Pension Asset-Liability Study: Initial Results

Florida State Board of Administration
February 2017

Aon Hewitt
Retirement and Investment

Investment advice and consulting services provided by Aon Hewitt Investment Consulting, Inc., an Aon Company.
Table of Contents

- Executive Summary
- Overview
  - Asset-Liability Management Background
  - Asset-Liability Profile
- Analysis
  - Investment Analysis
  - Asset-Liability Projection Analysis
  - Public Pension Peer Comparison
- Summary & Conclusions
- Appendix
Executive Summary
Executive Summary

We believe the current portfolio is well-constructed with 81% return-seeking assets.

The equity risk premium is 3.72%, compared to 3.94% from 2016.

Asset returns are not expected to keep pace with the actuarial assumed rate of return (7.60%).

Expected real return of 4.52% falls short of the investment policy target of 5.00%.

The funded ratio is projected to trend toward full funding over the course of the projection period.

Higher return-seeking strategies trend closer to full funding but with greater risk.

Longer time horizons are expected to reward higher levels of risk; shorter time horizons reward risk less.

Adverse market experience could significantly impact the funded status of the Plan over the projection period.
Overview

- Asset-Liability Management Background
Scope of Project

- Annual Asset-Liability Management (ALM) review and update
  - 30 year asset-liability projection analysis
  - Review stochastic risk/reward results
  - Review multiple portfolio strategies
Asset-Liability Management Background
What is an Asset-Liability Study?

- Provides fiduciaries with an understanding of the dynamic relationship between plan assets and liabilities over time

- Illustrates the impact of various asset allocation targets on required contributions and funded status under a range of different macro-economic scenarios

- Identifies future trends in the financial health of the plan based on economic uncertainties that may not be evident from an actuarial valuation, which provides only a snapshot at a point in time

- Helps determine the level of risk that is appropriate in the context of the Plan’s liabilities

An asset-liability study provides the tools to align a plan’s risk taking with its liabilities
Asset-Liability Management Background
Balance of Liabilities and Assets

PENSION PLAN

+ New Benefit Accrual  + Liability Return
- Benefit Payments

+ Cash Contributions  + Asset Return

Balance of Liabilities and Assets

Liabilities

Assets

- Benefit Payments
<table>
<thead>
<tr>
<th>Types of Risk</th>
<th>Time Horizon</th>
<th>Risk Management Tools and Controls</th>
</tr>
</thead>
</table>
| Return Shortfall     | Long-Term (10+ years) | • Funding policy  
• Plan design  
• Investment policy  
• Assumptions & methods |
| Liquidity            | Short- to Medium-Term (<5 years) | • Funding policy  
• Benefit accruals  
• Use of Illiquid investments  
• Scenario analysis  
• Monitoring |
| Investment           | Short-to Medium-Term (<5 years) | • Investment policy statement  
– Static/dynamic  
– Asset allocation  
– Rebalancing  
– Manager guidelines  
– Monitoring/roles & responsibilities  
• Risk budgeting  
• Monitoring / dashboards  
• Medium term views  
• Regression and scenario analysis |
Asset-Liability Management Background
Overview of the Asset-Liability Study Process

Planning Discussions
- Planning
  - Objectives of the Study
  - Modeling and Liability Assumptions
- Risk Tolerance
  - Risk Preference
  - Demographics
  - Funded Status
  - Business/Financial
  - Industry Practices

Asset-Liability Projections
- Asset Modeling
  - Capital Market Analysis
  - Efficient Frontier Analysis
  - Portfolios for Study
- Liability Analysis
  - Cost Projections
  - Funded Status
  - Sensitivity Analysis

Desired Outcomes:
- Understand the pension risk
- Identify optimal investment strategy

Implementation

Monitoring & Execution
Asset-Liability Management Background
Modeling Process

- Goals of an asset-liability study:
  - Understand the pension plan’s asset-liability risk, and
  - Identify the optimal investment strategies

- Stochastic, Monte Carlo simulation analysis used
  - 5,000 independent economic trials
  - Building block approach
    - Starts with inflation and interest rates
    - Using a multi-factor regression analysis, other asset classes are then modeled
  - Assets and liabilities are modeled over the projection period
    - Projections include contribution requirements and funded ratios

- Asset-liability studies are best-suited to determine the optimal mix of return-seeking (e.g., equity) and fixed income assets for the pension fund
  - Asset mix is the single most important investment decision for the plan sponsor
    - Is it worthwhile to have a more aggressive allocation in order to reduce long term cost in exchange for risk of higher costs in a bad outcome?
    - Is it worthwhile to have a more conservative allocation in order to have a more predictable cost in exchange for potentially higher average costs?
Asset-Liability Management Background
Mechanics of Asset-Liability Modeling Process

- Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Asset Mix
- Demographics
- Plan Design
- Actuarial Assumptions

Inflation
- Interest Rate
- Duration
- Discount Rate
- Salary Increase

Portfolio Return

Liabilities

Portfolio Return

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio

Asset and liability modeling integrated in single platform
- Integrates impact of key economic variables

Flexibility in modeling parameters and output to client preferences

Stochastic and deterministic modeling performed

Contributions
- Funded Ratio
Asset-Liability Management Background
Long-Term Economic Cost of Plan

Long-Term Economic Cost =

- Present Value of Plan Contributions +
- Present Value of Terminal Funding, adjusted by a utility factor

<table>
<thead>
<tr>
<th>Terminal Funding</th>
<th>Surplus</th>
<th>Shortfall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utility Rationale</td>
<td>Declining value, or utility, from very high funded ratios</td>
<td>Increasing &quot;pain&quot; as unfunded amounts grow to high levels</td>
</tr>
<tr>
<td>Threshold</td>
<td>PVB / AL</td>
<td>(5 Yrs. of Benefit Payments) / AL</td>
</tr>
<tr>
<td>Utility Factor above/below threshold</td>
<td>50%</td>
<td>200%</td>
</tr>
</tbody>
</table>

- Main component of long-term economic cost
- Does not reflect the plan’s funded status at the end of the forecast period
- Reflects the plan’s funded status at the end of the forecast period
- Surplus assets are valuable as they lower future contributions
- Unfunded liabilities are costs that will be recognized in future years
Asset-Liability Management Background
Utility Factor For Terminal Funded Status

- Modest deviations from 100% funding are normal, and no special adjustment is needed for these scenarios – the amount of surplus or unfunded liability can be reflected at its dollar value

- As surplus amounts grow to very high levels, there is a declining value, or utility, to the surplus:
  - Contributions cannot go below zero
  - Long contribution holidays may create a false sense of how much the plan really costs, and lead to confusion when cost levels revert to “normal”
  - Large surplus amounts can become a potential target for non-pension applications

- As unfunded amounts grow to very high levels, there is an increasing amount of “pain” as contributions rise to unacceptable levels:
  - May be viewed as “breaking trust” with future taxpayers
  - Freezing of the pension plan becomes a possibility
Asset-Liability Management Background

Risk and Return in an Asset-Liability Context

- **Traditional:**
  - Return = Investment performance
  - Risk = Annual volatility of investment gains and losses (e.g. weak/negative capital market returns)

- **Asset-Liability:**
  - Return = Potential cost reduction or funded status improvement under average economic conditions
  - Risk = During the worst economic conditions, contributions need to increase or funded status declines (e.g., stocks decline, inflation/deflation shocks and/or interest rates decline)
Asset-Liability Management Background
Key Factors Affecting the Risk/Reward Trade-off

- The key take-away from the A/L study is the allocation between equity ("return-seeking") vs. fixed income ("risk-reducing")

- Major factors affecting the ultimate mix are:
  - Time horizon (or amortization period of unfunded liability) to fund the liability: a longer time horizon supports more risk taking
  - Characteristics of plan participants: a growing population of active participants supports more risk taking; a mature population with significant retirees might need a more conservative policy
  - Funded status: a less funded plan can utilize additional returns from equity investments
  - Nature of plan benefits: a pension with sensitivity to wage inflation growth can benefit from equities in the long-term; an increased need in liquidity due to significant benefit payments in the near future can have a more conservative policy
Asset-Liability Management Background
Glossary of Terms

- **AVA** = Actuarial Value of Assets (i.e., incorporates smoothing of gains and losses)
- **Asset Growth Rate or “Hurdle Rate”** – The required rate of growth of the assets (through both contributions and investment returns) to keep pace with the growth of the liability
- **Current Frontier** – uses SBA’s mix of asset classes within the Return-Seeking allocation, then dials the Return-Seeking allocation up and down from 0% to 100% to illustrate forecasted returns at various Return-Seeking / Safety Asset mixes
- **Economic Cost** – Present Value of forecasted future contributions + Funding Shortfall / (Surplus)
- **Liability Growth Rate** – the projected growth of the liability over the coming year as measurement by the sum of the Normal Cost (new benefit accruals) and Interest Cost (one year of discounting)
- **MVA** = Market Value of Assets (i.e., un-smoothed / economic reality)
- **Return-Seeking Assets (“R-S”)** – All non “Safety” assets
- **Safety Assets** – Assets where the primary function is risk control / downside mitigation.
- **Target Mix** – the allocation of assets between Return-Seeking Assets and Safety Assets
Overview

- Asset-Liability Profile
Asset-Liability Profile as of July 1, 2016

**Asset-Liability Snapshot as of 7/1/2016**

<table>
<thead>
<tr>
<th>Metric ($, Billions)</th>
<th>Value</th>
<th>Fund %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Market Value of Assets</td>
<td>$141.8</td>
<td>83.2%</td>
</tr>
<tr>
<td>Actuarial Value of Assets</td>
<td>$145.5</td>
<td>85.4%</td>
</tr>
</tbody>
</table>

**Liability Metrics**

| Actuarial Liability (AL) - Funding | $170.4¹ |

¹ Based on plan's valuation interest rate of 7.60% from the 2016 actuarial valuation report (Funding)

**Asset-Liability Growth Metrics**

<table>
<thead>
<tr>
<th>Metric ($, Billions)</th>
<th>Value</th>
<th>% Liability</th>
<th>% Assets</th>
</tr>
</thead>
<tbody>
<tr>
<td>AL Interest Cost</td>
<td>$12.9</td>
<td>7.6%</td>
<td>9.1%</td>
</tr>
<tr>
<td>AL Normal Cost</td>
<td>$1.7</td>
<td>1.0%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Total Liability Hurdle Rate</td>
<td>$14.7</td>
<td>8.6%</td>
<td>10.3%</td>
</tr>
<tr>
<td>Expected Return on Assets</td>
<td>$10.8</td>
<td>6.3%</td>
<td>7.6%</td>
</tr>
<tr>
<td>ER + EE Contributions</td>
<td>$3.1</td>
<td>1.8%</td>
<td>2.2%</td>
</tr>
<tr>
<td>Total Exp. Asset Growth</td>
<td>$13.9</td>
<td>8.1%</td>
<td>9.8%</td>
</tr>
<tr>
<td>Hurdle Rate Shortfall</td>
<td>$0.7</td>
<td>0.5%</td>
<td>0.5%</td>
</tr>
<tr>
<td>Est. Benefit Payments</td>
<td>$9.2</td>
<td>5.4%</td>
<td>6.5%</td>
</tr>
</tbody>
</table>

**Target Asset Allocation as of 7/1/2016**

<table>
<thead>
<tr>
<th>Metric ($, Billions)</th>
<th>Value</th>
<th>Alloc %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Return-Seeking</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Global Equity</td>
<td>$75.1</td>
<td>53%</td>
</tr>
<tr>
<td>- Private Equity</td>
<td>$8.5</td>
<td>6%</td>
</tr>
<tr>
<td>- Strategic</td>
<td>$17.0</td>
<td>12%</td>
</tr>
<tr>
<td>- Real Estate</td>
<td>$14.2</td>
<td>10%</td>
</tr>
<tr>
<td>- Total</td>
<td>$114.8</td>
<td>81%</td>
</tr>
<tr>
<td><strong>Risk-Reducing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Cash &amp; Short Duration Fixed Income</td>
<td>$1.4</td>
<td>1%</td>
</tr>
<tr>
<td>- Intermediate Duration Fixed Income</td>
<td>$25.5</td>
<td>18%</td>
</tr>
<tr>
<td>- Total</td>
<td>$26.9</td>
<td>19%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$141.8</td>
<td>100%</td>
</tr>
</tbody>
</table>
Analysis

- Investment Analysis
Starting in 2016, the SBA averages the Global equity risk premiums from four consulting firms and then uses that average risk premium to scale AHIC’s expected returns for the “Risk Assets”

**2017 Average Global Equity Risk Premium** = Average (Global Equity Return – U.S. Bond Return) = **3.72%**

<table>
<thead>
<tr>
<th></th>
<th>AHIC</th>
<th>Mercer</th>
<th>Wilshire</th>
<th>Callan</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>2017 Assumptions (15-year geometric average expected returns)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Global Equity</td>
<td>7.15%</td>
<td>7.53%</td>
<td>6.70%</td>
<td>6.93%</td>
<td>7.08%</td>
</tr>
<tr>
<td>- Core U.S. Bonds</td>
<td>3.40%</td>
<td>3.40%</td>
<td>3.65%</td>
<td>3.00%</td>
<td>3.36%</td>
</tr>
<tr>
<td>- Global Equity Risk Premium</td>
<td>3.75%</td>
<td>4.13%</td>
<td>3.05%</td>
<td>3.93%</td>
<td>3.72%</td>
</tr>
<tr>
<td><strong>2016 Global Equity Risk Premium</strong></td>
<td>3.70%</td>
<td>4.40%</td>
<td>3.20%</td>
<td>4.45%</td>
<td>3.94%</td>
</tr>
<tr>
<td><strong>Change 2017 vs. 2016</strong></td>
<td>0.05%</td>
<td>-0.27%</td>
<td>-0.15%</td>
<td>-0.52%</td>
<td>-0.22%</td>
</tr>
<tr>
<td><strong>Prior Years:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- 2015 (based on U.S. ERP)</td>
<td>3.62%</td>
<td>3.00%</td>
<td>2.90%</td>
<td>4.60%</td>
<td>3.53%</td>
</tr>
<tr>
<td>- 2013 (based on U.S. ERP)</td>
<td>5.10%</td>
<td>4.30%</td>
<td>4.50%</td>
<td>5.15%</td>
<td>4.76%</td>
</tr>
<tr>
<td>- 2012 (based on U.S. ERP)</td>
<td>4.50%</td>
<td>3.80%</td>
<td>4.65%</td>
<td>4.50%</td>
<td>4.36%</td>
</tr>
<tr>
<td>- 2011 (based on U.S. ERP)</td>
<td>3.60%</td>
<td>3.80%</td>
<td>3.50%</td>
<td>4.25%</td>
<td>3.79%</td>
</tr>
</tbody>
</table>

---

1. Equity Risk Premium is defined as the excess return earned over bonds that compensates investors for taking on higher risk.
2. Prior to 2016, ERP was U.S.-based. Starting in 2016, ERP was globally-based.
### Key Takeaways:
- The current portfolio is well-diversified
  - Return-seeking assets are broadly diversified
  - Safety asset allocation should withstand stressed markets

### Investment Analysis
**Current Frontier**

![Current Frontier Graph](image)

<table>
<thead>
<tr>
<th>Expected Nominal Return</th>
<th>Expected Nominal Volatility</th>
<th>Sharpe Ratio</th>
<th>Global Equity</th>
<th>Real Estate</th>
<th>Strategic</th>
<th>Private Equity</th>
<th>Cash &amp; Short Duration Bonds</th>
<th>Interm. Duration Gov't Bonds</th>
<th>Interm. Duration Credit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Policy (81% RS)</td>
<td>6.81%</td>
<td>12.68%</td>
<td>0.3160</td>
<td>53%</td>
<td>10%</td>
<td>12%</td>
<td>6%</td>
<td>1%</td>
<td>9%</td>
</tr>
<tr>
<td>0% Return-Seeking</td>
<td>3.56%</td>
<td>4.25%</td>
<td>0.1793</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>50%</td>
</tr>
<tr>
<td>10% Return-Seeking</td>
<td>4.05%</td>
<td>4.19%</td>
<td>0.2979</td>
<td>7%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>0%</td>
<td>45%</td>
</tr>
<tr>
<td>20% Return-Seeking</td>
<td>4.51%</td>
<td>4.70%</td>
<td>0.3632</td>
<td>13%</td>
<td>2%</td>
<td>3%</td>
<td>1%</td>
<td>0%</td>
<td>40%</td>
</tr>
<tr>
<td>30% Return-Seeking</td>
<td>4.94%</td>
<td>5.64%</td>
<td>0.3802</td>
<td>20%</td>
<td>4%</td>
<td>4%</td>
<td>2%</td>
<td>0%</td>
<td>35%</td>
</tr>
<tr>
<td>40% Return-Seeking</td>
<td>5.36%</td>
<td>6.83%</td>
<td>0.3746</td>
<td>26%</td>
<td>5%</td>
<td>6%</td>
<td>3%</td>
<td>0%</td>
<td>30%</td>
</tr>
<tr>
<td>50% Return-Seeking</td>
<td>5.75%</td>
<td>8.16%</td>
<td>0.3614</td>
<td>33%</td>
<td>6%</td>
<td>7%</td>
<td>4%</td>
<td>0%</td>
<td>25%</td>
</tr>
<tr>
<td>60% Return-Seeking</td>
<td>6.11%</td>
<td>9.57%</td>
<td>0.3464</td>
<td>39%</td>
<td>7%</td>
<td>9%</td>
<td>4%</td>
<td>0%</td>
<td>20%</td>
</tr>
<tr>
<td>70% Return-Seeking</td>
<td>6.46%</td>
<td>11.03%</td>
<td>0.3318</td>
<td>46%</td>
<td>9%</td>
<td>10%</td>
<td>5%</td>
<td>0%</td>
<td>15%</td>
</tr>
<tr>
<td>80% Return-Seeking</td>
<td>6.78%</td>
<td>12.53%</td>
<td>0.3180</td>
<td>52%</td>
<td>10%</td>
<td>12%</td>
<td>6%</td>
<td>0%</td>
<td>10%</td>
</tr>
<tr>
<td>90% Return-Seeking</td>
<td>7.09%</td>
<td>14.05%</td>
<td>0.3051</td>
<td>59%</td>
<td>11%</td>
<td>13%</td>
<td>7%</td>
<td>0%</td>
<td>5%</td>
</tr>
<tr>
<td>100% Return-Seeking</td>
<td>7.37%</td>
<td>15.58%</td>
<td>0.2932</td>
<td>65%</td>
<td>12%</td>
<td>15%</td>
<td>7%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>
Investment Analysis
Range of Nominal Returns

Note: Returns based on AHIC’s 30 Year Capital Market Assumptions as of December 31, 2016
Investment Analysis
Range of Real Returns

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>5th</td>
<td>-4.27%</td>
<td>-1.78%</td>
<td>-0.65%</td>
<td>0.84%</td>
</tr>
<tr>
<td>25th</td>
<td>0.82%</td>
<td>1.89%</td>
<td>2.37%</td>
<td>2.99%</td>
</tr>
<tr>
<td>50th</td>
<td>4.52%</td>
<td>4.52%</td>
<td>4.52%</td>
<td>4.52%</td>
</tr>
<tr>
<td>75th</td>
<td>8.36%</td>
<td>7.22%</td>
<td>6.72%</td>
<td>6.07%</td>
</tr>
<tr>
<td>95th</td>
<td>14.12%</td>
<td>11.22%</td>
<td>9.96%</td>
<td>8.34%</td>
</tr>
</tbody>
</table>

Note: Returns based on AHIC’s 30 Year Capital Market Assumptions as of December 31, 2016
Analysis

- Asset-Liability Projection Analysis
Asset-Liability Projection Analysis
Employer Contribution Rate (Defined Benefit Plan Only)

Key Takeaway:
- Higher return-seeking allocations will reduce the expected (50th percentile) outcome but with a wider range of outcomes

* Projections assume constant 7.60% discount rate for pension liabilities for all investment policies studied
Asset-Liability Projection Analysis
Market Value of Assets / Actuarial Liability Funded Ratio

Key Takeaways:

- Higher return-seeking allocations will increase the probability of fully funding the plan in the expected (50th percentile) outcome but with a wider range of outcomes
- Downside risk (95th percentile outcomes) illustrates a steady decline in funded ratios across the policies modeled

* Projections assume constant 7.60% discount rate for pension liabilities for all investment policies studied
Asset-Liability Projection Analysis
Net Outflow Analysis: (Benefit Payments less Contributions) / Market Value of Assets

Key Takeaway:
- Net outflow is consistent across the policies modeled

* Projections assume constant 7.60% discount rate for pension liabilities for all investment policies studied
Asset-Liability Projection Analysis
Economic Cost Analysis over a 5, 10, 15, and 30-Year Horizon

**Economic Cost**
Present Value of Contributions plus AL Funding Shortfall/(Surplus)* at 7.60%, $billions

**Key Takeaway:**
- The magnitude of the risk/reward trade-off changes over a longer-term projection

* Excludes 50% of surplus in excess of 110% of Actuarial liability, and includes twice the shortfall below 40% of Actuarial liability, on a market value basis

* Projections assume constant 7.60% discount rate for pension liabilities for all investment policies studied
Risk-Reward Analysis
Sensitivity to Equity Risk Premium Assumption

Economic Cost
Present Value of Contributions plus AL Funding Shortfall/(Surplus)* at 7.60%, $billions

Average Cost (All 5,000 Scenarios)

Average Risk (Worst 1,000 Scenarios)

Observation:
- The dashed lines illustrate how the Economic Cost curve shifts under alternative equity risk premium assumptions over a 5 and 15-year time horizon.

Risk-Reward Analysis
Sensitivity to Equity Risk Premium Assumption

Economic Cost
Present Value of Contributions plus AL Funding Shortfall/(Surplus)* at 7.60%, $billions

- Projections assume constant 7.60% discount rate for pension liabilities for all investment policies studied.

- Excludes 50% of surplus in excess of 110% of Actuarial liability, and includes twice the shortfall below 40% of Actuarial liability, on a market value basis

Baseline ERP = 3.72%
ERP = 4.72%
ERP = 2.72%

* Excludes 50% of surplus in excess of 110% of Actuarial liability, and includes twice the shortfall below 40% of Actuarial liability, on a market value basis

July 1, 2021
(5 Year)

July 1, 2031
(15 Years)

Aon Hewitt | Retirement and Investment
Investment advice and consulting services provided by Aon Hewitt Investment Consulting, Inc., an Aon Company.
Short-Term Funded Ratio Shortfall Analysis
(Based on Market Value of Assets)

FRS’ funded ratio based on the current allocation projects to the following outcomes after 5 years:

- 34.6% probability of being below 70% funded
- 19.0% probability of being below 60% funded
- 7.8% probability of being below 50% funded

**Probability that Funded Ratio After 5 Years is Below the Target**

70% Funded Status

- Dialing up the risk to 90% return-seeking assets will reduce the probability of falling below 70% funded to 33.8%
- Dialing down risk to 70% return-seeking assets will increase the probability to 36.1%

50% Funded Status

- Dialing up the risk to 90% return-seeking assets will increase this probability of falling below 50% funded to 8.9%
- Dialing down risk to 70% return-seeking assets will decrease the probability to 6.1%
Analysis

- Public Pension Peer Comparison
Public Pension Peer Comparison
Overview

- Public Fund Peer Asset Allocation Comparison
  - Asset allocation should be matched to each defined benefit plan’s unique design
  - Peer comparison is meant to inform and not dictate policy
Public Pension Peer Comparison
FRS’ Investment Return Assumption versus Public Peers

- The chart to the left illustrates the trend in investment return assumptions over the past 15 years according to information compiled by Public Plans Data (PPD).
- The median investment return assumption has declined from 8.00% in 2001-2010 to 7.50% based on the latest survey data.
- FRS’ historical return assumption has been plotted to show how it lines up with the historical trends.

Source: Public Plans Data (publicplansdata.org) as of December 2016
## Public Pension Peer Comparison

### FRS' Asset Allocation versus Public Peers

<table>
<thead>
<tr>
<th>Asset Allocation</th>
<th>Florida Retirement System</th>
<th>Large Public Pension Plans (&gt;$5B)*</th>
<th>Total Public Pension Universe*</th>
<th>Wilshire Report on State Retirement Systems **</th>
<th>AHIC Public Peer Average ***</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equity Exposure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Global Equity</td>
<td>53.0%</td>
<td>3.9%</td>
<td>3.8%</td>
<td>45.5%</td>
<td></td>
</tr>
<tr>
<td>Total U.S. Equity</td>
<td>0.0%</td>
<td>24.9%</td>
<td>25.3%</td>
<td>27.3%</td>
<td></td>
</tr>
<tr>
<td>Total Int'l Equity</td>
<td>0.0%</td>
<td>18.5%</td>
<td>18.4%</td>
<td>20.1%</td>
<td></td>
</tr>
<tr>
<td>Private Markets</td>
<td>6.0%</td>
<td>8.3%</td>
<td>8.1%</td>
<td>10.0%</td>
<td>12.1%</td>
</tr>
<tr>
<td><strong>Total Equity</strong></td>
<td>59.0%</td>
<td>55.6%</td>
<td>55.6%</td>
<td>57.4%</td>
<td>57.6%</td>
</tr>
<tr>
<td><strong>Fixed Income Exposure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>U.S. Fixed Income</td>
<td>18.0%</td>
<td>20.8%</td>
<td>20.7%</td>
<td>21.1%</td>
<td></td>
</tr>
<tr>
<td>High Yield Bonds / Bank Loans</td>
<td>0.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-US Developed Bonds</td>
<td>0.0%</td>
<td>2.6%</td>
<td>2.7%</td>
<td>2.3%</td>
<td></td>
</tr>
<tr>
<td>Emerging Market Debt</td>
<td>0.0%</td>
<td>0.7%</td>
<td>0.7%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inflation Protected</td>
<td>0.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total Fixed Income</strong></td>
<td>18.0%</td>
<td>24.1%</td>
<td>24.1%</td>
<td>23.4%</td>
<td>21.3%</td>
</tr>
<tr>
<td><strong>Real Asset Exposure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>US Infrastructure (Public + Private)</td>
<td>0.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commodities / Gold</td>
<td>0.0%</td>
<td>1.2%</td>
<td>1.2%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Real Estate</strong></td>
<td>10.0%</td>
<td>8.5%</td>
<td>8.4%</td>
<td>8.1%</td>
<td>12.9%</td>
</tr>
<tr>
<td><strong>Total Real Assets</strong></td>
<td>10.0%</td>
<td>9.7%</td>
<td>9.6%</td>
<td>8.1%</td>
<td></td>
</tr>
<tr>
<td>Hedge Funds / Strategic</td>
<td>12.0%</td>
<td>4.3%</td>
<td>4.4%</td>
<td>5.8%</td>
<td></td>
</tr>
<tr>
<td>Multi-Asset / Risk Parity</td>
<td>0.0%</td>
<td>1.4%</td>
<td>1.5%</td>
<td>2.3%</td>
<td></td>
</tr>
<tr>
<td>Money Market / Cash</td>
<td>1.0%</td>
<td>1.8%</td>
<td>1.8%</td>
<td>0.4%</td>
<td></td>
</tr>
<tr>
<td>Leverage</td>
<td>0.0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0.0%</td>
<td>3.0%</td>
<td>3.0%</td>
<td>11.1%</td>
<td></td>
</tr>
<tr>
<td><strong>Net Other</strong></td>
<td>13.0%</td>
<td>10.5%</td>
<td>10.7%</td>
<td>11.1%</td>
<td>8.5%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

*** Source: AHIC Public Peer Average is based on a universe of AHIC’s 11 largest public pension plans with total assets ranging from $14B–$142B
Summary & Conclusions
### Summary of Results

#### Key Observations:
- Plan is projected to approach fully funded status via the current policy.
- Employer contribution rate is expected to grow over the near-term before eventually declining.
- Adjusting the return-seeking vs. risk-reducing allocation will exhibit standard risk/reward trade-off of expected costs and risks.

#### Table: Summary of Results

<table>
<thead>
<tr>
<th>All Scenarios</th>
<th>30-year Present Value of Contributions (ER + EE)</th>
<th>30-year Ending Funded Ratio (MVA / AL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$ billions</td>
<td>Expected&lt;sup&gt;1&lt;/sup&gt;</td>
<td>Downside&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Current Policy (81% RS)</td>
<td>$66.0</td>
<td>$114.8</td>
</tr>
<tr>
<td>0% Return-Seeking</td>
<td>$98.9</td>
<td>$106.7</td>
</tr>
<tr>
<td>10% Return-Seeking</td>
<td>$94.7</td>
<td>$104.7</td>
</tr>
<tr>
<td>20% Return-Seeking</td>
<td>$90.6</td>
<td>$104.7</td>
</tr>
<tr>
<td>30% Return-Seeking</td>
<td>$86.4</td>
<td>$105.7</td>
</tr>
<tr>
<td>40% Return-Seeking</td>
<td>$82.5</td>
<td>$107.2</td>
</tr>
<tr>
<td>50% Return-Seeking</td>
<td>$78.3</td>
<td>$108.9</td>
</tr>
<tr>
<td>60% Return-Seeking</td>
<td>$74.3</td>
<td>$110.9</td>
</tr>
<tr>
<td>70% Return-Seeking</td>
<td>$70.5</td>
<td>$112.8</td>
</tr>
<tr>
<td>80% Return-Seeking</td>
<td>$66.3</td>
<td>$114.5</td>
</tr>
<tr>
<td>90% Return-Seeking</td>
<td>$62.2</td>
<td>$116.8</td>
</tr>
<tr>
<td>100% Return-Seeking</td>
<td>$58.5</td>
<td>$119.1</td>
</tr>
</tbody>
</table>

<sup>1</sup> Expected = 50<sup>th</sup> percentile outcome or central expectation across all 5,000 simulations
<sup>2</sup> Downside = 95<sup>th</sup> percentile outcome across all 5,000 simulations
Summary and Conclusions

- We believe the current portfolio is well-constructed with 81% return-seeking assets.
- The equity risk premium is 3.72%, compared to 3.94% from 2016.
- Asset returns are not expected to keep pace with the actuarial assumed rate of return (7.60%).
- Expected real return of 4.52% falls short of the investment policy target of 5.00%.

- The funded ratio is projected to trend toward full funding over the course of the projection period.
- Higher return-seeking strategies trend closer to full funding but with greater risk.
- Longer time horizons are expected to reward higher levels of risk; shorter time horizons reward risk less.
- Adverse market experience could significantly impact the funded status of the Plan over the projection period.
Appendix

- Assumptions & Methods
<table>
<thead>
<tr>
<th></th>
<th>Expected Real Return</th>
<th>Expected Nominal Return</th>
<th>Expected Nominal Volatility</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Equity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Global Equity IMI</td>
<td>4.9%</td>
<td>7.2%</td>
<td>19.0%</td>
</tr>
<tr>
<td><strong>Fixed Income</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 Cash (Gov't)</td>
<td>0.6%</td>
<td>2.8%</td>
<td>2.0%</td>
</tr>
<tr>
<td>3 Intermediate Gov't Bonds (4-Year Duration)</td>
<td>0.9%</td>
<td>3.1%</td>
<td>4.0%</td>
</tr>
<tr>
<td>4 Intermediate Corporate Bonds (4-Year Duration)</td>
<td>1.8%</td>
<td>4.0%</td>
<td>5.0%</td>
</tr>
<tr>
<td><strong>Alternatives</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 Strategic Allocation (Custom)^2</td>
<td>5.1%</td>
<td>7.4%</td>
<td>9.0%</td>
</tr>
<tr>
<td>6 Real Estate (Custom)^3</td>
<td>3.0%</td>
<td>5.3%</td>
<td>11.5%</td>
</tr>
<tr>
<td>7 Private Equity</td>
<td>6.1%</td>
<td>8.4%</td>
<td>24.5%</td>
</tr>
<tr>
<td><strong>Inflation</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 Inflation</td>
<td>0.0%</td>
<td>2.2%</td>
<td>1.5%</td>
</tr>
</tbody>
</table>

1 Expected return assumptions are based upon the AHIC capital market assumptions adjusted for the delta in Global Equity Risk Premium (ERP)
2 Strategic assumption breakdown is found on the next page
3 Real Estate assumption was modeled as follows:
   - 76.50% Core Real Estate
   - 13.50% Broad Real Estate
   - 10.00% REITs
The Strategic Investment allocation was modeled as follows:

<table>
<thead>
<tr>
<th>Capital Market Assumption</th>
<th>% of Total Asset Allocation</th>
<th>% of Strategic Investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Equity Mezzanine</td>
<td>0.7%</td>
<td>6.0%</td>
</tr>
<tr>
<td>Direct Lending</td>
<td>0.6%</td>
<td>4.9%</td>
</tr>
<tr>
<td>Private Equity Distressed Debt</td>
<td>2.0%</td>
<td>16.6%</td>
</tr>
<tr>
<td>Global Public Equity</td>
<td>1.1%</td>
<td>9.2%</td>
</tr>
<tr>
<td>Hedge Funds – Equity Long/Short</td>
<td>0.5%</td>
<td>4.2%</td>
</tr>
<tr>
<td>Real Estate Debt</td>
<td>1.2%</td>
<td>10.2%</td>
</tr>
<tr>
<td>Timber</td>
<td>0.5%</td>
<td>4.0%</td>
</tr>
<tr>
<td>Commodities</td>
<td>0.2%</td>
<td>1.9%</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>0.4%</td>
<td>3.1%</td>
</tr>
<tr>
<td>Hedge Funds – Global Macro</td>
<td>1.1%</td>
<td>9.2%</td>
</tr>
<tr>
<td>Hedge Funds – CTAs</td>
<td>1.0%</td>
<td>8.3%</td>
</tr>
<tr>
<td>Hedge Funds – Event Driven</td>
<td>0.6%</td>
<td>5.0%</td>
</tr>
<tr>
<td>Hedge Funds – Direct Hedge Funds (Buy List)</td>
<td>2.1%</td>
<td>17.5%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12.0%</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>
## AHIC Capital Market Assumptions—Q1 2017

<table>
<thead>
<tr>
<th>Nominal Correlations</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Equity IMI</td>
<td>1.00</td>
<td>0.08</td>
<td>-0.06</td>
<td>0.09</td>
<td>0.85</td>
<td>0.47</td>
<td>0.67</td>
<td>0.07</td>
</tr>
<tr>
<td>Cash (Gov't)</td>
<td>0.08</td>
<td>1.00</td>
<td>0.63</td>
<td>0.50</td>
<td>0.12</td>
<td>0.16</td>
<td>0.09</td>
<td>0.50</td>
</tr>
<tr>
<td>Intermediate Gov't Bonds (4-Year Duration)</td>
<td>-0.06</td>
<td>0.63</td>
<td>1.00</td>
<td>0.78</td>
<td>-0.05</td>
<td>0.04</td>
<td>-0.04</td>
<td>0.27</td>
</tr>
<tr>
<td>Intermediate Corporate Bonds (4-Year Duration)</td>
<td>0.09</td>
<td>0.50</td>
<td>0.78</td>
<td>1.00</td>
<td>0.23</td>
<td>0.10</td>
<td>0.08</td>
<td>0.20</td>
</tr>
<tr>
<td>Strategic Allocation (Custom)</td>
<td>0.85</td>
<td>0.12</td>
<td>-0.05</td>
<td>0.23</td>
<td>1.00</td>
<td>0.42</td>
<td>0.59</td>
<td>0.12</td>
</tr>
<tr>
<td>Real Estate (Custom)</td>
<td>0.47</td>
<td>0.16</td>
<td>0.04</td>
<td>0.10</td>
<td>0.42</td>
<td>1.00</td>
<td>0.38</td>
<td>0.09</td>
</tr>
<tr>
<td>Private Equity</td>
<td>0.67</td>
<td>0.09</td>
<td>-0.04</td>
<td>0.08</td>
<td>0.59</td>
<td>0.38</td>
<td>1.00</td>
<td>0.06</td>
</tr>
<tr>
<td>Inflation</td>
<td>0.07</td>
<td>0.50</td>
<td>0.27</td>
<td>0.20</td>
<td>0.12</td>
<td>0.09</td>
<td>0.06</td>
<td>1.00</td>
</tr>
</tbody>
</table>
The following capital market assumptions were developed by Aon Hewitt's Global Asset Allocation Team and represent the long-term capital market outlook (i.e., 30 years) based on data at the end of the fourth quarter of 2016. The assumptions were developed using a building block approach, reflecting observable inflation and interest rate information available in the fixed income markets as well as Consensus Economics forecasts. Our long-term assumptions for other asset classes are based on historical results, current market characteristics, and our professional judgment.

Inflation – Expected Level (2.2%)
Based on Consensus Economics long-term estimates and our near-term economic outlook, we expect U.S. consumer price inflation to be approximately 2.2% during the next 30 years.

Real Returns for Asset Classes

Fixed Income
- **Cash (0.6%)** – Over the long run, we expect the real yield on cash and money market instruments to produce a real return of 0.6% in a moderate- to low-inflationary environment.
- **TIPS (1.3%)** – We expect intermediate duration Treasury Inflation-Protected Securities to produce a real return of about 1.3%.
- **Core Fixed Income (i.e., Market Duration) (1.6%)** – We expect intermediate duration Treasuries to produce a real return of about 0.9%. We estimate the fair value credit spread (credit risk premium - expected losses from defaults and downgrades) to be 0.7%, resulting in a long-term real return of 1.6%.
- **Long Duration Bonds – Government and Credit (1.8%)** – We expect Treasuries with a duration comparable to the Long Government Credit Index to produce a real return of 1.2%. We estimate the fair value credit spread (credit risk premium - expected losses from defaults and downgrades) to be 0.6%, resulting in an expected real return of 1.8%.
Explanation of Capital Market Assumptions—Q1 2017 (30 Years)

- **Long Duration Bonds – Credit (2.3%)** – We expect Treasuries with a duration comparable to the Long Credit Index to produce a real return of 1.2%. We estimate the fair value credit spread (credit risk premium - expected losses from defaults and downgrades) to be 1.1%, resulting in an expected real return of 2.3%.

- **Long Duration Bonds – Government (1.2%)** – We expect Treasuries with a duration of ~12 years to produce a real return of 1.2% during the next 30 years.

- **High Yield Bonds (3.3%)** – We expect intermediate duration Treasuries to produce a real return of about 0.9%. We estimate the fair value credit spread (credit risk premium - expected losses from defaults and downgrades) to be 2.4%, resulting in an expected real return of 3.3%.

- **Bank Loans (2.8%)** – We expect LIBOR to produce a real return of about 1.1%. We estimate the fair value credit spread (credit risk premium - expected losses from defaults) to be 1.7%, resulting in an expected real return of 2.8%.

- **Non-US Developed Bonds: 50% Hedged (0.8%)** – We forecast real returns for non-US developed market bonds to be 0.8% over a 30-year period after adjusting for a 50% currency hedge. We assume a blend of one-third investment grade corporate bonds and two-thirds government bonds. We also produce assumptions for 0% hedged and 100% hedged non-US developed bonds.

- **Emerging Market Bonds (Sovereign; USD) (3.2%)** – We forecast real returns for emerging market sovereign bonds denominated in USD to be 3.2% over a 30-year period.

- **Emerging Market Bonds (Corporate; USD) (2.9%)** – We forecast real returns for emerging market corporate bonds denominated in USD to be 2.9% over a 30-year period.

- **Emerging Market Bonds (Sovereign; Local) (3.9%)** – We forecast real returns for emerging market sovereign bond denominated in local currency to be 3.9% over a 30-year period.

- **Multi Asset Credit (MAC) (4.4%)** – We assume real returns from beta exposure to high yield, bank loans and emerging market debt to add 3.4% plus 1.0% from alpha (net of fees) over a 30-year period.
Explanation of Capital Market Assumptions—Q1 2017 (30 Years)

**Equities**

- **Large Cap U.S. Equity (4.1%)** – This assumption is based on our 30-year outlook for large cap U.S. company dividends and real earnings growth. Adjustments are made for valuations as needed.

- **Small Cap U.S. Equity (4.6%)** – Adding a 0.5% return premium for small cap U.S. equity over large cap U.S. equity results in an expected real return of 4.6%. This return premium is theoretically justified by the higher risk inherent in small cap U.S. equity versus large cap U.S. equity, and is also justified by historical data. In recent years, higher small cap valuations relative large cap equity has reduced the small cap premium.

- **Global Equity (Developed & Emerging Markets) (4.9%)** – We employ a building block process similar to the U.S. equity model using the developed and emerging markets that comprise the MSCI All-Country World Index. Our roll-up model produces an expected real return of 4.9% for global equity.

- **International (Non-U.S.) Equity, Developed Markets (4.7%)** – We employ a building block process similar to the U.S. equity model using the non-U.S. developed equity markets that comprise the MSCI EAFE Index.

- **Emerging Market Stocks (5.4%)** - We employ a building block process similar to the U.S. equity model using the non-U.S. emerging equity markets that comprise the MSCI Emerging Markets Index.

- **Equity Risk Insurance Premium Strategies- High Beta (3.9%)** – We expect nominal returns from insurance equity risk premium to average 4.4% plus 1.8% from cash & dividends over the next 30 years.

**Alternative Asset Classes**

- **Hedge Fund-of-Funds Universe (2.1%)** – The generic category “hedge funds” encompasses a wide range of strategies accessed through “fund-of-funds” vehicles. We also assume the median manager is selected and also allow for the additional costs associated with Fund-of-Funds management. A top-tier portfolio of funds (hedge fund-of-funds buy-list) could add an additional 1.1% in return at similar volatility based on alpha, lower fees and better risk management.
Explanation of Capital Market Assumptions—Q1 2017 (30 Years)

- **Hedge Fund-of-Funds Buy List (3.2%)** – The generic category of top-tier “hedge funds” encompasses a wide range of strategies accessed through “fund-of-funds” vehicles. We assume additional costs associated with Funds-of-Funds management. To use this category the funds must be buy rated or we advise on manager selection.

- **Broad Hedge Funds (3.5%)** – Represents a diversified portfolio of direct hedge fund investments. This investment will tend to be less diversified than a typical “fund-of-funds” strategy as there will be fewer underlying managers and will not include the extra layer of fees found in a Fund-of-Funds structure.

- **Broad Hedge Funds Buy List (4.8%)** – Represents a diversified portfolio of top-tier direct hedge fund investments. This investment will tend to be less diversified than a typical “fund-of-funds” strategy as there will be fewer underlying managers and will not include the extra layer of fees found in a Fund-of-Funds structure. To use this category the funds must be buy rated or we advise on manager selection.

- **Real Estate (3.1%)** – Our real return assumption for broad real estate market is based on a gross income of about 5.1%, management fees of roughly 2%, and future capital appreciation near the rate of inflation during the next 30 years. We assume a portfolio of equity real estate holdings that is diversified by property type and by geographic region.

- **Core Real Estate (2.8%)** – Our real return assumption for core real estate is based on a gross income of about 4.8%, management fees of roughly 2%, and future capital appreciation near the rate of inflation during the next 30 years. We assume a portfolio of equity real estate holdings that is diversified by property type and geographic region.

- **U.S. REITs (3.9%)** – Our real return assumption for U.S. REITs is based on income of 3.9% and future capital appreciation near the rate of inflation over the next 30 years. REITs are a sub-set of the U.S. small/mid cap equities.

- **Commodities (3.2%)** – Our commodity assumption is for a diversified portfolio of commodity futures contracts. Commodity futures returns are composed of three parts: spot price appreciation, collateral return, and roll return (positive or negative change implied by the shape of the future curve). We believe that spot prices will converge with CPI over the long run (i.e., 2.2%). Collateral is assumed to be LIBOR cash 1.1%. Also, we believe the roll effect will be near zero, resulting in a real return of approximately 3.2% for commodities.
Explanation of Capital Market Assumptions—Q1 2017 (30 Years)

- **Private Equity (6.2%)** – Our private equity assumption reflects a diversified fund of funds with exposure to buyouts, venture capital, distressed debt, and mezzanine debt.

- **Infrastructure (3.9%)** – Our infrastructure assumption is formulated using a cash flow based approach that projects cash flows (on a diversified portfolio of assets) over a 30 year period. Income and capital growth as well as gearing levels, debt costs and terms, relevant tax and management expenses are all taken into consideration. Our approach produces an expected real return of 3.9% for infrastructure.

- **Equity Risk Insurance Premium Strategies- Low Beta (4.0%)** – We assume nominal returns from cash of 2.8% + 3.5% from alpha.

**Volatility / Correlation Assumptions**

Assumed volatilities are formulated with reference to implied volatilities priced into option contracts of various terms, as well as with regard to historical volatility levels. For asset classes which are not marked to market (for example real estate), we “de-smooth” historical returns before calculating volatilities. Importantly, we consider expected volatility trends in the future – in recent years we assumed the re-emergence of an economic cycle and a loss of confidence in central bankers would lead to an increase in volatility. Correlation assumptions are generally similar to actual historical results; however, we do make adjustments to reflect our forward-looking views as well as current market fundamentals.
Appendix

- Horizon Survey of Capital Market Assumptions
Capital Market Assumption Overview

- We have what we consider a consistent and conservative approach to modeling asset class returns, risk, and correlations.
- AHIC regularly reviews these critical inputs relative to peer consultants as well as the investment management community.
- The following slides include a review of 2016 assumptions relative to a study of peer averages:
  - AHIC is often more conservative from an expected return standpoint than the peer average.
  - While we do not seek to change our approach based on how we stack up to peers, it is a helpful double-check to make sure we are not too far off from others in the industry.
The 2016 Horizon Survey generally showed return expectations slightly lower in 2016 than 2015
  - Equity return assumptions are lower by an average of 0.1%
  - Fixed income return assumptions are higher by an average of 0.1%
  - Alternative asset class return assumptions are lower by an average of 0.1%

2016 AHIC 10-year forecast assumptions tend to be similar to the survey average in some asset classes (e.g., public equities), and somewhat lower in others (e.g., alternatives)
  - AHIC equity assumptions are driven by market valuations, earnings growth expectations and assumed payouts to investors. Recent experience suggests strong equity market performance has been driven more by increasing valuations than increasing profits. As markets have become more expensive, our equity return assumptions have consequently fallen
  - AHIC fixed income assumptions reflect falling yields and flattening of yield curves during the first two quarters of 2016
  - AHIC alternative asset class assumptions are generally lower due to methodological and inflation forecast differences compared to survey participant forecasts

In conclusion, AHIC assumptions appear somewhat more conservative than peers included in the 2016 Horizon Survey of capital market assumptions
2016 Horizon Survey Results
Distribution of Expected Returns from 35 Consultants

**Expected Geometric Returns by Asset Class**
*(10 Year Forecast)*

**SOURCE:** Horizon Actuarial survey of 2016 capital market assumptions from 35 independent investment advisors
Expected returns of the survey are annualized over 10-years (geometric).
AHIC expected returns are annualized over 10-years as of June 30, 2016
2016 Horizon Survey Results
AHIC Versus Peers

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Expected Geometric Returns (10-Yr)</th>
<th>Expected Risk</th>
<th>10 Year Forecasts</th>
<th>AHIC Forecasts</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Maximum</td>
<td>Minimum</td>
<td>Average</td>
<td>Average</td>
</tr>
<tr>
<td>US Equity - Large Cap</td>
<td>8.0%</td>
<td>5.1%</td>
<td>6.6%</td>
<td>16.9%</td>
</tr>
<tr>
<td>US Equity - Small/Mid Cap</td>
<td>9.0%</td>
<td>5.0%</td>
<td>7.0%</td>
<td>21.0%</td>
</tr>
<tr>
<td>Non-US Equity - Developed</td>
<td>9.2%</td>
<td>3.0%</td>
<td>7.1%</td>
<td>19.5%</td>
</tr>
<tr>
<td>Non-US Equity - Emerging</td>
<td>11.3%</td>
<td>5.8%</td>
<td>8.5%</td>
<td>26.4%</td>
</tr>
<tr>
<td>US Fixed Income - Core</td>
<td>5.3%</td>
<td>2.1%</td>
<td>3.4%</td>
<td>6.0%</td>
</tr>
<tr>
<td>US Fixed Income - Long Duration Corp</td>
<td>5.3%</td>
<td>2.3%</td>
<td>3.8%</td>
<td>10.5%</td>
</tr>
<tr>
<td>US Fixed Income - High Yield</td>
<td>7.5%</td>
<td>3.7%</td>
<td>5.9%</td>
<td>11.0%</td>
</tr>
<tr>
<td>Non-US Fixed Income - Developed</td>
<td>4.6%</td>
<td>0.9%</td>
<td>2.4%</td>
<td>7.6%</td>
</tr>
<tr>
<td>Non-US Fixed Income - Emerging</td>
<td>7.7%</td>
<td>3.9%</td>
<td>5.8%</td>
<td>11.6%</td>
</tr>
<tr>
<td>Treasuries (Cash Equivalents)</td>
<td>3.5%</td>
<td>0.3%</td>
<td>2.1%</td>
<td>2.8%</td>
</tr>
<tr>
<td>TIPS (Inflation-Protected)</td>
<td>5.0%</td>
<td>1.9%</td>
<td>2.8%</td>
<td>6.5%</td>
</tr>
<tr>
<td>Real Estate</td>
<td>10.0%</td>
<td>4.1%</td>
<td>6.4%</td>
<td>14.7%</td>
</tr>
<tr>
<td>Hedge Funds</td>
<td>7.6%</td>
<td>4.2%</td>
<td>5.4%</td>
<td>8.4%</td>
</tr>
<tr>
<td>Commodities</td>
<td>6.8%</td>
<td>1.8%</td>
<td>4.0%</td>
<td>18.5%</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>8.0%</td>
<td>5.5%</td>
<td>6.6%</td>
<td>13.8%</td>
</tr>
<tr>
<td>Private Equity</td>
<td>11.8%</td>
<td>7.4%</td>
<td>9.2%</td>
<td>23.1%</td>
</tr>
<tr>
<td>Inflation</td>
<td>2.2%</td>
<td>1.8%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes (Horizon Survey):
Source: Horizon Actuarial survey of 2016 capital market assumptions from 35 independent investment advisors
Expected returns are annualized (geometric).

Notes (AHIC Forecasts):
AHIC Forecasts are as of June 30, 2016
US Equity - Small/Mid Cap forecasts represents AHIC forecasts for US Small Cap
US Fixed Income - Long Duration forecasts represents AHIC forecasts for Long Duration Credit
Non-US Fixed Income - Developed forecasts represents AHIC forecasts for Non-US Fixed Income - Developed (50% Hedged)
Non-US Fixed Income- Emerging forecasts represents AHIC forecasts for Non-US Fixed Income- Emerging Sovereign USD
Real Estate forecasts represents AHIC forecasts for Core Private Real Estate
Hedge Funds forecasts represents AHIC forecasts for Hedge Fund-of-Funds (Buy List)
2016 Horizon Survey Results
Leading Methodologies & Reasons for Differences

Leading Methodologies
- Building Block
- Global Capital Asset Pricing Model (Global CAPM)
- Surveys
- Historical data (as a guide to future)
- Black-Litterman (combination of building block and CAPM)

Reasons for Differences
- Methodology
- Time Horizon
- Arithmetic vs. Geometric forecasts*
- Alpha (active management)*
- Inflation
- Investment Fees
- Asset class definition

* While some firms in Horizon survey responded with Arithmetic forecasts, the results have been converted to Geometric forecasts for comparison purposes. Additionally, the return expectations included in the Horizon survey are based on indexed returns (no “alpha”). However, AHIC return assumptions for certain asset classes include “alpha” or active management premium (e.g., Private Equity and Hedge Funds)
Appendix

- Investment Guidance for Public Employee Retirement System Trustees
Investment Guidance for Public Employee Retirement System Trustees

1. PERS trustees should look to the state for statutory direction on behalf of the taxpayers
   a) Prudent-person rule
   b) Peer analysis

2. PERS trustees should not be daunted by a liability value that exceeds the value of assets
   a) Do not feel obliged to incur greater risk in an effort to narrow the gap
   b) Funded status has less to do with investment performance than it does with public policy and politics

3. PERS trustees should not assume that an equity-oriented investment policy is suitable for their fund
   a) Discern the risk tolerance of taxpayers
   b) May conclude that a moderate level of risk is warranted

4. Trustees of individual PERSs should be cognizant of the existence and implications of the unitary state pension fund
   a) Unitary state pension fund is the only fund of economic consequence to the taxpayers
   b) Multiple actively managed funds may form, in total, a closet index fund

5. PERS investments should be exposed to rewarded risks, and insulated from unrewarded risks
   a) Market risk (equity exposure) is rewarded risk, on average
   b) Diversifiable risk is not

---

Appendix

- About This Material
About This Material

This material includes a summary of calculations and consulting related to the finances of Florida State Board of Administration (SBA). The following variables have been addressed:

- Contributions
- Economic Cost
- Funded Ratio
- Net Outflow

This analysis is intended to assist the Investment Committee with a review of the associated issues and options, and its use may not be appropriate for other purposes. This analysis has been prepared solely for the benefit of the Investment Committee. Any further dissemination of this report is not allowed without the written consent of Aon Hewitt Investment Consulting, Inc.

Our calculations were generally based on the methodologies identified in the actuary’s valuation report for SBA. We believe the methodology used in these calculations conforms to the applicable standards identified in the report.

Experience different than anticipated could have a material impact on the ultimate costs of the benefits. In addition, changes in plan provisions or applicable laws could have a significant impact on cost. Actual experience may differ from our modeling assumptions.

Our calculations were based on data provided by the plan actuary. The actuarial assumptions and methods and plan provisions reflected in these projections are the same as those used for the 2016 fiscal year actuarial valuation for SBA as noted in the actuarial report, except where noted in this report. Unless specifically noted, our calculations do not reflect any other changes or events after July 1, 2016.

In conducting these projections, we have relied on plan design, demographic and financial information provided by other parties, including the plan’s actuary and plan sponsor. While we cannot verify the accuracy of all of the information, the supplied information was reviewed for consistency and reasonableness. As a result of this review, we have no reason to doubt the substantial accuracy or completeness of the information and believe that it has produced appropriate results.

These projections have been conducted in accordance with generally accepted actuarial principles and practices, including applicable Actuarial Standards of Practice as issued by the Actuarial Standards Board. The undersigned actuary is familiar with the near-term and long-term aspects of pension valuations and meet the Qualification Standards of the American Academy of Actuaries necessary to render the actuarial opinions contained herein. All sections of this report are considered an integral part of the actuarial opinions.

To our knowledge, no associate of Aon Hewitt Investment Consulting, Inc. providing services to SBA has any direct financial interest or indirect material interest in SBA. Thus, we believe there is no relationship existing that might affect our capacity to prepare and certify this report for SBA.

Aon Hewitt Investment Consulting, Inc.
Phil Kivarkis FSA, CFA
Legal Disclosures and Disclaimers

Investment advice and consulting services provided by Aon Hewitt Investment Consulting, Inc. (“AHIC”). The information contained herein is given as of the date hereof and does not purport to give information as of any other date. The delivery at any time shall not, under any circumstances, create any implication that there has been a change in the information set forth herein since the date hereof or any obligation to update or provide amendments hereto.

This document is not intended to provide, and shall not be relied upon for, accounting, legal or tax advice or investment recommendations. Any accounting, legal, or taxation position described in this presentation is a general statement and shall only be used as a guide. It does not constitute accounting, legal, and tax advice and is based on AHIC’s understanding of current laws and interpretation.

This document is intended for general information purposes only and should not be construed as advice or opinions on any specific facts or circumstances. The comments in this summary are based upon AHIC’s preliminary analysis of publicly available information. The content of this document is made available on an “as is” basis, without warranty of any kind. AHIC disclaims any legal liability to any person or organization for loss or damage caused by or resulting from any reliance placed on that content. AHIC reserves all rights to the content of this document. No part of this document may be reproduced, stored, or transmitted by any means without the express written consent of AHIC.

Aon Hewitt Investment Consulting, Inc. is a federally registered investment advisor with the U.S. Securities and Exchange Commission. AHIC is also registered with the Commodity Futures Trading Commission as a commodity pool operator and a commodity trading advisor, and is a member of the National Futures Association. The AHIC ADV Form Part 2A disclosure statement is available upon written request to:

Aon Hewitt Investment Consulting, Inc.
200 E. Randolph Street
Suite 1500
Chicago, IL 60601
ATTN: AHIC Compliance Officer

© Aon plc 2017. All rights reserved.