2019 Annual Investment Risk Management Review

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TMRS
Texas Municipal Retirement System
I. Plan for Addressing Key Risk Related Needs in 2019
   1. Improved modeling of long-term Alternative Asset Class risks
      ▪ For risk measurement and asset allocation
   2. Introduction of Total Fund Strategies
      ▪ To take advantage of risk management and return opportunities not available when only using strategic allocations to asset classes

II. Review of Current Risk Reporting
   1. Quarterly Board Risk Report
   2. Internal Risk Analysis
I. Plan for Addressing Key Risk Management Needs in 2019

1. Improved modeling of long term Alternative Asset Class risks
   (for risk measurement and asset allocation)
All asset classes are assumed to be liquid and can be rebalanced instantaneously.

Asset Class assumptions (return, standard deviation and correlations) fully describe the behavior of an asset class.

Asset Class assumptions do not vary over time or time periods.

Optimal portfolios are identified as those with the highest expected return for a given standard deviation (Efficient Frontiers).
MPT was not designed to handle risks introduced by Alternative Asset Classes

- **Illiquidity risks:**
  - Much slower rebalancing in response to market moves, decreases diversification
  - Sensitivity to market conditions of liquidity demand and supply makes the rebalancing problem worse

- **Illiquidity costs:**
  - Slower rebalancing can also affect returns
  - Responding to liquidity risks has costs (for example: higher cash reserves, forced sales)

- **Volatility of assets with appraisal based pricing increases over longer time periods**
  - For short time periods (quarterly), volatility appears low due to smoothing effect of appraisal pricing
  - For longer time horizons (3 years), smoothing effect decreases and volatility increases

- **Correlations are not static and increase in turbulent markets**
  - Diversifying effect in general, and for alternatives specifically, can be less than expected
Observed investor behaviors in response to risks introduced by Alternative Asset Classes

- Setting Alternative Asset Class risk assumptions much higher than historical return volatility

- Perceiving Risk in two dimensions:
  - Balance of Equity and Fixed Income (Return Volatility)
  - How much in Alternatives (Financial risks not captured by a single volatility assumption)

- Applying a primarily subjective basis for allocation decisions regarding alternatives
The chart on the left shows multiple Frontiers, each allowing an increasing allocation to alternatives.

From a simple MPT perspective, we should pick a portfolio from the unconstrained frontier.

However, we also recognize that Alternatives introduce many risks that MPT simply does not reflect.

So we are left to judge qualitatively how significant these risks are and how much that matters to us.

This decision framework would be significantly improved if we could measure the alternative risks that are currently being evaluated only qualitatively.

Chart is based on RVK 2018 Capital Market Assumptions.
In 2019, the Risk Management team will conduct portfolio analysis that explicitly measures risks of Alternatives

- Use ORTEC capital market simulation model to:
  - Simulate market cycle behavior
  - Simulate historically observed term structure of volatility for all asset classes including alternatives
  - Simulate time-varying conditional correlations (to measure the risk of not getting diversification when most needed)
  - Generate 2000 simulations of asset class returns over 10 years representing the full distribution of possible behavior

- Run the TMRS private fund cash flow simulation model in each of the market simulations
  - Model dependence of simulated private market cash flows on market conditions
  - Measure risk consequences and cost of responding to liquidity risks (e.g. higher cash reserves, forced sales)
  - Measure cost of slower rebalancing and allocation drift (away from target allocation) that is larger and lasts longer
I. Plan for Addressing Key Risk Management Needs in 2019

2. Introduction of Total Fund Strategies
   To take advantage of risk management and return opportunities not available when only using strategic allocations to asset classes
What are Total Fund Strategies?

- Once asset classes are “rolled up” into an efficient portfolio, there is more we can do to improve the risk adjusted performance of the portfolio.

- Top down focus on Total Fund performance

- Total fund level management of:
  - Crisis Risk
  - Dynamic Asset Class Risk Premiums
  - Foreign Exchange risk exposures

- Not part of any TMRS Asset Class
Why Would a Strategy Fall Outside of the Existing TMRS Asset Classes?

❖ Choosing an Asset Allocation is essentially a “bottom up” exercise
  ▪ The capital markets are divided up into Asset Classes based on some common aspect
  ▪ Each Asset Class has unique return and risk objectives (if they are not unique the asset class becomes redundant)
  ▪ The performance of each asset class is measured against its unique return and risk objectives

❖ Total Fund Strategies take a “top down” perspective
  ▪ No common aspect
  ▪ Have Total Fund return and risk objectives (6.75 return target, 10.5 risk target)
  ▪ Performance is measured against total fund risk and return objectives
Tail Risk Hedging

Tail risk hedging mitigates crisis risk, which is not diversifiable.

- Market crisis risk is not diversifiable within a market (like US stocks)
- Market crisis risk is typically not diversifiable across markets (or asset classes) either
- In the Global Financial Crisis (GFC) everything (except short treasuries) went down together
- After the GFC, many in the industry complained that when you need it most, diversification doesn't work

“Passive” tail risk hedging:

- Uses derivative options to buy protection against losses beyond a specific downside limit
- We could buy a one month “put” option that protects us against losses greater than 15% in the US equity market
- In a crisis, we could lose 15% (but not more than that)
- Such an option would cost us between 1.5% and 2% a year, so simplistic hedging is quite expensive

Active tail risk hedging:

- Can incorporate return enhancing components so that the overall cost of the hedge is affordable
- Can adjust amount of protection in excess of a “loss floor” so that if the market declines below the “loss floor” the portfolio is made whole
- In normal markets, these strategies should have a small, predictable cost. Over long periods containing a large market decline, the strategies should more than pay for the costs

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1. Tail Risk refers to large market declines that can occur but with very low probability. The name comes from the extreme left side of a bell shaped distribution graph, which is called a “tail” of the distribution.
2. For example, volatility capture
Why is Tail Risk Hedging a Total Fund Strategy?

- Tail risk hedging does not reduce risk by simply lowering the volatility; it dramatically changes the shape (i.e. distribution) of the risk outcomes
  - Upside potential is unchanged, but downside risk is truncated below a certain level
  - Evaluating an asymmetric distribution of potential outcomes is challenging; all existing TMRS Asset Classes have nearly symmetric\(^1\) risk

- The proportion of expected return is conditional on equity market performance
  - Active asset class strategies have a constant amount by which they are expected to outperform a benchmark; for tail risk hedging, the amount of expected return varies significantly
  - The varying proportion of expected return requires complex performance measurement not consistent with any asset class
  - Mitigating downside risk for an affordable cost has obvious benefits to TMRS’s total fund objectives, but no single asset class is incentivized to evaluate or recommend a tail risk strategy

- Depending on size, an equity tail risk hedge can change the optimal asset allocation for the balance of the portfolio
  - Allocation to “capital preservation” assets partially depends on the size of the crisis risk hedge
  - Limiting severe drawdowns can significantly improve long-term geometric return expectations

\(^1\) The natural logarithm of the distribution is normally distributed and thus symmetric
Dynamic Asset Allocation

- Dynamic/Tactical Asset Allocation seeks to reduce risk and improve returns by adjusting the allocations to liquid asset classes in response to market conditions.
  - All markets/asset classes go through valuation (pricing) and fundamental (cash flow growth and/or quality) cycles
  - Relative extremes (i.e. highs or lows in the cycle) are generally clear to most in the market
  - When those extremes will reverse, however, is not clear at all

- Older rules based models:
  - Use relative valuation measures to over-allocate to assets that are cheap relative to historical valuation levels
  - Use a variety of “momentum” signals to over-allocate to assets that have done well recently and are likely to continue to do well

- Advancements over the last 20 years:
  - Use sophisticated quantitative models to form views of how expected economic growth and inflation dynamics are likely to be reflected in asset classes
  - Typically have a strong risk-management orientation and generate a significant portion of their return by knowing when to take risk off the table
  - Strategies that are rules based, proprietary, complex and continue to “evolve” with new market behavior
Why is Dynamic Asset Allocation a Total Fund Strategy?
(Isn’t it already an Absolute Return Strategy?)

- Most dynamic asset allocation strategies are structured as hedge funds, so one might expect to put them in the Absolute Return Strategy asset class
  - We do already have Absolute Return funds (e.g. Global Macro) that use dynamic asset allocation

- The Absolute Return Strategy asset class has a different return and risk objective than the Total Fund
  - Absolute Return has a specific asset class return objective of LIBOR + 4%, and a specific risk objective of 8.5% volatility with low correlations to other TMRS Asset Classes
  - Total Fund Objectives are different, return objective is 6.75% and Risk objective is 10.5%

- Sizing a dynamic allocation strategy within the context of the Absolute Return Strategies asset class will be very different from the sizing that would be optimal if it were considered as an overlay to the Total Fund
Currency Hedging

- Currency hedging mitigates the impact of currency risk on non-dollar international investment returns

- Currency risk is generally considered an unrewarded (but diversifiable) risk
  - Currency returns have volatility, but their long-term expected return is zero
  - Return volatility slightly reduces geometric returns over time
  - Currency returns have, for a large part of history, had low correlations with asset returns

- Possible Responses
  - Accept currency risk: If future currency returns have low correlations incremental risk will be very low
  - Passive currency hedge: Hedge of a fixed percent (50%, 75%, 100%) of currency exposure; can be very expensive at times
  - Active dynamic currency hedging: Employs active dynamic hedging strategies to increase hedging when it is most needed and save hedging costs when the hedge is not needed

Current Currency Risk Posture:
- Accept currency risk in our passive allocations
- Outsource currency risk management in our active allocations
Why is Currency Hedging a Total Fund Strategy?

- A fund’s approach to currency risk management should be consistent across asset classes and be related to a fund’s investment beliefs.

- Currency exposure produces the same risk regardless of the asset classes.

- A hedging program is much more efficient if implemented from a total fund exposure perspective.

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- Prioritizing based on Total Fund impact, Risk Management is not currently monitoring any currency hedging strategies.

- If/when we do evaluate such strategies, a structure like “Total Fund Strategies” would provide the necessary framework for us to bring it to the Board for consideration.
Why Now?

- TMRS has reached the size, maturity and institutional capacity necessary to consider these opportunities
  - The Board has overseen the largely completed implementation of a highly diversified asset class structure
  - We have developed significant internal expertise and consulting relationships for conducting complex due diligence
  - Integrated investment team will allow for sourcing of relevant skills
    - Public asset classes – currency risks
    - Absolute return strategies – complexity
  - Operationally we are capable of designing and implementing complex performance evaluation methodology
Practical Considerations

- With the addition of Total Fund Strategies, our asset class structure would span the entire space of investment opportunities so that we are considering all strategies that might benefit TMRS.

- Some well-known plans have implemented Total Fund Strategies\(^1\) as they have developed the resources to prudently do so:
  - Evaluate unique value creation models
  - Conduct complex due diligence
  - Hold complex performance expectations
  - Consider strategies that don’t fit in an Asset Class box

- Total Fund Strategies are often implemented as a new Asset Class with 0% target allocation:
  - It is not part of the Policy Benchmark and requires no actuarial return assumption
  - Manager performance evaluation standards can be complex, and those can be rolled up as necessary to evaluate the performance of Total Fund Strategies

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1. Also sometimes called Total Portfolio Strategies, Risk Mitigation Strategies, Trust Level Portfolio Management, etc.
II. Review of Risk Reporting

1. Quarterly Board Risk Report
Board Level Risk Governance

- Define the Board’s Risk Intentions

- Ensure that management mechanisms are created and supported to:
  - Implement the Board’s intent
  - Monitor adherence to that intent
Purpose of Quarterly Board Risk Report

Allows Board to confirm that material risks taken in the investment portfolio are in line with Board intent as expressed in the Investment Policy Statement and related Asset Allocation and Asset/Liability Studies.
# Reasons for having two types of Risk Reports

<table>
<thead>
<tr>
<th>Portfolio View</th>
<th>Time Horizon</th>
<th>Short</th>
<th>Long</th>
</tr>
</thead>
</table>
| More Granular  | Short        | Security Level Holdings provide an exposure and risk view that is:  
• Objective  
• Meaningful | Security Level Holdings provide an exposure and risk view that is:  
• Objective  
• Not meaningful |
| Less Granular  | Less Granular | Asset Class Strategy\(^1\) level exposures provide a risk view that is:  
• Subjective  
• Meaningful | Asset Class Strategy\(^1\) level exposures provide a risk view that is:  
• Subjective  
• Meaningful |

1. Conceptually analogous to sub-asset class market risk premiums like: credit, rates, real estate, complexity, asymmetric knowledge, etc.)
Quarterly Board Risk Report – Long Time Horizon

Implementation Risk Ranges Implied by IPS Asset Class Guidelines

September 2018

Based on current as-invested strategy allocations and Investment Department long-term assumptions regarding each strategy.

- Maximum risk implied by IPS
- Minimum risk implied by IPS

Legend:
- Current TMRS Risk Estimate
- RVK Long-Term Assumption
- Risk range implied by IPS Rebalancing Policy
## Quarterly Board Risk Report – Short Time Horizon

### Comparing Recent Volatility to Long-Term Assumptions

**Total Fund Risk by Asset Class**

September 2018

#### Holdings-Based Risk Model: Short-term outlook based on recent volatility of actual holdings\(^1\)

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Portfolio</th>
<th>Policy Benchmark</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Weight (%)</td>
<td>Risk</td>
</tr>
<tr>
<td>Total</td>
<td>100.0%</td>
<td>6.2</td>
</tr>
<tr>
<td>Cash Assets</td>
<td>0.1%</td>
<td>0.0</td>
</tr>
<tr>
<td>Global Equity</td>
<td>38.9%</td>
<td>10.2</td>
</tr>
<tr>
<td>Core Fixed Income</td>
<td>13.8%</td>
<td>3.9</td>
</tr>
<tr>
<td>Non-Core Fixed Income</td>
<td>17.1%</td>
<td>5.2</td>
</tr>
<tr>
<td>Real Estate</td>
<td>8.5%</td>
<td>9.9</td>
</tr>
<tr>
<td>Real Return</td>
<td>10.2%</td>
<td>6.6</td>
</tr>
<tr>
<td>Absolute Return</td>
<td>9.7%</td>
<td>2.9</td>
</tr>
<tr>
<td>Private Equity</td>
<td>1.5%</td>
<td>15.9</td>
</tr>
</tbody>
</table>

#### Strategy Implementation Risk: Long-term outlook based on TMRS Staff expectations

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Minimum Risk Implied by IPS</th>
<th>Current Portfolio Risk</th>
<th>Maximum Risk Implied by IPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>8.2</td>
<td>9.8</td>
<td>12.5</td>
</tr>
<tr>
<td>Cash Assets</td>
<td>--</td>
<td>0.0</td>
<td>--</td>
</tr>
<tr>
<td>Global Equity</td>
<td>16.5</td>
<td>17.2</td>
<td>19.2</td>
</tr>
<tr>
<td>Core Fixed Income</td>
<td>3.5</td>
<td>3.5</td>
<td>4.6</td>
</tr>
<tr>
<td>Non-Core Fixed Income</td>
<td>5.4</td>
<td>7.6</td>
<td>11.6</td>
</tr>
<tr>
<td>Real Estate</td>
<td>12.5</td>
<td>12.9</td>
<td>16.6</td>
</tr>
<tr>
<td>Real Return</td>
<td>7.0</td>
<td>10.5</td>
<td>20.0</td>
</tr>
<tr>
<td>Absolute Return</td>
<td>4.7</td>
<td>5.4</td>
<td>9.0</td>
</tr>
<tr>
<td>Private Equity</td>
<td>12.0</td>
<td>17.3</td>
<td>22.3</td>
</tr>
</tbody>
</table>

#### RVK Long-term outlook

<table>
<thead>
<tr>
<th>Benchmark Risk</th>
<th>10.4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>18.4</td>
</tr>
<tr>
<td></td>
<td>6.0</td>
</tr>
<tr>
<td></td>
<td>9.1</td>
</tr>
<tr>
<td></td>
<td>13.9</td>
</tr>
<tr>
<td></td>
<td>8.9</td>
</tr>
<tr>
<td></td>
<td>8.5</td>
</tr>
</tbody>
</table>

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1. Short-term risk numbers are based on the recent past and can be significantly different than long-term averages
1. Review of Risk Reporting

2. Internal Risk Analytics
Board Risk Reports That Require Action Suggest Risk Management Failure

- In our Three Lines of Defense Risk Governance Model\(^1\)
  - Investment (Asset Class) Teams are the First Line of Defense
  - The CIO, Risk Management, and Compliance are the Second Line of Defense
  - Independent and/or external sources provide the Third Line of Defense

- The Risk Management function is explicitly tasked to “Independently monitor and report on the level of risk against established risk appetite as expressed in IPS Guidelines”

- To help support and not just monitor the achievement of desired results, the Risk Management function provides detailed internal analytics with the goal of identifying potential problems while there is still time to avoid them

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1. Presented in the 2017 Annual Risk Management Review; details in Appendix 2
Internal Analysis and Monitoring Conducted by Risk Management

- **Cash Flow**
  - Records all private market fund capital calls and distributions
  - Projects expected future fund cash flows for asset class pacing planning and total fund liquidity management
  - Provides input to liquidity risk simulation model

- **Account Allocation and Rebalancing**
  - Used by the CIO to review allocations and funding sources for new accounts

- **Liquidity & Leverage**
  - Aggregates liquidity and leverage expectations for each account to the Total Fund level

- **Asset Class Specific**
  - Risk reporting as appropriate
  - Manager performance attribution analysis as appropriate
Conclusions

- Current methodology for risk measurement and asset allocation (MPT) was not designed to handle issues specific to Alternative Asset Classes
  - In 2019, the Risk Management team will conduct portfolio analysis that improves our ability to measure Alternative Asset Class risk

- Significant investment opportunities exist for TMRS that do not fit into our current asset class framework:
  - TMRS is reaching the size and institutional capacity necessary to engage these opportunities
  - The 2019 Asset/Liability Study could be a good opportunity to present Total Fund Strategies for the Board’s consideration

- Quarterly Board Risk Reporting allows the Board to confirm that risks taken in the investment portfolio are in line with the Board’s intent
  - Compares short horizon, Holdings Based, Risk to Investment Policy Benchmarks
  - Compares Implementation Risk to long term policy risk guidance ranges

- Internal Risk Analytics are produced, and continue to be developed, with the goal of helping the investment teams identify potential problems while there is still time to avoid them
Appendix
**Quarterly Board Risk Report**

**Active Risk Due to: Allocation Decisions**

**September 2018**

Active risk (i.e. risk of being different from the benchmark) can be divided into Allocation and Selection decisions.

Note that a large part of our active risk is due to not yet fully implementing our Strategic Target Allocation.

Total Active Risk = 0.86

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Policy Benchmark</th>
<th>Strategic Target Allocation (%)</th>
<th>Portfolio Allocation (%)</th>
<th>Allocation Difference (%)</th>
<th>Pending Policy Allocations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash Assets</td>
<td>30 Day T- Bill</td>
<td>0.00%</td>
<td>0.13%</td>
<td>0.13%</td>
<td>0.00</td>
</tr>
<tr>
<td>Global Equity</td>
<td>MSCI ACWI IMI</td>
<td>35.00%</td>
<td>38.93%</td>
<td>3.93%</td>
<td>-3.50%</td>
</tr>
<tr>
<td>Core Fixed Income</td>
<td>Barclays U.S. Agg</td>
<td>10.00%</td>
<td>13.83%</td>
<td>3.83%</td>
<td>-4.00%</td>
</tr>
<tr>
<td>Non-Core Fixed Income</td>
<td>50% High Yield, 50% Levered Loan</td>
<td>20.00%</td>
<td>17.08%</td>
<td>-2.92%</td>
<td>3.00%</td>
</tr>
<tr>
<td>Real Estate</td>
<td>NCREIF ODCE</td>
<td>10.00%</td>
<td>8.52%</td>
<td>-1.48%</td>
<td>1.00%</td>
</tr>
<tr>
<td>Real Return</td>
<td>Manager Benchmark Rollup</td>
<td>10.00%</td>
<td>10.25%</td>
<td>0.25%</td>
<td>0.00</td>
</tr>
<tr>
<td>Absolute Return</td>
<td>HFRI FOF Diversified Index</td>
<td>10.00%</td>
<td>9.73%</td>
<td>-0.27%</td>
<td>0.00</td>
</tr>
<tr>
<td>Private Equity</td>
<td>Custom risk proxy</td>
<td>5.00%</td>
<td>1.53%</td>
<td>-3.47%</td>
<td>3.50%</td>
</tr>
<tr>
<td><strong>Total Active Allocation Risk</strong></td>
<td></td>
<td><strong>100.00%</strong></td>
<td><strong>100.00%</strong></td>
<td><strong>0.00%</strong></td>
<td><strong>0.37</strong></td>
</tr>
</tbody>
</table>

Active Risk from Allocation

Active Risk from Selection

Note that a very small part of our risk is due to active allocation decisions to deviate from our Strategic Target Allocation.

**Appendix 1**

**Total Active Risk from Allocation Decisions**: 0.37

**Total Active Risk from Selection Decisions**: 0.49
Active Risk Due to: **Selection Decisions**

**September 2018**

Note how much of our active risk is due to choosing manager benchmarks different from policy benchmarks.

Note how much of our active risk is due to managers holding portfolios different from their benchmarks.

For alternatives, the best available benchmarks do not satisfy all of TMRS’s benchmarking criteria, so active risk measurements are less precise.

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Policy Benchmark</th>
<th>Portfolio Allocation (%)</th>
<th>Contribution of Strategy Benchmark Decisions</th>
<th>Contribution of Active Manager Decisions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Public/Traditional Investments</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cash Assets</td>
<td>30 Day T- Bill</td>
<td>0.13%</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Global Equity</td>
<td>MSCI ACWI IMI</td>
<td>38.93%</td>
<td>0.06</td>
<td>-0.01</td>
</tr>
<tr>
<td>Core Fixed Income</td>
<td>Barclays U.S. Agg</td>
<td>13.83%</td>
<td>0.00</td>
<td>0.01</td>
</tr>
<tr>
<td>Public Non-Core Fixed Income</td>
<td>50% High Yield, 50% Levered Loan</td>
<td>10.81%</td>
<td>0.10</td>
<td>0.00</td>
</tr>
<tr>
<td>Public Real Return</td>
<td>Manager Benchmark Rollup</td>
<td>8.89%</td>
<td>0.06</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>Private/Alternative Investments</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Private Non-Core Fixed Income</td>
<td>50% High Yield, 50% Levered Loan</td>
<td>6.27%</td>
<td>0.00</td>
<td>0.03</td>
</tr>
<tr>
<td>Private Real Return</td>
<td>Manager Benchmark Rollup</td>
<td>1.36%</td>
<td>0.00</td>
<td>-0.03</td>
</tr>
<tr>
<td>Real Estate</td>
<td>NCREIF ODCE</td>
<td>8.52%</td>
<td>0.00</td>
<td>0.06</td>
</tr>
<tr>
<td>Absolute Return</td>
<td>HFRI FOF Diversified Index</td>
<td>9.73%</td>
<td>0.00</td>
<td>0.14</td>
</tr>
<tr>
<td>Private Equity</td>
<td>Custom risk proxy</td>
<td>1.53%</td>
<td>0.00</td>
<td>0.03</td>
</tr>
<tr>
<td><strong>Total Active Selection Risk</strong></td>
<td></td>
<td>100.00%</td>
<td>0.21</td>
<td>0.28</td>
</tr>
</tbody>
</table>

Total Active Risk = 0.86
Evolution of Risk Over Time
September 2018

Total Risk

Active Risk

Appendix 1
### Total Fund & Asset Class Regional Exposures

**September 2018**

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Developed Americas</th>
<th>Developed Europe</th>
<th>Developed Asia &amp; Pacific Rim</th>
<th>Emerging Americas</th>
<th>Emerging Europe</th>
<th>Emerging Asia &amp; Pacific Rim</th>
<th>Middle East &amp; Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash Assets</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Global Equity</td>
<td>58%</td>
<td>19%</td>
<td>11%</td>
<td>1%</td>
<td>1%</td>
<td>9%</td>
<td>1%</td>
</tr>
<tr>
<td>Core Fixed Income</td>
<td>88%</td>
<td>8%</td>
<td>1%</td>
<td>1%</td>
<td>0%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Non-Core Fixed Income</td>
<td>76%</td>
<td>9%</td>
<td>1%</td>
<td>5%</td>
<td>5%</td>
<td>3%</td>
<td>1%</td>
</tr>
<tr>
<td>Real Estate</td>
<td>95%</td>
<td>5%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Real Return</td>
<td>67%</td>
<td>18%</td>
<td>10%</td>
<td>3%</td>
<td>1%</td>
<td>1%</td>
<td>0%</td>
</tr>
<tr>
<td>Absolute Return</td>
<td>45%</td>
<td>33%</td>
<td>7%</td>
<td>2%</td>
<td>6%</td>
<td>7%</td>
<td>0%</td>
</tr>
<tr>
<td>Private Equity</td>
<td>92%</td>
<td>6%</td>
<td>0%</td>
<td>1%</td>
<td>0%</td>
<td>1%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>Total Fund</strong></td>
<td><strong>69%</strong></td>
<td><strong>15%</strong></td>
<td><strong>6%</strong></td>
<td><strong>2%</strong></td>
<td><strong>2%</strong></td>
<td><strong>5%</strong></td>
<td><strong>1%</strong></td>
</tr>
</tbody>
</table>

**Notes:**
1. Developed Americas consists almost entirely of the USA. Canada is a very small allocation.
2. The Absolute Return regional breakdown is based on manager and ARS consultant estimates.
Review of Risk Reporting

Three Lines of Defense Risk Governance

Board of Trustees

Executive Director

Chief Investment Officer

First Line of Defense

Risk Owners
- Asset Class Directors
  - Accountable for:
    - Identification
    - Measurement
    - Response
    - Monitoring
    - Communication
  - Risk Guidance given by IPS Guidelines

Risk Oversight

Risk Management
- Establish risk management framework
- Provide oversight of the effectiveness of First Line risk management practices (responsibility held by CIO)
- Independently monitor and report on the level of risk against established risk appetite as expressed in IPS Guidelines

Compliance
- Independently monitor and report on compliance with IPS Guidelines

Second Line of Defense

Independent Assurance
- Internal Auditor
  - Independent assurance to Board of Trustees on effectiveness of risk management practices
- External Auditors
- Consultants

Third Line of Defense

Appendix 2