INVESTMENT MANAGEMENT COMMITTEE

December 2016
TEACHER RETIREMENT SYSTEM OF TEXAS MEETING  
BOARD OF TRUSTEES  
AND  
INVESTMENT MANAGEMENT COMMITTEE  

(Committee Chair and Members: Mr. Colonnetta, Chair; Mr. Corpus; Mr. Kelly;  
Mr. Moss and Ms. Ramirez)  

All or part of the December 1, 2016, meeting of the TRS Investment Management Committee and Board of Trustees may be held by telephone or video conference call as authorized under Sections 551.130 and 551.127 of the Texas Government Code. The Board intends to have a quorum and the presiding officer of the meeting physically present at the following location, which will be open to the public during the open portions of the meeting: 1000 Red River, Austin, Texas 78701 in the TRS East Building, 5th Floor, Boardroom.  

AGENDA  

December 1, 2016 – 12:30 p.m.  
TRS East Building, 5th Floor, Boardroom  

1. Call roll of Committee members.  
2. Consider the approval of the proposed minutes of the September 22, 2016 committee meeting – Joe Colonnetta.  

NOTE: The Board of Trustees (Board) of the Teacher Retirement System of Texas will not consider or act upon any item before the Investment Management Committee (Committee) at this meeting of the Committee. This meeting is not a regular meeting of the Board. However, because the full Investment Management Committee constitutes a quorum of the Board, the meeting of the Committee is also being posted as a meeting of the Board out of an abundance of caution.
Minutes of the Investment Management Committee

September 22, 2016

The Investment Management Committee of the Board of Trustees of the Teacher Retirement System of Texas met on September 22, 2016, in the boardroom located on the fifth floor of the TRS East Building offices at 1000 Red River Street, Austin, Texas.

Committee Members present:
Mr. Joe Colonnetta, Chair
Mr. David Corpus
Mr. David Kelly
Mr. Chris Moss
Ms. Dolores Ramirez

Other Board Members present:
Ms. Karen Charleston
Mr. John Elliott
Ms. Anita Palmer

Others present:
Brian Guthrie, TRS          Dr. Keith Brown
Ken Welch, TRS             Steve Huff, Reinhart Boerner Van Deuren s.c.
Britt Harris, TRS           Steve Voss, Aon Hewitt
Jerry Albright, TRS         Ann Fickel, TCTA
Carolina de Onis, TRS       Ted Melina Raab, Texas AFT
Mike Pia, TRS               Leroy DeHaven, TRTA
J.B Daumerie, TRS           Philip Mullins, TRTA
Dale West, TRS
Susanne Gealy, TRS
Brad Gilbert, TRS
Katherine Farrell, TRS

Investment Management Committee Chair Mr. Colonnetta called the meeting to order at 12:28 p.m.

1. Call roll of Committee members.

Ms. Farrell called the roll. A quorum was present.

2. Consider the approval of the proposed minutes of the June 16, 2016 committee meeting – Committee Chair Joe Colonnetta.

On a motion by Mr. Corpus, seconded by Mr. Kelly, the committee voted to approve the proposed minutes for the June 16, 2016, Investment Management Committee meeting as presented.

3. Receive the Public Strategic Partnership Network – Michael Pia and J.B. Daumerie.
Mr. Mike Pia provided an overview of the Public Strategic Partnership Network (SPN). The public market SPN is a $6.5 billion portfolio aggregated across four managers. Mr. Pia highlighted a couple of key attributes of the SPN concept. Mr. Pia reported a signature element of this SPN concept is the investment insights pulled from these managers to be used as headlights across the trust.

Mr. J.B. Daumerie provided further details of asset allocation and the traditional performance and positioning. He stated that the objective for the portfolio is to generate 200 basis points of alpha per year, with a tracking error of 250 basis points. He said that since inception, the portfolio has returned six percent which is equivalent to adding 0.8 percent of alpha per year. Mr. Daumerie noted this past year has only been the second time since inception that there has been a negative absolute return. Compared to peers, Mr. Daumerie stated the short term performance has been in the lower percentiles, but longer term performance has outperformed the peers. Mr. Daumerie then reviewed the various factors that impacted equities such as Fed policy, interest rates, currencies, and EPS growth.

Mr. Daumerie then spoke to diversification. In response to Dr. Brown’s inquiry about two of the partners underperforming, Mr. Pia explained the review of those partners. Mr. Harris expounded upon the diversification and how confidence of performance should be viewed through a three, five, or seven-year time frame.

Mr. Daumerie provided an update on the August summit. Mr. Daumerie concluded his presentation with a brief overview of the portfolio accomplishments and priorities.

4. **Review the External Public Markets Portfolio - Dale West, Susanne Gealy, and Brad Gilbert.**

Mr. Dale West explained the external public markets group is charged with hiring external managers, both in traditional long oriented fashion and hedge funds in the public markets. Mr. West provided a summary of the results for the year. The external public markets group manages just over $35 billion in assets at the end of June, representing a little over 27 percent of the trust. Mr. West noted long term results are positive and value added over the five years. However, over one year, negative absolute returns in line with the world markets, and also a negative .4 percent in value added or alpha.

Mr. West stated over the twelve months to June, there was positive value added internationally, in both developed and emerging markets and in stable value hedge funds. He noted this was offset by the negative performance in the U.S. and in the world portfolio. He said the U.S. portfolio has shrunk quite a bit in the last year, $2 and half billion was taken out of the U.S. portfolio. In response to Mr. Colonnetta’s inquiry, Mr. West reported over the last year underperforming managers were fired and reduced position size. Additionally, Mr. West reported they have taken advantage of some underperforming managers in the market environment to renegotiate terms with 16 managers over the twelve months.

Mr. West stated over the past five years, the external public markets program has added about $485 million versus passive benchmarks. For the 2016 priorities, Mr. West stated they are going
to continue to reduce the U.S. portfolio and review how active management in U.S. is organized going forward.

Mr. West reported on the two main legislative restrictions that apply to the Trust level. One restriction is the 30 percent on agency investment management agreements where authority has been delegated to a manager to run our assets. Mr. West reported currently using 19.5 percent of that authority. The other restriction is the 10 percent limit on hedge fund investments. Mr. West reported the Trust is currently at 8.3 percent.

Ms. Susanne Gealy reported on the global equity external manager program. She noted this portfolio is $24.3 billion of Trust capital that is allocated across four equity asset class mandates and 34 manager relationships. Starting with the U.S. portfolio, Ms. Gealy stated on a three-year basis, the portfolio has returned 8.5 percent. Ms. Gealy stated this portfolio is a top priority and reported a couple of relationships have been terminated and manager fees renegotiated. Additionally, she stated they shrunk capital to deploy to better opportunities from the strategic asset allocation plan from the Trust.

Ms. Gealy reported on international investing, both on the developed market side and the emerging market side, strong alpha was achieved. For the international developed portfolio, $5.2 billion is allocated. Ms. Gealy noted on one to three year basis, achieved strong alpha with 1.9 percent alpha on a three year basis. Ms. Gealy reported on emerging markets, $8.1 billion is allocated. Ms. Gealy noted a 2.2 percent alpha on a one-year basis and positive alpha on a three year basis.

Ms. Gealy reported on the world equity portfolio with $5.2 billion of capital, with a three year annualized absolute return of 5.3 percent. Ms. Gealy noted this portfolio has also faced headwinds from alpha. Ms. Gealy provided further details as to the U.S. portfolios explaining that large cap has returned 3.9 percent. She further stated midcap has been essentially flat and Small cap stocks have lagged by 7 percent.

Mr. Brad Gilbert provided the hedge fund portion of the update. Mr. Gilbert reported the allocation to hedge funds is just under $11 billion. Mr. Gilbert noted the allocation is split across two separate hedge fund portfolios called directional and stable value. The directional portfolio has been annualized 1.2 percent ahead of its benchmark and stable value has been 80 basis points ahead of its benchmark on an annualized basis. Mr. Gilbert reported the stable value portfolio outperformed its benchmark by 5.8 percent. The directional value underperformed by 3.9 percent. Mr. Gilbert stated steps have been taken recently to address performance, including manager terminations, new additions and reducing fees.

Mr. Gilbert further reported the alpha is positive for both directional and stable value. The directional value’s alpha is in line with that of its benchmark. The stable value’s alpha is 3.6 which is over 200 basis points higher than its benchmark. Mr. Harris expounded upon the need to retain hedge funds even when not performing to ensure risk diversification.

Without further discussion, the meeting adjourned at 1:31 p.m.

________________________________________         ______________________
Katherine H. Farrell                               Date
Secretary of the TRS Board of Trustees
Risk Group Annual Update
Jase Auby, Chief Risk Officer
James Nield, Deputy Chief Risk Officer
December 2016
Agenda

I. Executive Summary

II. Risk Group Personnel

III. Mandate

IV. Risk Management
   • Bubbles
   • Environmental
   • CUSUM
   • Bear Market Indicators

V. Portfolio Management
   • Risk Parity
   • Low Volatility
   • Reinsurance
   • Dynamic Currency

VI. Accomplishments and Priorities
Executive Summary
As of September 30, 2016

In 2016, the Risk Group:

- **Executed our mandate** to enable efficient risk taking:
  - Completed six priority projects: (1) achieved 5% target allocation to risk parity, (2) expanded low volatility to include EAFE and EM, (3) conducted global equity best practice review, (4) developing risk signals portfolio, (5) enhanced risk parity technology, and (6) hosted the pension risk conference

<table>
<thead>
<tr>
<th></th>
<th>Total Assets</th>
<th>Return</th>
<th>Alpha (bp)</th>
<th>Incept Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$, mm</td>
<td></td>
<td>1-Year</td>
<td>3-Year</td>
</tr>
<tr>
<td>External Risk Parity</td>
<td>3,508</td>
<td>2.6%</td>
<td>13.0%</td>
<td>4.8%</td>
</tr>
<tr>
<td>Internal Risk Parity</td>
<td>3,217</td>
<td>2.4%</td>
<td>15.0%</td>
<td>7.7%</td>
</tr>
<tr>
<td>Low Volatility</td>
<td>775</td>
<td>0.6%</td>
<td>22.7%</td>
<td>16.7%</td>
</tr>
<tr>
<td>Reinsurance</td>
<td>300</td>
<td>0.2%</td>
<td>11.0%</td>
<td>13.3%</td>
</tr>
<tr>
<td>Dynamic Currency*</td>
<td>0</td>
<td>0.0%</td>
<td>-0.5%</td>
<td>NA</td>
</tr>
<tr>
<td><strong>Total Risk Group</strong></td>
<td><strong>7,801</strong></td>
<td><strong>5.9%</strong></td>
<td><strong>13.6%</strong></td>
<td><strong>7.3%</strong></td>
</tr>
</tbody>
</table>

Periods longer than 12 months are annualized. Dynamic Currency is shown as a contribution to Total Risk Group

*Research portfolio - notional value up to $500 mm
Risk Group Personnel

Jase Auby, CFA
Chief Risk Officer, Senior Managing Director
BS, Electrical Engineering, Harvard College

James Nield, CFA, FRM
Deputy Chief Risk Officer
Senior Director
MBA, Finance, New York University
BS, Finance, Pennsylvania State University

Mark Telschow, CFA
Investment Manager
BS, Civil Engineering, University of Texas

Mike Simmons
Senior Associate
MPA, Accounting, University of Texas
BBA, Finance, Texas A&M University

Steven Lambert
Associate
BS, Business Management, Saint Joseph’s College

Stephen Kim
State Street Employee
MBA, Finance, University of Texas
BS, Computer Science, Dartmouth College

Josiah Stevenson
Senior Analyst
MS, Economics, University of Texas
BS, Economics, Texas A&M University

Paul Waclawsky
Administrative
BS, Accounting, University of Maryland

Risk Group Highlights
Four Masters Degrees
Three CFAs
One FRM
The two mandates highlighted in **green** are the primary focus of the remainder of our presentation:

- **Manage**
  - **Signals**: Identify and monitor key statistical thresholds, which when crossed, will cause specific investigation and action. *Bubble Signals* and *CUSUM Signals* are examples of key risk signals.
  - **Strategies**: Invest in strategies that are (1) less reliant on equity returns or (2) are otherwise diversifying to the Trust. *Risk Parity, Low Volatility, Dynamic Currency and Reinsurance*.
  - **Budgeting**: Manage how Trust allocations and correlations combine to either overweight or underweight the risk of the Trust. Focus upon *Tracking Error* and *Value-at-Risk*.

The four **blue** mandates are addressed in our semi-annual Investment Risk Report presentations to the Board Risk Committee:

- **Monitor**
  - **Certification**: Certify all new External Public investments with respect to Market Factors, Leverage, Drawdown History, Liquidity, Risk Management Systems and Audit History.
  - **Compliance**: Monitor and resolve *Compliance Issues* raised by the Investment Compliance group.

- **Reporting**: Prepare useful *Risk Reports*.
  - Monitor Trust risks which include Market, Leverage, Liquidity, Concentration, Currency, Counterparty and other risks.

---

*TRS*
Risk Management

• Identify and monitor key statistical thresholds, which when crossed, will cause specific investigation and action
• Bubble Signals and CUSUM Signals are examples of key risk signals

Key Risk Signals:
• Bubbles
• Environmental
• CUSUM
• Bear Market Indicators

• In total, we monitor over 200 risk signals on a daily basis
Key Risk Signals

Bubbles

- No bubble signals in the past year
  - Longest time period without a bubble signal since 1995
  - This is consistent with an expansion cycle that has been longer than most but accompanied by below average growth
- As of September 2016 Real Estate indices were closest to generating a signal but were not at extreme levels

Source: TRS IMD
Key Risk Signals

Environmental

- US is currently in Box 5 and is projected to stay there
- U.S. has been in Box five 55% of the time since 1957

The world has been predominantly in a Global Equity regime throughout the year
Key Risk Signals
CUSUM: TRS Public Portfolios

• **CUSUM Signal**: a tool designed to identify patterns of persistent underperformance within portfolios; signal initiates a buy/sell decision

• CUSUM Signals program launched in January 2010

• A primary advantage of the program is to ensure a systematic review of underperforming managers

**CUSUM Signals to Date**

• 125 Portfolio CUSUM Signals since inception:
  - 92 buys
  - 27 sells
  - 6 pending

*Source: TRS IMD*
Key Risk Signals

*Bear Market Indicators*

- TRS Bear Market Indicators consist of 24 macroeconomic and market signals
  - Example: Inflation, Employment, Growth, Credit and Market
- Since 1967, when 50% or more indicators are “on”, the market has entered a bear market within the next six months 67% of the time

### Last 10 Years: Percentage of Indicators On

- **Current Level**: 22%
- **Threshold Level**: 50%

Note: Shading indicates a bear market as defined by a 20% decline in the S&P 500

- Currently, 22% of indicators are on indicating a heightened risk of a bear market

Source: TRS IMD
## Portfolio Management

**As of September 30, 2016**

- **Strategies**
  - Invest in strategies that are (1) less reliant on equity returns or (2) are otherwise diversifying to the Trust
  - Risk Parity, Low Volatility, Dynamic Currency and Reinsurance

<table>
<thead>
<tr>
<th>RISK GROUP</th>
<th>Total Assets</th>
<th>Return</th>
<th>Alpha (bp)</th>
<th>Incept Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$, mm</td>
<td>% Trust</td>
<td>1-Year</td>
<td>3-Year</td>
</tr>
<tr>
<td>External Risk Parity</td>
<td>$3,508 2.6%</td>
<td>13.0% 4.8%</td>
<td>73 137</td>
<td>Feb-12</td>
</tr>
<tr>
<td>Internal Risk Parity</td>
<td>3,217 2.4%</td>
<td>15.0 7.7</td>
<td>268 424</td>
<td>Jul-13</td>
</tr>
<tr>
<td>Low Volatility</td>
<td>775 0.6%</td>
<td>22.7 16.7</td>
<td>645 540</td>
<td>Jan-13</td>
</tr>
<tr>
<td>Reinsurance</td>
<td>300 0.2%</td>
<td>11.0 13.3</td>
<td>1072 1120</td>
<td>Oct-13</td>
</tr>
<tr>
<td>Dynamic Currency*</td>
<td>0 0.0%</td>
<td>-0.5 NA</td>
<td>-51 NA</td>
<td>Mar-15</td>
</tr>
<tr>
<td><strong>Total Risk Group</strong></td>
<td><strong>$7,801 5.9%</strong></td>
<td><strong>13.6% 7.3%</strong></td>
<td><strong>189 286</strong></td>
<td><strong>Feb-12</strong></td>
</tr>
</tbody>
</table>

Periods longer than 12 months are annualized. Dynamic Currency is shown as a contribution to Total Risk Group.

*Research portfolio - notional value up to $500 mm

Source: State Street Bank
## Risk Parity

### Portfolio Overview

**Portfolio Managers:** James Nield, Mark Telschow  

**Size:** $6.7 billion  
- $3.5b external, $3.2b internal  

**Start Date:** February 2012  

**Profit Center(s):** Risk  

**Benchmark:** Equal weighted blend of external strategies  

**Objective:** Gain diversified exposure to risk premia  

### Portfolio Construction

<table>
<thead>
<tr>
<th>Rising Growth</th>
<th>Rising Inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>25% of risk</td>
<td>25% of risk</td>
</tr>
</tbody>
</table>

- Equities  
- Credit  
- Base Metals / Energy

<table>
<thead>
<tr>
<th>Falling Growth</th>
<th>Falling Inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>25% of risk</td>
<td>25% of risk</td>
</tr>
</tbody>
</table>

- Nominal Bonds  
- Inflation-linked Bonds

### Performance

- **1 Yr. Return (External):** 13.0%  
- **1 Yr. Return (Internal):** 15.0%  
- **1 Yr. Alpha (External):** 0.7%  
- **1 Yr. Alpha (Internal):** 2.7%  
- **3 Yr. Return (External):** 4.8%  
- **3 Yr. Return (Internal):** 7.7%  
- **3 Yr. Alpha (External):** 1.4%  
- **3 Yr. Alpha (Internal):** 4.2%

### Holdings

As of September 2016

- **Equities:** 27.1%  
- **Nominal Bonds:** 28.0%  
- **IL Bonds:** 25.7%  
- **Credit:** 12.7%  
- **Commodities:** 6.5%
Risk Parity

SAA Implementation Update

• Risk Parity allocation is now at the desired 5% allocation per the Strategic Asset Allocation recommendation

• Internal Risk Parity represents roughly 50% of the total Risk Parity allocation in line with the long-term target

• Per the SAA study, the stated objective of including Risk Parity was to:
  1) increase the probability of achieving 8%:
     o One year return is greater than 8%
     o Outperformed 60/40 on a 3-year basis
  2) improve the risk profile of the Trust
     o Risk Parity is 5% of Trust assets but only 4.1% of total risk

Source: State Street Bank
Risk Parity

Performance Analysis

- Risk Parity was trailing a 60/40 portfolio by more than 5% when performance was reviewed with the Board in November 2015
- Today, Risk Parity is outperforming a 60/40 portfolio when using trailing 3 year returns
- Recent allocations have coincided with strong portfolio performance

% of Periods Since 1925 that Risk Parity Outperformed a Global 60/40 Portfolio

- Rolling 1-Year Returns: 58%
- Rolling 3-Year Returns: 62%
- Rolling 5-Year Returns: 65%
- Rolling 10-Year Returns: 72%
- Rolling 20-Year Returns: 80%

Source: Bridgewater (upper right table and TRS (lower chart)
Note: 60/40 based on MSCI ACWI and Barclays AGG. Risk Parity performance based on a blend of realized manager performance
Low Volatility
Portfolio Overview

Portfolio Managers: Mark Telschow, Kyle Schmidt
Size: $0.8 billion
Start Date: January 2013
Profit Center(s): Risk, Asset Allocation
Benchmark: MSCI USA IMI, MSCI EAFE & Canada, MSCI EM
Objective: Provide exposure to two diversifying risk premia, low volatility and the volatility risk premium

Portfolio Construction

- Our risk controls (portfolio constraints and beta-drag mitigation) have resulted in outperformance relative to peers

Cumulative Excess Return (vs MSCI USA IMI)

Sample Holdings

TRS Low Vol USD has outperformed its peers, including the largest peer, USMV

Source: State Street Bank
Reinsurance

Portfolio Overview

Portfolio Managers: James Nield, Steven Wilson
Size: $0.3 billion
Start Date: October 2013
Profit Center(s): Risk, EPU
Benchmark: HFRI Fund of Funds Conservative
Objective: Capture premium of being willing to provide additional capital to insurance companies

- Provide coverage to insurance companies for a wide range of loss events
- Model probability of risk events to build an efficient portfolio

Source: TRS IMD, Validus (Sample holdings)
Dynamic Currency

Portfolio Overview

Portfolio Managers: James Nield, Mike Simmons
Size: $0.0 billion ($0.5 notional value)
Start Date: February 2015 (Research Portfolio)
Profit Center(s): Risk
Benchmark: Absolute Return
Objective: Hedge Trust currency exposure during periods of dollar strength while limiting downside when dollar is weak

Portfolio Construction

- 30% of the Trust is in non USD assets
- Hedge the most liquid developed market currencies (shown in color at right) by going short the foreign currency and long the US dollar
- Reduce the size of the hedge during periods of dollar weakness

Source: State Street Bank
Note: 1) the Hong Kong dollar is pegged to the US dollar and therefore is not hedged, 2) there are no 3 year performance numbers as the strategy launched in February 2015

Performance

Sample Holdings

Trust Non-USD Currency Exposure

[Graph showing currency exposure percentages]
• Portfolio is designed to do well in periods of US dollar strength
  • Example: 2008, 2014
• Designed to mitigate portfolio losses in periods of US dollar weakness
• Portfolio struggles when the US dollar neither strengthens nor weakness
  • Example: 2015-2016

Source: TRS IMD
Accomplishments and Priorities

2016 Accomplishments

- Executed our mandate to enable efficient risk taking
- Contributed to the Trusts alpha over all time horizons including 1Y (+189 bp), 3Y (+286 bp) and since inception (+185 bp)
- Delivered key annual priorities:
  1. Concluded the ramp-up of the Risk Parity portfolio to 5% of the Trust
  2. Expand Low Volatility to include EAFE and EM
  3. Led a project to investigate global equity best practices for active management
  4. Developing a risk signals paper portfolio for potential implementation of asset allocation tilts
  5. Enhanced risk parity technology
  6. Hosted a Pension Risk Conference

2017 Priorities (Preliminary)

- Execute mandate to enable efficient risk taking
- Contribute to Trust alpha
- Deliver key annual priorities (preliminary):
  1. Implement Risk Parity allocation tilts
  2. Review expansion of Low Volatility
  3. Extend currency hedging to other Trust portfolios as necessary
  4. Standardize major events risk analysis (e.g., Brexit)
  5. Initiate Risk Signal research portfolio (paper)
  6. Support Global Equity Best Practice and Blank Canvas initiatives
Global Risk Conference

Austin, Texas

2016 Global Risk Conference – Austin, TX

- Hosted 9 of the 10 largest Canadian Pension plans in June 2016 for a two-day Risk Conference at the TRS offices
- Round table discussions on eleven different topics
  - Topics included negative rates, risk budgeting, currency hedging, and liquidity management amongst others
- Key findings:
  - Organizations face similar issues
  - TRS Risk capabilities compares well with that of our northern neighbors
  - TRS has a much smaller risk organization which requires us to focus on high impact items
This slide was intentionally left blank.
Asset Allocation

Mohan Balachandran, Senior Managing Director

December 2016
Agenda

I. Performance
II. Organization
III. Asset Allocation Team Overviews
   • Treasury Team
   • Quantitative Equity Strategies
   • Special Opportunities
   • Tactical Asset Allocation
IV. 2016 Accomplishments and 2017 Goals
V. Appendix
## Performance Executive Summary

### As of September 30, 2016

Source: State Street Bank

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Asset ($) MM</th>
<th>1Y</th>
<th>3Y</th>
<th>1Y</th>
<th>3Y</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stand-alone Strategies:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Long Treasuries</td>
<td>$13,480</td>
<td>13.4%</td>
<td>11.3%</td>
<td>23</td>
<td>14</td>
</tr>
<tr>
<td>TIPS</td>
<td>$3,670</td>
<td>6.8%</td>
<td>2.6%</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>Quantitative Equity Strategies</td>
<td>$3,424</td>
<td>12.6%</td>
<td>7.4%</td>
<td>-52</td>
<td>125</td>
</tr>
<tr>
<td>Special Opportunities1</td>
<td>$203</td>
<td>6.9%</td>
<td>7.8%</td>
<td>-32</td>
<td>443</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$20,777</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Overlay Strategies:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrated TAA2</td>
<td></td>
<td>-0.1%</td>
<td>-0.2%</td>
<td>-11</td>
<td>-17</td>
</tr>
</tbody>
</table>

Source: State Street Bank

1 IRR of 16.3% since inception in June 2012; benchmark is combination of MSCI USA and Absolute Return

2 Integrated TAA returns and alpha represented at Trust level
Asset Allocation Mandate

<table>
<thead>
<tr>
<th>Monitor Trust-Wide Exposures and Develop Alpha Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Beta Management</strong></td>
</tr>
<tr>
<td>SAA</td>
</tr>
<tr>
<td>• <strong>Strategic Asset Allocation</strong>: Responsible for development and implementation of Trust-wide asset allocation based on long-term risk and return expectations</td>
</tr>
<tr>
<td>Fixed Income</td>
</tr>
<tr>
<td>• <strong>Fixed Income</strong>: Manages Treasury and TIPS portfolios with low tracking error</td>
</tr>
<tr>
<td>Treasury</td>
</tr>
<tr>
<td>• <strong>Treasury</strong>: Manages Trust liquidity, rebalances, and cash flows</td>
</tr>
<tr>
<td><strong>Alpha Generation</strong></td>
</tr>
<tr>
<td>TAA</td>
</tr>
<tr>
<td>• <strong>Tactical Asset Allocation</strong>: Develops dynamic overlay strategies using signals from forecasting models, SPN positioning and risk premia</td>
</tr>
<tr>
<td>QES</td>
</tr>
<tr>
<td>• <strong>Quantitative Equity Strategies</strong>: Manages systematic active portfolios using alpha models and risk premia</td>
</tr>
<tr>
<td>Spec Opps</td>
</tr>
<tr>
<td>• <strong>Special Opportunities</strong>: Accesses opportunistic investments that are accretive to the overall Trust</td>
</tr>
</tbody>
</table>
Objectives:
• Manage total Trust asset allocation and capital activity
• Delivery of Index returns for US Bond Strategies
• Manage $1.5 billion Risk Parity global inflation-linked bond allocation

Performance as of 9/30:

<table>
<thead>
<tr>
<th>Allocation ($ bn)</th>
<th>% of Trust</th>
<th>1Y Return</th>
<th>1Y Alpha</th>
<th>3Y Return</th>
<th>3Y Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long Treasuries</td>
<td>$13.5</td>
<td>10.1%</td>
<td>13.4%</td>
<td>0.23%</td>
<td>11.3%</td>
</tr>
<tr>
<td>TIPS</td>
<td>$3.7</td>
<td>2.8%</td>
<td>6.8%</td>
<td>0.22%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Total</td>
<td>$17.1</td>
<td>12.9%</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

% of Trust vs. Risk:

<table>
<thead>
<tr>
<th>% of Trust</th>
<th>% of Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long Treasuries</td>
<td>10.1%</td>
</tr>
<tr>
<td>TIPS</td>
<td>2.8%</td>
</tr>
<tr>
<td>Total</td>
<td>12.9%</td>
</tr>
</tbody>
</table>

2017 Goals:
• Manage internal Treasury and Inflation portfolios
• Oversee and communicate SAA Implementation
• Research viability of active fixed income strategies

Source: State Street Bank

1 Estimate as of 10/5/2016
Quantitative Equity Strategies (QES)

Objectives:
• Manage internal QES strategies totaling $3.4 billion or 2.6% of the Trust
• Generate 100 bps in alpha

Performance as of 9/30:

<table>
<thead>
<tr>
<th>Allocation ($ bn)</th>
<th>1Y Return</th>
<th>1Y Alpha</th>
<th>3Y Return</th>
<th>3Y Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global QES</td>
<td>$2.6</td>
<td>10.3%</td>
<td>(2.0%)</td>
<td>5.8%</td>
</tr>
<tr>
<td>Low Vol (w/ Risk Group)</td>
<td>$0.8</td>
<td>22.7%</td>
<td>6.5%</td>
<td>16.8%</td>
</tr>
<tr>
<td>Quantitative Equity Strategies</td>
<td>$3.4</td>
<td>12.6%</td>
<td>(0.5%)</td>
<td>7.4%</td>
</tr>
</tbody>
</table>

• Since June 2009 inception, Quantitative Equity Strategies has achieved an annualized return of 11.9%, annualized alpha of 199 bps, realized tracking error of 1.9%, and an IR of 1.0

2017 Goals:
• Achieve alpha target of 100 bps
• Research Long/Short approach for existing and additional portfolios
• Enhance data quality with additional point-in-time data and improved transaction cost modeling
• Continue to increase positive impact

Source: State Street Bank
Special Opportunities Summary

Objectives:
- Generate an absolute return of 8 - 10% IRR over a 3 year period
- Access unique investments that are accretive to the overall Trust with acceptable risk and liquidity
- Approved two new managers and approved four new investments for $146 million

Performance as of 9/30:

- Realized a 16.3% internal rate of return since inception in June 2012

2017 Goals:
- Expand impact of Special Opportunities
- Enhance Special Opportunities processes and procedures

<table>
<thead>
<tr>
<th></th>
<th>1Y Return</th>
<th>1Y Alpha¹</th>
<th>3Y Return</th>
<th>3Y Alpha¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Special Opportunities</td>
<td>6.9%</td>
<td>(0.3%)</td>
<td>7.8%</td>
<td>4.4%</td>
</tr>
</tbody>
</table>

¹ Benchmark is combination of MSCI USA and Absolute Return

Team members:
- Ashley Baum, CFA, CPA
  Sr. Investment Manager
  MPA and BBA, UT Austin

- Don Stanley
- Patrick Zerda
- Eric Morris

In collaboration with:
- External Public
- Private Markets
- Internal Public
- SPN Team

Source: State Street Bank
Tactical Asset Allocation (TAA)

Objectives:
- Generate 25 bps of Trust level alpha per year with a long term tracking error target of 50 bps
- Allocate to achieve portfolio risk and return targets

Performance as of 9/30:

<table>
<thead>
<tr>
<th></th>
<th>1Y Alpha</th>
<th>3Y Alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Integrated TAA</td>
<td>(0.11%)</td>
<td>(0.17%)</td>
</tr>
</tbody>
</table>

2017 Goals:
- Achieve alpha target
- Increase TAA allocation to Alternative Risk Premia strategy

Matt Talbert, PhD  
Investment Manager  
PhD, Economics, University of Texas

Team members:
- Jingshan Fu
- Solomon Gold
- Teresa Lwin
- Kyle Schmidt
- Ryan Leary

In collaboration with:
- SPN
- Risk Group

Source: State Street Bank
The integrated TAA portfolio uses four dynamic allocation models as signals for Trust asset class positioning.

For 2016 the majority of TAA risk was allocated to the SPN model, driving performance for the year.

**Model:** QVF and Dynamic Factor are internal models that use macroeconomic trends, valuation metrics, sentiment and liquidity measures to create forecasts to dynamically allocate to equites, bonds, currencies, and commodities.

**Outlook:** Returns to our internal forecasting models were positive but muted.

The SPN model replicates the performance of the public Strategic Partners due to their tactical asset allocation efforts. The team collects security level positioning from the partners to inform allocation.

**Outlook:** Partner performance has been challenged recently. We expect performance to recover.

**Model:** Alternative Risk Premia model invests in well-known, empirically tested, uncorrelated sources of return harvested through long/short strategies.

**Outlook:** Strategy was launched in October 2015 at small scale with strong performance in the first year.

Source: State Street Bank, TRS IMD
Why Fund an Alternative Risk Premia Portfolio?

- Risk Premia/factor investing may be the next step in the evolution of passive portfolio management – active research area among our top peers and strategic partners. The factors are value, momentum, carry, and quality
- Provides a robust and defensible channel for the Trust to take additional compensated tracking error
- Portfolio uses TAA assets plus a long/short single name equity portfolio managed by the QES team
- Team is developing experience and tools to consider factor investing as Trust level allocation building blocks

Value
- Cheap assets outperform relatively expensive ones

Momentum
- An asset’s recent relative performance continues in the near future

Carry
- Higher-yielding assets provide higher returns than lower yielding assets

Quality
- Lower risk and higher-quality assets generate higher risk adjusted returns

Current Strategies in ARP Portfolio

<table>
<thead>
<tr>
<th>Equity Names</th>
<th>Equity Indices</th>
<th>Bonds &amp; Rates</th>
<th>Currencies</th>
<th>Commodities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Momentum</td>
<td>●</td>
<td>● ●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Carry</td>
<td>● ● ● ●</td>
<td>● ● ● ● ● ● ●</td>
<td>●</td>
<td>● ● ● ● ● ● ●</td>
</tr>
<tr>
<td>Quality</td>
<td>●</td>
<td>● ● ● ● ● ● ●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

Source: State Street Bank, TRS iMD
Asset Allocation – 2016 Accomplishments and 2017 Goals

2016 Accomplishments on Trust-Wide Priorities

- **SAA Implementation:** Completed increase to Risk Parity allocation

- **Preferred Destination:** Approved two new managers and approved four new investments for $146 million through the Special Opportunities program

- **Advanced Technology Solutions:** Robust process in TAA for model development, model validation, daily reporting and infrastructure support

- **Global Equities Best Practices:** With the Risk Group, investigated global equity best practices for active management

Preliminary Asset Allocation Group 2017 Goals

- **Tactical Asset Allocation:** Focus on improving performance, research and further build out of Alternative Risk Premia strategies

- **Quant Equity:** Ongoing research and development of Quant Equity models

- **Special Opportunities:** Focus on build out of existing relationships and process improvements to be responsive to market opportunities

- **Global Equities Best Practices:** Ongoing support for this process
APPENDIX
## Quant Equity Strategies (QES)

### Quantitative Equity Strategies

<table>
<thead>
<tr>
<th>Global QES</th>
<th>Low Vol</th>
<th>Emerging Markets</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total QES Strategic</strong></td>
<td><strong>US</strong></td>
<td><strong>Non-US Developed</strong></td>
</tr>
<tr>
<td>$1,314.6</td>
<td>$543.2</td>
<td>$111.7</td>
</tr>
<tr>
<td><strong>50 Models</strong></td>
<td><strong>48 Models</strong></td>
<td><strong>48 Models</strong></td>
</tr>
<tr>
<td><strong>Long-term</strong></td>
<td><strong>Dynamic</strong></td>
<td><strong>Macro Regimes</strong></td>
</tr>
<tr>
<td><strong>Static Factors &amp; Equal Weights</strong></td>
<td><strong>Flexible Factors &amp; Weights</strong></td>
<td><strong>Flexible Factors &amp; Weights</strong></td>
</tr>
</tbody>
</table>

**Developed Markets**
- Region / Sector Models
- Country Models

**Emerging Markets**
- Country Models

- **Launched**
  - June 2009
  - September 2009
  - March 2012
  - January 2013
  - February 2016
  - February 2016

### Paper Portfolios

<table>
<thead>
<tr>
<th>Regional Quant</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>US IMI</strong></td>
</tr>
<tr>
<td><strong>Non-US Developed</strong></td>
</tr>
<tr>
<td><strong>Emerging Markets</strong></td>
</tr>
</tbody>
</table>
| **Launched**
  - November 2015
  - November 2015
  - November 2015

### Other

<table>
<thead>
<tr>
<th>US High Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>US IMI</strong></td>
</tr>
<tr>
<td><strong>Absolute Return</strong></td>
</tr>
<tr>
<td><strong>$99.1</strong></td>
</tr>
<tr>
<td><strong>ITAA</strong></td>
</tr>
</tbody>
</table>
| **Launched**
  - July 2011
  - November 2015

<table>
<thead>
<tr>
<th>Single Name Equity ARP</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Absolute Return</strong></td>
</tr>
<tr>
<td><strong>$50</strong></td>
</tr>
</tbody>
</table>

**Market Value as of 09/30/2016**

Source: State Street Bank
This slide was intentionally left blank.