conversely, while non-equities may offer the best potential for capital preservation, their returns often underperform equities over extended periods (see charts below). Therefore, a suitable asset allocation must be tailored to an investor's individual **time horizon**, **risk tolerance**, and **investment goals**.

ANNUAL RETURNS: EQUITIES VS. FIXED INCOME



GROWTH OF $100: EQUITIES VS. FIXED INCOME

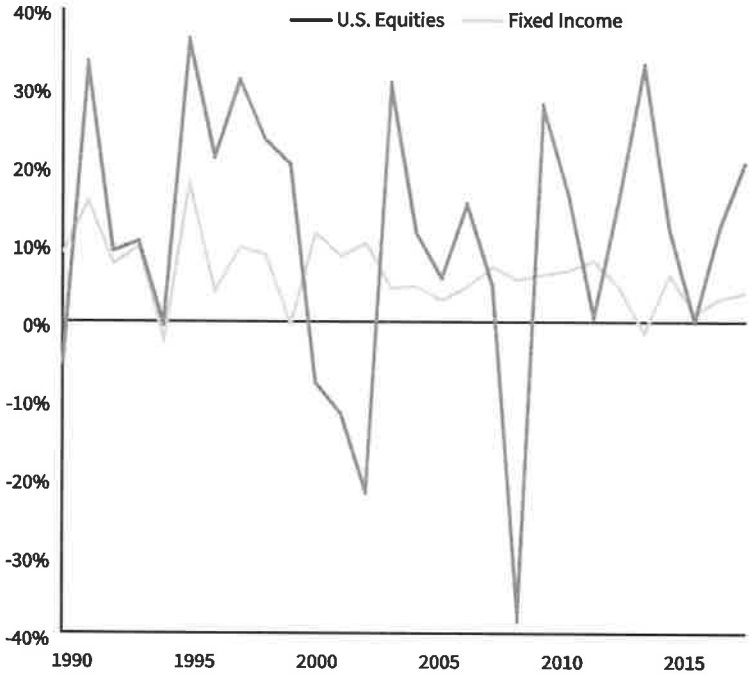


Source: Morningstar Direct as of 12/31/2017

TIME HORIZON

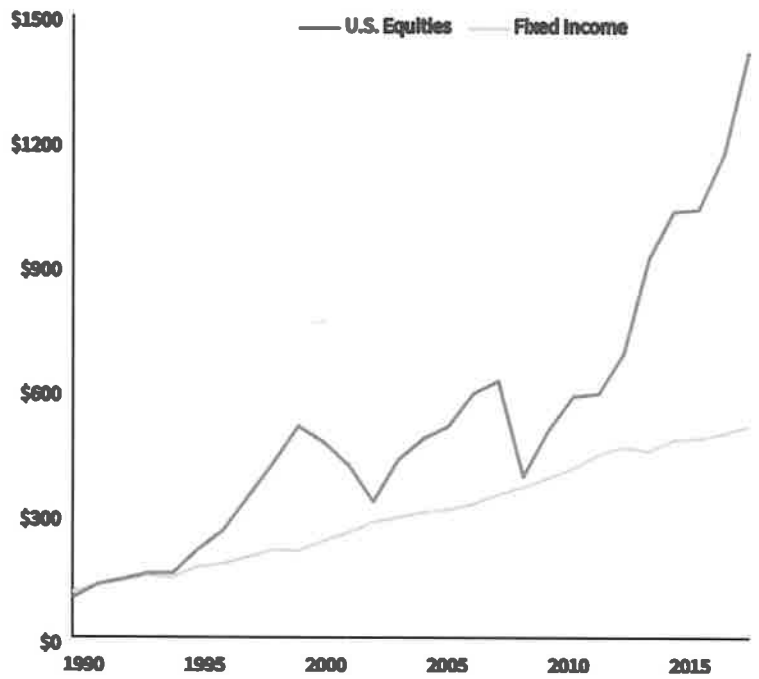
While many factors can affect an investor's ultimate asset allocation, his individual investment **time horizon** will have the most impact. An asset allocation suitable for a young professional at the start of his career is not necessarily suitable for an executive who is nearing retirement. For those who have long investment time horizons, higher allocations to equities may provide better potential for growth and wealth accumulation. Conversely, for those with shorter time horizons, higher allocations to non-equities may provide better potential for stability and wealth preservation.

ANNUAL RETURNS: EQUITIES VS. FIXED INCOME



Source: Morningstar Direct as of 12/31/2017

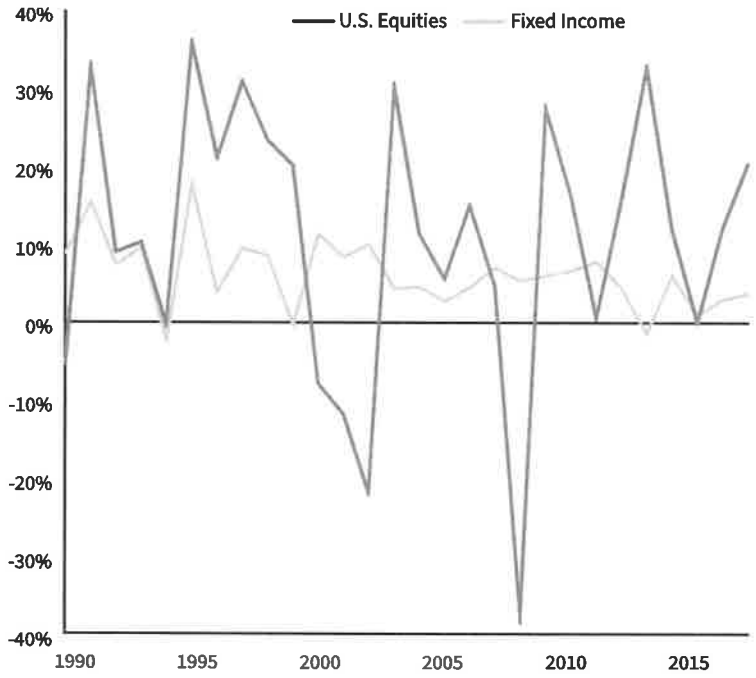
GROWTH OF $100: EQUITIES VS. FIXED INCOME



RISK TOLERANCE

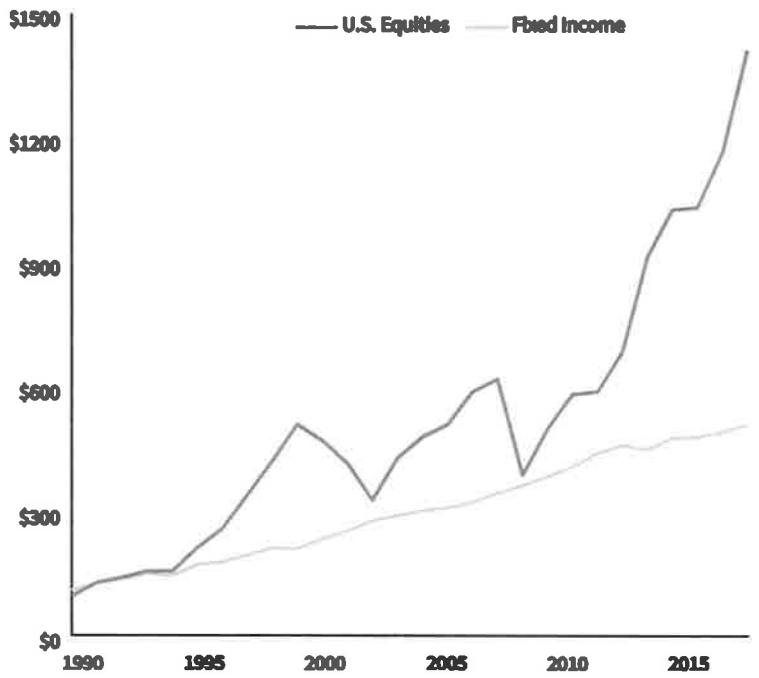
Equally important to an investor's asset allocation is his **risk tolerance**. Assets with greater upside potential generally carry greater risk. While stocks generally outperform bonds over extended periods of time, they are generally much more volatile and carry a greater risk for loss. Conversely, while bonds generally underperform stocks over extended periods of time, they are generally much less volatile and carry less risk for loss. If an investor has a low tolerance for risk, a portfolio with a smaller percentage allocated towards stocks and a greater percentage allocated towards bonds may be more suitable. Conversely, a portfolio with a greater percentage allocated towards stocks and a smaller percentage allocated towards bonds may be more suitable for an investor with a high tolerance for risk.

ANNUAL RETURNS: EQUITIES VS. FIXED INCOME



Source: Morningstar Direct as of 12/31/2017

GROWTH OF $100: EQUITIES VS. FIXED INCOME

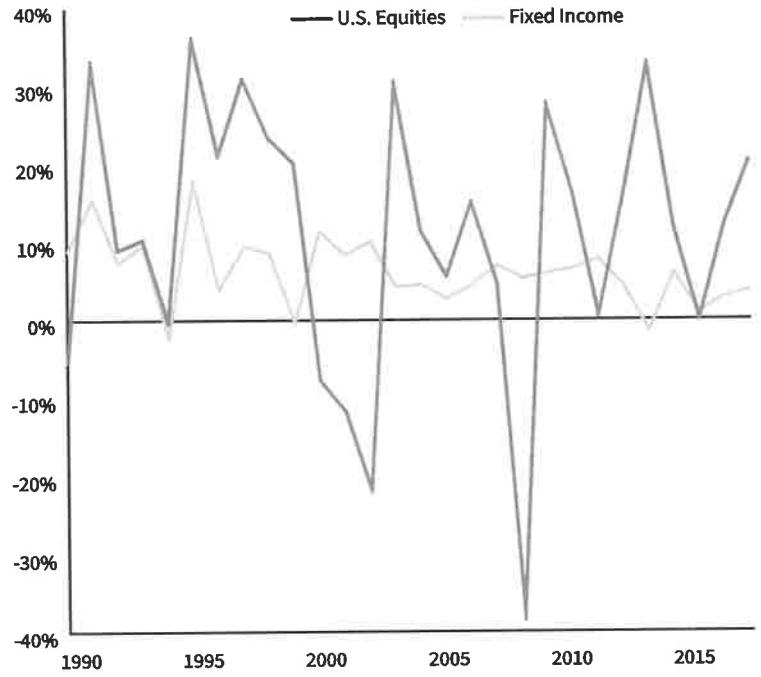


INVESTMENT GOALS

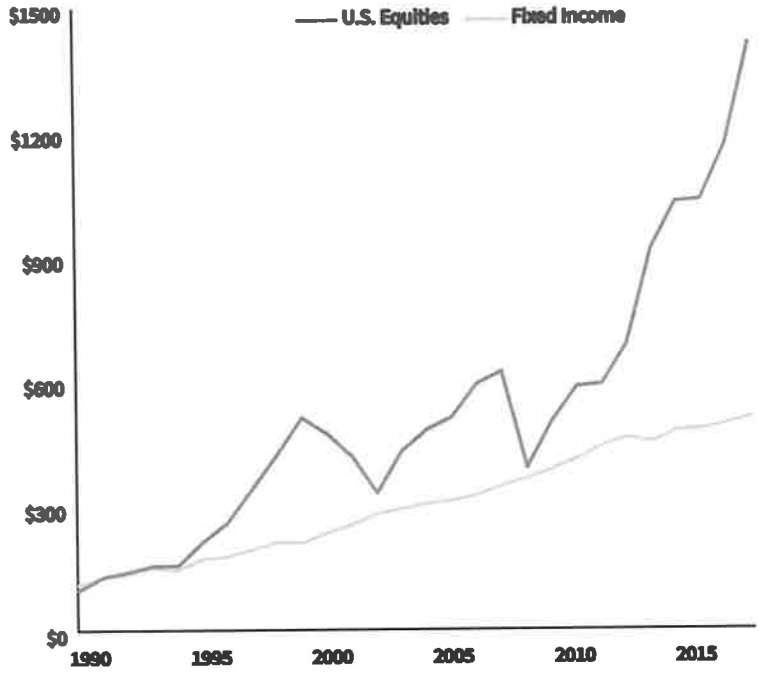
Finally, an investor's asset allocation must align with his **investment goals**. If an investor wishes to grow and accumulate wealth for retirement over a long period of time, a higher allocation to stocks may be suitable. Conversely, if an investor merely wishes to preserve wealth and reduce his risk for loss, a higher allocation to bonds may be suitable.

An investor's time horizon, risk tolerance, and investment goals are often synthesized in an investment policy statement. A Raymond James advisor is uniquely suited and trained to assess the individual needs of an investor and tailor an asset allocation in order to help successfully reach his investment objectives.

ANNUAL RETURNS: EQUITIES VS. FIXED INCOME



GROWTH OF $100: EQUITIES VS. FIXED INCOME



Source: Morningstar Direct as of 12/31/2017

DISCLOSURES & INDEX DECRIPTIONS

All content written and assembled by Taylor Krystkowiak, Investment Strategy Analyst.

BROAD ASSET CLASS RETURNS

U.S. EQUITY | Russell 3000 Total Return Index: This index represents 3000 large U.S. companies, ranked by market capitalization. It represents approximately 98% of the U.S. equity market. This index includes the effects of reinvested dividends.

NON-U.S. EQUITY | MSCI ACWI Ex USA Net Return Index: The index is a market-capitalization-weighted index maintained by Morgan Stanley Capital International (MSCI) and designed to provide a broad measure of stock performance throughout the world, with the exception of U.S.-based companies. The index includes both developed and emerging markets.

GLOBAL REAL ESTATE | FTSE EPRA/NAREIT Global Net Return Index: This index is designed to track the performance of listed real estate companies and REITs in both developed and emerging markets. By making the index constituents free-float adjusted, liquidity, size and revenue screened, the series is suitable for use as the basis for investment products. Prior to 2009, this asset class was represented by the NASDAQ Global Real Estate Index.

CASH & CASH ALTERNATIVES | Citigroup 3 Month U.S. Treasury-Bill Total Return Index: This index is a measurement of the movement of 3-month T-Bills. The income used to calculate the monthly return is derived by subtracting the original amount invested from the maturity value.

FIXED INCOME | Bloomberg Barclays Capital Aggregate Bond Total Return Index: This index represents securities that are SEC-registered, taxable, and dollar denominated. The index covers the U.S. investment grade fixed rate bond market, with index components for government and corporate securities, mortgage pass-through securities, and asset-backed securities.

COMMODITIES | Bloomberg Commodity Total Return Index: The index tracks prices of futures contracts on physical commodities on the commodity markets. The index is designed to minimize concentration in any one commodity or sector. It currently has 22 commodity futures in seven sectors. No one commodity can compose less than 2% or more than 15% of the index, and no sector can represent more than 33% of the index (as of the annual weightings of the components). The weightings for each commodity included in the Bloomberg Commodity Index are calculated in accordance with rules that ensure that the relative proportion of each of the underlying individual commodities reflects its global economic significance and market liquidity. Annual rebalancing and reweighting ensure that diversity is maintained over time.

ADDITIONAL DISCLOSURES

ALTERNATIVES | Alternative investments involve substantial risks that may be greater than those associated with traditional investments and are not suitable for all investors. They may be offered only to clients who meet specific suitability requirements, including minimum-net-worth tests. These risks include, but are not limited to, limited liquidity, tax considerations, incentive fee structures, potentially speculative investment strategies, and different regulatory and reporting requirements.

STANDARD DEVIATION | Standard deviation is a measure of the dispersion of a set of data from its mean. It is calculated as the square root of variance by determining the variation between each data point relative to the mean. If the data points are further from the mean, there is higher deviation within the data set. In finance, standard deviation is a statistical measurement; when applied to the annual rate of return of an investment, it sheds light on the historical volatility of that investment. The greater the standard deviation of a security, the greater the variance between each price and the mean, indicating a larger price range.

ADDITIONAL DISCLOSURES | Any charts and tables presented herein are for illustrative purposes only and should not be considered as the sole basis for an investment decision. There can be no assurance that the future performance of any specific investment or investment strategy made reference to be profitable or equal any corresponding indicated historical performance level(s). This information should not be construed as a recommendation. The foregoing content is subject to change at any time without notice. Content provided herein is for informational purposes only. There is no guarantee that these statements, opinions or forecasts provided herein will prove to be correct. Past performance is not a guarantee of future results. Indices and peer groups are not available for direct investment. Any investor who attempts to mimic the performance of an index or peer group would incur fees and expenses that would reduce returns. All investing involves risk. Asset allocation and diversification does not ensure a profit or protect against a loss. Dividends are not guaranteed and a company's future ability to pay them may be limited.

Not FDIC or NCUA Insured • No Bank Guarantee • May Lose Value.

Callan

Callan LLC
600 Montgomery Street
Suite 800
San Francisco, CA 94111

Main 415.974.5060
Fax 415.291.4014

www.callan.com

Memorandum

To: Sewerage & Water Board of New Orleans
From: Callan LLC
Date: June 28, 2018
Subject: 2018 Asset Allocation and Liability Study Results

The Sewerage & Water Board of New Orleans Staff worked with Callan to conduct an asset/liability study for the Employees' Retirement System. The study was conducted in two phases. Phase I was designed to test and confirm the liability methodology and assumptions for the study. Phase II focused on the analysis of various asset mixes to provide the asset/liability analysis and support the conclusions. Callan will present the results of the asset/liability study at the July 18, 2018 meeting.

PHASE I – METHODOLOGY AND ASSUMPTIONS

The objective of Phase I of the study is to consider the methodology and assumptions for modeling the System. To conduct an asset-liability study, Callan constructs a liability model that projects the future Plan population (or demographics) of the System each year for the next 10 years. In each future year the model performs an actuarial valuation, thereby allowing us to examine how investment risk associated with the asset allocation decision can impact the size of the unfunded liability and contribution requirements. Therefore, assumptions must be made for future experience, the size of the employee population earning a benefit under the System, as well those entitled to a benefit (vested or in payment).

Liability Modeling and Assumptions:

The modeling process begins by using the most recent participant data as of January 1, 2018. Callan modeled the Plan's benefit structure, actuarial assumptions, liabilities and funding policy in accordance with the most recent actuarial valuation. Next, Callan projected the future demographic profile of the Plan using the System's current actuarial assumptions for mortality, retirement, termination and disability (i.e. future experience will exactly equal the actuary's assumptions). In addition, assumptions were made for new hires to join the Plan. Finally, Callan considered four different employee or workforce scenarios:

1. A level population of 1,088 employees;
2. Increasing to 1,500 employees over the next 5 years;
3. Accelerated retirements over the next 5 years; and,
4. Closing the plan to new hires.

Only one exception was made to the model and that centered on actual payroll increasing at 3% relative to the actuarial valuation assumptions of 5%. A lower payroll increase than assumed in the valuation

assumptions implies actuarial gains in each year in our model, but this assumption is consistent with the System's actual experience as shown in the last two valuation reports.

Another issue involved the DROP program of the Plan. For investment decision making purposes, we excluded the current Drop Account Balances of $11.6M because these assets are invested in a separate cash account.

Deterministic Projections

A deterministic projection is a single scenario whereby the future experience of the plan exactly matches the actuarial expectations for return and inflation. For example, one scenario includes future returns exactly matching the 7% discount rate assumption and inflation being exactly 2% in each future year. For each workforce scenario, the study presents the projected employer contribution rate under this "actuarial basis", but also using the "Callan basis" with an expectation for lower geometric returns of 5.65% over the next 10 year time frame. The impact of lower market returns for the System's current asset allocation policy is to expect an elevated employer contribution rate.

Each workforce scenario is presented in this deterministic framework comparing the impact on employer contribution rates (as a % of the projected payroll) using a "closed" 15 year amortization versus an "open" 30 year amortization funding policy.

One key conclusion of the deterministic analysis regards workforce scenario 3, which assumes everyone who can retire over the next 5 years will do so, maintaining a level population of 1,088 active employees. Accelerated retirements over the next 5 years had no material impact on contributions rates.

The last element of the deterministic projection analysis is to assess the System's future liquidity needs and to ascertain how net cash flow (total contributions less benefit payments) influences the asset allocation decision. Liquidity needs help define the appropriate time horizon for investments and shape the Plan's ability to commit to less liquid asset strategies. Overall, the Plan is expected to have net negative cash flow of 4-7% of the market value of assets each year, which could increase to 11% of assets each year under a Katrina-like scenario where the city effectively shuts down. Our conclusion is that net negative cash flow needs of 4-7% of assets each year is not unlike other public funds, and is manageable under your current policy.

Capital Market Assumptions:

To derive the Callan basis for the total portfolio, we relied on our 10-year forward looking January 2018 Capital Market projections to create the risk, return and correlation projections for each asset class. Callan's capital market projections covered inflation and most broad asset classes. Callan's inflation expectation is 2.25% and the 10-year geometric nominal return expectations for the asset classes are shown below:

- US Bonds 3.00%
- Cash Equivalents 2.25%
- Domestic Equity 6.85%
- Non-US Equity 7.00%
- Real Estate 5.75%
- Hedge Funds 5.05%

PHASE II – ASSET/LIABILITY ANALYSIS AND CONCLUSIONS

The objective of Phase II of the study was to combine the liability modeling and the various asset projections in order to select the appropriate asset mix for the System.

Callan employed a mean-variance optimization using expected returns and standard deviations of the broad assets classes as well as the correlations among the assets classes to determine the composition of several potential asset mixes located on the efficient frontier.

In addition, Callan employed Monte Carlo method to simulate a distribution of financial outcomes ten years out using five selected assets mixes. In this analysis, Callan calculated an "ultimate net cost" estimate based on an analysis of cumulative employer contributions and the unfunded liability (present value basis) for median outcomes and for 97.5th percentile outcomes over the next 10 years.

50th Percentile Median Outcome	Represents that there is a 50% probability of achieving the outcome
97.5th Percentile Worse-Case Outcome	Represents that there is 97.5% probability of achieving a return better than this outcome or a 2.5% probability that the outcome will be as bad, or worse than this level. (2 Standard Deviations from Median)

CONSIDERATION OF FIVE ASSET MIXES

Callan selected five potential asset mixes (Mix 1- Mix 5) to be considered in this asset liability study. A summary comparison of these 5 mixes to the current policy is shown below:

1. All five asset mixes employ the same asset classes, but some new strategies are considered. Within Real Estate, Callan recommends the System move away from REITS which have equity-like volatility to a structure that is oriented towards private real estate, focusing on highly-leased, income generating properties in major metropolitan areas. Education material on Private Real Estate and Multi-asset Class strategies (hedge fund alternatives) are provided in the appendix.
2. Callan does not recommend the System invest in Private Equity given the size of the fund and the demand on internal resources required to manage the investment.
3. All five asset mixes lower the cash allocation to 1% of assets to manage the cash drag associated with net negative liquidity needs. Actual sources of liquidity can be provided through implementation of the fixed income portfolio or a derivative overlay strategy with the need for a cash allocation which has the lowest expected return.
4. Mix 1 marginally increases Domestic Bonds to 40% relative to the current policy of 37%.
    a. Increases the portion allocated to Non-US equity at the expense of lower US equity
    b. Increases the real estate allocation, funded through a combination of equity and bonds
5. Mixes 2 through Mix 5 lower the Domestic Bonds from 35% down to 20% in increments of 5%.
    a. Each mix increases the portion of Non-US equity and private real estate.

OBSERVATIONS AND CONCLUSIONS

- Volatility: the study shows that the majority of risk to the System's financial health stems from the asset allocation decision. The system liabilities have less volatility in outcomes from inflation risk impacting salary increases. COLA has a maximum 2% increase.

- Liquidity: the study found that the System has manageable liquidity needs and could invest up to 20% of the Plan's assets in less liquid investment strategies. The System can also marginally lower the cash allocation in the asset mix while still providing a source for liquidity within fixed income or through an overlay strategy.

- Expected Returns: the five asset mixes vary in return only a small amount, from 5.50 to 6.25% over 10 years, but with risk profiles of 9.6% to 13.10% as measured by annual standard deviation of return. However, relative to the System's liability growth rate of 6.50% (lower than the 7% discount rate due to actuarial gains from salary) each mix is expected to underperform this targeted return.

- Ultimate Net Cost: our analysis concludes there are benefits to moving to an asset allocation policy with 35% or 30% fixed income. The reward for lowering fixed income is to reduce the total cost in the 50th percentile outcomes. The tradeoff is a marginal increase in total costs in the 97.5th percentile outcomes, but not such that the expected increase in risk overwhelms the expected reward benefits.

- Peer Group Comparisons: reducing the fixed income allocation to 35% or 30% of the total asset allocation does not result in a policy that is substantially different than other public pension funds. The median fixed income allocation in the Callan Peer Group of plans between $100M and $1 Billion in assets is 26% fixed income. The recommended changes to the portfolio also move the System in the direction of the median allocations for the other asset classes in the portfolio.

PROPOSAL AND RECOMMENDATION

Callan recommends the System's asset allocation policy change to Mix 3 or 30% Domestic Bonds as shown in the Table below. This alternative mix is supported using the risk and reward tradeoff analysis for a majority of the workforce scenarios tested, and the 15 year closed amortization policy. The recommended asset mix yields an expected market return of 6.00%, reducing the gap between the targeted return of 6.50% as measured by the liability growth rate. In addition, Callan's asset class return expectations reflect beta only and do not reflect the potential for positive active risk and incremental return, or alpha, that the system has historically achieved for the portfolio overall. A reasonable contribution from active management is in the range of 0.25-0.50%.

If the Board's risk tolerance is more focused on downside risk and worse-case outcomes, and is therefore opposed to the idea of increasing the overall risk of the investments, then Callan suggests that Mix 2 may be a more appropriate choice for the System going forward.

Component	Target	Mix 2	Change	Mix 3	Change
Broad US Equity	40.25%	27%	-13.25%	29%	-11.25%
Global ex US Equity	9%	20%	11%	22%	13%
Real Estate	3.25%	8%	4.75%	9%	5.75%
Hedge Funds	8.75%	9%	0.25%	9%	0.25%
Domestic Fixed	37%	35%	-2%	30%	-7%
Cash Equivalents	1.75%	1%	-0.75%	1%	-0.75%
Total	**100%**	**100%**		**100%**	
Total Fixed Income+Cash	**38.75%**	**36%**		**31%**	
Asset-Only					
Expected Return	5.64%	5.76%		5.93%	
Standard Deviation	10.05%	10.46%		11.33%	
Sharpe Ratio	0.329	0.327		0.317	

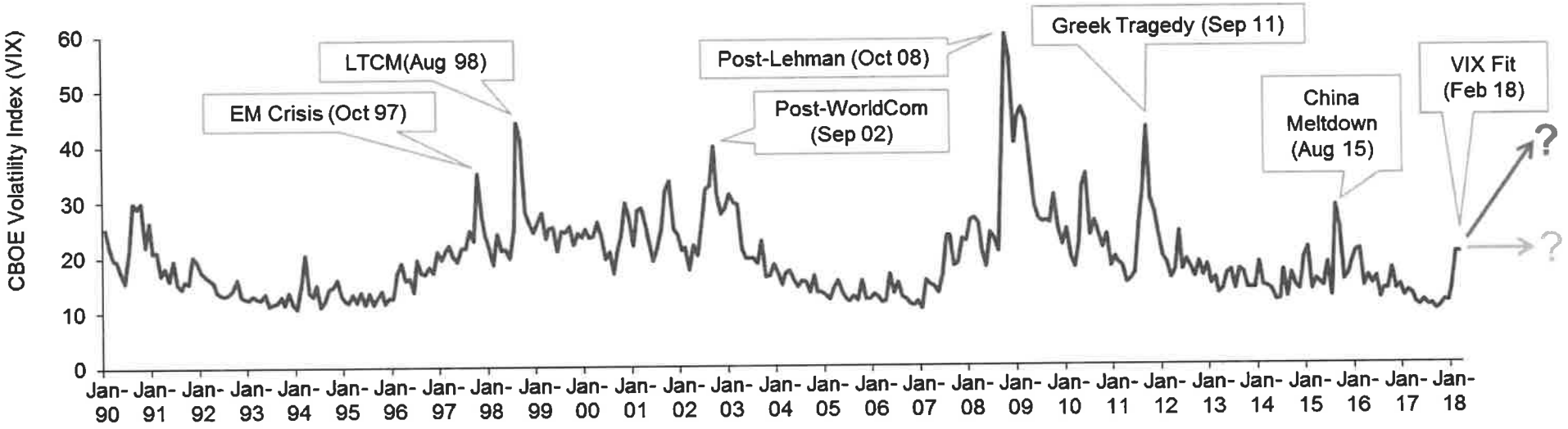
Callan

3/31/2018

Historical Valuations

Market Sentiment

VIX (S&P 1-Month ATM Implied Volatility – Month-End Closing Values)*



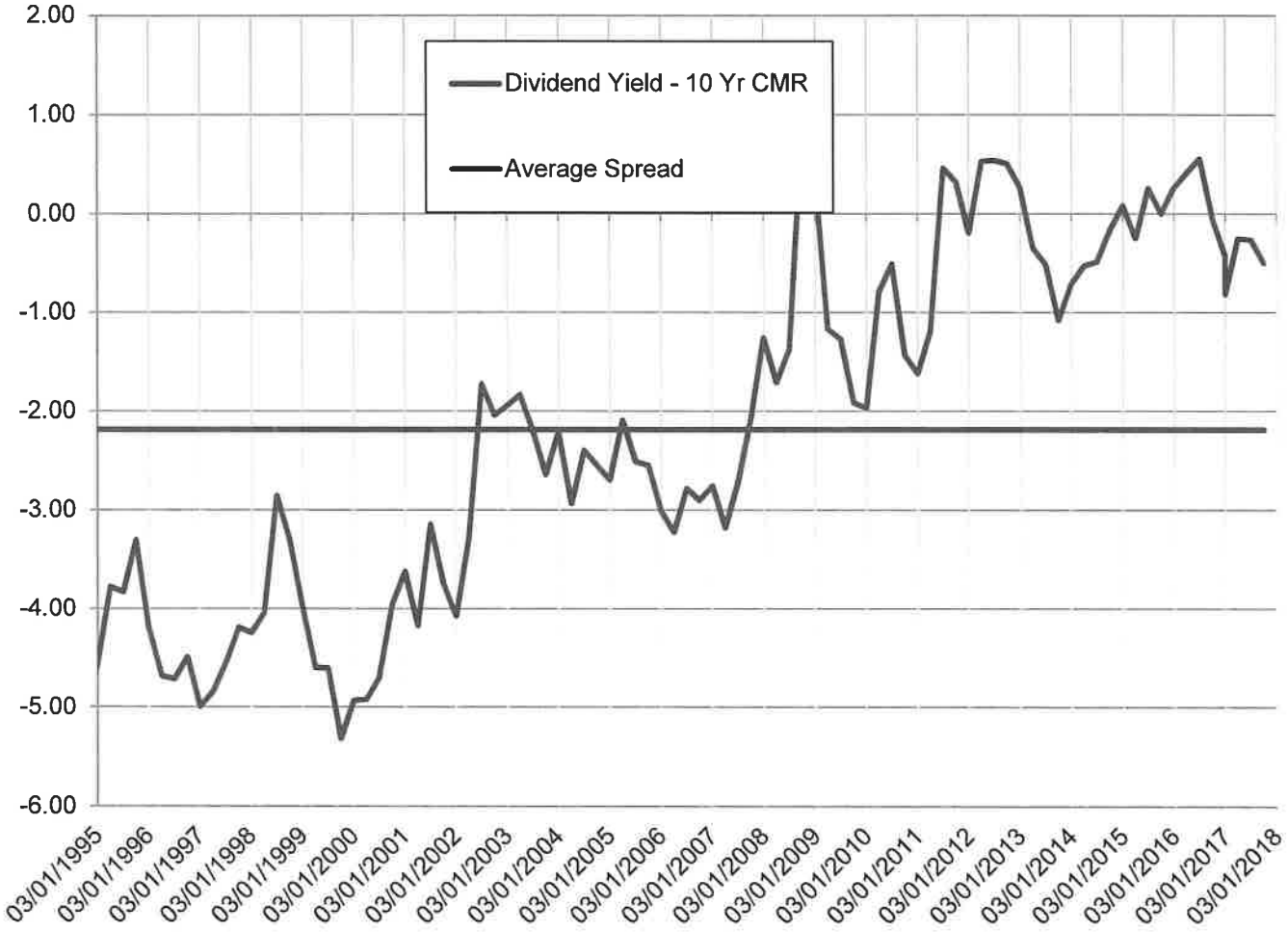
*Source: www.cboe.com/products/vix-index-volatility/vix-options-and-futures/vix-index/vix-historical-data

US Equity vs. Fixed Income

Dividend Yield – 10-Year Treasury Yield Spread

For values >0, the average equity dividend payout from S&P 500 exceeds the 10-year Treasury rate

For values <0, the average equity dividend payout from S&P 500 is less than the 10-year Treasury rate



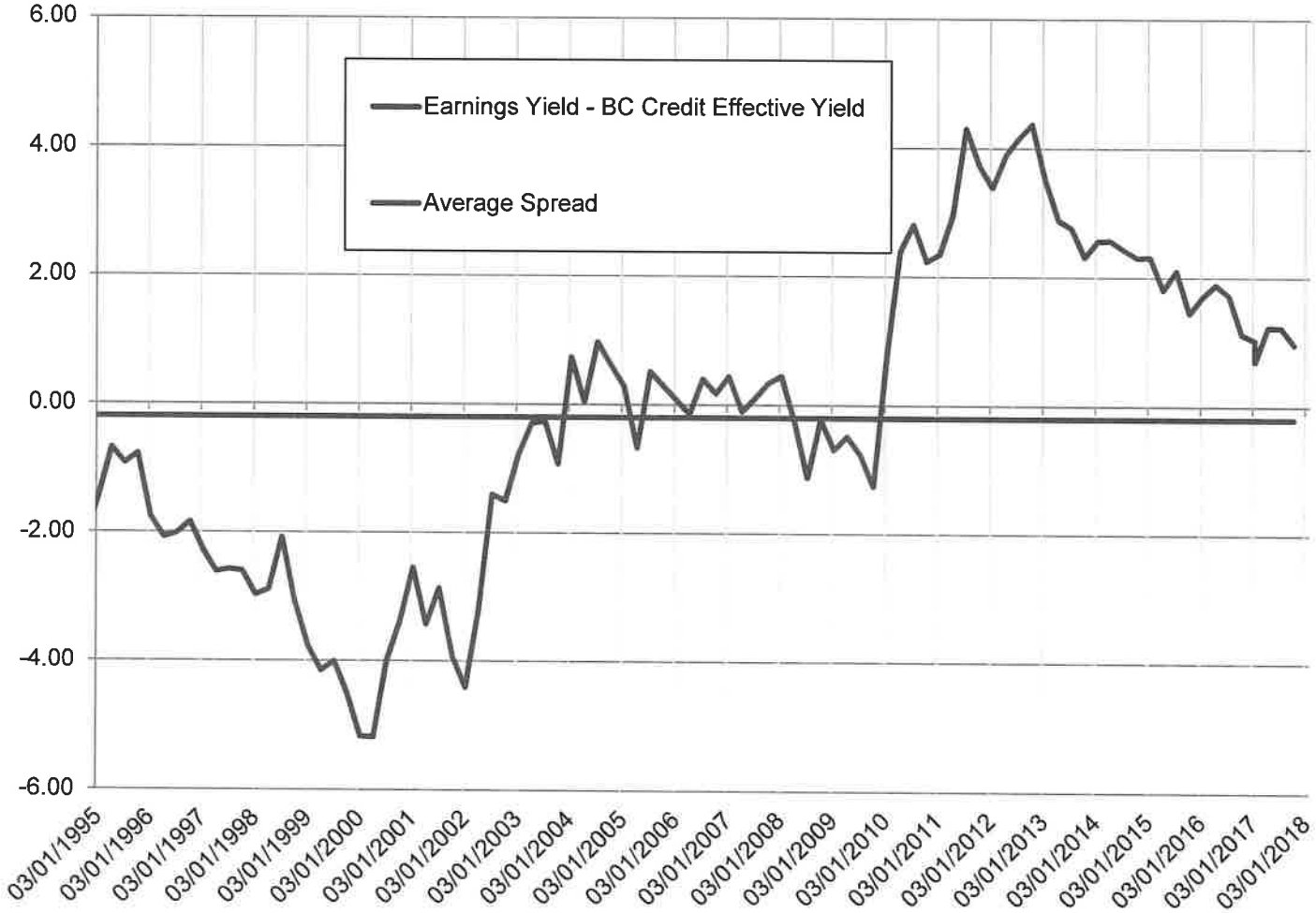
Source: Federal Reserve Bank of St. Louis

US Equity vs. Fixed Income

S&P 500 Earnings Yield – BC Credit Yield Spread

For values >0, the average earnings payout of S&P 500 stocks exceed average income investors receive for investment grade credit

For values <0, the average earnings payout of S&P 500 stocks below average income investors receive for investment grade credit

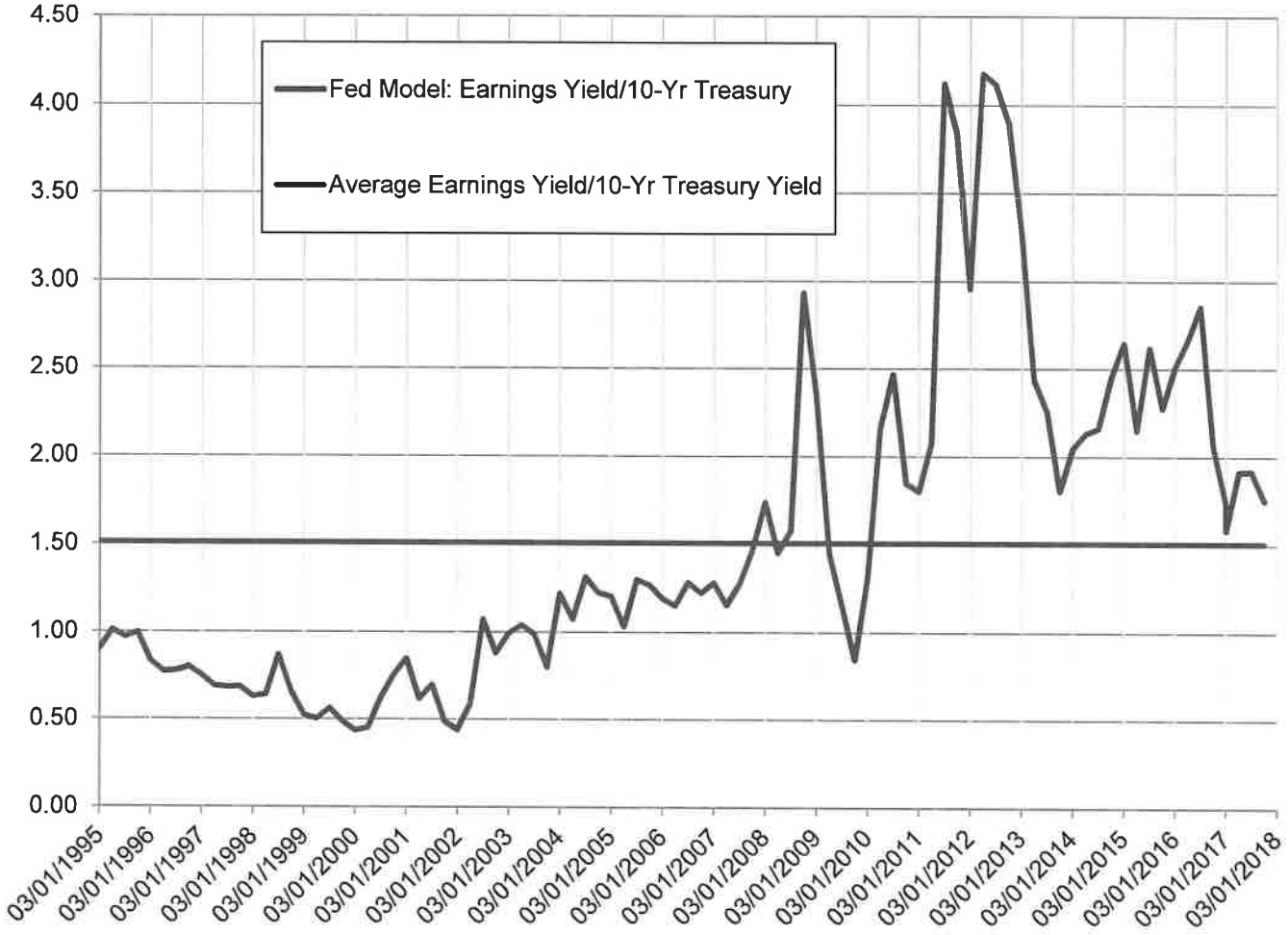


US Equity vs. Fixed Income

Fed Model: Earnings Yield/10-Year Treasury Yield

For values >1, Fed model suggests stocks undervalued, bonds overvalued.

For values <1, Fed model suggests bonds undervalued, stocks overvalued.



The Fed model, in its strongest form, suggests that the stock market is in equilibrium and fairly valued when Earnings Yield = 10-Year Treasury Note Yield; ($E/P = Y_{10}$)

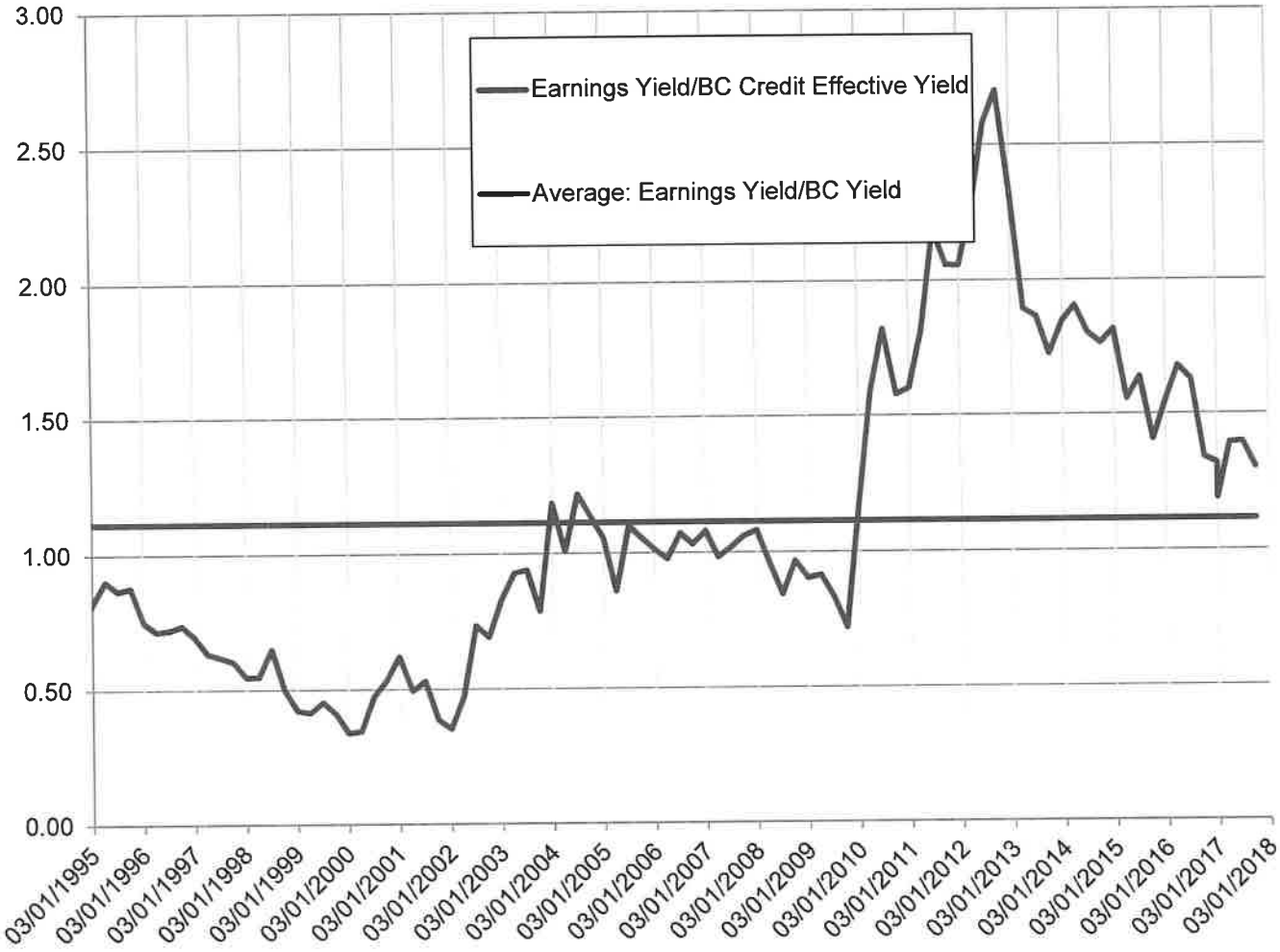
Source: Federal Reserve Bank of St. Louis

US Equity vs. Fixed Income

Earnings Yield/Credit Yield

For values >1, the average earnings payout of S&P 500 stocks exceed average income investors receive for investment grade credit

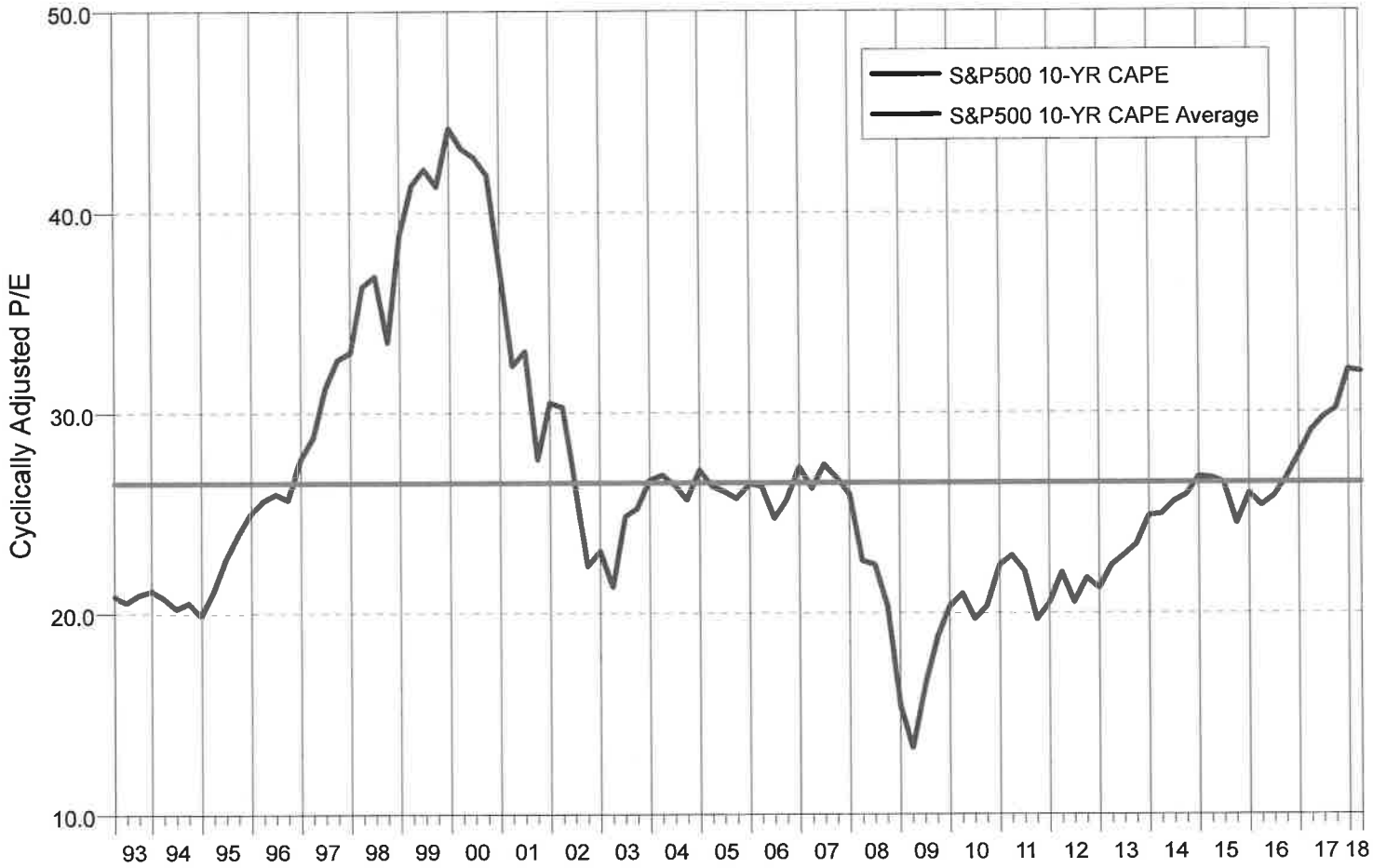
For values <1, the average earnings payout of S&P 500 stocks is below average income investors receive for investment grade credit



US Equity

Historical Valuations: US Price/10-Year Normalized Earnings

10-Year Cyclically Adjusted P/E
for 25 Years Ended March 31, 2018



Source: http://www.econ.yale.edu/~shiller/data.htm

US Equity

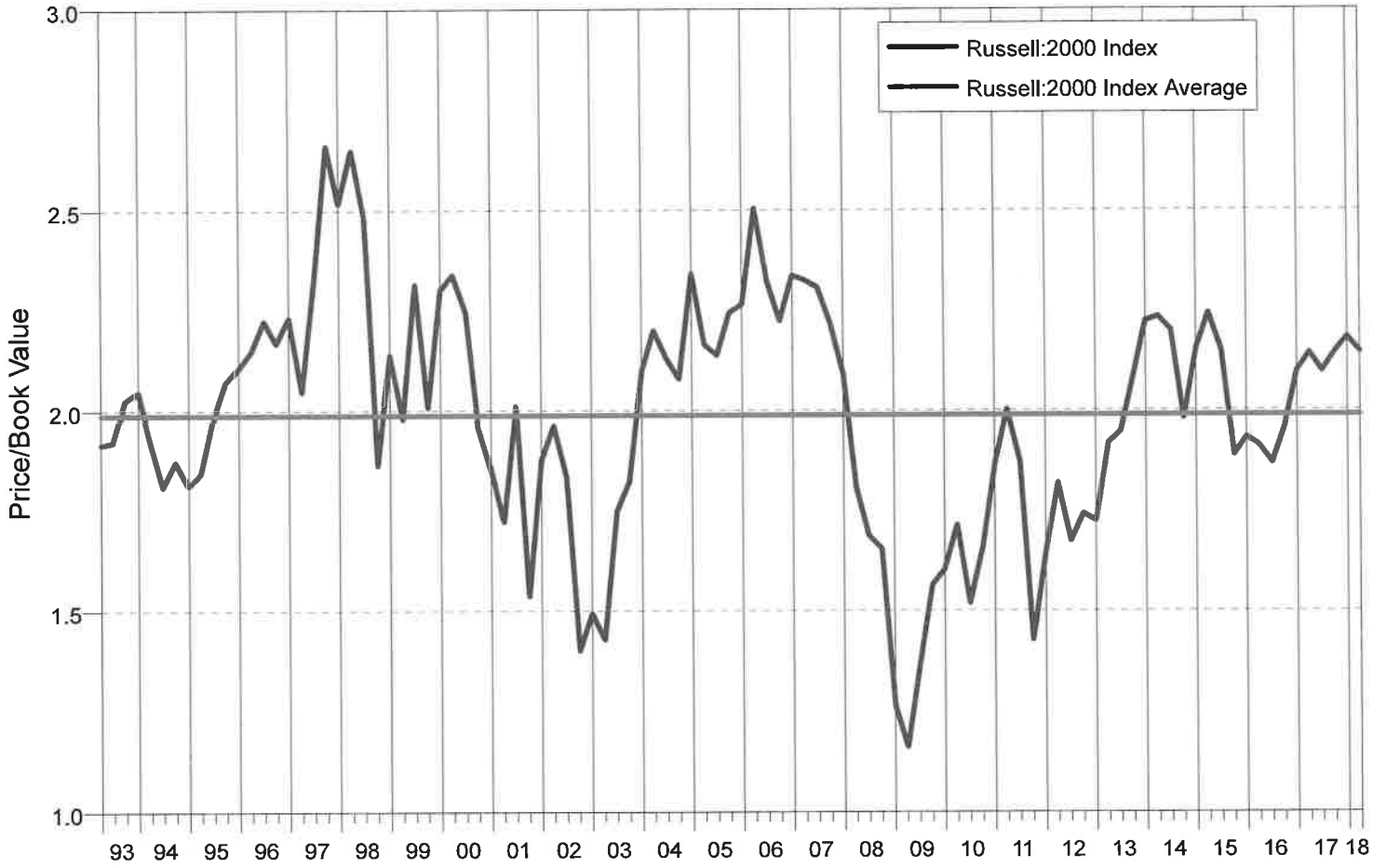
Historical Valuations: Large Cap P/B

Price/Book Value
for 25 Years Ended March 31, 2018

US Equity

Historical Valuations: Small Cap P/B

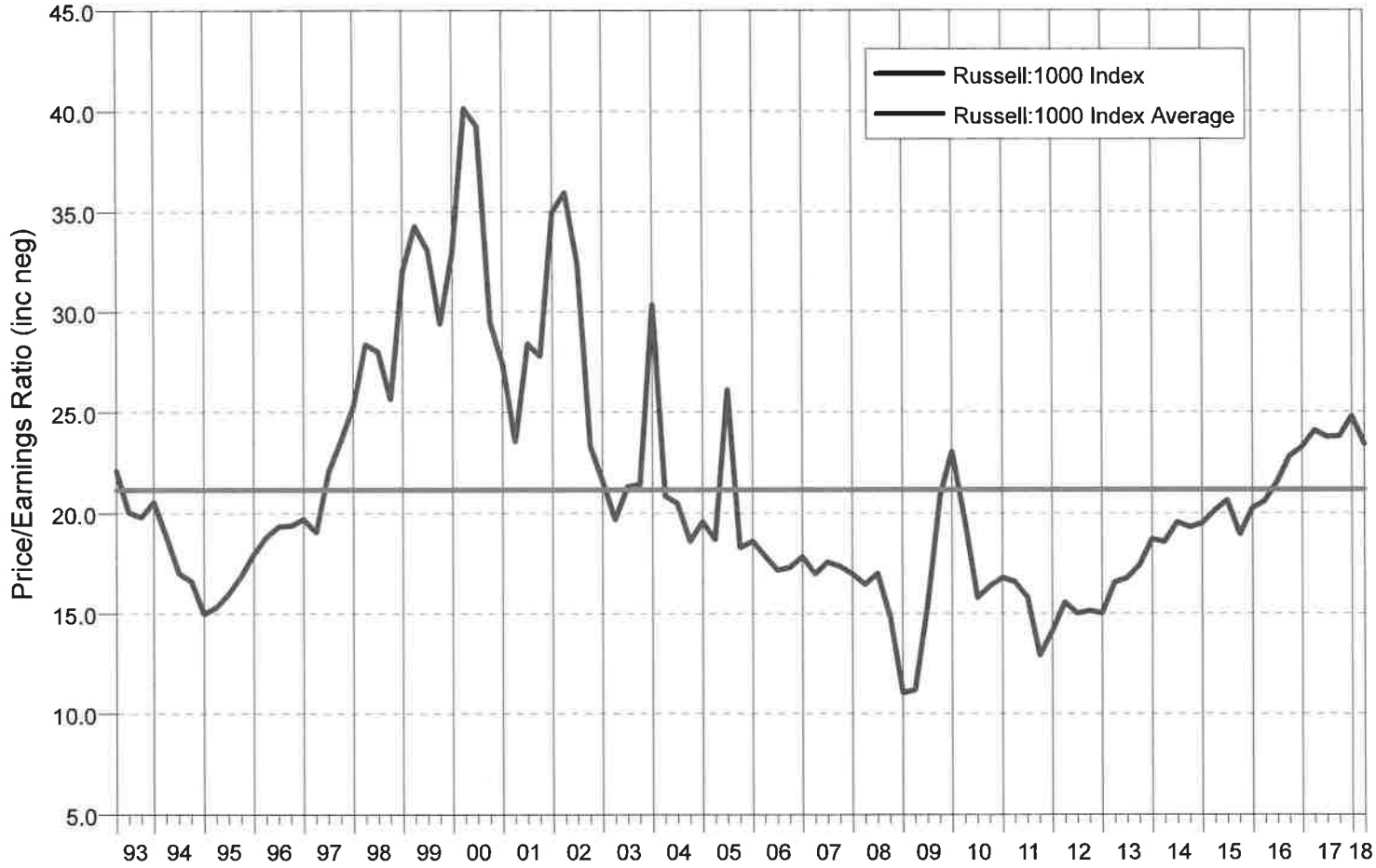
Price/Book Value
for 25 Years Ended March 31, 2018



US Equity

Historical Valuations: Large Cap P/E

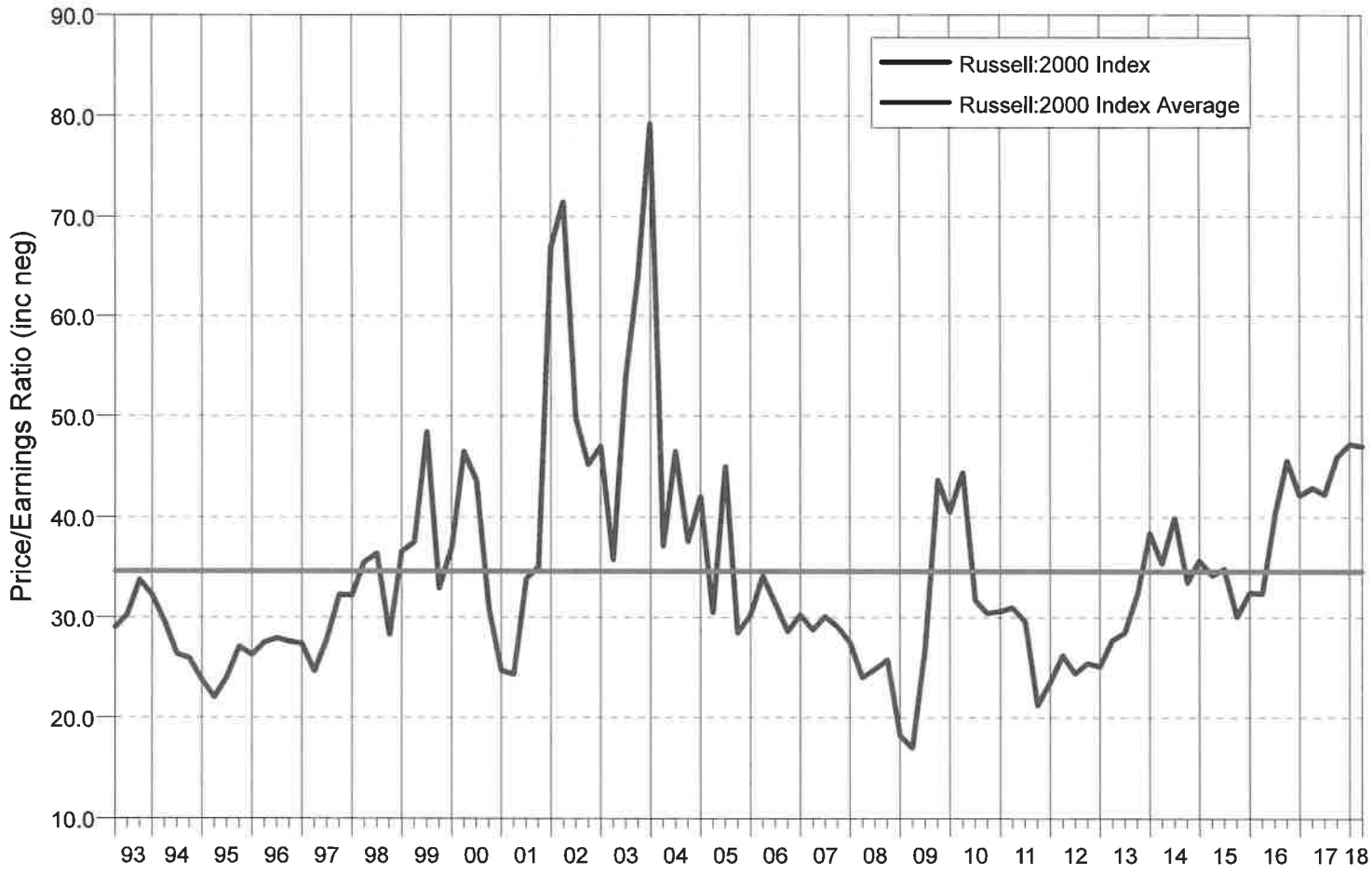
Price/Earnings Ratio (inc neg)
for 25 Years Ended March 31, 2018



US Equity

Historical Valuations: Small Cap P/E

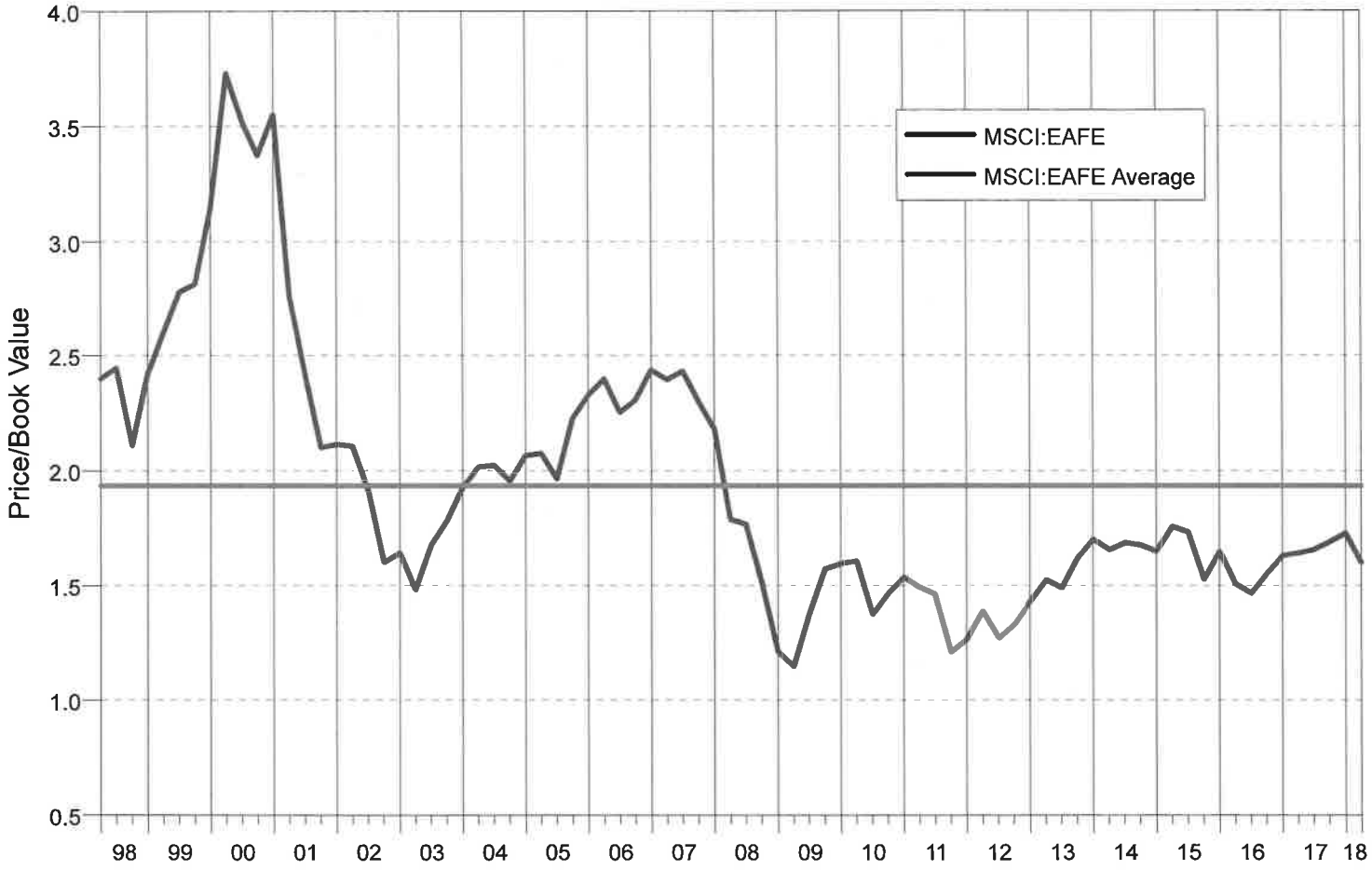
Price/Earnings Ratio (inc neg)
for 25 Years Ended March 31, 2018



Non-US Equity

Historical Valuations: International Developed P/B

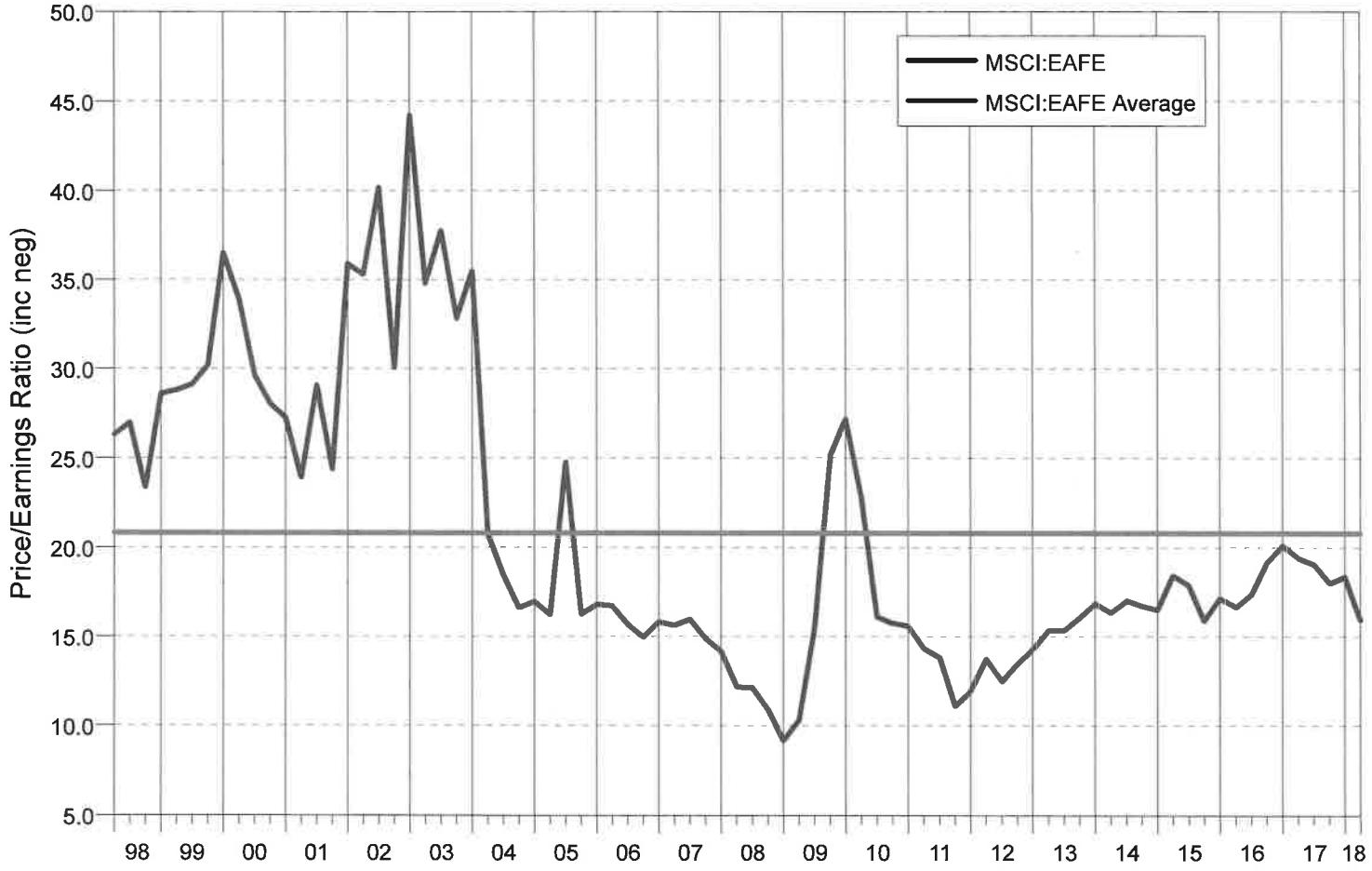
Price/Book Value
for 20 Years Ended March 31, 2018



Non-US Equity

Historical Valuations: International Developed P/E

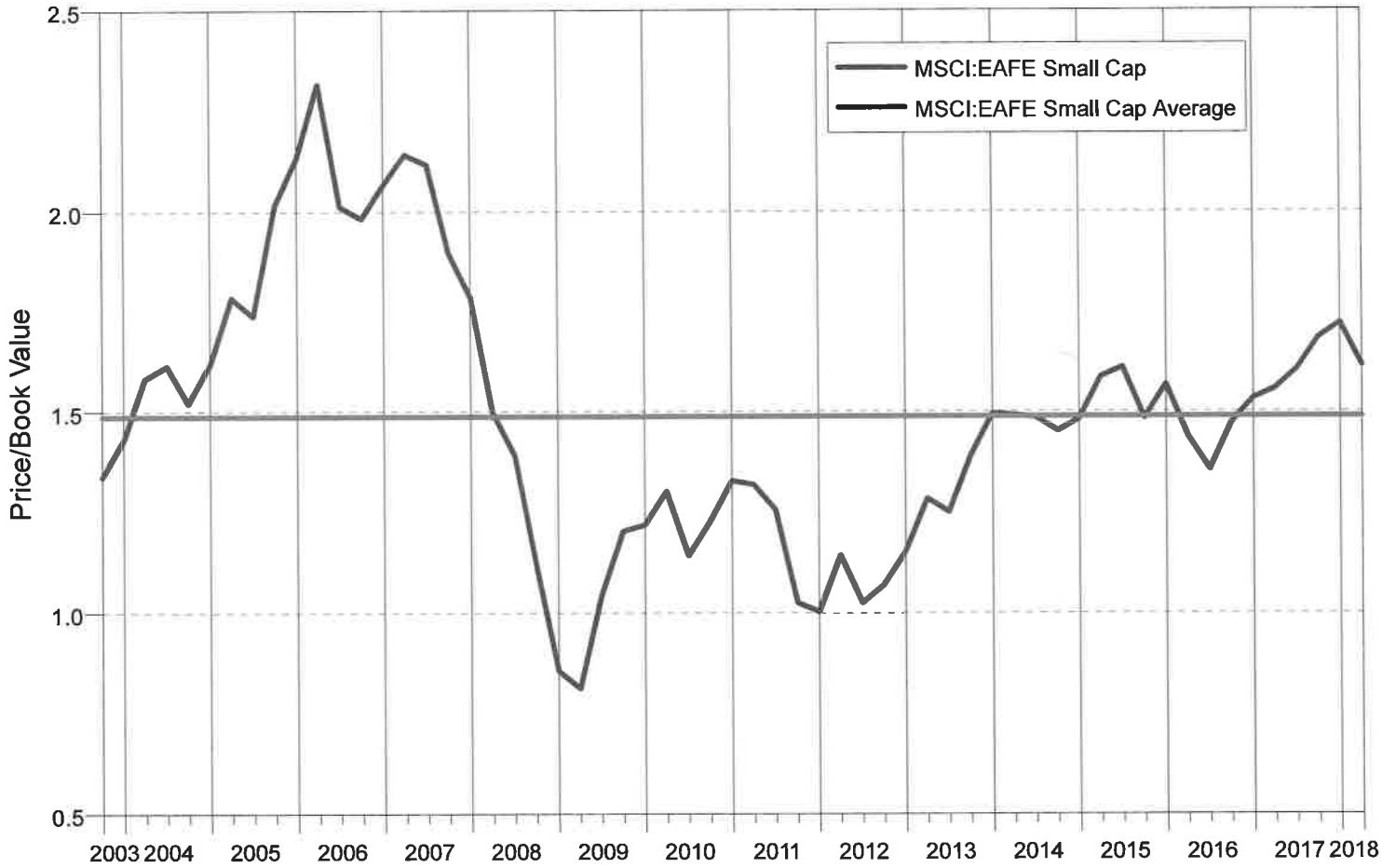
Price/Earnings Ratio (inc neg)
for 20 Years Ended March 31, 2018



Non-US Equity

Historical Valuations: International Small Cap P/B

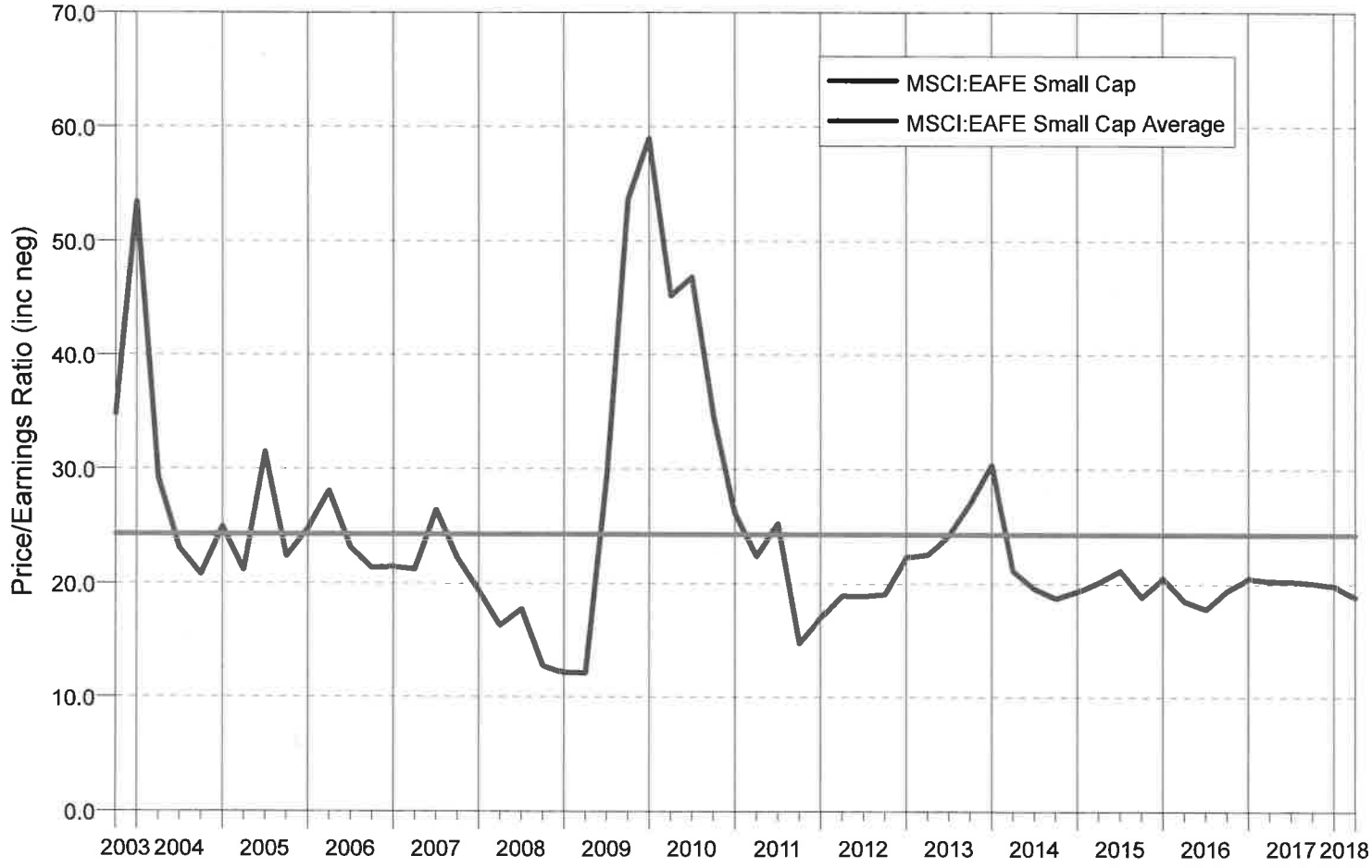
Price/Book Value
for 14 1/2 Years Ended March 31, 2018



Non-US Equity

Historical Valuations: International Small Cap P/E

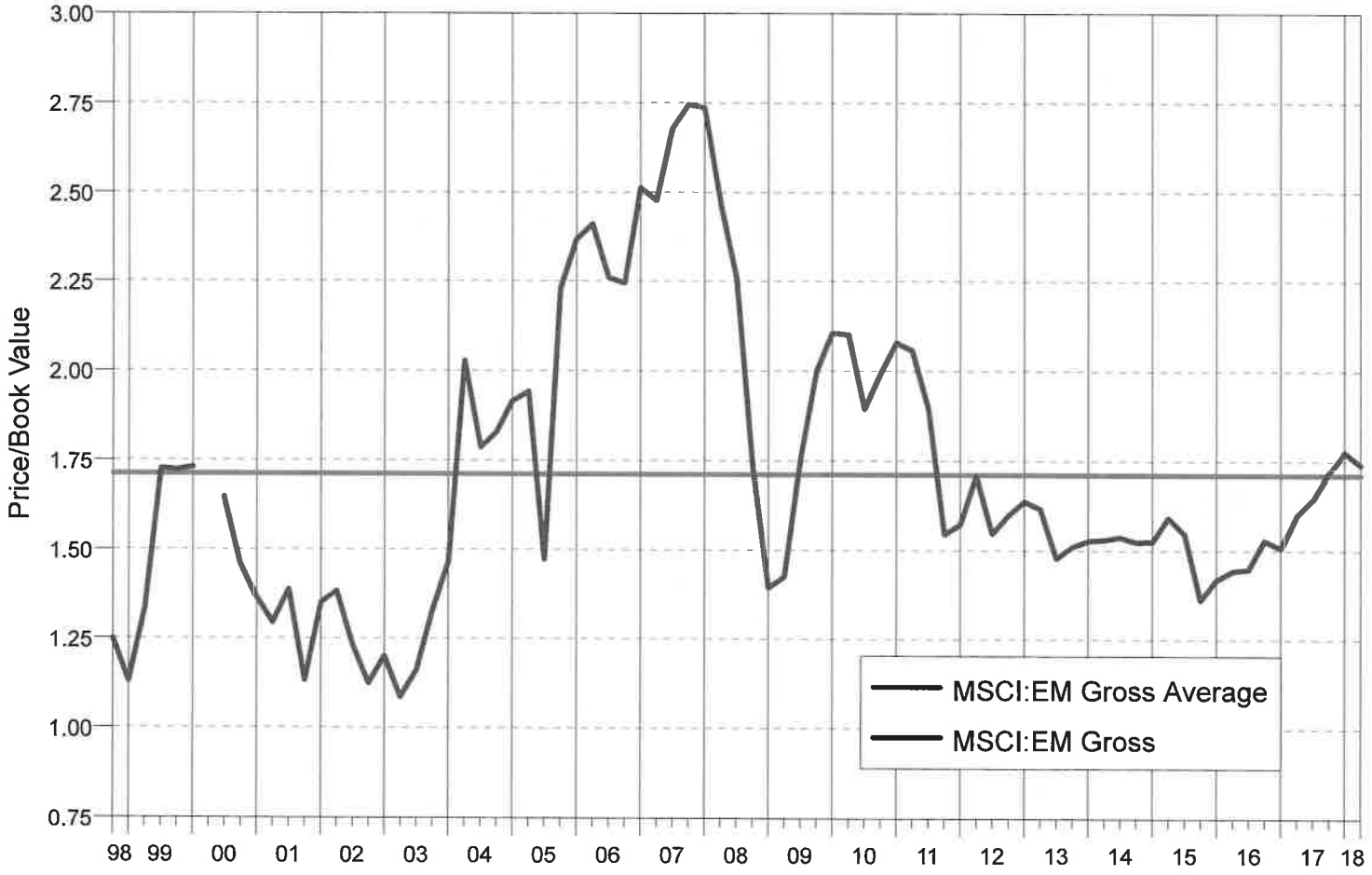
Price/Earnings Ratio (inc neg)
for 14 1/2 Years Ended March 31, 2018



Non-US Equity

Historical Valuations: Emerging Markets P/B

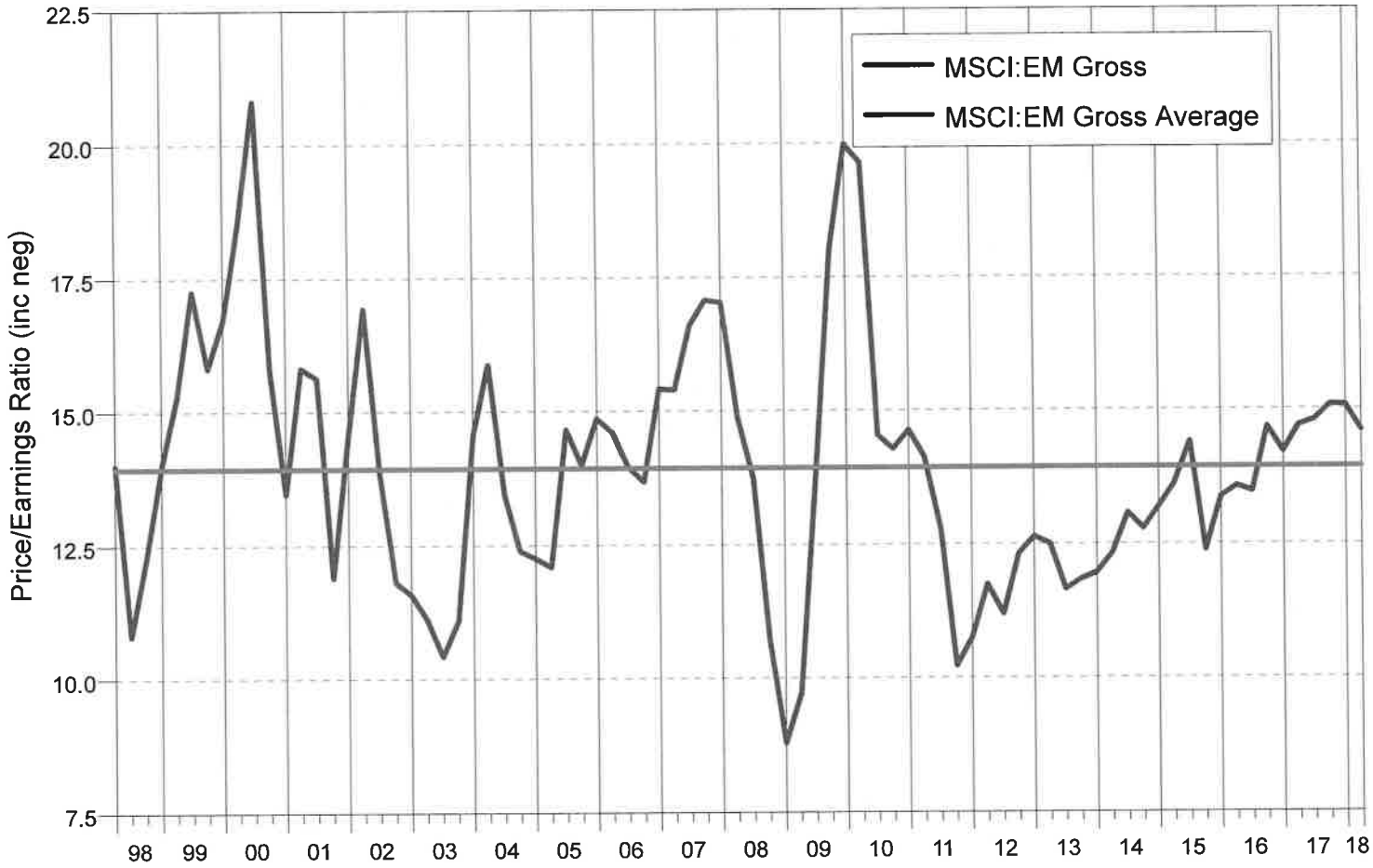
Price/Book Value
for 19 1/2 Years Ended March 31, 2018



Non-US Equity

Historical Valuations: Emerging Markets P/E

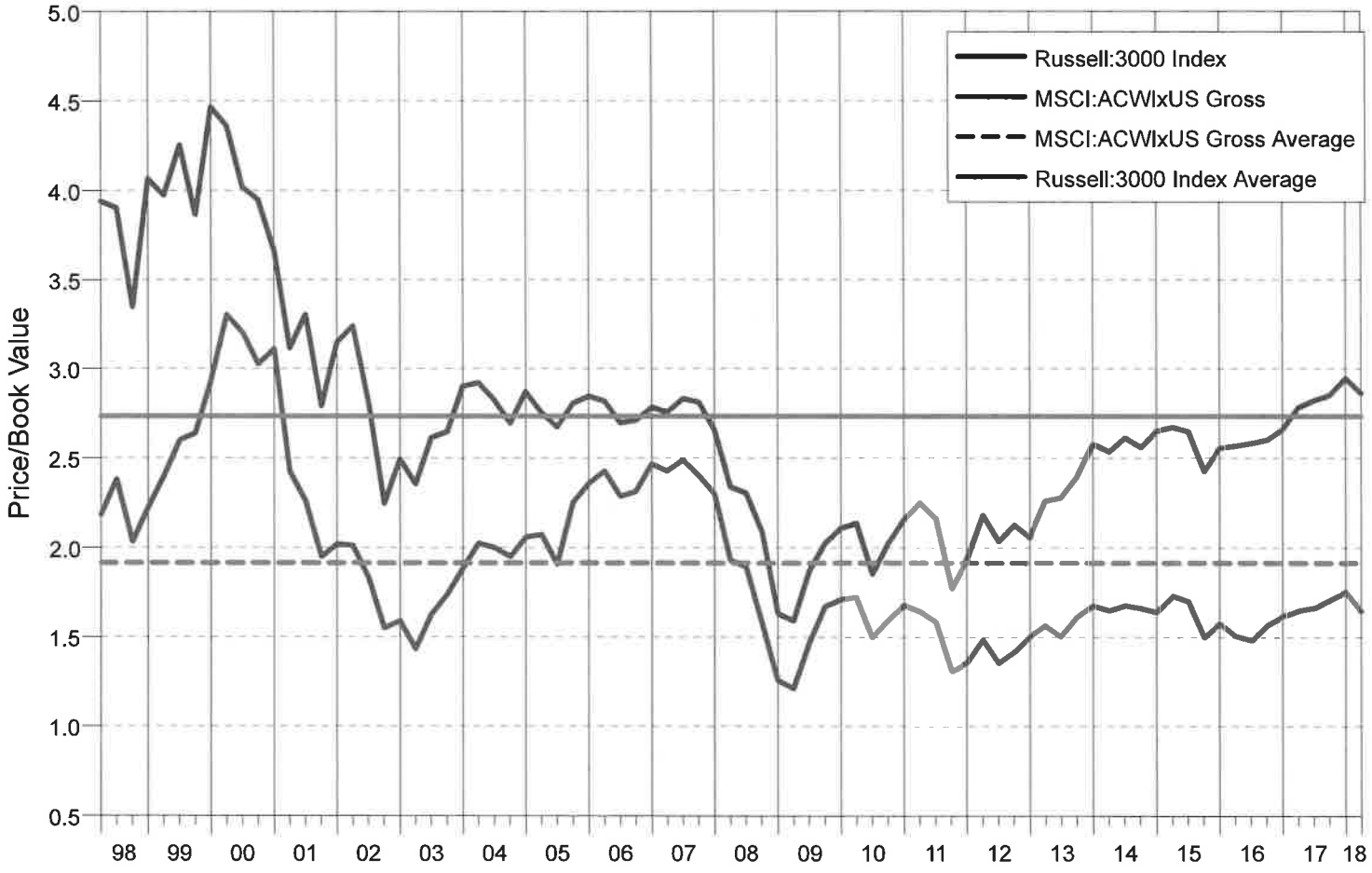
Price/Earnings Ratio (inc neg)
for 20 Years Ended March 31, 2018



Global Equity

Historical Valuations: US and International P/B

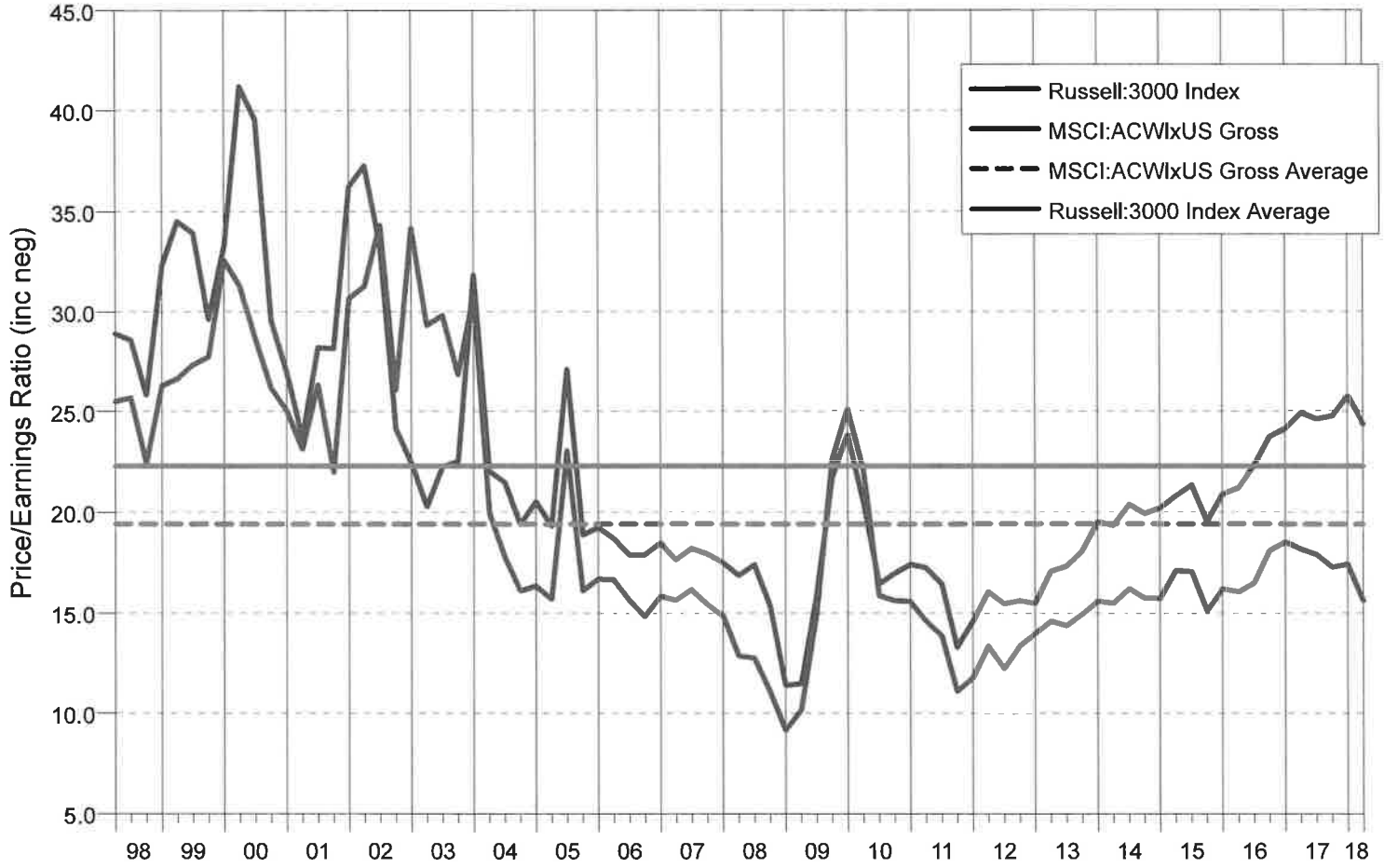
Price/Book Value
for 20 Years Ended March 31, 2018



Global Equity

Historical Valuations: US and International P/E

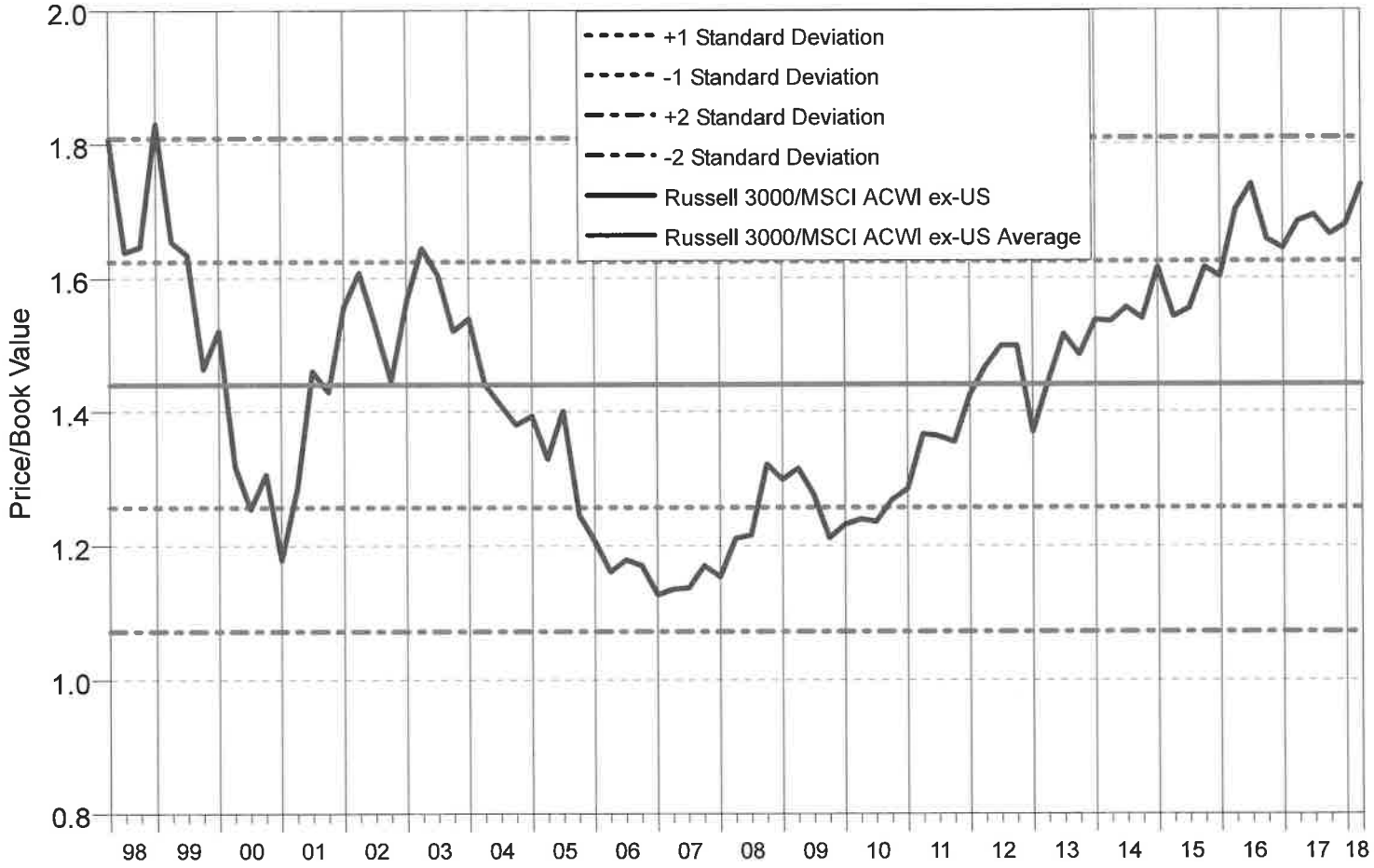
Price/Earnings Ratio (inc neg)
for 20 Years Ended March 31, 2018



Global Equity

Relative Valuations: US vs. International P/B

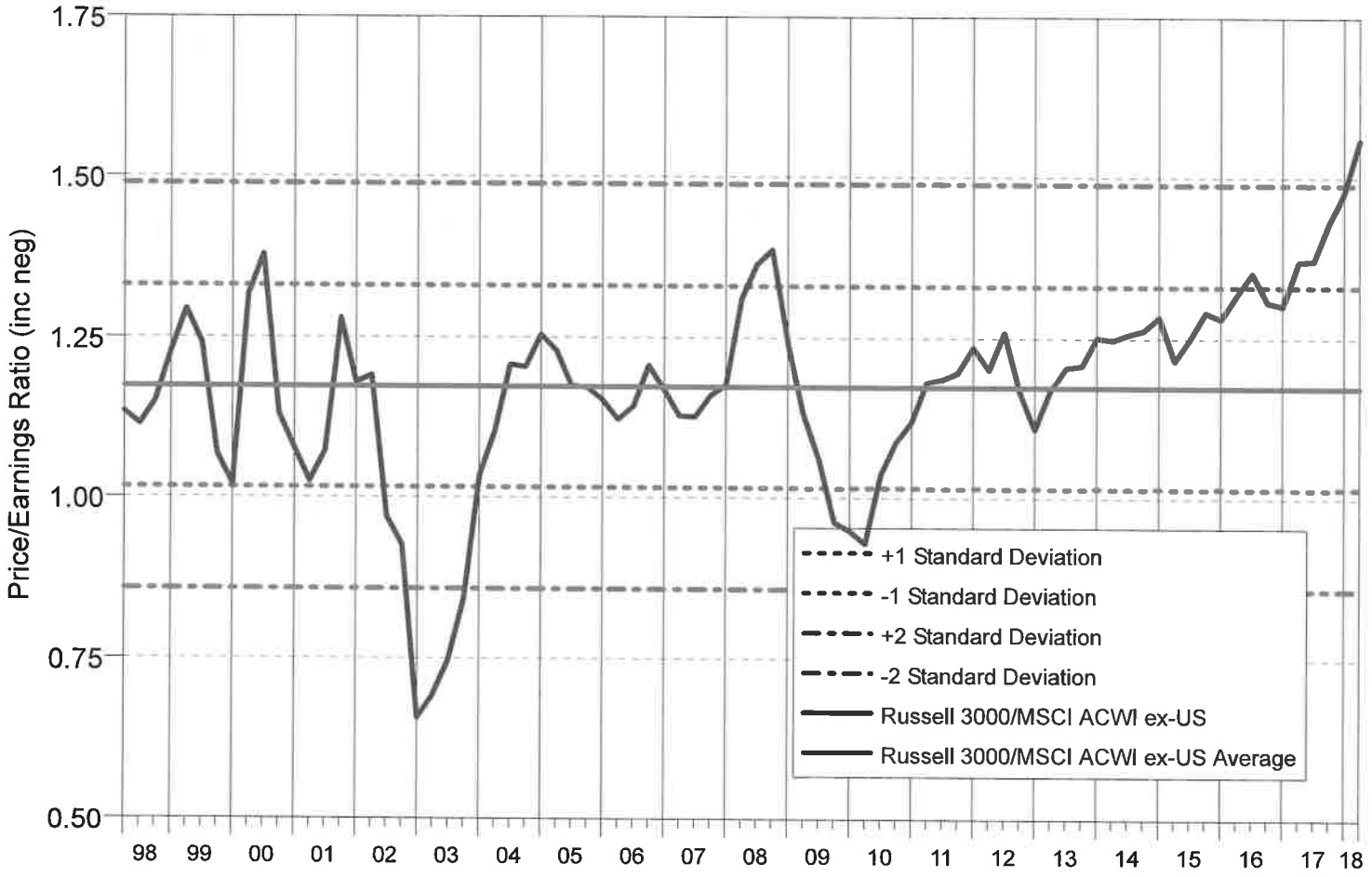
Price/Book Value
for 20 Years Ended March 31, 2018



Global Equity

Relative Valuations: US vs. International P/E

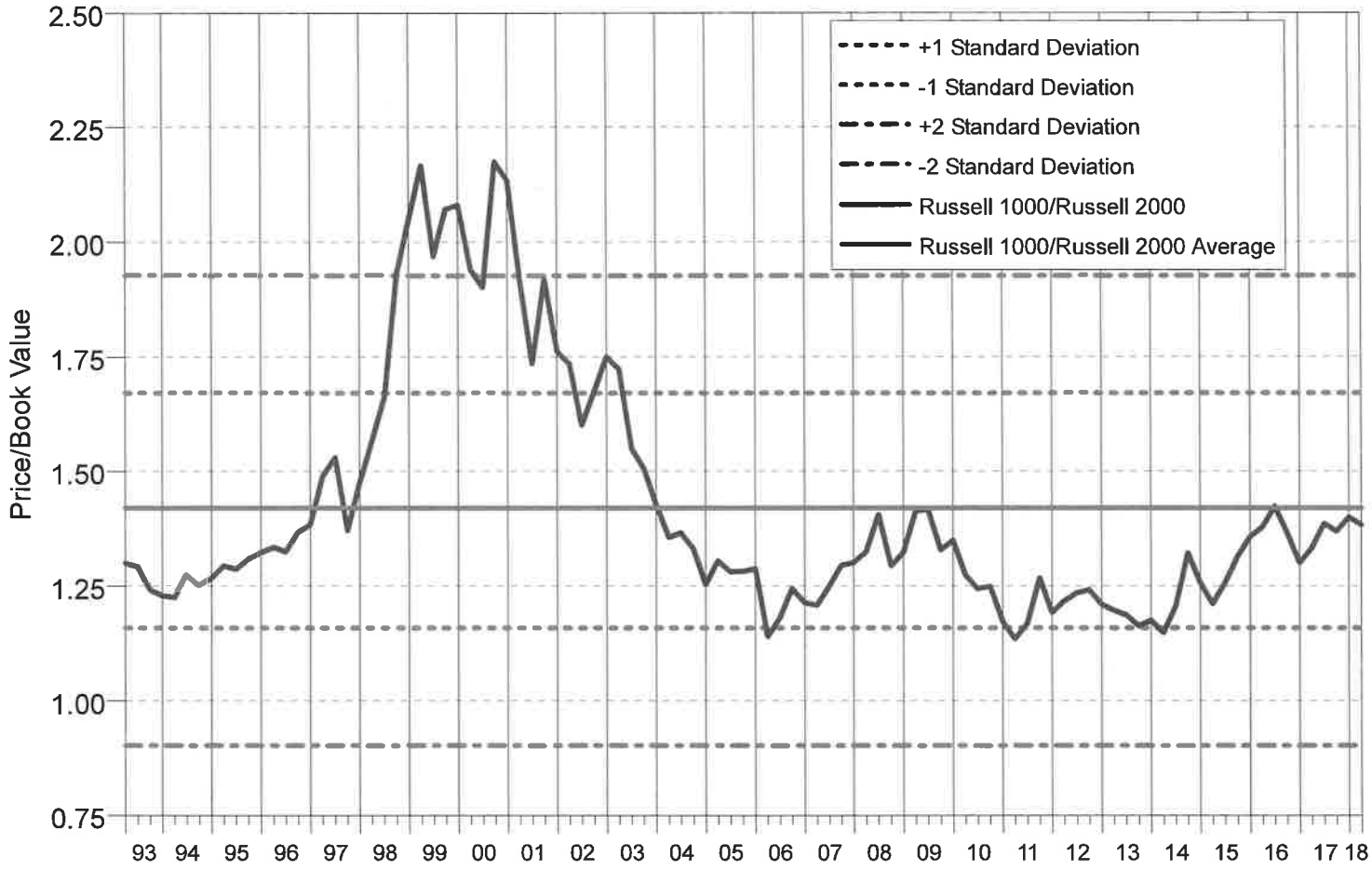
Price/Earnings Ratio (inc neg)
for 20 Years Ended March 31, 2018



US Equity

Relative Valuations: Large Cap vs. Small Cap P/B

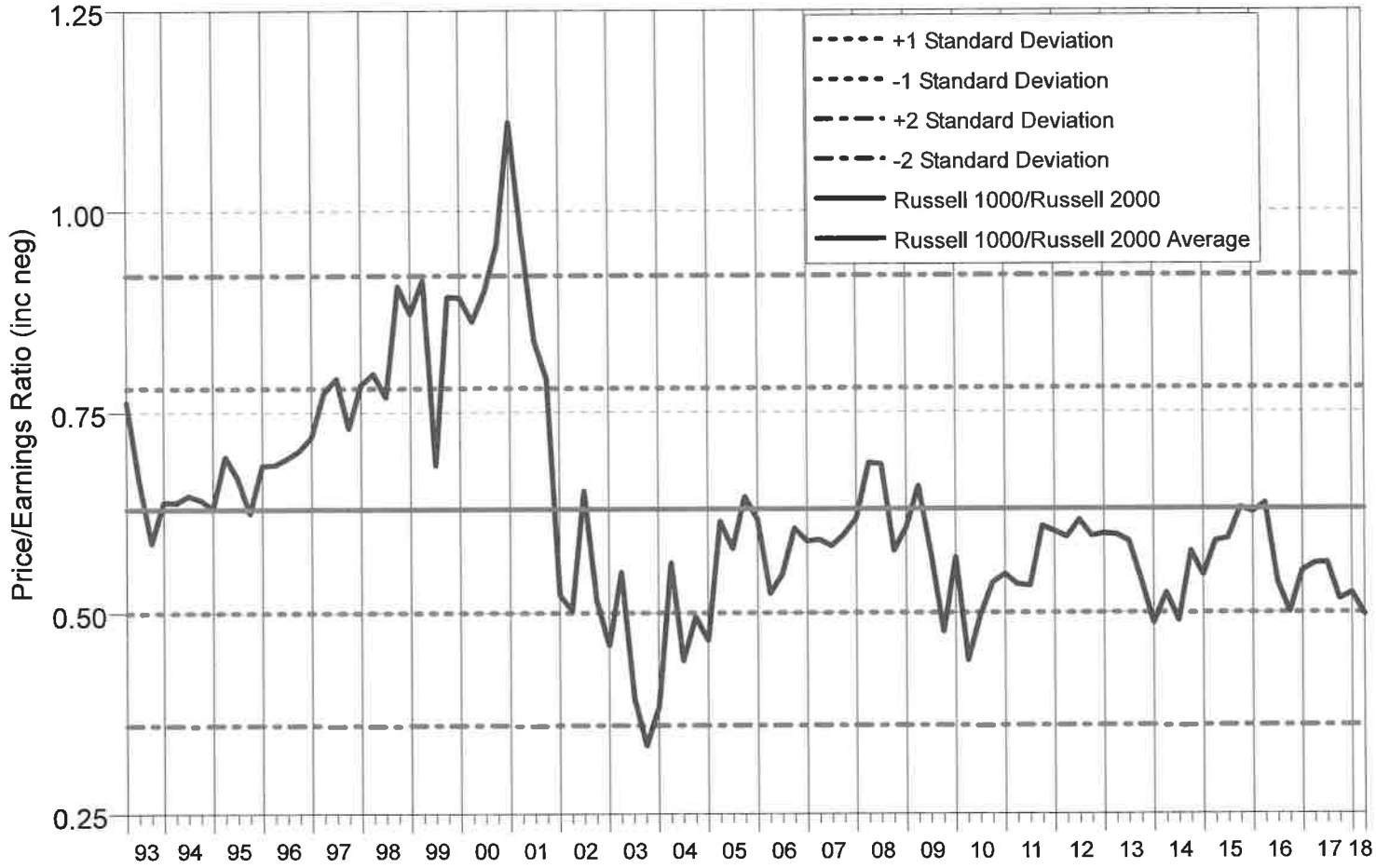
Price/Book Value
for 25 Years Ended March 31, 2018



US Equity

Relative Valuations: Large Cap vs. Small Cap P/E

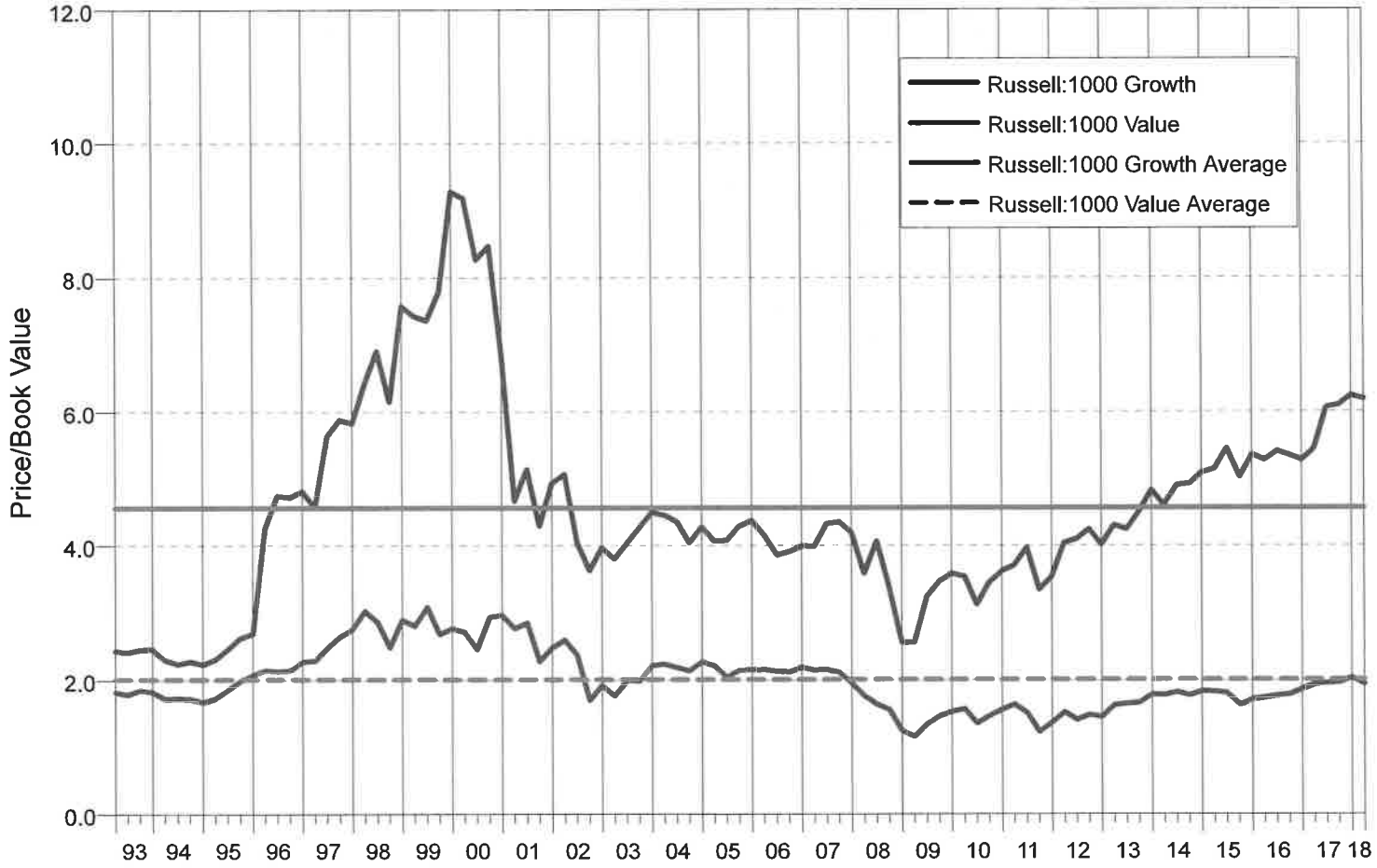
Price/Earnings Ratio (inc neg)
for 25 Years Ended March 31, 2018



US Equity

Historical Valuations: Large Growth and Large Value P/B

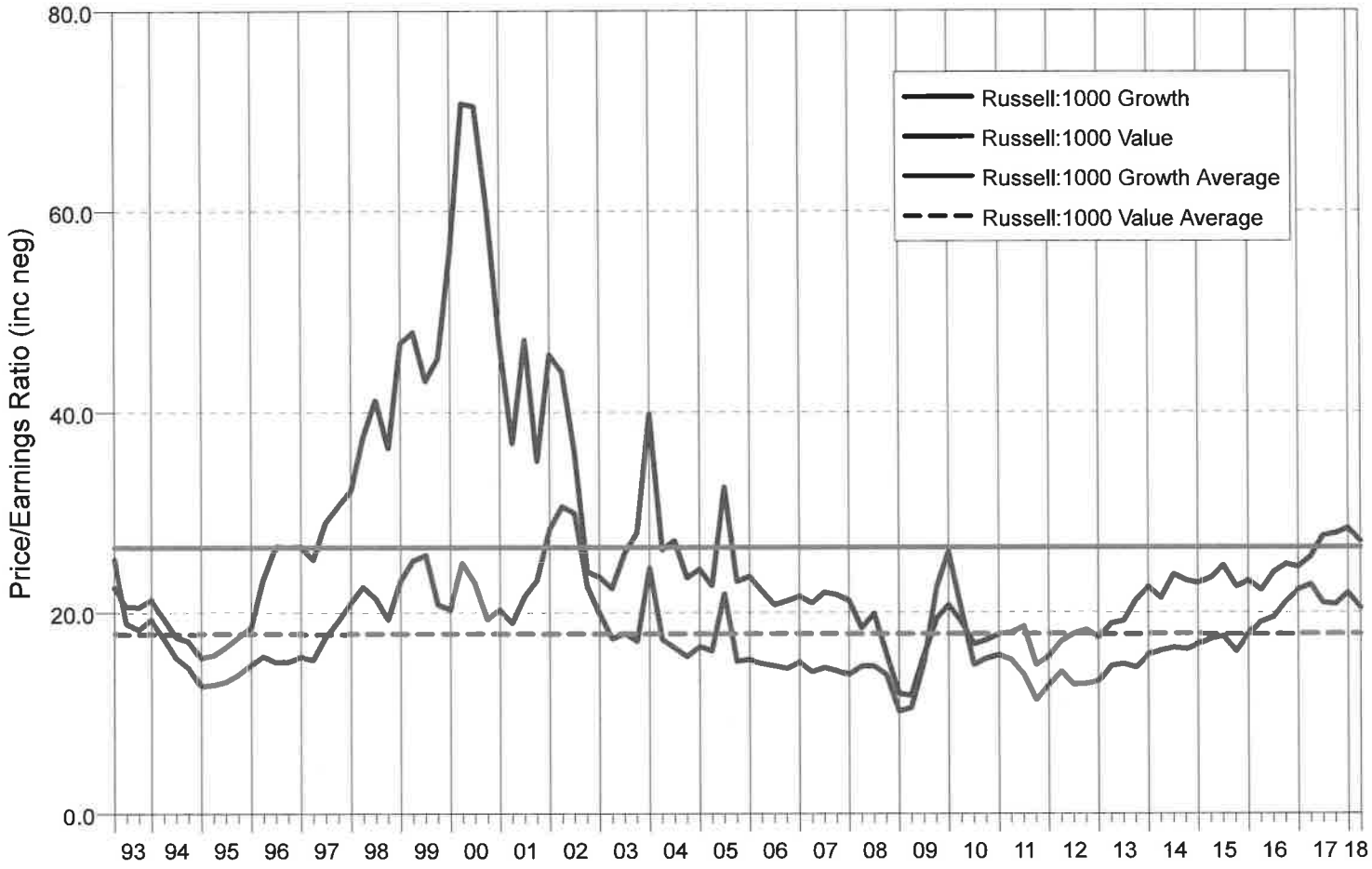
Price/Book Value
for 25 Years Ended March 31, 2018



US Equity

Historical Valuations: Large Growth and Large Value P/E

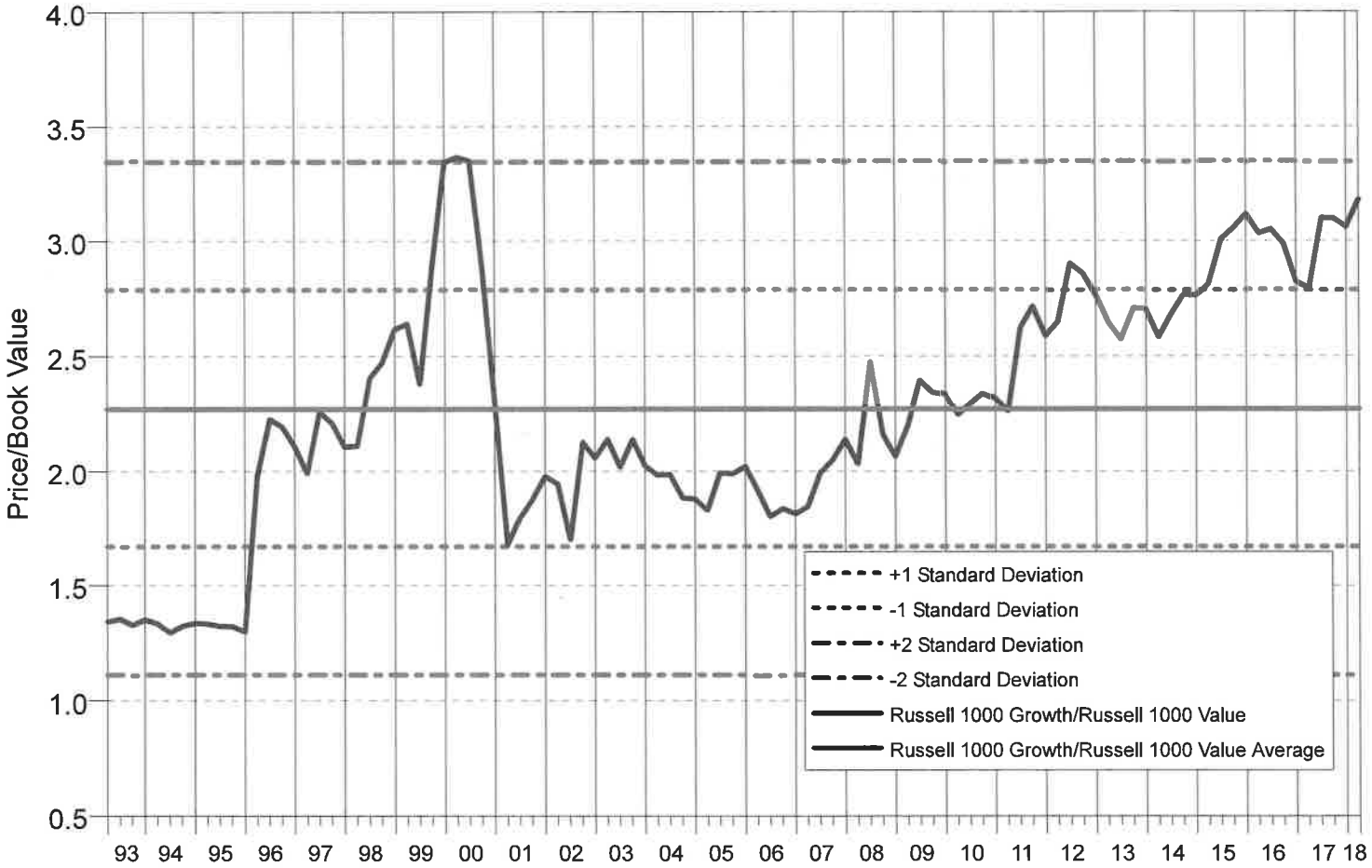
Price/Earnings Ratio (inc neg)
for 25 Years Ended March 31, 2018



US Equity

Relative Valuations: Large Growth vs. Large Value P/B

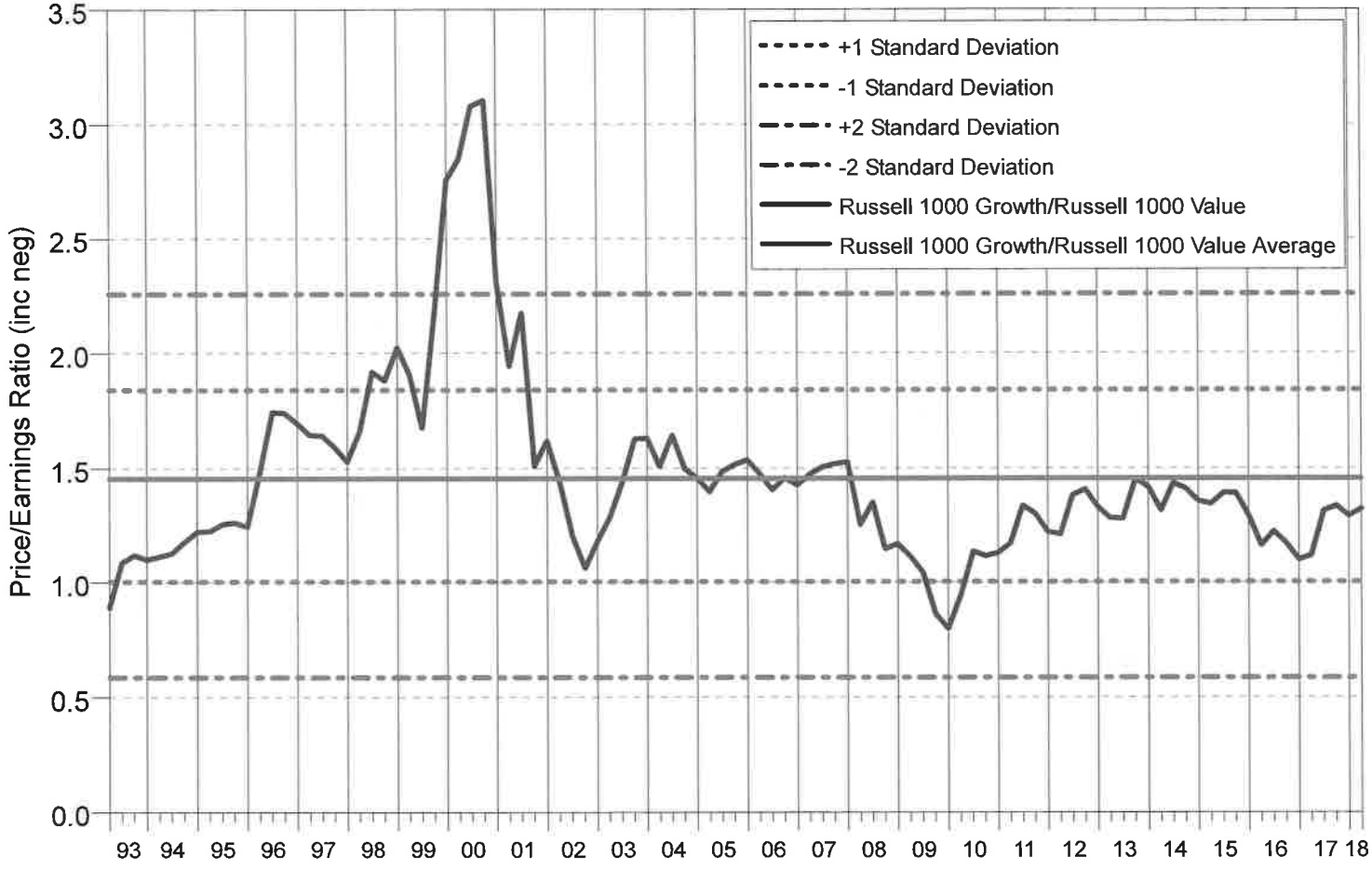
Price/Book Value
for 25 Years Ended March 31, 2018



US Equity

Relative Valuations: Large Growth vs. Large Value P/E

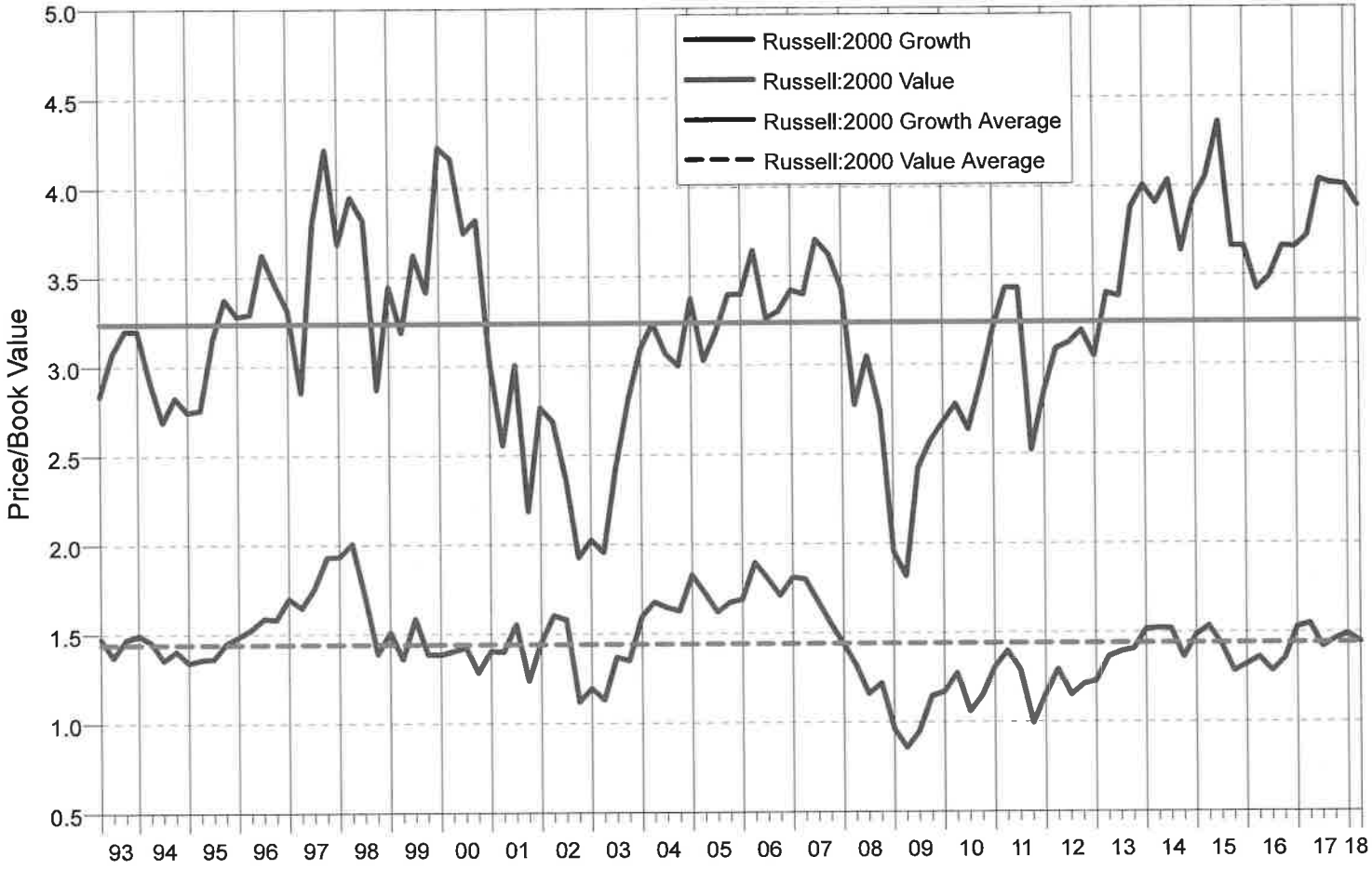
Price/Earnings Ratio (inc neg)
for 25 Years Ended March 31, 2018



US Equity

Historical Valuations: Small Growth and Small Value P/B

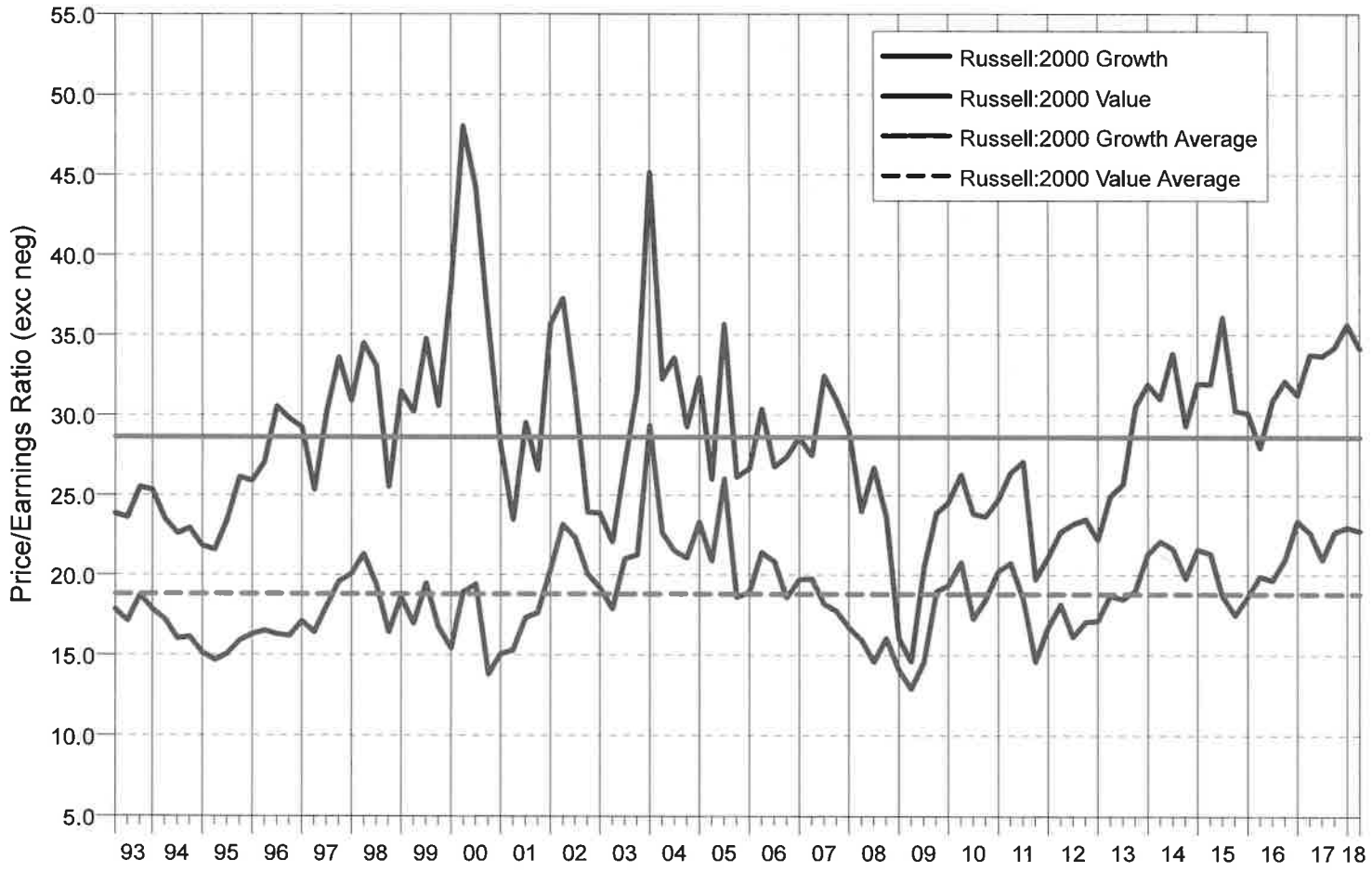
Price/Book Value
for 25 Years Ended March 31, 2018



US Equity

Historical Valuations: Small Growth and Small Value P/E

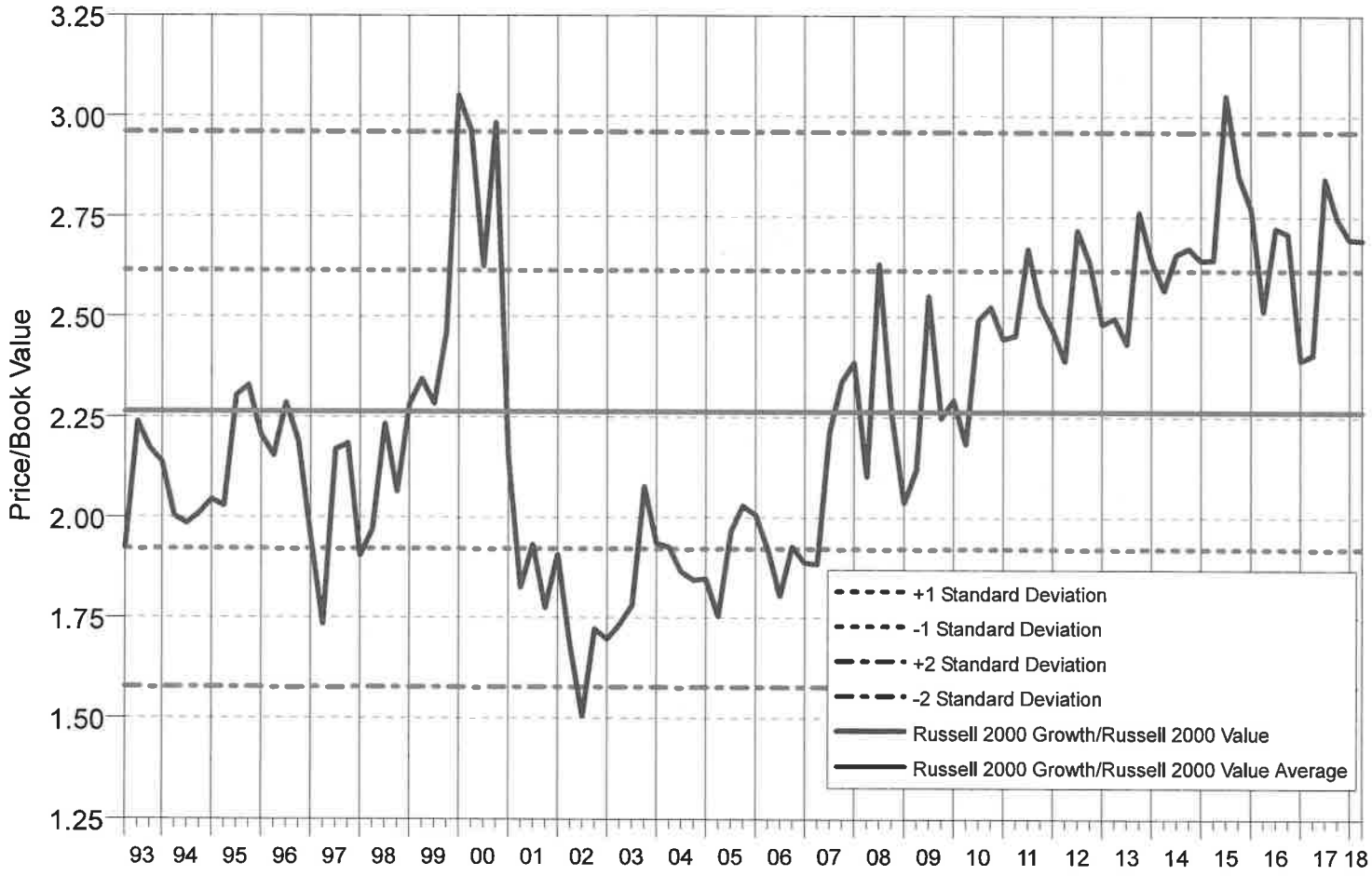
Price/Earnings Ratio (exc neg)
for 25 Years Ended March 31, 2018



US Equity

Relative Valuations: Small Growth vs. Small Value P/B

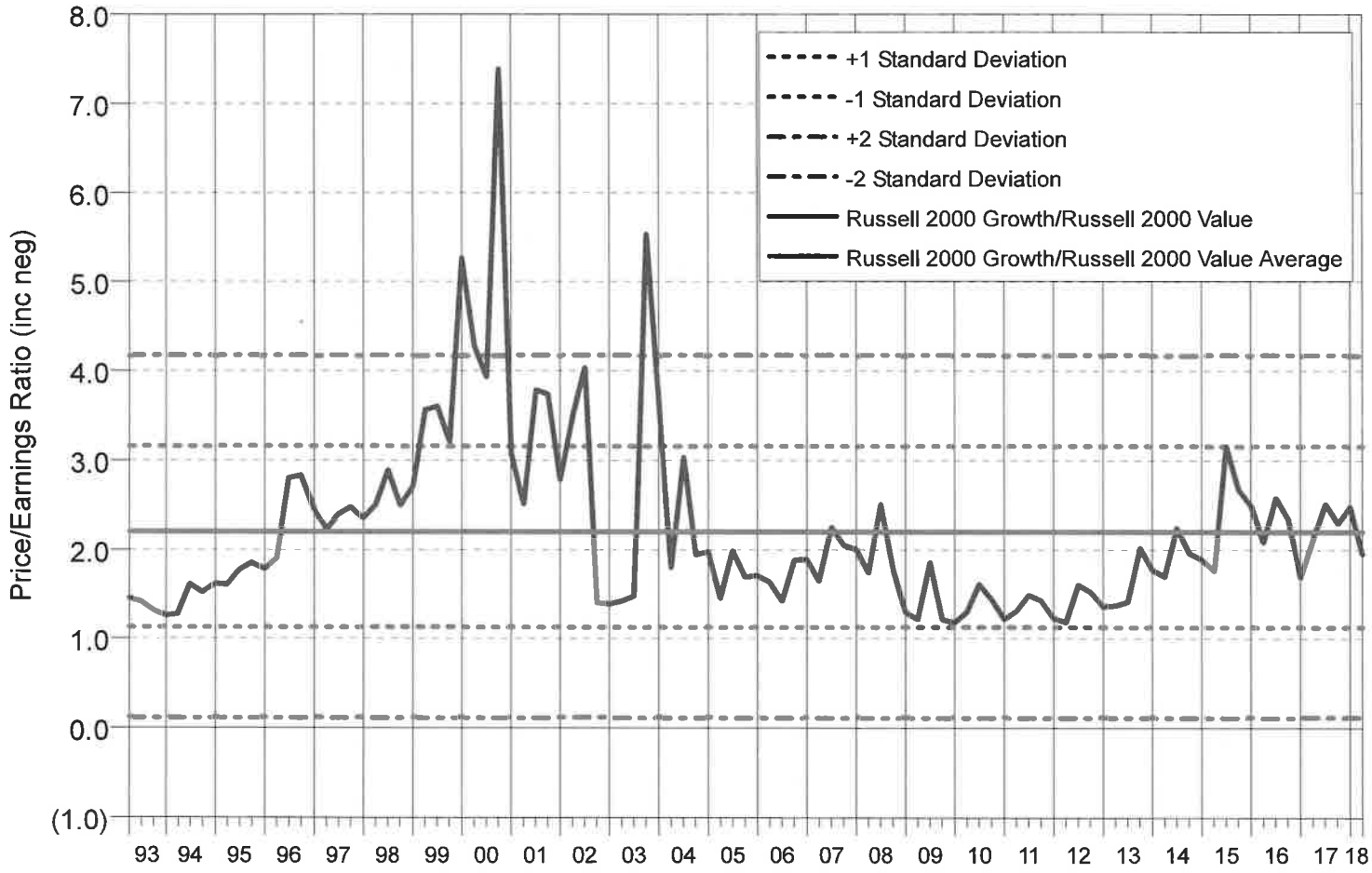
Price/Book Value
for 25 Years Ended March 31, 2018



US Equity

Relative Valuations: Small Growth vs. Small Value P/E

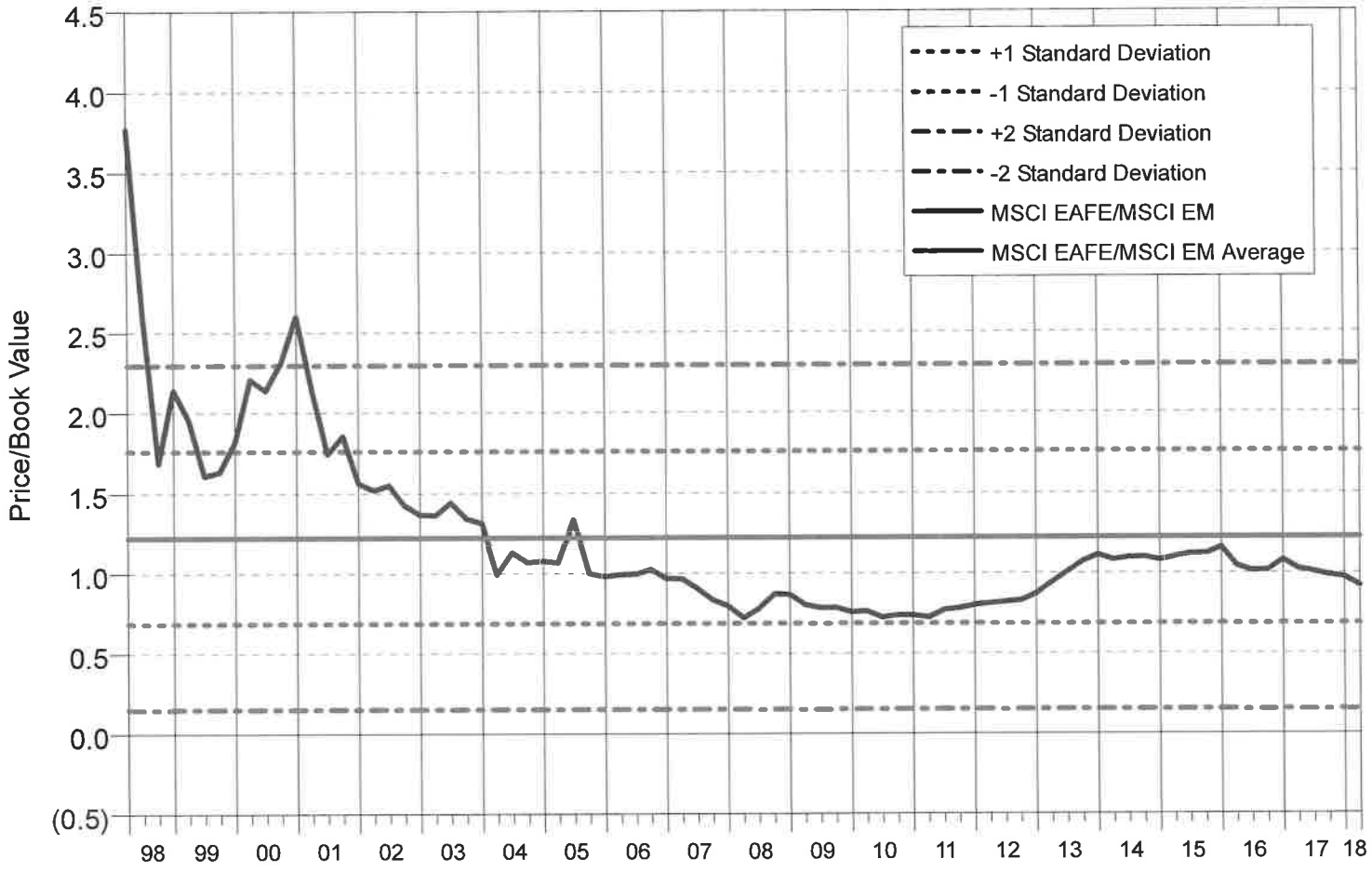
Price/Earnings Ratio (inc neg)
for 25 Years Ended March 31, 2018



Non-US Equity

Relative Valuations: International Developed vs. Emerging Markets P/B

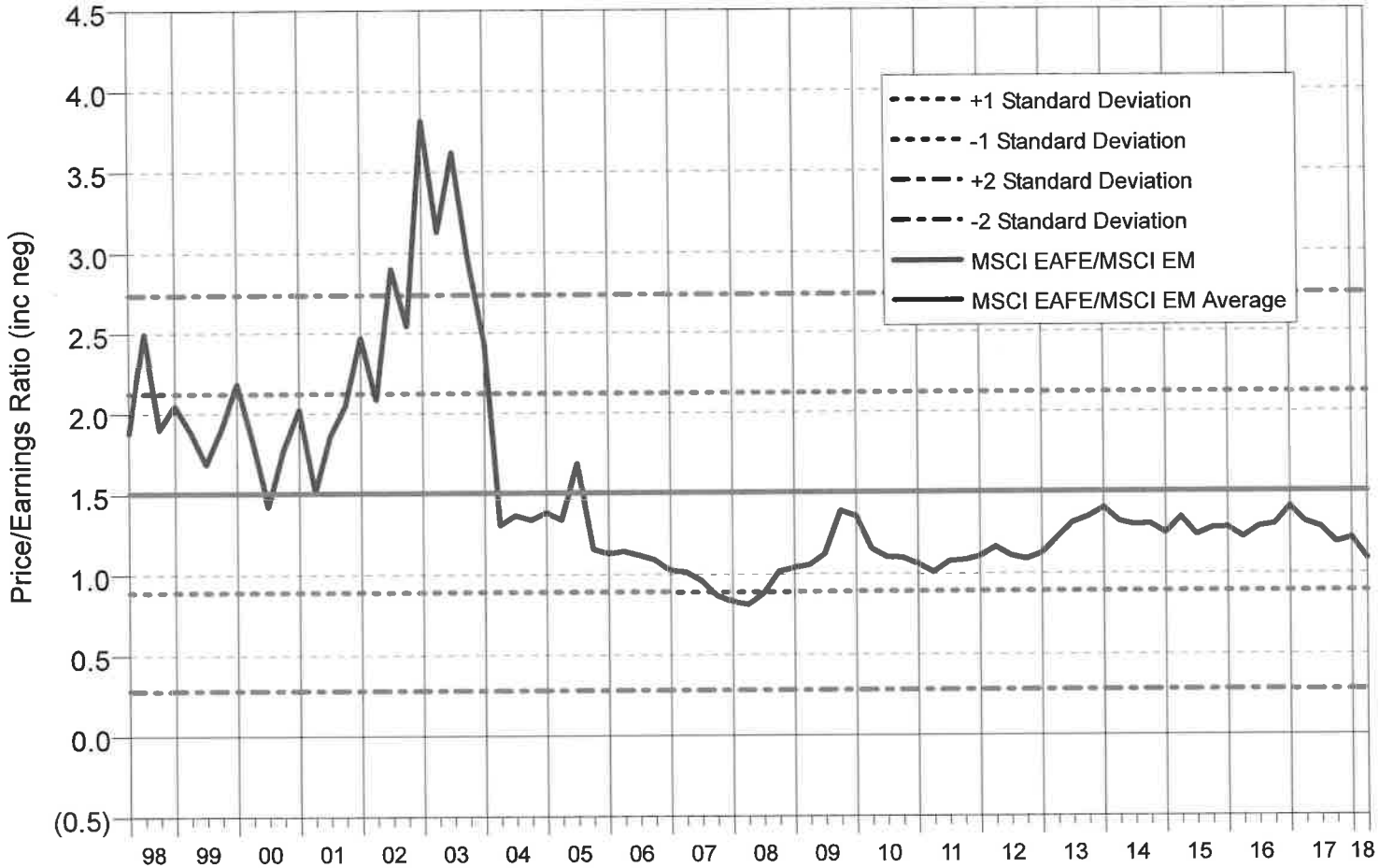
Price/Book Value
for 20 Years Ended March 31, 2018



Non-US Equity

Relative Valuations: International Developed vs. Emerging Markets P/E

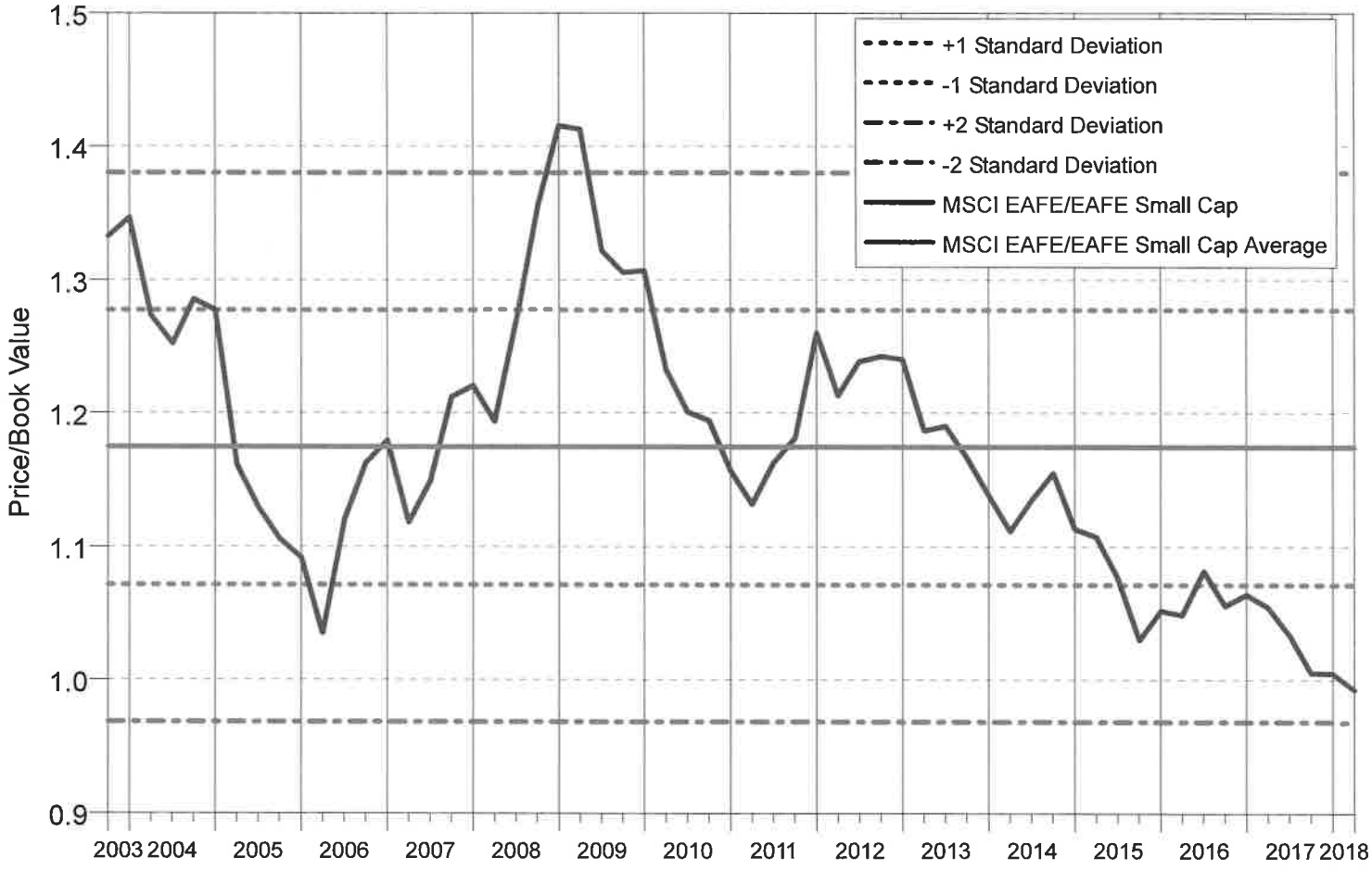
Price/Earnings Ratio (inc neg)
for 20 Years Ended March 31, 2018



Non-US Equity

Relative Valuations: International Large vs. Small Cap P/B

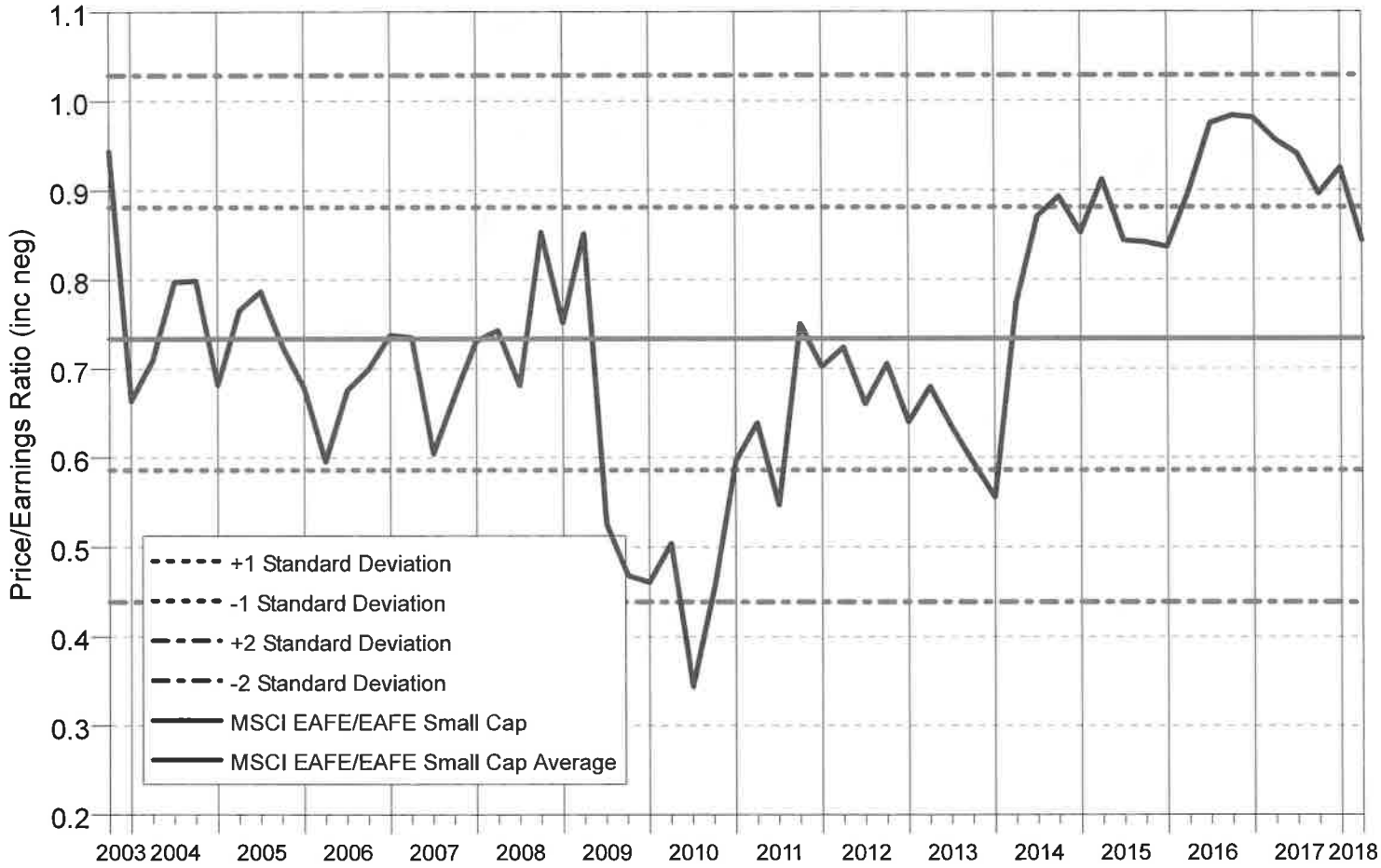
Price/Book Value
for 14 1/2 Years Ended March 31, 2018



Non-US Equity

Relative Valuations: International Large vs. Small Cap P/E

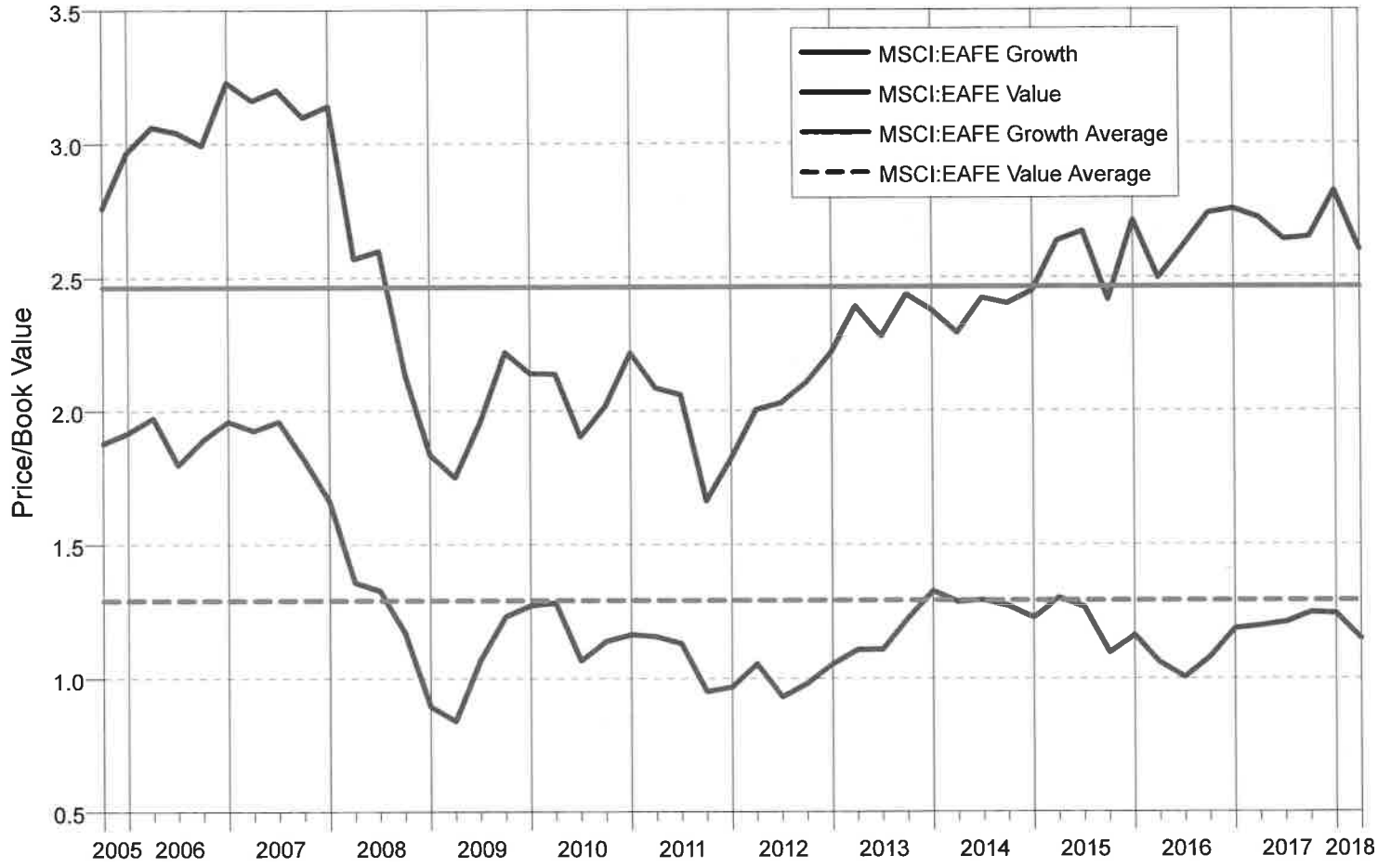
Price/Earnings Ratio (inc neg)
for 14 1/2 Years Ended March 31, 2018



Non-US Equity

Historical Valuations: International Growth and Value P/B

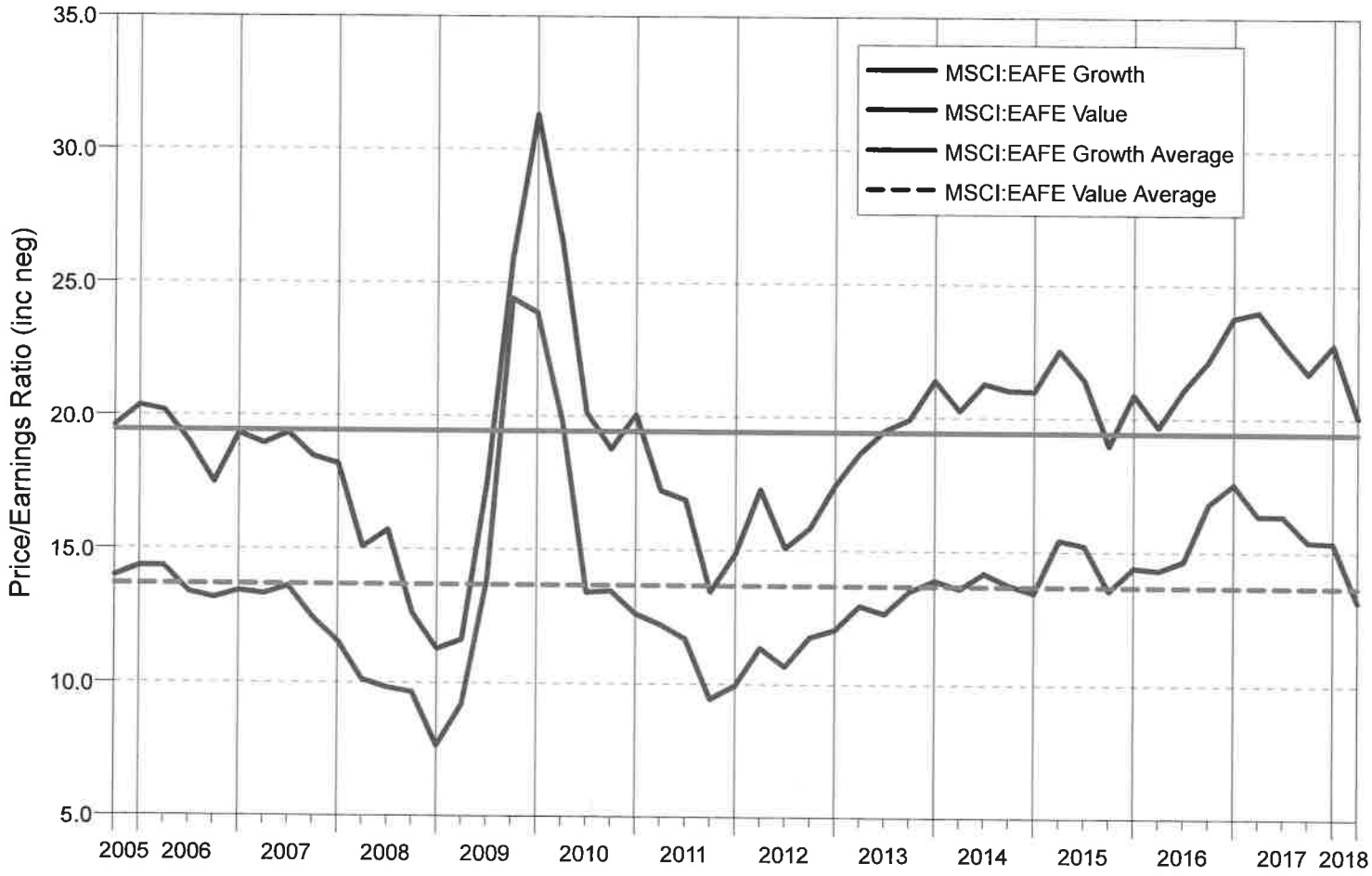
Price/Book Value
for 12 1/2 Years Ended March 31, 2018



Non-US Equity

Historical Valuations: International Growth and Value P/E

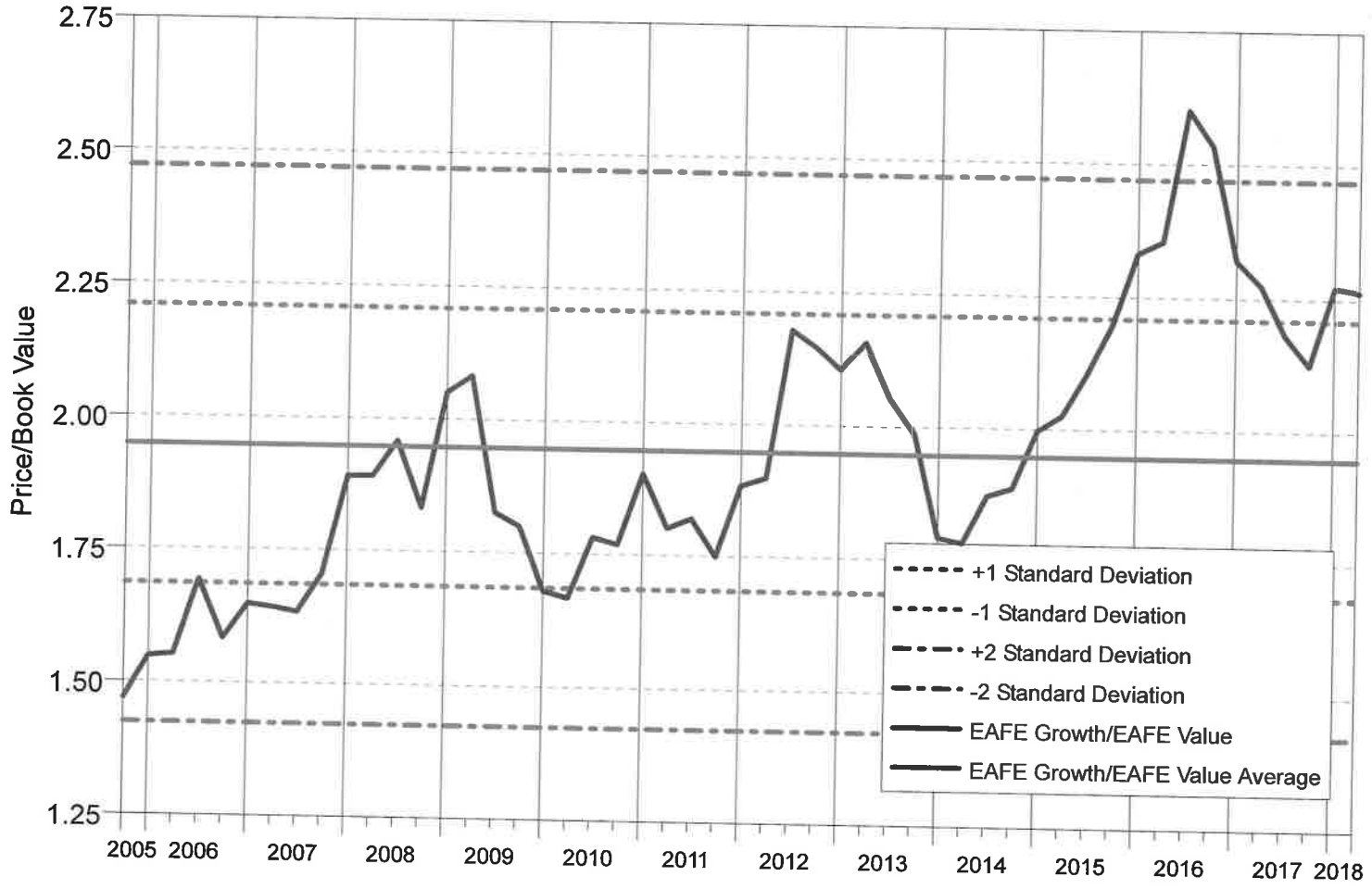
Price/Earnings Ratio (inc neg)
for 12 1/2 Years Ended March 31, 2018



Non-US Equity

Relative Valuations: International Growth vs. Value P/B

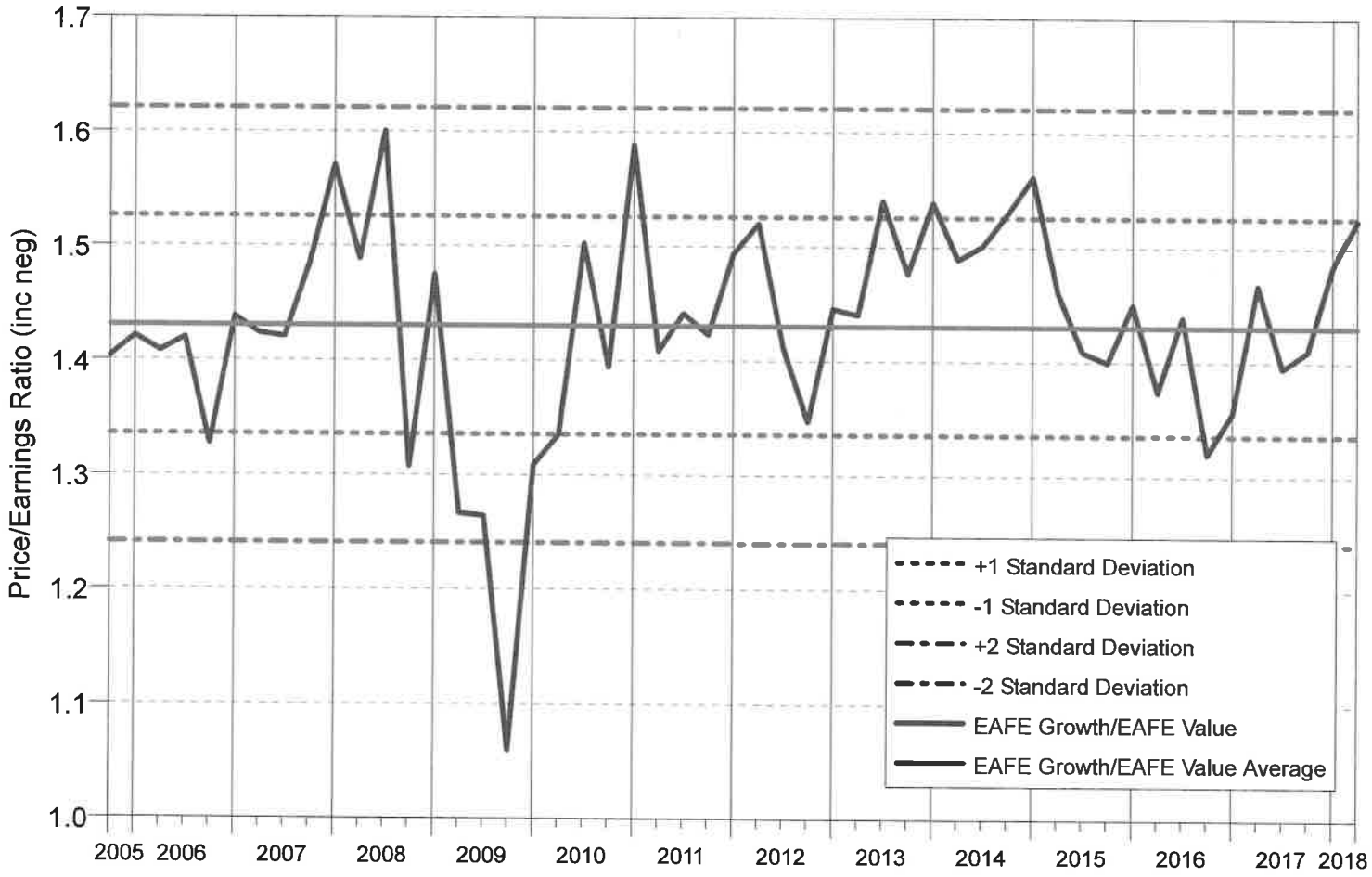
Price/Book Value
for 12 1/2 Years Ended March 31, 2018



Non-US Equity

Relative Valuations: International Growth vs. Value P/E

Price/Earnings Ratio (inc neg)
for 12 1/2 Years Ended March 31, 2018



ASSET ALLOCATION STUDY
MONTE CARLO ANALYSIS

Strategic Raymond James Institutional Portfolios

FFC Investment Advisors of Raymond James
Octave J. Frances III, CIMA
Senior Vice President, Investments
400 Poydras Street, Suite 2430
New Orleans, LA 70130
www.ffcinvestmentadvisors.com

IFS | INSTITUTIONAL FIDUCIARY SOLUTIONS

RAYMOND JAMES

Source: Morningstar Direct

Efficient Frontier – Asset Allocation

As of January 2018

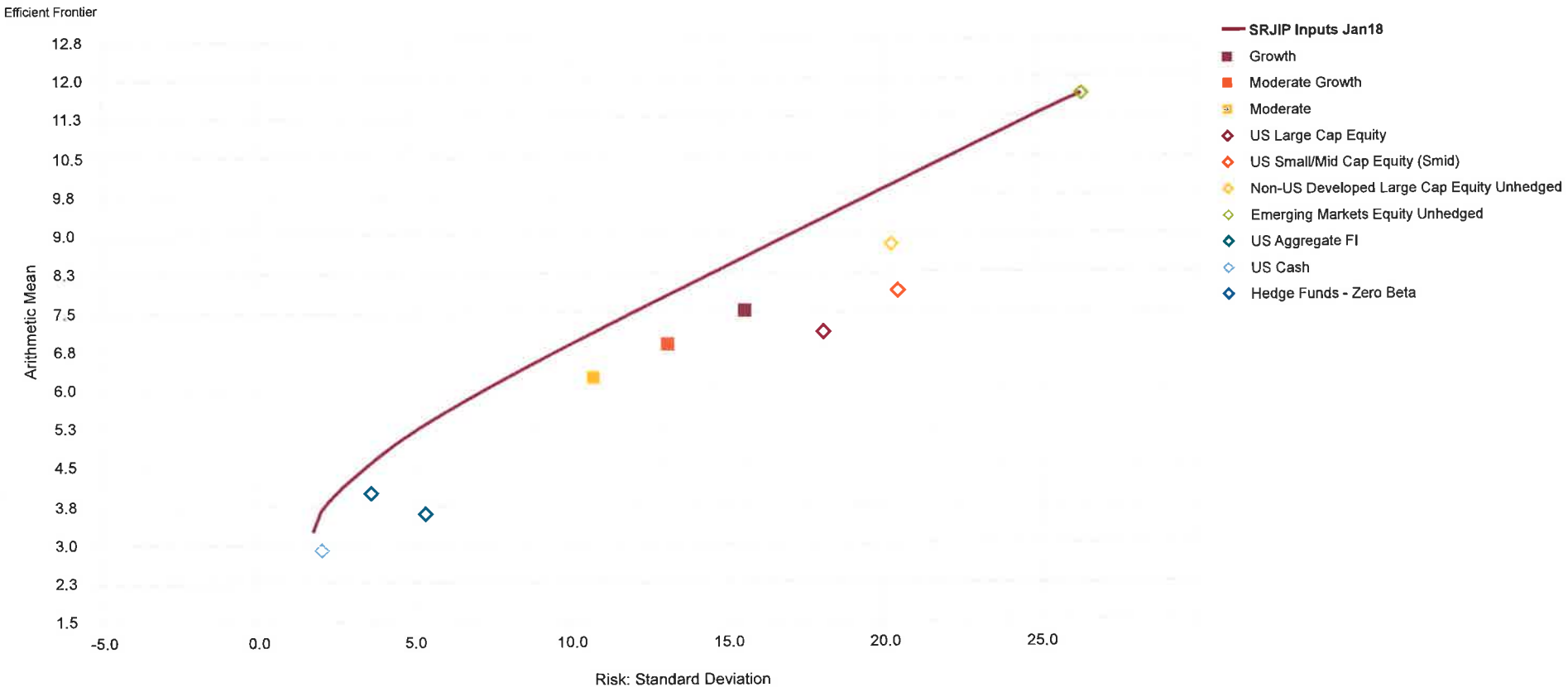


Chart is for illustrative purposes only and is not representative of the future performance of any particular portfolio or security. Please see asset class descriptions beginning on page 14. Arithmetic inputs are utilized in the optimizer to calculate the Efficient Frontier and Geometric assumptions are calculated in the simulations. For explanations and additional information regarding Arithmetic Mean, Geometric Mean, Standard Deviation , Sharpe Ratio, and asset classes see important disclosures beginning on page 11.

Return Assumption Inputs (Capital Market Assumptions) are forward looking data and subject to change at any time. There is no assurance that the projections will be realized. Variations to capital market assumptions are expected and specific sectors or industries are more susceptible due to their increased vulnerability to any single economic, political or regulatory development.

The Efficient Frontier: Generally, investors seek to receive a higher return for assuming additional levels of risk. With the addition of asset classes that do not move in lock step (meaning correlation is less than one), the risk/return relationship changes to a theoretical "Efficient Frontier" – a curve along which returns would be maximized at each level of risk. The Efficient Frontier illustration used herein does not take into account fees, state or federal income taxes or specific securities.

RAYMOND JAMES®

Source: Morningstar Direct

Asset Allocation – Structure & Inputs

As of January 2018

Asset Class Statistics

	Geometric Mean	Standard Deviation
US Large Cap Equity	5.43	18.10
US Small/Mid Cap Equity (Smid)	5.78	20.50
Non-US Developed Large Cap Equity Unhedged	6.74	20.30
Emerging Markets Equity Unhedged	8.32	26.40
US Aggregate FI	3.45	5.30
US Cash	2.88	2.00
Hedge Funds - Zero Beta	3.93	3.60

Asset Class Correlation Matrix

Asset Class	1	2	3	4	5	6	7
1 US Large Cap Equity	1.00						
2 US Small/Mid Cap Equity (Smid)	0.95	1.00					
3 Non-US Developed Large Cap Equity Unhedged	0.77	0.73	1.00				
4 Emerging Markets Equity Unhedged	0.73	0.70	0.76	1.00			
5 US Aggregate FI	0.11	0.10	0.03	-0.03	1.00		
6 US Cash	-0.01	-0.01	-0.11	-0.03	0.15	1.00	
7 Hedge Funds - Zero Beta	-0.01	-0.01	-0.01	-0.02	0.13	0.02	1.00

All investing involves risk. Asset allocation and diversification do not ensure a profit or protect against a loss.

Information presented is for illustrative purposes only and is not representative of the future performance of any particular portfolio or security. Diversification does not ensure a profit or protect against a loss. Arithmetic inputs are utilized in the optimizer to calculate the Efficient Frontier and Geometric assumptions are calculated in the simulations. For explanations and additional information regarding Arithmetic Mean, Geometric Mean, Standard Deviation , Sharpe Ratio, and asset classes see important disclosures beginning on page 11.

Return Assumption Inputs (Capital Market Assumptions) are forward looking data and subject to change at any time. There is no assurance that the projections will be realized. Variations to capital market assumptions are expected and specific sectors or industries are more susceptible due to their increased vulnerability to any single economic, political or regulatory development.

Source: Morningstar Direct

Asset Allocation – Structure & Inputs

As of January 2018

Asset Mix Composition Detail

Asset Class	Growth Allocation %	Moderate Growth Allocation %	Moderate Allocation %
US Large Cap Equity	35.80	30.00	24.20
US Small/Mid Cap Equity (Smid)	14.20	12.00	8.80
Non-US Developed Large Cap Equity Unhedged	29.00	24.00	20.00
Emerging Markets Equity Unhedged	6.00	5.00	4.00
US Aggregate FI	0.00	17.00	34.00
US Cash	0.00	0.00	0.00
Hedge Funds - Zero Beta	15.00	12.00	9.00
Total Portfolio	100.00	100.00	100.00

Asset Mix Statistics

	Growth	Moderate Growth	Moderate
Geometric Mean	6.29	6.00	5.64
Standard Deviation	15.79	13.30	10.89
Sharpe Ratio	0.48	0.52	0.57

All investing involves risk. Asset allocation and diversification do not ensure a profit or protect against a loss.

Information presented is for illustrative purposes only and is not representative of the future performance of any particular portfolio or security. Diversification does not ensure a profit or protect against a loss. Arithmetic inputs are utilized in the optimizer to calculate the Efficient Frontier and Geometric assumptions are calculated in the simulations. For explanations and additional information regarding Arithmetic Mean, Geometric Mean, Standard Deviation , Sharpe Ratio, and asset classes see important disclosures beginning on page 11.

Return Assumption Inputs (Capital Market Assumptions) are forward looking data and subject to change at any time. There is no assurance that the projections will be realized. Variations to capital market assumptions are expected and specific sectors or industries are more susceptible due to their increased vulnerability to any single economic, political or regulatory development.

Source: Morningstar Direct

Simulation Models - Return Analysis

The simulated Return Percentiles table displays the range of return possibilities (broken down by percentiles) of possible future annualized returns for the selected allocation mixes resulting from the Monte Carlo simulation.

As of January 2018

Return Percentiles

	Percentile		
	95th	50th	5th
Growth			
1 Year	35.57%	6.51%	-16.01%
5 Year	18.30%	6.24%	-4.64%
10 Year	14.85%	6.36%	-1.51%
20 Year	12.20%	6.31%	0.65%
Moderate Growth			
1 Year	30.35%	6.04%	-13.07%
5 Year	16.07%	5.94%	-3.22%
10 Year	13.20%	5.99%	-0.59%
20 Year	10.99%	5.98%	1.20%
Moderate			
1 Year	25.83%	5.59%	-9.99%
5 Year	13.84%	5.55%	-1.92%
10 Year	11.49%	5.62%	0.18%
20 Year	9.72%	5.59%	1.75%

IMPORTANT: The projections or other information generated by Morningstar's Direct Asset Allocation software regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results and are not guarantees of future results. Each scenario is randomly generated and as a result, the software's results will vary with each use and over time as markets change. Asset classes listed above are not available for direct investment and projected returns do not reflect either management fees or costs.

For a complete description of the Monte Carlo analysis provided above please see important definitions and disclosures beginning on page 11.

Source: Morningstar Direct

Simulation Models - Probability Analysis

The Target Return Probabilities Table displays the probability of achieving the listed target returns over the displayed investment periods resulting from the Monte Carlo Simulation.

As of January 2018

Monte Carlo Simulation

	Target Return			
	4%	5%	6%	7%
Growth				
1 Year	56.12	53.46	51.52	48.74
5 Year	63.10	58.00	51.68	45.52
10 Year	68.56	60.38	52.48	45.06
20 Year	74.76	65.20	53.72	42.46
Moderate Growth				
1 Year	55.84	52.96	50.18	46.62
5 Year	63.10	56.82	49.62	42.86
10 Year	68.78	59.50	49.88	40.82
20 Year	75.34	63.66	49.66	37.16
Moderate				
1 Year	55.84	52.14	48.20	44.60
5 Year	62.94	54.74	46.34	38.54
10 Year	68.72	57.16	45.92	34.52
20 Year	75.54	60.56	43.98	29.30

IMPORTANT: The projections or other information generated by Morningstar's Direct Asset Allocation software regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results and are not guarantees of future results. Each scenario is randomly generated and as a result, the software's results will vary with each use and over time as markets change.

For a complete description of the Monte Carlo analysis provided above please see important definitions and disclosures beginning on page 11.

Source: Morningstar Direct

IMPORTANT DISCLOSURES AND DEFINITIONS

The information provided in this report should not be considered a recommendation to purchase or sell any particular security. It should not be assumed that any security transactions, holdings, or sectors discussed were or will be profitable, or that the investment recommendations or decisions we make in the future will be profitable or will equal the investment performance discussed herein.

Past performance is not a guarantee of future results. Indices are not available for direct investment. Any investor who attempts to mimic the performance of an index would incur fees and expenses which would reduce returns. All investing involves risk. Diversification and asset allocation do not ensure a profit or protect against a loss.

Capital Market Assumptions:

Capital Market Assumptions are forward looking data and are subject to change at any time and there is no assurance that the projections mentioned herein will be realized. Variations to capital market assumptions are expected and specific sectors or industries are more susceptible due to their increased vulnerability to any single economic, political or regulatory development.

Monte Carlo Simulations:

IMPORTANT: The projections or other information generated by Morningstar's Direct Asset Allocation software regarding the likelihood of various investment outcomes are hypothetical in nature, do not reflect actual investment results and are not guarantees of future results. Each scenario is randomly generated and as a result, the software's results will vary with each use and over time as markets change.

The Change of a particular portfolio ending value was projected using Monte Carlo simulation. It attempts to show the probability that a particular return can be achieved after a particular number of years. Probabilities are calculated by projecting simulated returns into the future for many iterations and determining the percentage of time the iterations result in a value that is above or below a specific threshold. Standard deviation is a measure of central tendency, that is, the spread of the difference of returns from their average. Return percentages referenced are average annual returns. We do not adjust for any state or federal income taxes or fees.

Results are based on the simulated performance of the major market indices that represent the asset classes in the target allocations. Return and standard deviation assumptions utilized to simulate various market scenarios are based upon forward-looking capital market assumptions provided by an outside institution. Numerous asset classes are utilized in developing risk and return assumptions for diversified portfolios. Utilizing this data, 500 – 5,000 Monte Carlo simulations of investment scenarios are generated in an effort to determine the probability of achieving certain returns, the default is 2,000 simulations.

Limitations of this analysis include, but are not restricted to, the possibility that market extremes may occur more frequently than projected, that return assumptions for asset classes may not reflect actual investment returns of the asset classes and that inflation is assumed to be constant when it is unlikely it will be so over the simulated periods.

While the Morningstar Direct Asset Allocation system runs many simulations in an effort to develop statistically reliable data, it cannot foresee or account for all possible situations that could negatively impact an investor's financial situation. The "5th Percentile (Worst)" Annual Average Returns is represented as the simulations showing the simulations in that percentile yielding the worst returns. While we believe that this is a suitable level for planning purposes, there is no guarantee that a portfolio will not perform worse than the simulations in the 5th percentile. Therefore, this performance should only be used in conjunction with the sound judgment of a financial advisor. Due to the ever-changing nature of investment and retirement objectives, it is critical that an advisor revisit an investor's retirement investment and income plans at least once a year and more frequently if possible.

For the purposes of this report the software does not analyze any specific mutual funds or other securities, nor does it favor any particular asset classes other than those previously stated. There may be investments with characteristics similar or superior to those being analyzed by the software.

Source: Morningstar Direct

IMPORTANT DISCLOSURES AND DEFINITIONS

Risks:

• Fixed-income securities (or "bonds") are exposed to various risks including but not limited to credit (risk of default or principal and interest payments), market and liquidity, interest rate, reinvestment, legislative (changes to the tax code), and call risks.

• There is an inverse relationship between interest rate movements and fixed income prices. Generally, when interest rates rise, fixed income prices fall and when interest rates fall, fixed income prices generally rise. Short-term bonds with maturities of three years or less will generally have lower yields than long term bonds which are more susceptible to interest rate risk.

• International investing involves special risks, including currency fluctuations, different financial accounting standards, and possible political and economic volatility.

• Investing in emerging markets can be riskier than investing in well-established foreign markets. Emerging and developing markets may be less liquid and more volatile because they tend to reflect economic structures that are generally less diverse and mature and political systems that may be less stable than those in more developed countries.

• Investing in small-cap stocks generally involves greater risks, and therefore, may not be appropriate for every investor. Stocks of smaller or newer or mid-sized companies may be more likely to realize more substantial growth as well as suffer more significant losses than larger or more established issuers.

• Commodities trading is generally considered speculative because of the significant potential for investment loss. Among the factors that could affect the value of the fund's investments in commodities are cyclical economic conditions, sudden political events, changes in sectors affecting a particular industry or commodity, and adverse international monetary policies. Markets for precious metals and other commodities are likely to be volatile and there may be sharp price fluctuations even during periods when prices overall are rising.

• Specific sector investing such as real estate can be subject to different and greater risks than more diversified investments. Declines in the value of real estate, economic conditions, property taxes, tax laws and interest rates all present potential risks to real estate investments.

• Some accounts may invest in Master Limited Partnership ("MLP") units, which may result in unique tax treatment. MLPs may not be appropriate for ERISA or IRA accounts, and cause K-1 tax treatment. Please consult your tax adviser for additional information regarding the tax implications associated with MLP investments.

• Alternative investments are generally considered speculative in nature and may involve a high degree of risk, particularly if concentrating investments in one or few alternative investments. These risks are potentially greater and substantially different than those associated with traditional equity or fixed income investments. The investment strategies used by certain Funds may require a substantial use of leverage. The investment strategies employed and associated risks are more fully disclosed in each Fund's prospectus, which is available from your financial advisor.

• Changes in the value of a hedging instrument may not match those of the investment being hedged.

• These portfolios may be subject to international, small-cap and sector-focus exposures as well. Accounts may have over weighted sector and issuer positions, and may result in greater volatility and risk

• Companies in the technology industry are subject to fierce competition, and their products and services may be subject to rapid obsolescence.

• Specific sector investing such as real estate can be subject to different and greater risks than more diversified investments. Declines in the value of real estate, economic conditions, property taxes, tax laws and interest rates all present potential risks to real estate investments. In a rising interest rate environment REITs (real estate investment trusts) may experience an increase in rent rates or mortgage rates or may experience higher acquisition costs.

Definitions:

Efficient Frontier - Generally, investors seek to receive a higher return for assuming additional levels of risk. With the addition of asset classes that do not move in lock step (meaning correlation is less than one), the risk/return relationship changes to a theoretical "Efficient Frontier" – a curve along which returns would be maximized at each level of risk. The Efficient Frontier illustration used herein does not take into account fees, state or federal income taxes or specific securities. Various indices represent asset classes and it is important to note that any investor who attempts to mimic the performance of an index would incur fees and expenses which would reduce returns.

Sharpe Ratio:
A risk statistic that measure the excess return per unit of Total Risk taken in a portfolio. The excess return is the total excess return without adjustment for risk. The ratio is equal to the excess return divided by the Standard Deviation of a portfolio.

Correlation:
The relationship between two variables during a period of time. For example, all utility stocks tend to have a high degree of correlation because their share prices are influenced by the same forces. Conversely, gold stock price movements are not closely correlated with utility stock price movements because they are influenced by different factors.

Source: Morningstar Direct

IMPORTANT DISCLOSURES AND DEFINITIONS

As of January 2018

Definitions Continued:

Arithmetic Mean – The arithmetic mean return is the measure of reward in conventional mean-variance optimization (MVO). The conventional MVO is a single-period model in which the expected arithmetic mean return is a forecast of return over the next period of investment.

Geometric Mean - The return measures how fast wealth accumulates. It is a more familiar statistic than arithmetic mean return because it is a more standard measure of performance. By selecting this reward measure, the user is taking a multi-period viewpoint, in contrast to the conventional MVO which is a single-period model concerned with maximizing expected return just for the next period. In other words, the geometric mean is a more relevant measure of performance for an investor who is investing for a long time and will be rebalancing their portfolio back to the same asset allocation every period. Optimizing on expected geometric mean return rather than expected arithmetic mean return can lead to meaningful differences in the efficient asset mixes, especially at the riskier end of the efficient frontier. The geometric mean is the same as the arithmetic mean when returns are constant. When returns vary it is always below the arithmetic mean.

Standard Deviation:
A measure of volatility, commonly viewed as risk. Regarding quarterly returns, it is the square root of the variance, which equals the expected value of the squared deviation from the mean value.

See page 4 for asset mixes for the below chart:

Asset Mix Statistics

	Growth	Moderate Growth	Moderate
Arithmetic Mean	7.55	6.89	6.25

Asset Class Statistics

	Arithmetic Mean
US Large Cap Equity	7.12
US Small/Mid Cap Equity (Smid)	7.94
Non-US Developed Large Cap Equity Unhedged	8.84
Emerging Markets Equity Unhedged	11.80
US Aggregate FI	3.60
US Cash	2.90
Hedge Funds - Zero Beta	4.00

RAYMOND JAMES®

Source: Morningstar Direct

IMPORTANT DISCLOSURES AND DEFINITIONS

Asset Class Descriptions

US All Cap Equity: Represents registered equity securities, traded on a U.S. exchange and having a market cap generally between $170mm and $545bb, as of May 31, 2104. Based on a combination of requisite quality characteristics and their market capitalization the list of companies includes approximately 3000 securities.

US Large Cap Equity: Represents registered equity securities, traded on a U.S. exchange and having a market cap generally between $2bb and $545bb, as of May 31, 2104. Based on a combination of requisite quality characteristics and their market capitalization the list of companies includes approximately 1000 securities, and representing approximately 92% of the largest 3000 companies in the US.

US Small/Mid Cap Equity: Represents registered equity securities, traded on a U.S. exchange and having a market cap generally between $170mm and $27bb. Based on a combination of requisite quality characteristics and their market capitalization the list of companies includes approximately 2,800 securities.

International Equity: Represents registered equity securities of developed markets, excluding the U.S. and Canada. As of December 31, 2010, the list included securities from the following countries: Australia, Austria, Belgium, Denmark, Finland, France, Germany, Greece, Hong Kong, Ireland, Israel, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, and the United Kingdom.

International SMID Equity: Represents registered equity securities of developed markets, excluding the U.S. and Canada. As of December 31, 2010, the list included securities from the following countries: Australia, Austria, Belgium, Denmark, Finland, France, Germany, Greece, Hong Kong, Ireland, Israel, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, and the United Kingdom.

Emerging Markets Equity: Represents registered equity securities of emerging markets. As of December 31, 2010, the list included securities from the following 21 emerging market countries: Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Morocco, Peru, Philippines, Poland, Russia, South Africa, Taiwan, Thailand, and Turkey.

Source: Morningstar Direct

IMPORTANT DISCLOSURES AND DEFINITIONS

Asset Class Descriptions Continued:

US Aggregate FI: SEC-registered, taxable, and dollar denominated securities. The asset class covers the U.S. investment grade fixed rate bond market, inclusive of asset-backed securities, government and corporate securities, and mortgage pass-through securities. Must be rated investment grade (Baa3/BBB- or higher) by at least two of the following rating agencies: Moody's, S&P, Fitch; regardless of call features have at least one year to final maturity, and have an outstanding par value amount of at least $250 million.

US Short G/C FI: Includes securities in the maturity range from 1 up to (but not including) 3 years with the following characteristics: U.S. Treasuries (i.e., public obligations of the U.S. Treasury that have remaining maturities of more than one year), government-related issues (i.e., agency, sovereign, supranational, and local authority debt), and corporates. Further characteristics include: For Treasury, government-related, and corporate securities, USD 250mn minimum par amount outstanding, Rated investment-grade (Baa3/BBB-/BBB-) or higher using the middle rating of Moody's, S&P, and Fitch, and at least one year until final maturity.

Government: This asset class represents managers that seek to earn income by investing primarily in Treasuries and U.S. government agency securities. Government backing applies only to the timely payment of principal and interest on the underlying securities and does guarantee that you will not lose money.

Corporate: This asset class represents managers that seek to provide current income through investments in higher quality debt securities. Capital preservation is a secondary objective, achieved by maintenance of a prudent level of risk. Guarantees of repayment of principal and interest do not apply to the market prices and yields of the securities which will vary with changes in interest rates and other market conditions.

High Yield: This asset class represents managers that seek to maximize current income and/or total return through investments in lower rated, higher risk, debt securities. High Yield bonds are rated below investment grade quality and entail significant credit and liquidity risks relative to more highly rated fixed income securities.

US Cash: This index measures monthly return equivalents of yield averages that are not marked to market. The Three-Month Treasury Bill Indices consist of the last three-month Treasury bill issues.

Emerging Markets Debt: Includes USD denominated debt from sovereign, quasi-sovereign, and corporate EM issuers. Country eligibility and classification as an Emerging Market is rules-based and reviewed on an annual basis using World Bank income group and International Monetary Fund (IMF) country classifications. As of December 31, 2010, the MSCI Emerging Markets consists of the following 21 emerging market country indices: Brazil, Chile, China, Colombia, Czech Republic, Egypt, Hungary, India, Indonesia, Korea, Malaysia, Mexico, Morocco, Peru, Philippines, Poland, Russia, South Africa, Taiwan, Thailand, and Turkey.

Global Broad FI (Non-US Broad Fixed Income): Includes global investment grade debt from twenty-four different local currency markets, representing multi-currency issues to include: fixed-rate treasury, government-related, corporate and securitized bonds from both developed and emerging markets issuers. Constituents are largely comprised of three major global regions: the U.S., Pan-European, and Asian-Pacific. In addition, this group also includes investment grade Eurodollar, Euro-Yen, Canadian, and 144A Index-eligible securities not already in the three major regions. Securities must be rated investment grade using the middle rating of Moody's, S&P, and Fitch, be publicly issued in the global and regional markets, and only fully taxable issues are eligible.

Municipal FI: Fixed income securities rated investment-grade (Baaa3/BBB- or higher) by at least two of the following rating agencies: Moody's, S&P, Fitch. The bonds must be fixed rate, have a dated-date after December 31, 1990, have an outstanding par value of at least $7 million, and be issued as part of a transaction of at least $75 million. This list is inclusive of general obligation bonds, revenue bonds, insured bonds (including all insured bonds with a Aaa/AAA rating), and prefunded bonds. Remarketed issues, taxable municipal bonds, floating rate bonds, and derivatives, are excluded.

Source: Morningstar Direct

IMPORTANT DISCLOSURES AND DEFINITIONS

Asset Class Descriptions Continued:

Global Real Estate – REITS: Includes comprehensive list of publicly traded Real Estate Investment Trusts (REITs) which cover the commercial real estate space across the Global economy. Offering exposure to all investment and property sectors, constituents are not required to meet minimum size and liquidity criteria.

Real Estate Securities: This asset class represents managers that seek current income and/or total return through a combination of investments in real estate securities. Managers do not invest directly in real estate, but instead generally take positions in real estate investment trusts (REITs) and real estate operating companies. The REIT positions may include equity REITs, fixed income REITs, or hybrid REITs. Investments in real estate securities have risks associated with declines in property values, increasing property taxes, interest rates, zoning laws, overbuilding, and losses from casualty or condemnation.

Alternatives (Diversified Bucket): Alternatives and the subcategories of alternatives are not asset classes by the strict definition and so the indices are used as proxies. The index only contains fund of funds, which invest with multiple managers through funds or managed accounts. It is an equal-weighted index, which includes over 650 domestic and offshore funds that have at least $50 Million under management or have been actively trading for at least 12 months. All funds report assets in US Dollar, and Net of All Fees returns which are on a monthly basis. FOFs classified as "Market Defensive" exhibit one or more of the following characteristics: invests in funds that generally engage in short-biased strategies such as short selling and managed futures; shows a negative correlation to the general market benchmarks (S&P). A fund in the FOF Market Defensive Index historically exhibits higher returns during down markets than up markets.

Managed Futures: Managed Futures are not an asset class by the strict definition and so an index is used as a proxy. The Barclay CTA Index is a leading industry benchmark of representative performance of commodity trading advisors. There are currently 582 programs included in the calculation of the Barclay CTA Index for the year 2013, which is un-weighted and rebalanced at the beginning of each year.

Hedge Funds: Hedge Funds are not an asset class by the strict definition and so the index is used as a proxy contains fund of funds, which invest with multiple managers through funds or managed accounts. It is an equal-weighted index, which includes over 650 domestic and offshore funds that have at least $50 Million under management or have been actively trading for at least 12 months. All funds report assets in US Dollar, and Net of All Fees returns which are on a monthly basis. FOFs classified as "Market Defensive" exhibit one or more of the following characteristics: invests in funds that generally engage in short-biased strategies such as short selling and managed futures; shows a negative correlation to the general market benchmarks (S&P). A fund in the FOF Market Defensive Index historically exhibits higher returns during down markets than up markets.

Private Equity: Private Equity is a term used to describe private negotiated equity investments in public as well as private companies. Such investments range from venture or startup capital to capital used to take public companies private, i.e. LBO financing. In private negotiations, better-than-market rates of return are typically sought to compensate for relative illiquidity.

...

Horizon
Actuarial Services, LLC

Survey of Capital Market Assumptions

2017 Edition

Horizon Actuarial Services, LLC is proud to serve as the actuary to over 90 multiemployer defined benefit pension plans across the United States and across various industries. As actuary to these plans, we must develop assumptions regarding future investment returns on plan assets. We then use those assumptions as we determine the actuarial values of the benefits promised by these plans to their participants and beneficiaries, as well as to project plan funding and solvency levels years into the future.

At Horizon Actuarial, we are actuaries, not investment professionals. Therefore, when developing assumptions as to what returns a pension plan's assets might be expected to earn in the future, we look to our colleagues in the investment advisory community. Each year, as part of this survey, we ask different investment firms to provide their "capital market assumptions" – their expectations for future risk and returns for different asset classes in which pension plans commonly invest. The information gathered from this survey can help answer the common question: "Are my plan's investment return assumptions reasonable?"

Of course, there are many factors to consider when evaluating a plan's investment return assumptions, such as its asset allocation and the maturity of its participant population. Any of these factors can make the expected return for one plan very different from others. Therefore, this report does not opine on the reasonableness of any one plan's investment return assumptions. Nevertheless, we hope this report will be a useful resource for trustees, actuaries, and investment professionals alike.

Horizon Actuarial sincerely thanks the 35 investment advisors who participated in this survey.

Atlanta ▪ Cleveland ▪ Los Angeles ▪ Miami ▪ Washington, D.C.
www.horizonactuarial.com

Published: August 2017

Table of Contents

Introduction 1

Summary 2

Survey Participants 3
A listing of advisors participating in the survey

Investment Horizons 3
A summary of assumptions by investment horizon

Short-Term vs. Long-Term 4
A comparison of expected returns over shorter time horizons versus over longer horizons

Differing Opinions 5
The distribution of expected returns and volatilities by asset class

Changing Outlooks: Last Five Years 6
A look at how expected returns and volatility have changed from 2013 to 2017

Evaluating the Return Assumption 7
Evaluating expected returns for a hypothetical multiemployer pension plan, using the results from the 2017 survey

Comparison with Prior Surveys 9
Reviewing the expected returns for the same hypothetical pension plan, using survey results over the past few years

Glossary 10
Basic definitions for certain investment terms

Methodology 10
A high-level description of the methodologies used in compiling the results of the survey

Appendix 11
Supplemental exhibits showing the detail behind the expected returns for the hypothetical plan, a summary of the average assumptions from the 2017 survey, and ranges of expected returns for 10-year and 20-year horizons

Horizon Actuarial Services, LLC is an independent consulting firm specializing in providing actuarial and consulting services to multiemployer benefit plans. Horizon Actuarial does not provide investment, legal, or tax advice. Please consult with your investment advisor, legal counsel, or tax advisor for information specific to your plan's investment, legal, or tax implications.

Summary

Horizon Actuarial first conducted this survey in 2010, and it included 8 investment advisors. In 2012, we first published a report on the survey results, which included 17 advisors. The survey has expanded considerably over the past few years; this 2017 edition of the survey includes assumptions from 35 different investment firms.

In general, expected returns have come down in recent years. When we focus on the 18 advisors who participated in each of the last five surveys, we see that expected returns for equity and alternative investments generally decreased from 2013 to 2017. During the same period, expected returns for core fixed income investments have actually increased. Expected volatilities for equity investments have decreased in recent years, but have remained relatively flat (or increased slightly) for other asset classes.

As we have seen in prior surveys, expected returns are noticeably lower over the short term than over the long term. This trend is apparent when we focus on the 12 advisors who provided assumptions for both the short term (up to 10 years) and long term (20 years or more). The difference is more pronounced for equity and fixed income investments, and less apparent for certain alternative investments such as real estate.

For ongoing pension plans without solvency issues, we believe a horizon of 20 years or more is appropriate for evaluating the reasonableness of the long-term investment return assumption. A shorter horizon, such as 10 years, may be more appropriate for evaluating the return assumption for a plan that is very mature or has solvency issues. Even for plans with long-term investment horizons, it is important to understand the potential impact of lower expected returns over the short term. Therefore, this survey evaluates return expectations over horizons of both 10 years and 20 years.

For illustration, this report also constructs an asset allocation for a hypothetical multiemployer pension plan and uses the results from the survey to develop a range of reasonably expected returns for the plan. When compared to the 2016 edition of the survey, the expected returns for this 2017 edition were lower over both 10-year and 20-year horizons. These decreases were primarily driven by lower expected returns across most asset classes for many of the advisors who participated in both the 2016 survey and the 2017 survey.

If you have questions about how the results of this survey relate to your multiemployer plan, please contact your consultant at Horizon Actuarial or visit the "contact us" page on our website, www.horizonactuarial.com. For questions about the survey itself, please contact Ben Ablin at ben.ablin@horizonactuarial.com.

Survey Participants

Exhibit 1 below lists the 35 investment advisors whose capital market assumptions are included in the 2017 survey. This report does not attribute specific assumptions to individual firms, which is a precondition of the survey.

Originally, this survey was exclusive to the multiemployer plan community; it included only assumptions from investment advisors to multiemployer pension plans. The survey has expanded over the years, and it now includes assumptions from investment advisors outside of the multiemployer plan community.

Of the 35 sets of capital market assumptions included in the 2017 edition of the survey, 26 were provided by investment advisors to multiemployer plans, 6 were obtained from published white papers, and 3 were provided by investment advisors who do not consult with multiemployer plans. The different types of firms participating in the survey are indicated below.

Exhibit 1

2017 Survey Participants

AJ Gallagher	*Merrill Lynch Global Institutional Consulting*
Alan Biller	*Morgan Stanley Wealth Management*
AndCo Consulting	*New England Pension Consultants (NEPC)*
Aon Hewitt	*Pavilion Advisory Group***
The Atlanta Consulting Group	*Pension Consulting Alliance*
*Bank of New York Mellon**	*PFM Asset Management, LLC*
*BlackRock**	*RVK*
Callan Associates	*Segal Marco Advisors*
CapTrust	*SEI*
Ellwood Associates	*Sellwood Consulting*
*Envestnet***	*Summit Strategies Group*
Goldman Sachs Asset Management	*SunTrust Investment Advisory Group**
Graystone Consulting	*UBS*
Investment Performance Services, LLC (IPS)	*Verus*
Janney Montgomery Scott, LLC	*Voya Investment Management**
*J.P. Morgan Asset Management**	*Wells Fargo Investment Institute**
Marquette Associates	*Willis Towers Watson***
Meketa Investment Group	

* Assumptions obtained from published white paper
** Advisor from outside multiemployer community

Investment Horizons

When evaluating the expected return assumption for an active, ongoing multiemployer pension plan, actuaries usually consider investment returns over a long-term investment horizon of 20 years or more. A shorter time horizon, say over the next 10 years, may be more appropriate when evaluating the return assumption for a very mature plan, a plan that has high negative cash flows, or a plan that is projected to become insolvent.

It is also important to understand the sensitivity of plan funding to changes in future investment returns. For example, the actuary for an active, ongoing pension plan will typically set the plan's investment return assumption based on expectations over a long-term horizon. However, it is still instructive for the actuary to evaluate the sensitivity of funding results to short-term investment returns that are expected to be higher or lower than the long-term assumption.

Survey participants were requested to provide their most recent capital market assumptions: expected returns for different asset classes, standard deviations for those expected returns, and a correlation matrix. The survey participants were also requested to indicate the investment horizon(s) to which their assumptions apply. If the participant develops separate assumptions for different time horizons, they were requested to provide each set of assumptions.

In the 2017 edition of the survey, 23 advisors provided one set of assumptions: of those, 21 specified a time horizon of 10 years and 2 specified a time horizon of 10 to 15 years. The remaining 12 advisors provided assumptions over both shorter-term (5 to 10 years) and longer-term (20 years or more) horizons.

Exhibit 2 below summarizes the time horizons specified by each advisor, grouped by type. Note that of the 12 advisors who provided both short-term and long-term assumptions, 11 of them are advisors to multiemployer pension plans.

Exhibit 2

Investment Time Horizons

Advisor Type	(A)	(B)	(C)	Total
10 Years	14	5	2	21
10 to 15 Years	1	1	-	2
Both Short- and Long-Term	11	-	1	12
Total	26	6	3	35

(A) Multiemployer plan investment advisor
(B) Published white paper
(C) Advisor from outside multiemployer community

Short-Term vs. Long-Term

As noted in the previous section, survey participants provided expected returns over different time horizons. Given current market conditions, many investment advisors may expect returns for certain asset classes to be different in the short term than over the long term.

For comparability, this survey groups expected returns into two time horizons: 10 years and 20 years. As pension plan actuaries, we often refer to the 10-year expected returns as "short-term" and the 20-year expected returns as "long-term." Note, however, that many investment firms consider 10-year expectations to be "long-term."

When comparing the expected returns for the 12 advisors who provided both short-term and long-term assumptions,[1] we see some interesting differences. See Exhibit 3 below. Expected returns are geometric and are generally considered to be indexed and net of fees.

Exhibit 3

Average Expected Returns: Short-Term vs. Long-Term
Subset of 12 Survey Respondents

Asset Class	10-Year Horizon	20-Year Horizon	Difference
US Equity - Large Cap	6.75%	7.83%	1.08%
US Equity - Small/Mid Cap	7.21%	8.40%	1.19%
Non-US Equity - Developed	6.93%	7.64%	0.72%
Non-US Equity - Emerging	7.96%	8.69%	0.73%
US Corporate Bonds - Core	3.52%	4.42%	0.90%
US Corporate Bonds - Long Dur.	3.65%	4.79%	1.14%
US Corporate Bonds - High Yield	5.02%	6.20%	1.18%
Non-US Debt - Developed	2.51%	3.47%	0.96%
Non-US Debt - Emerging	5.28%	6.23%	0.95%
US Treasuries (Cash Equivalents)	2.42%	3.23%	0.81%
TIPS (Inflation-Protected)	3.21%	3.98%	0.77%
Real Estate	6.20%	6.69%	0.49%
Hedge Funds	5.26%	5.97%	0.71%
Commodities	4.63%	5.02%	0.39%
Infrastructure	6.52%	7.09%	0.57%
Private Equity	9.23%	10.07%	0.84%
Inflation	2.32%	2.44%	0.12%

The 10-year and 20-year returns shown above are the averages for the 12 advisors who provided both short-term and long-term assumptions. Expected returns are annualized (geometric).

The consensus among these 12 advisors was that returns are expected to be lower in the short term compared to the long term. In general, the difference between long-term and short-term returns is more pronounced for US equity and fixed income investments.

As noted earlier, the results shown in Exhibit 3 are based on a subset of 12 advisors. If we include all 35 survey advisors, the short-term and long-term expected returns do not change dramatically. See Exhibit 4 below.

Exhibit 4

Average Expected Returns: Short-Term vs. Long-Term
All Survey Respondents

Asset Class	10-Year Horizon	20-Year Horizon	Difference
US Equity - Large Cap	6.46%	7.83%	1.37%
US Equity - Small/Mid Cap	6.90%	8.40%	1.50%
Non-US Equity - Developed	6.99%	7.64%	0.66%
Non-US Equity - Emerging	8.00%	8.69%	0.69%
US Corporate Bonds - Core	3.24%	4.42%	1.18%
US Corporate Bonds - Long Dur.	3.62%	4.79%	1.17%
US Corporate Bonds - High Yield	5.06%	6.20%	1.14%
Non-US Debt - Developed	2.18%	3.47%	1.28%
Non-US Debt - Emerging	5.30%	6.23%	0.93%
US Treasuries (Cash Equivalents)	2.27%	3.23%	0.96%
TIPS (Inflation-Protected)	2.85%	3.98%	1.13%
Real Estate	6.18%	6.69%	0.50%
Hedge Funds	4.92%	5.97%	1.05%
Commodities	4.05%	5.02%	0.97%
Infrastructure	6.67%	7.09%	0.43%
Private Equity	9.01%	10.07%	1.06%
Inflation	2.23%	2.44%	0.21%

10-year horizon results include all 35 survey respondents.
20-year horizon results include a subset of 12 survey respondents.
Expected returns are annualized (geometric).

The 10-year expected returns shown above include assumptions from all 35 advisors, while the 20-year expected returns include assumptions from only the 12 advisors who provided longer-term assumptions.

While past editions of this survey have indicated lower expected returns over the short term than over the long term, the difference appears more prounounced in this 2017 edition of the survey for many asset classes. For example, the difference between short term expected returns and long term expected returns for large cap US equity based on the average assumptions from the 2017 survey is 137 basis points. For comparison, the difference was 125 basis points based on the average assumptions from the 2016 survey.

For this reason, it may be more important than ever for the actuary to evaluate the sensitivity of funding results to short-term investment returns that are expected to be lower than the long-term assumption.

[1] In cases where an advisor indicated a time horizon shorter than 10 years, the shorter-term expected returns were combined with the longer-term expected returns to achieve a 10-year horizon. Similarly, if an advisor indicated a time horizon longer than 20 years, the longer-term expected returns were combined with the shorter-term expected returns to achieve a 20-year horizon.

Differing Opinions

Exhibit 5 below shows the distribution of expected returns and standard deviations (i.e., volatilities) for each asset class in the survey, as provided by the 35 individual advisors in the survey. Expected returns are geometric and apply to a 10-year investment horizon.[2] Average assumptions from the 2017 survey are listed in brackets for each asset class. As noted earlier, returns are assumed to be indexed and net of fees.

The exhibit below shows that there are significant differences in expected returns and standard deviations among investment advisors. As the saying goes, "reasonable people may differ."

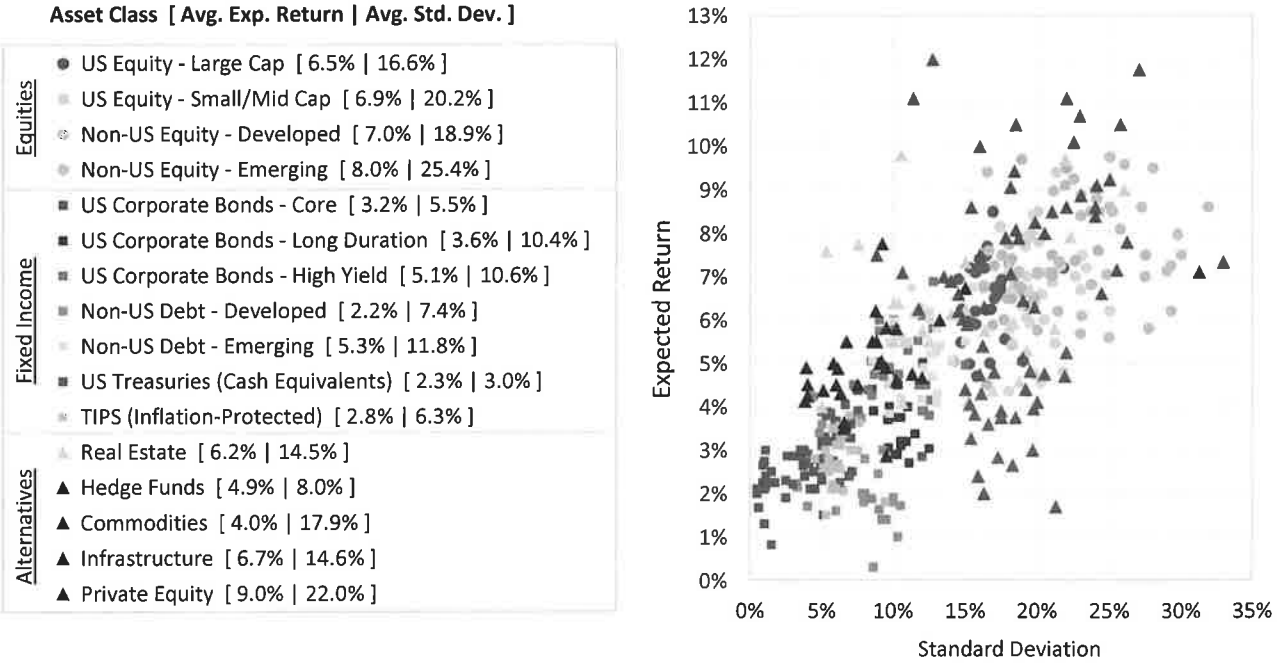
The differences in assumptions are more pronounced for alternative investments such as real estate, hedge funds, and private equity. A contributing factor may be differences in the underlying strategies different advisors apply to these alternative investments (for example, opportunistic versus defensive). To contrast, the differences in expected returns and volatilities are smaller for more traditional investments, such as US equity and US fixed income.

A summary of the average survey assumptions can be found in the appendix to this report as Exhibit 15. This summary includes expected returns, standard deviations, and a correlation matrix.

Exhibit 5

2017 Survey: Distribution of Expected Returns and Standard Deviations

10-Year Horizon | Geometric Returns



[2] The above exhibit focuses on a 10-year horizon in order to include assumptions from all 35 advisors. See Exhibit 16 in the appendix to this report for the assumptions over a 20-year horizon, based on the 12 advisors who provided longer-term assumptions. Also note that the exhibit above considers both expected returns and standard deviations. The ranges of expected returns by asset class can be found in the appendix as Exhibits 17 and 18.

Changing Outlooks: Last Five Years

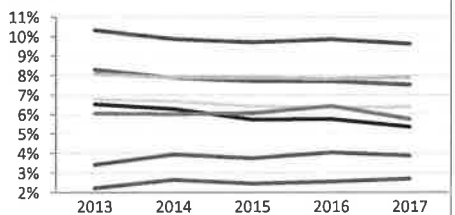
In recent years, there has been much discussion about whether it is reasonable to expect that future investment returns will be as high as they have been historically. Following the financial market collapse of 2008, economic uncertainty and historically low interest rates painted a gloomy outlook for future investment returns. Even with improving economic conditions, interest rates remain low, and concerns about future investment returns persist.

Exhibit 6 below shows average expected returns for selected asset classes each year from 2013 to 2017. For consistency, this exhibit includes only the 18 advisors who participated in the survey in each of these years.

Note that the expected returns shown below are based on a 20-year horizon for advisors who provided longer-term assumptions and a 10-year horizon for others.[3] For that reason (as well as the fact that we include only a subset of advisors), the expected returns shown below are not directly comparable with those in other sections.

Exhibit 6

Average Expected Returns: 2013 - 2017



	2013	2014	2015	2016	2017
Private Equity	10.3%	9.9%	9.7%	9.9%	9.6%
US Eq. (Large Cap)	8.3%	7.9%	7.7%	7.7%	7.5%
Non-US Eq. (Dev)	8.1%	7.9%	7.9%	7.8%	7.9%
Real Estate	6.8%	6.7%	6.4%	6.3%	6.4%
Hedge Funds	6.5%	6.3%	5.7%	5.7%	5.4%
US Bonds (HY)	6.0%	6.0%	6.1%	6.4%	5.7%
US Bonds (Core)	3.4%	3.9%	3.7%	4.0%	3.9%
US Treasuries	2.2%	2.6%	2.4%	2.5%	2.7%

Figures are average geometric returns for selected asset classes for the 18 advisors who participated in each of the surveys from 2013 through 2017.

For this subset of advisors, average expected returns for equity-type investments such as private equity, large cap US equity, and non-US developed equity, have generally decreased over the last five years. Most of the decrease occurred between 2013 and 2015 and changes from 2015 to 2017 appear to be more modest.

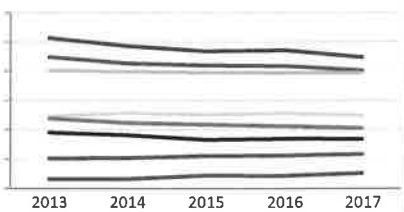
Average expected returns for alternative investment classes such as real estate and hedge funds behaved similarly with significant decreases from 2013 to 2015 and relative stabilization from 2015 to 2017.

Perhaps the most notable change from 2016 to 2017 was the decline in expected returns for high-yield US bonds. Over the course of only one year, expectations decreased by about 70 basis points, from 6.4% to 5.7%.

In addition to expected returns, it is also important to consider expected volatility of the returns, measured by standard deviations. Average standard deviations over the last five years are shown in Exhibit 7 below.

Exhibit 7

Average Standard Deviations: 2013 - 2017



	2013	2014	2015	2016	2017
Private Equity	25.7%	24.3%	23.4%	23.6%	22.3%
US Eq. (Large Cap)	22.4%	21.3%	21.0%	20.9%	20.1%
Non-US Eq. (Dev)	20.1%	19.9%	19.8%	19.7%	19.7%
Real Estate	12.4%	12.8%	12.6%	12.8%	12.4%
Hedge Funds	9.5%	9.1%	8.3%	8.4%	8.4%
US Bonds (HY)	11.9%	11.2%	10.9%	10.6%	10.3%
US Bonds (Core)	5.1%	5.2%	5.6%	5.6%	5.8%
US Treasuries	1.6%	1.6%	2.2%	2.1%	2.6%

Figures are average standard deviations for selected asset classes for the 18 advisors who participated in each of the surveys from 2013 through 2017.

In general, average standard deviations have decreased from 2013 to 2017. This may be related to the decrease in average expected returns over the same period as investments with lower expected returns are often less volatile than investments with higher expected returns. This trend of decreasing standard deviations is most apparent for asset classes with higher risk premiums such as private equity, large cap US equity, and high yield US bonds.

On the contrary, average standard deviations have increased for investments whose returns are more closely tied to interest rates such as core US bonds and US treasuries. This may indicate greater uncertainty about the timing of future changes in interest rates or the rate at which those rates are expected to change.

[3] Of the 12 survey advisors who provided both shorter-term and longer-term assumptions, 10 of them indicated no difference in the standard deviations of the expected returns over the short term versus the long term. For the other 2 advisors, the differences between short-term and long-term standard deviations were very minor.

Evaluating the Return Assumption

Multiemployer pension plans are usually invested in a well-diversified mix of stocks, bonds, real estate, and alternative investments structured to meet the goals of the Trustees. This typically involves maximizing returns over the long term while minimizing return volatility.

The actuary of a multiemployer pension plan must evaluate the plan's asset allocation and, based on expectations of future returns, develop an assumption for what plan assets are projected to earn over the long term. This assumption is then used (along with others) to determine the actuarial present value of the benefits promised by the plan to its participants and beneficiaries.

The actuary will often rely on the future return expectations of the plan's investment advisor in developing the plan's investment return assumption. However, as noted earlier, different investment advisors often have widely differing opinions on what future returns will be. Therefore, it can be beneficial to keep in mind other advisors' expectations when setting the investment return assumption.

In the following exhibits, we will evaluate the investment return assumption for a hypothetical multiemployer pension plan. Exhibit 8 below shows the asset allocation for this hypothetical plan. The asset allocations are arbitrary, except for the fact that we made sure to include at least a small allocation to every asset class in the survey.

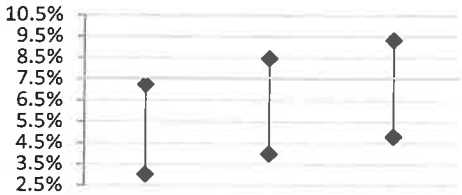
Exhibit 8

Hypothetical Multiemployer Plan	
Asset Class	**Weight**
US Equity - Large Cap	20.0%
US Equity - Small/Mid Cap	10.0%
Non-US Equity - Developed	7.5%
Non-US Equity - Emerging	5.0%
US Corporate Bonds - Core	7.5%
US Corporate Bonds - Long Duration	2.5%
US Corporate Bonds - High Yield	5.0%
Non-US Debt - Developed	5.0%
Non-US Debt - Emerging	2.5%
US Treasuries (Cash Equivalents)	5.0%
TIPS (Inflation-Protected)	5.0%
Real Estate	10.0%
Hedge Funds	5.0%
Commodities	2.5%
Infrastructure	2.5%
Private Equity	5.0%
TOTAL PORTFOLIO	**100.0%**

Exhibit 9 shows expected annualized (geometric) returns for the hypothetical plan over a 10-year horizon. These results may be appropriate for modeling sensitivities of future funding results to short-term investment returns, or for evaluating the return assumption for a plan with severely negative cash flows or solvency issues.

Exhibit 9

Annualized Expected Returns
Hypothetical Multiemployer Pension Fund
10-Year Horizon

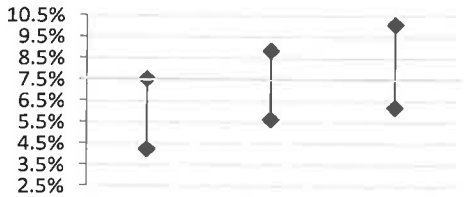


	Conservative Advisor	Survey Average	Optimistic Advisor
◆ 75th percentile	7.20%	8.42%	9.28%
◆ 25th percentile	2.98%	3.94%	4.76%
Probability of Meeting or Exceeding:			
8.00% per Year	17.6%	29.2%	38.5%
7.50% per Year	22.1%	34.6%	44.3%
7.00% per Year	27.1%	40.3%	50.3%

Exhibit 10 shows expected annualized (geometric) returns for the hypothetical plan over a 20-year horizon based on assumptions from the 12 advisors who provided longer-term assumptions. These results may be more appropriate for evaluating the return assumption for an ongoing plan with no projected solvency issues.

Exhibit 10

Annualized Expected Returns
Hypothetical Multiemployer Pension Fund
20-Year Horizon



	Conservative Advisor	Survey Average	Optimistic Advisor
◆ 75th percentile	7.56%	8.89%	10.12%
◆ 25th percentile	4.29%	5.67%	6.24%
Probability of Meeting or Exceeding:			
8.00% per Year	19.7%	38.1%	52.5%
7.50% per Year	25.8%	46.3%	59.4%
7.00% per Year	32.9%	54.6%	66.0%

Evaluating the Return Assumption (cont)

It is important to keep in mind that the expected returns shown in Exhibits 9 and 10 apply only to the hypothetical asset allocation shown in Exhibit 8. The expected returns will be different – perhaps significantly – for different asset allocations.

Exhibit 13 in the appendix to this report shows more detail regarding the derivation of the expected returns for this hypothetical pension plan.

The following are points to consider when reviewing the results in Exhibits 9 and 10:

Reasonable Range: When setting the investment return assumption for pension valuations, actuaries traditionally constructed a "reasonable range" of assumptions and then selected a best-estimate point within that range. Actuaries would often consider the reasonable range to be the middle 50 percent of possible results, bounded by the 25th and 75th percentiles.

The applicable actuarial standards of practice were updated in 2013, and the new standards de-emphasize use of the reasonable range when setting the investment return assumption. Nevertheless, considering this range remains instructive; it may be difficult for an actuary to justify an assumption outside of this range.

Based on the average assumptions in this 2017 survey, the middle 50 percent range for this hypothetical pension plan is very wide: 5.67% to 8.89% over the next 20 years. Note that the reasonable range is even wider for a 10-year horizon: 3.94% to 8.42%. This is due to the fact that, while returns may be volatile from one year to the next, deviations will be lower when returns are annualized (in other words, smoothed out) over longer horizons.

Probability of Meeting/Exceeding the Benchmark: For example, say that the actuary for this hypothetical pension plan expects its investment returns to be 7.50% per year, represented by the gold lines in Exhibits 9 and 10. Based on the average assumptions in this 2017 survey, there is a 46.3% probability the plan will meet or beat its 7.50% benchmark on an annualized basis over a 20-year period. The probability is lower, 34.6%, that the plan will meet or beat its benchmark over the next 10 years.

Also note that over a 20-year period, the probability that the annualized investment return will exceed 8.00% (arbitrarily, 50 basis points above the benchmark return) is 38.1%. The probability that the annualized return will exceed 7.00% (50 basis points below the benchmark) is 54.6%. These probabilities are a bit lower when focusing on a 10-year horizon rather than a 20-year horizon.

Optimistic and Conservative Assumptions: As previously noted, different investment advisors have sometimes widely varying future capital market expectations. Therefore, it may also be interesting to consider the range of expected returns based on the assumptions provided by the most conservative and most optimistic advisors in the survey.

For this hypothetical asset allocation, the assumptions from the most conservative advisor indicate that the probability of beating the 7.50% benchmark assumption over the next 20 years is 25.8%. Using assumptions from the most optimistic advisor results in a probability of 59.4%. Again, reasonable people may differ.

Limitations: The following are some important limiting factors to keep in mind when reviewing these results:

- The asset classes in this survey do not always align perfectly with the asset classes provided by the investment advisors. Adjustments were made to standardize the different asset classes provided by each of the advisors.
- Many of the advisors develop their future assumptions based on investment horizons of no more than 10 years, and some returns are generally expected to be lower in the short term. The typical multiemployer pension plan will have an investment horizon that is much longer than 10 years.
- The return expectations included in the survey are based on indexed returns. In other words, they do not reflect any additional returns that may be earned due to active asset managers outperforming the market ("alpha"), net of investment expenses.
- The return expectations do not adjust for plan size. Specifically, they do not take into account the fact that certain investment opportunities are more readily available to larger plans, as well as the fact that larger plans may often receive more favorable investment fee arrangements than smaller plans.
- The ranges of expected annualized returns were constructed using basic, often simplified, formulas and methodologies. More sophisticated investment models – which may consider various economic scenarios, non-normal distributions, etc. – could produce significantly different results.

In most cases, adjustments made to account for these limitations tended to slightly lower the expected returns in the survey, for the sake of conservatism.

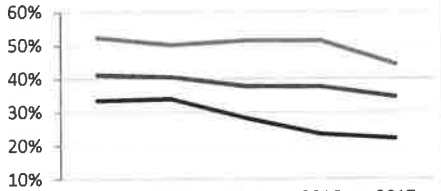
Comparison with Prior Surveys

Exhibits 6 and 7 showed how expected returns and standard deviations for certain asset classes have changed over the past few years. Similarly, Exhibits 11 and 12 below show how return expectations for the hypothetical multiemployer pension plan whose asset allocation is shown in Exhibit 8 have changed from 2013 to 2017. (Note that 2013 was the first year this survey developed separate 10-year and 20-year expected returns.)

Both exhibits show the probabilities that the hypothetical pension plan will meet or exceed its 7.50% benchmark return on an annualized basis over the given time horizon. Exhibit 11 focuses on expected returns over a 10-year period, and Exhibit 12 focuses on expected returns over a 20-year period. Probabilities are shown for the survey average for each year from 2013 through 2017. For comparison, probabilities are also shown for the most conservative and optimistic advisors in each survey.

Exhibit 11

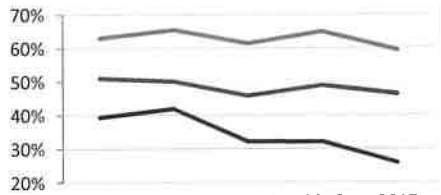
Probability of Meeting 7.50% Benchmark
Hypothetical Multiemployer Pension Fund
10-Year Horizon



Survey Year	2013	2014	2015	2016	2017
Most Optimistic	52.4%	50.2%	51.5%	51.4%	44.3%
Survey Average	41.2%	40.6%	37.8%	37.7%	34.6%
Most Conservative	33.6%	34.0%	28.2%	23.4%	22.1%

Exhibit 12

Probability of Meeting 7.50% Benchmark
Hypothetical Multiemployer Pension Fund
20-Year Horizon



Survey Year	2013	2014	2015	2016	2017
Most Optimistic	63.0%	65.4%	61.4%	64.8%	59.4%
Survey Average	51.0%	50.0%	45.7%	48.8%	46.3%
Most Conservative	39.4%	41.9%	32.1%	32.0%	25.8%

As shown in Exhibits 11 and 12, the probabilities that this hypothetical pension plan would meet or beat a benchmark return of 7.50% have generally decreased from 2013 to 2017. The decrease is more pronounced when considering a 10-year horizon versus a 20-year horizon.

For example:

- Based on the average assumptions from the 2017 survey, the probability of this hypothetical plan meeting or exceeding an annualized return of 7.50% over the next 10 years is 34.6%. For comparison, the probability was considerably higher (41.2%) five years ago when the 2013 survey was conducted.

- Based on the average assumptions from the 2017 survey, the probability of this hypothetical plan meeting or exceeding an annualized return of 7.50% over the next 20 years is 46.3%. While the probability was somewhat higher (51.0%) based on the average assumptions from 2013, longer-term expectations have remained more stable over time than shorter-term expectations.

Other points of note when comparing the results from the 2017 survey to those from prior years:

- The results for the most conservative advisor in each survey from 2013 through 2017 have changed more dramatically than the results for the survey average and the most optimistic advisors. Based on the assumptions of the most conservative advisor in the 2013 survey, the probability of this hypothetical plan meeting or exceeding its 7.50% benchmark over the next 20 years was 39.4%. This can be compared to a probability of only 25.8% for the most conservative advisor in the 2017 survey.

- The results for the most optimistic advisor in each survey have generally remained more stable over the past five years, though there was a significant decrease in the probability of meeting the 7.50% benchmark over a 10-year horizon based on the assumptions of the most optimistic advisor in the 2017 survey. The probability of meeting the benchmark based on the assumptions of the most optimistic advisor in each survey from 2013 to 2016 was at least 50.0%, compared to only a 44.3% chance using the assumptions of the most optimistic advisor in 2017.

- Note that the most conservative and most optimistic advisors are not necessarily the same from year to year.

Glossary

The following are basic definitions of some of the investment terminology used in this report.

Expected Return

The *expected return* is the amount, as a percentage of assets, that an investment is expected to earn over a period of time. Expected returns presented in this survey are generally assumed to be indexed and net of fees.

Arithmetic vs. Geometric Returns

The *arithmetic* return is the average return in any one year; in other words, it has a one-year investment horizon. A *geometric* return is the annualized return over a multi-year period. In general, when evaluating expected returns over multi-year horizons, it is more appropriate to focus on geometric returns. However, arithmetic returns are also important. For example, the expected return of a portfolio is calculated as the weighted average of arithmetic returns, not geometric returns.

This survey focuses on geometric returns. Many advisors provide both arithmetic and geometric expected returns. For advisors who provided expected returns only on an arithmetic basis, we converted them to geometric returns for consistency. The following formula was used in making this conversion.

$$E[R_G] = ((1 + E[R_A])^2 - VAR[R])^{1/2} - 1$$

In this formula, $E[R_G]$ is the expected geometric return, $E[R_A]$ is the expected arithmetic return, and VAR[R] is the variance of the expected annual return.

Standard Deviation

The *standard deviation* is a measure of the expected volatility in the returns. Generally, the standard deviation expresses how much returns may vary in any one year. Assuming that returns are "normally distributed," there is about a 68% probability that the actual return for a given year will fall within one standard deviation (higher or lower) of the expected return. There is about a 95% probability that the actual return will fall within two standard deviations of the expected return.

Correlation

An important aspect of capital market assumptions is the degree to which the returns for two different asset classes move in tandem with one another: this is their *correlation*. For example, if two asset classes are perfectly correlated, their correlation coefficient will be 1.00; in other words, if one asset class has a return of X% in a given market environment, then the other asset class is expected to also have a return of X%. A portfolio becomes better diversified as its asset classes have lower (or even negative) correlations with each other.

Methodology

The following is a high-level description of the methodology used in compiling the survey results.

Standardized Asset Classes

Not all investment advisors use the same asset classes when developing their capital market assumptions. Some are very specific (more asset classes), while others keep things relatively simple (fewer asset classes).

We exercised judgment in classifying each advisor's capital market assumptions into a standard set of asset classes. In the event that an advisor did not provide assumptions for a given asset class, the average assumptions from the other advisors was used when developing expected returns for that advisor.

Investment Horizons

This survey considers "short-term" expected returns to apply to a 10-year investment horizon, and "long-term" expected returns to apply to a 20-year horizon.

In this 2017 edition of the survey, 23 of the 35 advisors provided only short-term assumptions, indicating a horizon of no more than 10 years. Included in this group are 2 advisors who provided assumptions over a horizon of 10 to 15 years.

All 12 advisors who provided long-term assumptions over horizons of 20 years or more also provided short-term assumptions. In cases where such an advisor indicated a horizon shorter than 10 years, the shorter-term expected returns were combined with the longer-term expected returns to achieve a 10-year horizon. If an advisor indicated a time horizon longer than 20 years, the longer-term expected returns were combined with the shorter-term expected returns to achieve a 20-year horizon.

No Adjustment for Alpha

No adjustment was made to reflect the possible value added by an active investment manager outperforming market returns (earning "alpha").

Normally-Distributed Returns

This survey assumes that investment returns will be normally distributed according to the capital market assumptions provided. The survey also assumes that the investment return in one year does not affect the investment return in the following year.

Equal Weighting

Each advisor was given equal weight in developing the average assumptions for the survey, regardless of factors such as total assets under advisement, number of clients in common with Horizon Actuarial, etc.

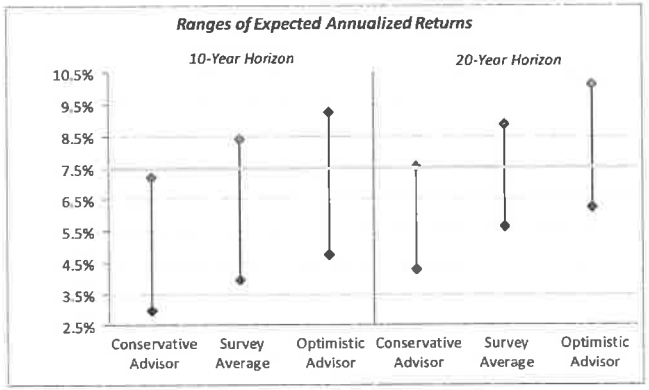
Exhibit 13

The following exhibit evaluates the investment return assumption for a hypothetical multiemployer pension plan. It reflects the same hypothetical asset allocation as shown in Exhibit 8, and it provides more detail than Exhibits 9 and 10. Note that the most conservative and optimistic advisors for the 10-year horizon are not necessarily the same as the most conservative and optimistic advisors for the 20-year horizon. This hypothetical pension plan has a benchmark return of 7.50% per year, which is indicated by the gold line in the exhibit below.

Hypothetical Multiemployer Plan
2017 Survey of Capital Market Assumptions

Asset Class	Portfolio Weight	*Average Survey Assumptions* 10-Year Horizon	20-Year Horizon	Standard Deviation
US Equity - Large Cap	20.0%	6.46%	7.83%	16.58%
US Equity - Small/Mid Cap	10.0%	6.90%	8.40%	20.22%
Non-US Equity - Developed	7.5%	6.99%	7.64%	18.86%
Non-US Equity - Emerging	5.0%	8.00%	8.69%	25.42%
US Corporate Bonds - Core	7.5%	3.24%	4.42%	5.50%
US Corporate Bonds - Long Duration	2.5%	3.62%	4.79%	10.44%
US Corporate Bonds - High Yield	5.0%	5.06%	6.20%	10.61%
Non-US Debt - Developed	5.0%	2.18%	3.47%	7.36%
Non-US Debt - Emerging	2.5%	5.30%	6.23%	11.79%
US Treasuries (Cash Equivalents)	5.0%	2.27%	3.23%	2.97%
TIPS (Inflation-Protected)	5.0%	2.85%	3.98%	6.32%
Real Estate	10.0%	6.18%	6.69%	14.52%
Hedge Funds	5.0%	4.92%	5.97%	8.00%
Commodities	2.5%	4.05%	5.02%	17.89%
Infrastructure	2.5%	6.67%	7.09%	14.55%
Private Equity	5.0%	9.01%	10.07%	21.98%
Inflation	N/A	2.23%	2.44%	1.72%
TOTAL PORTFOLIO	**100.0%**	*Expected returns are geometric.*		

	10-Year Horizon Conservative Advisor	Survey Average	Optimistic Advisor	*20-Year Horizon* Conservative Advisor	Survey Average	Optimistic Advisor
Expected Returns						
Average Annual Return (Arithmetic)	5.55%	6.70%	7.55%	6.48%	7.81%	8.94%
Annualized Return (Geometric)	5.09%	6.18%	7.02%	5.93%	7.28%	8.18%
Annual Volatility (Standard Deviation)	9.90%	10.50%	10.60%	10.87%	10.66%	12.84%
Range of Expected Annualized Returns						
◆75th Percentile	7.20%	8.42%	9.28%	7.56%	8.89%	10.12%
◆25th Percentile	2.98%	3.94%	4.76%	4.29%	5.67%	6.24%
Probabilities of Exceeding Certain Returns						
8.00% per Year, Annualized	17.6%	29.2%	38.5%	19.7%	38.1%	52.5%
7.50% per Year, Annualized	22.1%	34.6%	44.3%	25.8%	46.3%	59.4%
7.00% per Year, Annualized	27.1%	40.3%	50.3%	32.9%	54.6%	66.0%



Considerations and Limitations

- Allocations may be approximated if certain asset classes are not included in the survey.
- Many investment advisors provided only shorter-term assumptions (10 years or less).
- Assumptions are based on indexed returns and do not reflect anticipated alpha.
- Assumptions do not reflect investment opportunities or fee considerations available to larger funds.

SOURCE: Horizon Actuarial 2017 Survey of Capital Market Assumptions

Expected returns over a 10-year horizon include all 35 survey participants.

Expected returns over a 20-year horizon are based a subset of 12 survey participants who provided longer-term assumptions.

Exhibit 14

The following exhibit shows the distribution of expected annualized returns and annual standard deviations for the same hypothetical asset allocation that is shown in Exhibit 13. The expected annualized return and annual standard deviation of the hypothetical asset allocation is shown separately for each advisor who participated in the survey. Individual advisors are grouped by type and investment horizon, and the survey average assumptions are shown in red. The exhibit shows that there are a wide variety of investment return assumptions that could be considered to be reasonable for any given asset allocation.

2017 Survey: Distribution of Expected Portfolio Returns and Standard Deviations by Advisor

Hypothetical Plan Allocation | Geometric Returns

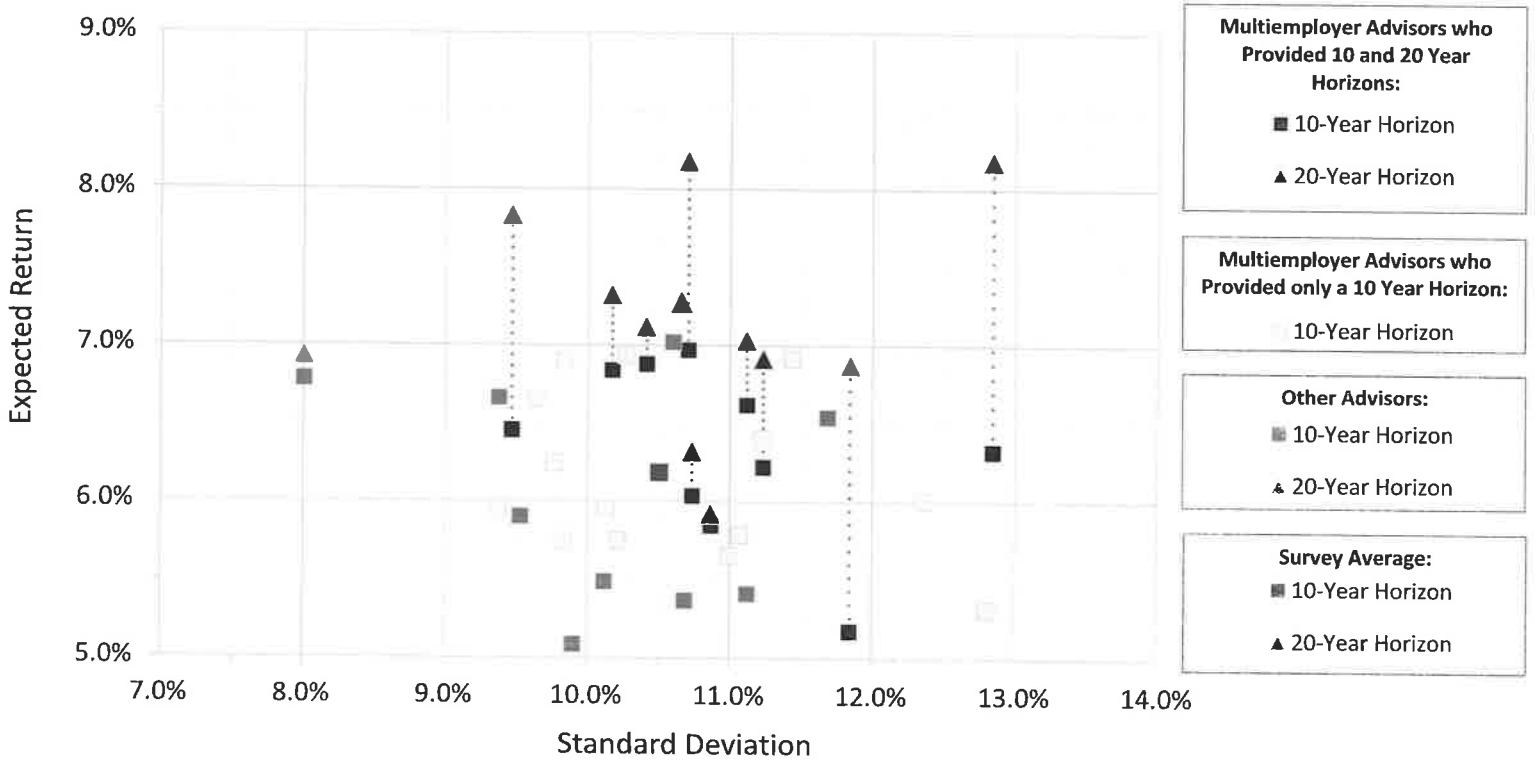


Exhibit 15

The following exhibit provides the average capital market assumptions for all 35 investment advisors in the 2017 survey. Each of the 35 advisors was given equal weight in determining the average assumptions. For reference, expected returns are shown over 10-year and 20-year horizons. Expected returns are also provided on both an arithmetic basis (one-year average) and geometric basis (multi-year annualized). The standard deviations (volatilities) and correlations apply to both arithmetic and geometric expected returns.

Horizon Actuarial 2017 Survey of Capital Market Assumptions

Average Survey Assumptions

		Expected Returns				
		10-Year Horizon		20-Year Horizon		Standard
	Asset Class	Arith.	Geom.	Arith.	Geom.	Deviation
1	US Equity - Large Cap	7.76%	6.46%	9.12%	7.83%	16.58%
2	US Equity - Small/Mid Cap	8.81%	6.90%	10.33%	8.40%	20.22%
3	Non-US Equity - Developed	8.66%	6.99%	9.42%	7.64%	18.86%
4	Non-US Equity - Emerging	10.99%	8.00%	11.83%	8.69%	25.42%
5	US Corporate Bonds - Core	3.40%	3.24%	4.59%	4.42%	5.50%
6	US Corporate Bonds - Long Duration	4.16%	3.62%	5.40%	4.79%	10.44%
7	US Corporate Bonds - High Yield	5.61%	5.06%	6.80%	6.20%	10.61%
8	Non-US Debt - Developed	2.48%	2.18%	3.74%	3.47%	7.36%
9	Non-US Debt - Emerging	5.97%	5.30%	6.96%	6.23%	11.79%
10	US Treasuries (Cash Equivalents)	2.34%	2.27%	3.25%	3.23%	2.97%
11	TIPS (Inflation-Protected)	3.05%	2.85%	4.22%	3.98%	6.32%
12	Real Estate	7.28%	6.18%	7.82%	6.69%	14.52%
13	Hedge Funds	5.26%	4.92%	6.33%	5.97%	8.00%
14	Commodities	5.60%	4.05%	6.53%	5.02%	17.89%
15	Infrastructure	7.70%	6.67%	8.28%	7.09%	14.55%
16	Private Equity	11.33%	9.01%	12.59%	10.07%	21.98%
	Inflation	2.24%	2.23%	2.44%	2.44%	1.72%

Correlation Matrix

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	1.00															
2	0.88	1.00														
3	0.81	0.75	1.00													
4	0.72	0.69	0.79	1.00												
5	0.13	0.08	0.14	0.13	1.00											
6	0.11	0.06	0.13	0.12	0.86	1.00										
7	0.62	0.61	0.61	0.63	0.36	0.31	1.00									
8	0.15	0.09	0.30	0.22	0.56	0.51	0.21	1.00								
9	0.55	0.50	0.59	0.68	0.45	0.40	0.61	0.39	1.00							
10	(0.10)	(0.13)	(0.08)	(0.08)	0.35	0.34	(0.05)	0.23	0.10	1.00						
11	0.06	0.03	0.12	0.19	0.69	0.57	0.29	0.47	0.41	0.35	1.00					
12	0.43	0.43	0.39	0.34	0.07	0.09	0.32	0.05	0.24	0.01	0.11	1.00				
13	0.62	0.61	0.64	0.64	0.17	0.09	0.56	0.10	0.47	(0.08)	0.16	0.32	1.00			
14	0.32	0.31	0.41	0.45	0.09	0.03	0.35	0.21	0.35	(0.02)	0.27	0.22	0.43	1.00		
15	0.51	0.47	0.52	0.47	0.23	0.19	0.46	0.28	0.42	(0.04)	0.18	0.27	0.42	0.31	1.00	
16	0.73	0.71	0.70	0.65	0.04	0.01	0.51	0.07	0.45	(0.10)	0.02	0.40	0.62	0.33	0.45	1.00

SOURCE: Horizon Actuarial 2017 Survey of Capital Market Assumptions

Expected returns over a 10-year horizon include all 35 survey participants.

Expected returns over a 20-year horizon are based a subset of 12 survey participants who provided longer-term assumptions.

Exhibit 16

Earlier in this report, Exhibit 5 showed the distribution of expected returns and standard deviations over an investment horizon of 10 years. The exhibit below shows the same distribution, but for a horizon of 20 years. Note that while Exhibit 5 included assumptions for all 35 advisors in the survey, the exhibit below includes only assumptions for the 12 advisors who provided longer-term assumptions (horizons of 20 years or more).

2017 Survey: Distribution of Expected Returns and Standard Deviations

20-Year Horizon | Geometric Returns

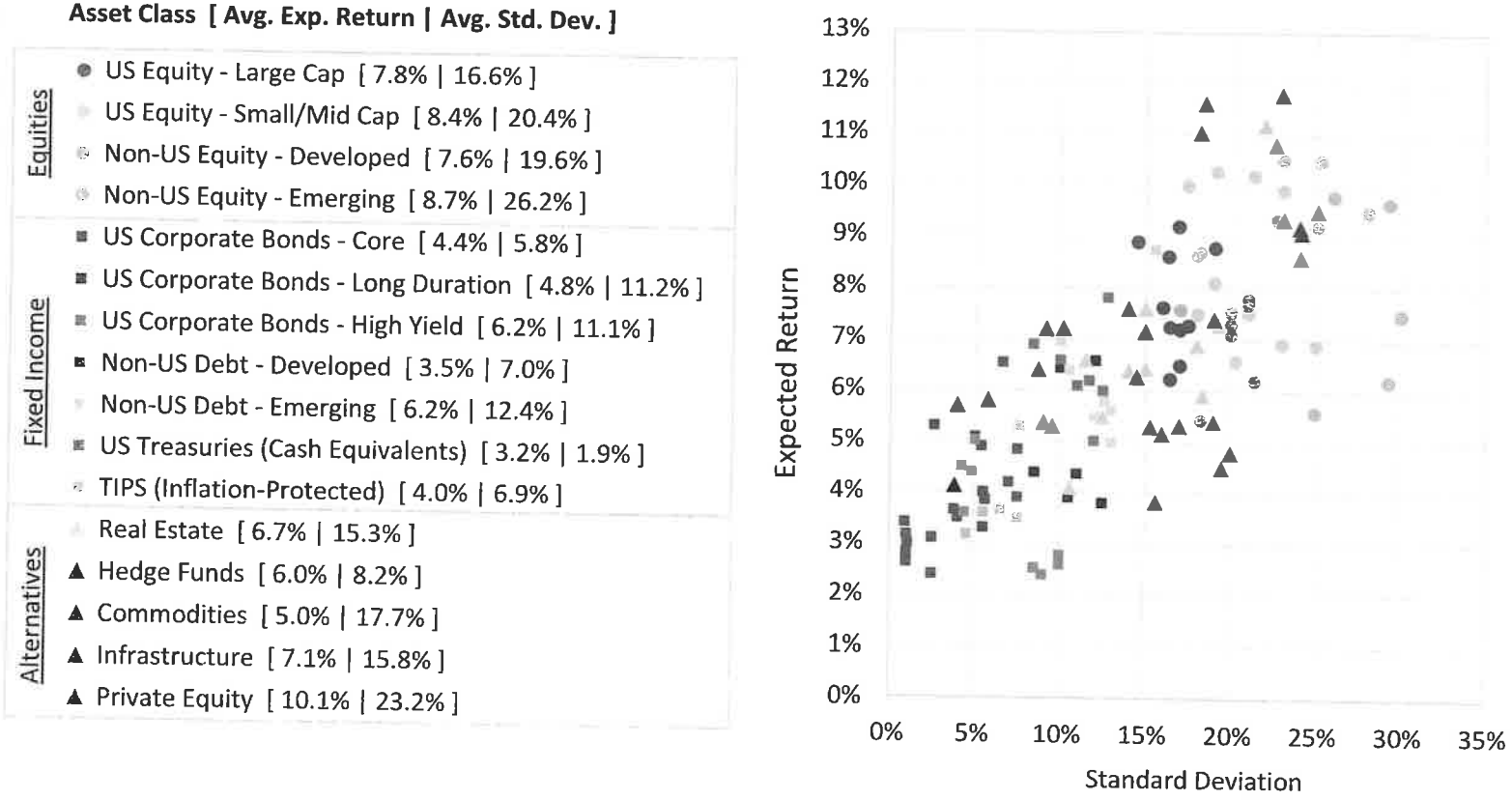
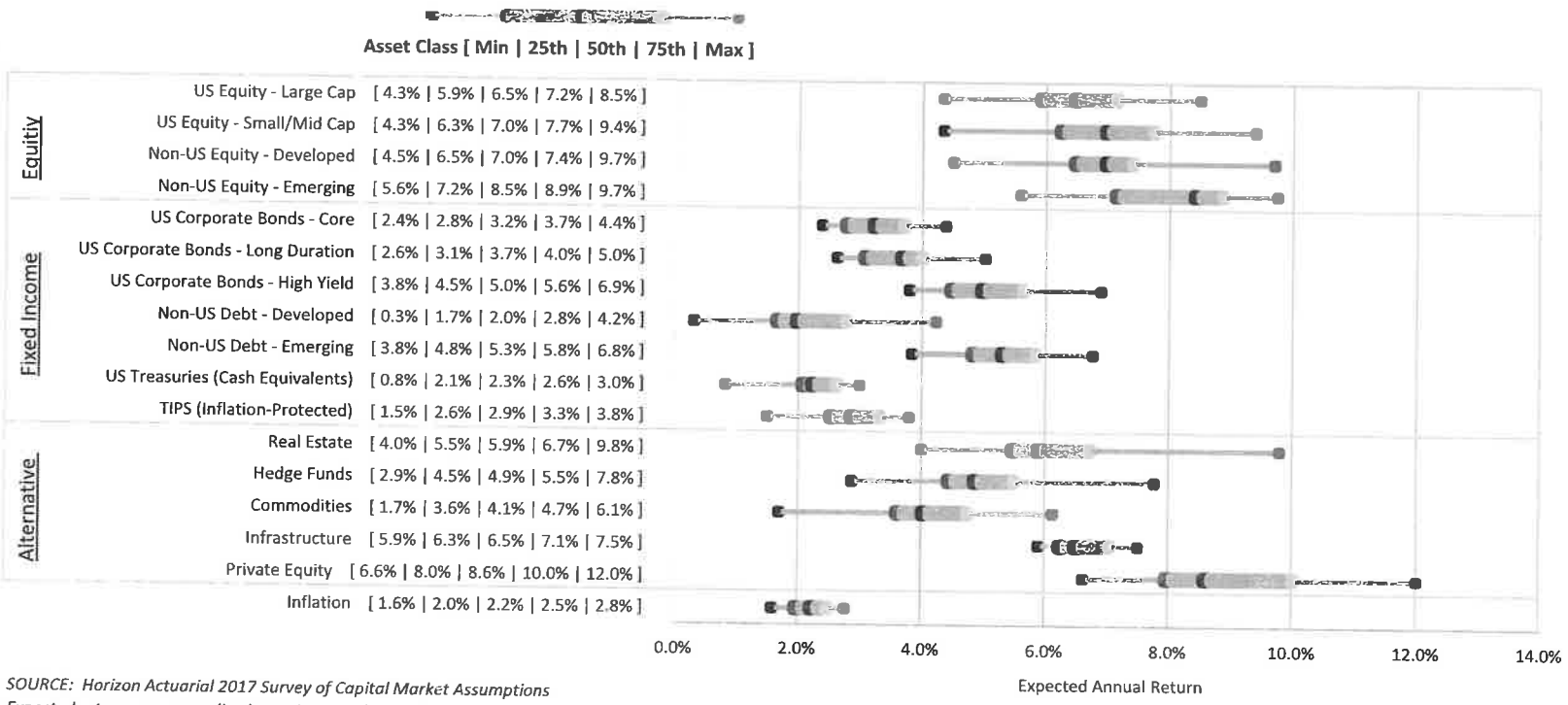


Exhibit 17

The exhibit below shows the ranges of expected annual returns for different asset classes over a 10-year investment horizon. The ranges shown below include assumptions for all the 35 advisors in the 2017 survey. Expected returns shown below are annualized (geometric).

To illustrate the distribution of expected returns, the exhibit shows the range of the middle 50 percent of results: the range between the 25th and 75th percentiles. It also shows the median expected return for each asset class: the 50th percentile. Note that the expected returns for the *median* advisor shown below are not the same as the *average* expected returns shown elsewhere in the report. In most cases, however, the differences between median and average expected returns are relatively small.

2017 Survey: Expected Returns by Asset Class (10-Year Horizon)



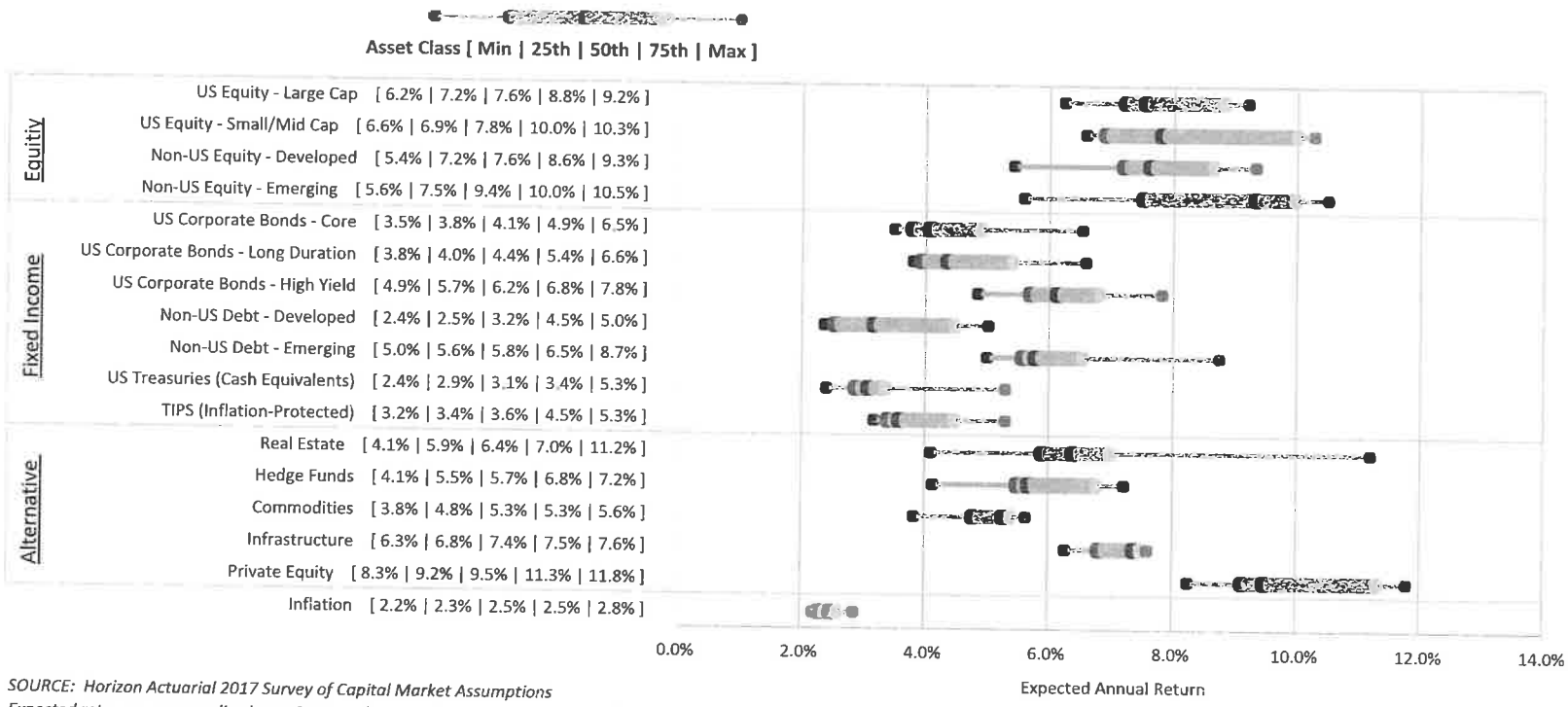
SOURCE: Horizon Actuarial 2017 Survey of Capital Market Assumptions
Expected returns are annualized over 10 years (geometric).

Exhibit 18

The exhibit below shows the ranges of expected annual returns for different asset classes over a 20-year investment horizon. The ranges shown below are based on the assumptions for 12 advisors who provided longer-term assumptions (horizons of 20 years or more). Expected returns shown below are annualized (geometric). Note that the ranges of expected returns are somewhat narrower when the investment horizon is longer.

To illustrate the distribution of expected returns, the exhibit shows the range of the middle 50 percent of results: the range between the 25th and 75th percentiles. It also shows the median expected return for each asset class: the 50th percentile. Note that the expected returns for the *median* advisor shown below are not the same as the *average* expected returns shown elsewhere in the report. In most cases, however, the differences between median and average expected returns are relatively small.

2017 Survey: Expected Returns by Asset Class (20-Year Horizon)



SOURCE: Horizon Actuarial 2017 Survey of Capital Market Assumptions
Expected returns are annualized over 20 years (geometric), based on a subset of 12 advisors who provided longer term assumptions.