



INVESTMENT MANAGEMENT COMMITTEE



December 2013

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

*(Mr. Barth, Committee Chair; Mr. Colonna; Mr. Corpus; Mr. Kelly; & Ms. Sissney,
Committee Members)*

AGENDA

**December 12, 2013 – 10:00 a.m.
TRS East Building, 5th Floor, Boardroom**

1. Consider the approval of the proposed minutes of the September 12, 2013 committee meeting – Todd Barth.
2. Review Risk Management and Strategies – Jase Auby.
3. Review Strategic Asset Allocation/Stable Value and Tactical Asset Allocation – Mohan Balachandran.

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.

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Minutes of the Investment Management Committee

September 12, 2013

The Investment Management Committee of the Board of Trustees of the Teacher Retirement System of Texas met on September 12, 2013 in the boardroom located on the Fifth Floor of the TRS East Building offices at 1000 Red River Street, Austin, Texas. The following committee members were present:

Todd Barth, Chair
Joe Colonna
David Kelly
Nanette Sissney

A quorum of the committee was present. Others present:

| | |
|---------------------------|--|
| Chris Moss, TRS Trustee | Eric Lang, TRS |
| Anita Palmer, TRS Trustee | Lynn Lau, TRS |
| Brian Guthrie, TRS | Scot Leith, TRS |
| Britt Harris, TRS | Denise Lopez, TRS |
| Ken Welch, TRS | James Nield, TRS |
| Amy Barrett, TRS | Hugh Ohn, TRS |
| Carolina de Onís, TRS | Noel Sherman, TRS |
| Jerry Albright, TRS | Patty Steinwedell, TRS |
| Thomas Albright, TRS | Sharon Toalson, TRS |
| Jase Auby, TRS | David Veal, TRS |
| Mohan Balachandran, TRS | Angela Vogeli, TRS |
| Grant Birdwell, TRS | Steven Wilson, TRS |
| Ronnie Bounds, TRS | Dr. Keith Brown, Investment Advisor |
| Susanne Gealy, TRS | Steven Huff, Fiduciary Counsel |
| Brad Gilbert, TRS | Brady O'Connell, Hewitt EnnisKnupp |
| Dennis Gold, TRS | Steve Voss, Hewitt EnnisKnupp |
| Brian Gomolski, TRS | Leroy DeHaven, Texas Retired Teachers Association |
| Dan Herron, TRS | Ann Fickel, Austin Classroom Teachers Association |
| Joel Hinkhouse, TRS | Ted Melinda Raab, Texas American Federation of Teachers |
| Katy Hoffman, TRS | Josh Sanderson, Association of Texas Professional Educators |
| Janis Hydak, TRS | Jeff Lambert, State Street |
| Dan Junell, TRS | Tom Rogers, Austin Retired Teachers Association & Texas Retired Teachers Association |

Mr. Barth called the meeting to order at 8:40 a.m.

1. Consider the approval of the proposed minutes of the June 13, 2013 committee meeting

On a motion by Mr. Kelly, the committee approved the minutes of the June 13, 2013 meeting as presented.

2. Review of the External Public Markets Portfolio

Mr. West reviewed the performance of the External Public Markets Portfolio as of June 30, 2013. He highlighted the following: the long-oriented global equities had grown from about \$23 billion to about \$26 billion over the 12-month period; about \$1.3 billion of the Hedge Fund

Portfolio had been in the Directional Hedge Fund Portfolio; and the liquidation of dislocated credit assets from the other absolute return portfolios was almost complete. He noted that \$750 million had accrued to the trust above what would have been achieved by investing passively. He stated that the team was shifting from hiring external investment managers for the long-oriented and hedge fund portfolios to strategically managing the portfolios. He presented the priorities and accomplishments in 2012, the team structure, and the role of the External Public Group in the context of the overall portfolio. He presented the trust's current use of investment management, or agency, agreements with external investment managers.

Ms. Gealy provided an update on the Long-Oriented Global Equity Portfolio. She reviewed its performance for the year ending June 30, 2013. She explained the process of sourcing a value manager using Wellington as a successful case study of hiring external managers. She noted that the expanded relationship with Wellington had provided staff more flexibility, greater collaboration with the firm, access to their insights on all markets and opportunities, alignment of interests, and a reduction of fees. She stated that under the fee netting arrangement, performance fees were paid on an aggregated net basis rather than on the performance of each individual manager, and therefore the arrangement helped to shift the risk of performance fees to the firm.

Mr. Gilbert provided an update on the hedge fund portfolios, including the Directional Hedge Fund Portfolio and the Stable Value Hedge Fund Portfolio. He presented their performance, objectives and accomplishments. Mr. Barth asked if the benchmark was appropriate. Mr. Harris said that the number of benchmarks was very limited and staff was not aware of a better benchmark. Mr. Voss confirmed that the current benchmark was the best option available.

Mr. West concluded by presenting the 2013 priorities of the External Public Group.

3. Receive a presentation on the five year anniversary of the Public Markets Strategic Partnership Network (SPN)

Mr. Veal provided an update on the Public Markets Strategic Partnership Network (SPN). He presented its performance for the year ending June 30, 2013 and the portfolio mandates. Responding to a question from Dr. Brown, Mr. Veal confirmed that the tactical allocation ranges for the Strategic Partners are wider than those established for the Trust overall in certain sub-asset classes such as real estate investment trusts (REITs). Mr. Harris explained for Dr. Brown that this additional latitude was given in order to reach a higher return target on a near-term basis. Mr. Harris also confirmed that since this latitude has the potential to result in noncompliance with Trust-level policy limits, staff monitors these limits closely. Mr. Auby confirmed for Mr. Barth that in situations where the allocation might exceed policy limits, the Risk Group would adjust allocations on a fund-wide basis to ensure compliance.

Mr. Veal reviewed the requirements for public markets Strategic Partners, the partnership positioning, key findings from the joint public – private SPN summit, research projects completed by the Strategic Partners, and the 2013 priorities of the group.

4. Discuss the process for developing new internal portfolios – Mohan Balachandran.

Mr. Balachandran described the development of new portfolio strategies. He emphasized the active involvement of the internal Management Committee as well as the Internal Investment Committee (IIC) at each step of the process. He explained the four-step process for researching and introducing new strategies: strategy development; launch of a paper portfolio; launch of a research portfolio with the IIC's approval; and, if it goes to full allocation, IIC approval would be needed to allocate assets to the new strategy. Responding to questions from Mr. Barth and Mr. Colonna regarding the labor devoted to the process, Mr. Harris stated that the process involved many investment teams and Mr. Balachandran's Tactical Asset Allocation Group. He said that five or six staff members of Mr. Auby's Risk Group devoted no more than 20 percent of their time to the process. There was a general discussion in response to Mr. Kelly's question about whether devoting a group or budget exclusively to the process would be more efficient.

5. Discuss risk parity

Mr. Harris provided background on the application of the risk parity strategy as a balanced approach to risk taking. He stated that the strategy was intended to produce a consistent, positive return in a systematic way by equalizing the risk in the portfolio and maximizing consistent real rate of annual return through leveraging. He confirmed for Mr. Barth that, because of leveraging, the primary risk to the portfolio would be counterparty risk instead of equity risk. Per Mr. Kelly's request, Dr. Brown commented on the use of risk parity. He stated that it would be a major paradigm shift from allocating capital to allocating risk within the overall portfolio.

Mr. Nield explained the risk parity strategy and provided an update on TRS' current development of the external and internal risk parity strategies. He presented a case study on the top performing fund in the Trust Universe Comparison Service (TUCS) universe, the Fairfax County Employees' Retirement System (FCERS), which incorporated a risk parity strategy. He confirmed for Mr. Barth that FCERS' one-year return had dropped from April to June, but their performance was still relatively strong. He explained the purpose and process of constructing a risk parity portfolio by setting a lower expected return and risk profile and applying leveraging to the portfolio to target a higher return.

Mr. Nield presented the benefits of a risk parity portfolio. He stated that risk parity would not require forecasting asset returns but instead would build a balanced portfolio without relying on the returns of any single asset class or past correlations between assets. He confirmed for Dr. Brown that the internal risk parity portfolio used standard deviation volatility as the risk measure. He noted that market conditions with rising interest rates above expectations or having cash as a preferred asset would negatively affect the performance of a risk parity portfolio. Responding to a question from Ms. Sissney, Mr. Nield stated that the external strategy was currently managed by two external managers. He responded for Dr. Brown that staff created leverage primarily through the use of futures. Responding to a question from Mr. Barth regarding the exposure of the external and internal management, Mr. Nield stated that about \$520 million had been invested in the external risk parity portfolio and about \$103 million in the internal one. Mr. Moss asked if the risk parity strategy would go against the fund's long-term perspective. Mr. Harris explained that funds using this strategy would have to significantly increase their risk

systems, set their risk metrics, and adjust the portfolio allocation going forward based on many factors.

The meeting adjourned at 10:45 a.m.





Risk

Jase Auby

Senior Managing Director

December 2013

Agenda

- I. Risk Mandate
- II. Risk Group
- III. Key Risk Signals
 - 1. Bubbles
 - 2. Macro Environment
 - 3. CUSUM
 - 4. Valuation
- III. 2013 Priorities
 - 1. Currency Hedging
 - 2. Political Risk Model
 - 3. Research Portfolios
- IV. 2014 Priorities (Preliminary)

Risk Mandate

| | | |
|------------|---------------|---|
| Managing | Signals | <ul style="list-style-type: none">• Identify and monitor key statistical thresholds, which when crossed, will cause specific investigation and action• Bubble Signals and CUSUM Signals are important types of Risk Signals |
| | Budgeting | <ul style="list-style-type: none">• 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 |
| | Strategies | <ul style="list-style-type: none">• Investment strategies to improve the return and risk profile of the Trust• Current strategies are Risk Parity, Reinsurance, and Low Volatility with Overlay• Additionally, three sub-strategies within TAA (Bubbles, Environmental, Valuation) |
| Monitoring | Monitoring | <ul style="list-style-type: none">• Prepare useful Risk Reports• Monitor Trust risks which include Market, Leverage, Liquidity, Concentration, Currency, Counterparty and other risks |
| | Certification | <ul style="list-style-type: none">• Certify all new External Public investments with respect to Market Factors, Leverage, Drawdown History, Liquidity, Risk Management Systems and Audit History• Review new strategies within External Private investments |
| | Compliance | <ul style="list-style-type: none">• Monitor and resolve and Compliance Issues raised by the Investment Compliance group |

Risk Group



Jase Auby, CFA
Chief Risk Officer, Senior Managing Director
*BS, Electrical Engineering,
Harvard College
Lehman Brothers, Goldman Sachs*



James Nield, CFA
Director
*MBA, Finance,
New York University
Ford Motor Co.*



Mark Telschow, CFA
Sr. Associate
*BS, Civil Engineering,
UT Austin
Austin Capital Management*



Mike Simmons
Sr. Analyst
*MPA, Accounting,
UT Austin*



Steven Lambert
Sr. Analyst
*BS, Business Management,
Saint Joseph's College of Maine
State Street*



Stephen Kim
State Street Employee
*MBA, Finance,
UT Austin*

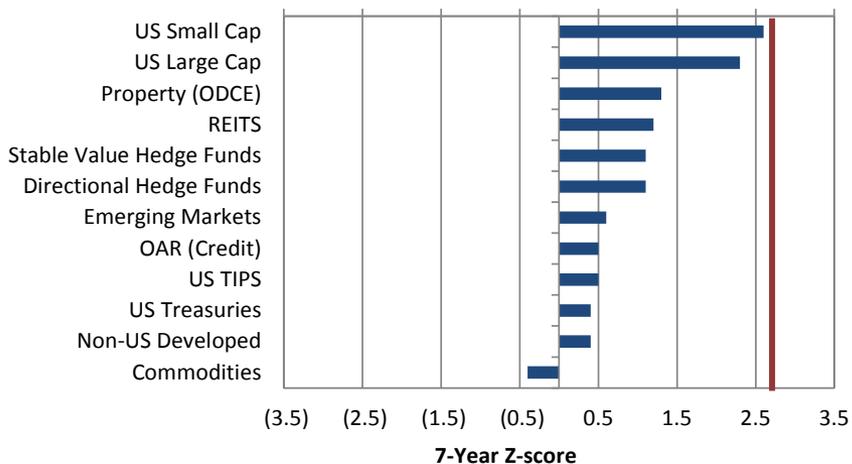


Babette Ruiz
Group Support

Key Risk Signals

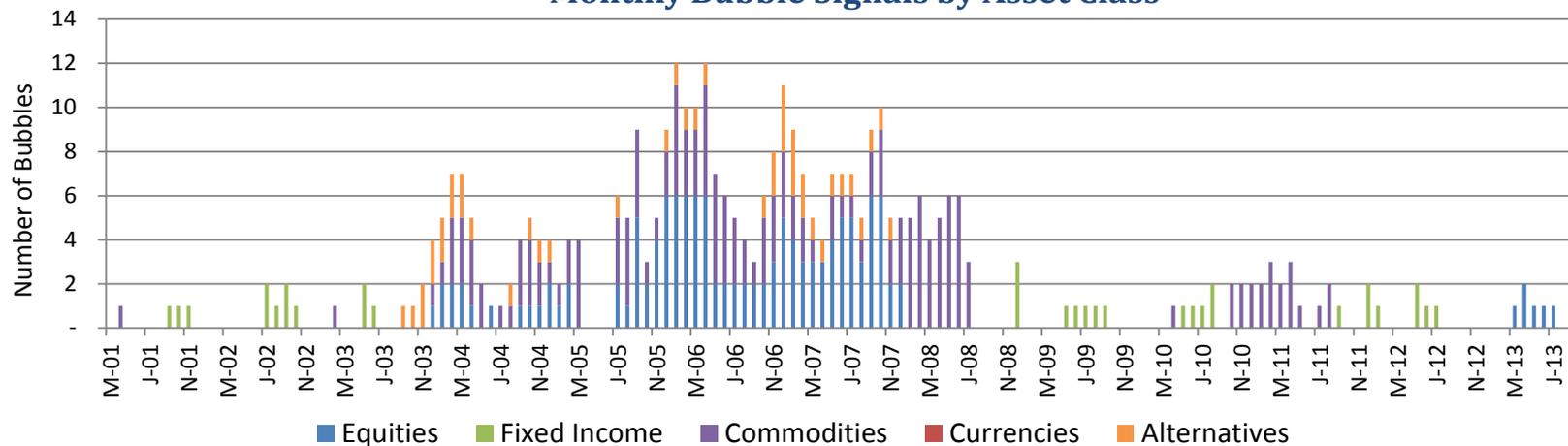
1. Bubbles

Bubble Level Monitor: September 2013



| 10 Most Recent Bubble Signals | Signal Ended | Return Since Signal ¹ |
|-------------------------------|--------------|----------------------------------|
| Healthcare Sector | Jul - 13 | 0.9% |
| Consumer Staples Sector | Apr - 13 | (2.1)% |
| Australian Gov. Bonds | Jul - 12 | (6.4)% |
| UK Gov. Bonds | May - 12 | (9.3)% |
| Canadian Gov. Bonds | Feb - 12 | (3.2)% |
| UK Gov. Bonds | Dec-11 | (5.7)% |
| Canadian Gov. Bonds | Sep - 11 | (2.5)% |
| Gold | Aug - 11 | (27.2)% |
| Silver | Aug - 11 | (47.8)% |
| Silver | May - 11 | (43.7)% |

Monthly Bubble Signals by Asset Class



Bubble Monitor signal is based on 3 factors: 1) A rolling 7-year Z-score; 2) Change in correlation to a benchmark; 3) Absolute change in price within the past 7 years

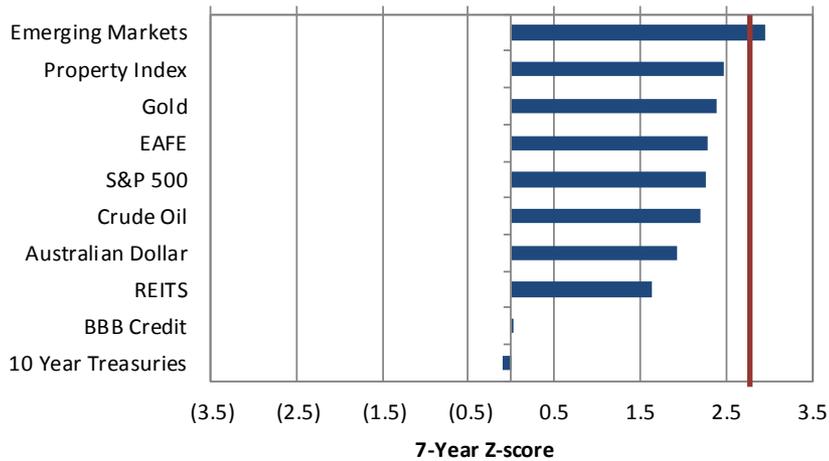
¹ Returns through September 30, 2013



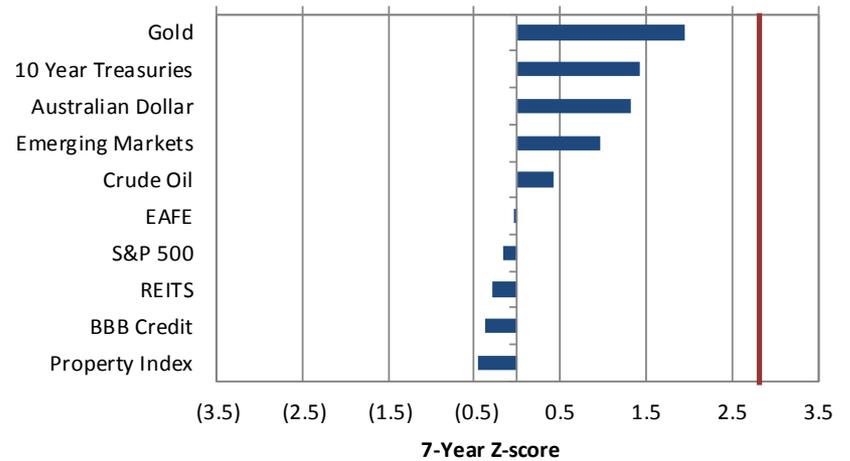
Key Risk Signals

1. Bubbles

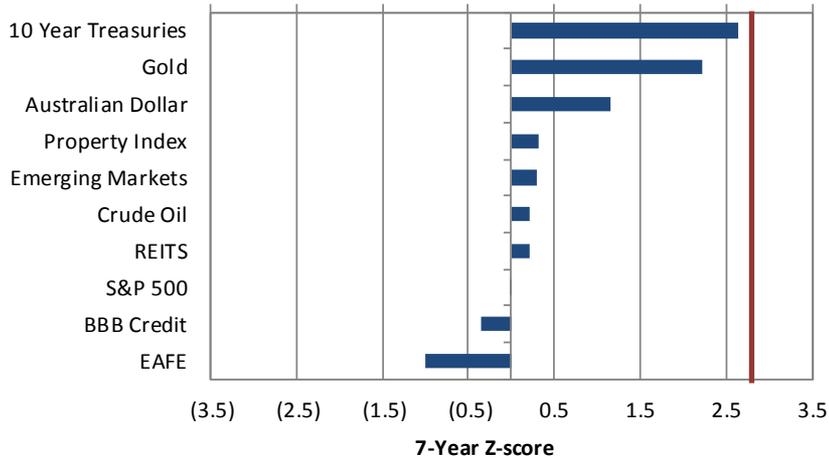
Bubble Level Monitor: September 2007



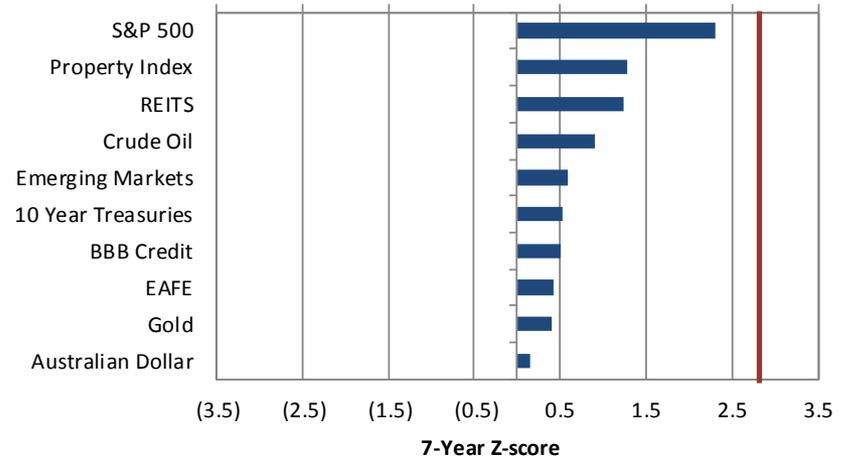
Bubble Level Monitor: September 2009



Bubble Level Monitor: September 2011



Bubble Level Monitor: September 2013

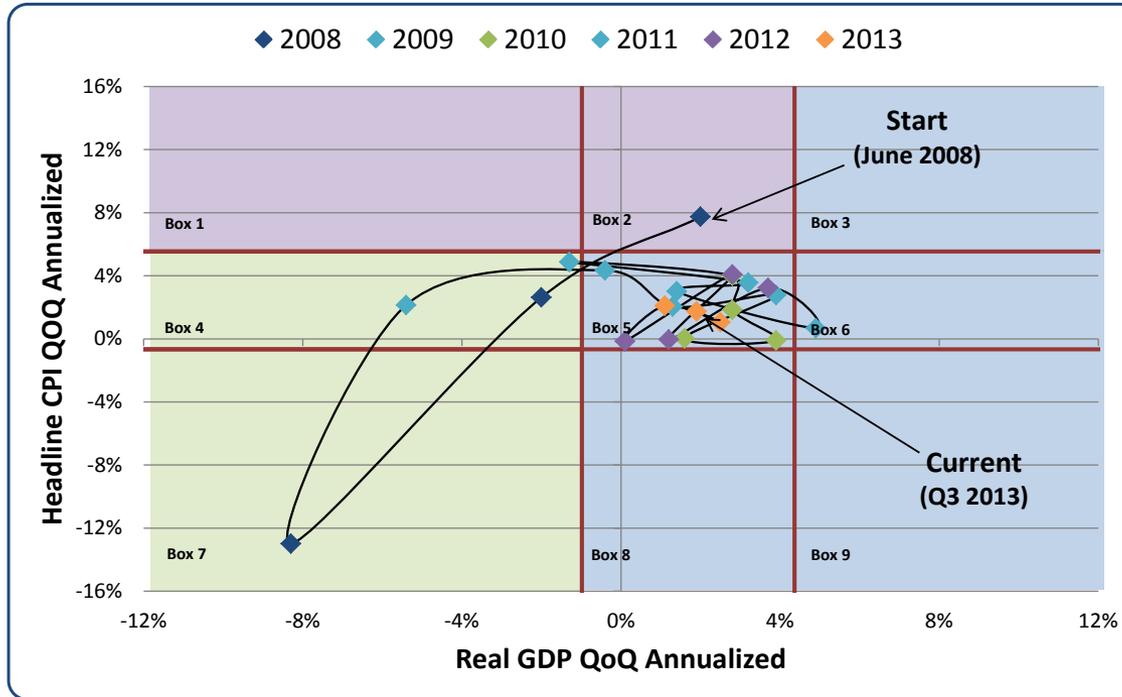


Key Risk Signals

2. Macro Environment

| | |
|--------------|---------------|
| Real Return | Global Equity |
| Stable Value | |

US Macro Environment



- US is currently in Box 5

Global Macro Environment

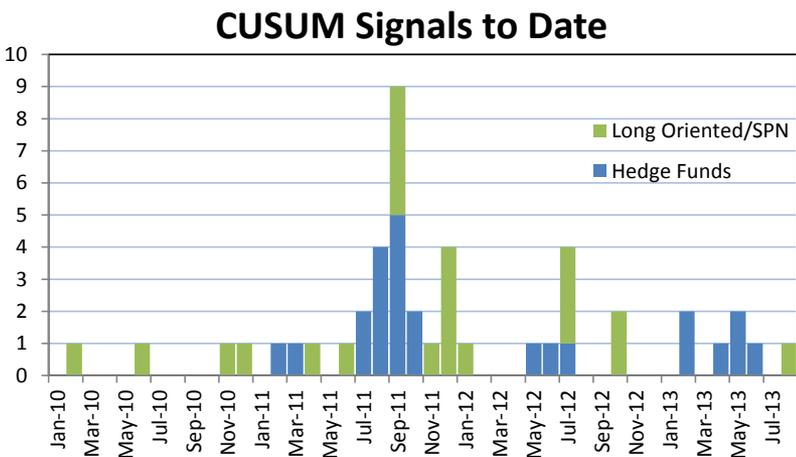
| Region | Q4 2012 | Q1 2013 | Q2 2013 | Q3 2013 |
|-------------|---------|---------|---------|---------|
| US | Box 5 | Box 8 | Box 5 | Box 5 |
| Europe | Box 5 | Box 5 | Box 5 | Box 5 |
| Japan | Box 5 | Box 5 | Box 5 | Box 2 |
| EM ex-China | Box 5 | Box 5 | Box 5 | Box 5 |
| China | Box 4 | Box 4 | Box 4 | Box 4 |

- The world has been predominantly in a Global Equity regime throughout the year

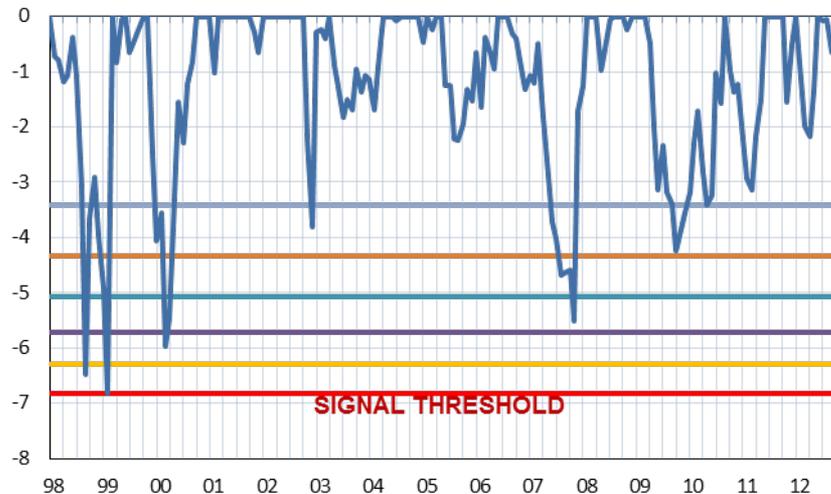
Key Risk Signals

3. CUSUM: External TRS 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



Example: CUSUM Information Ratio Signal



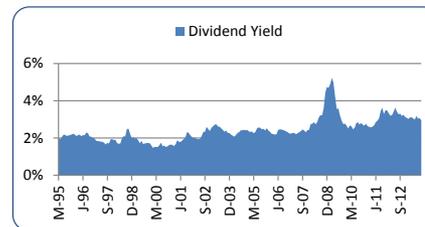
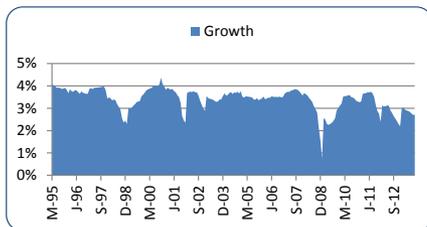
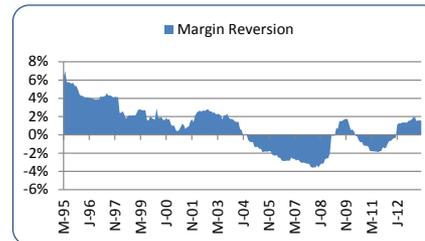
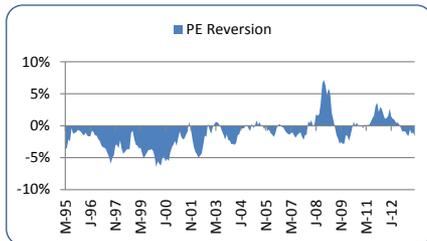
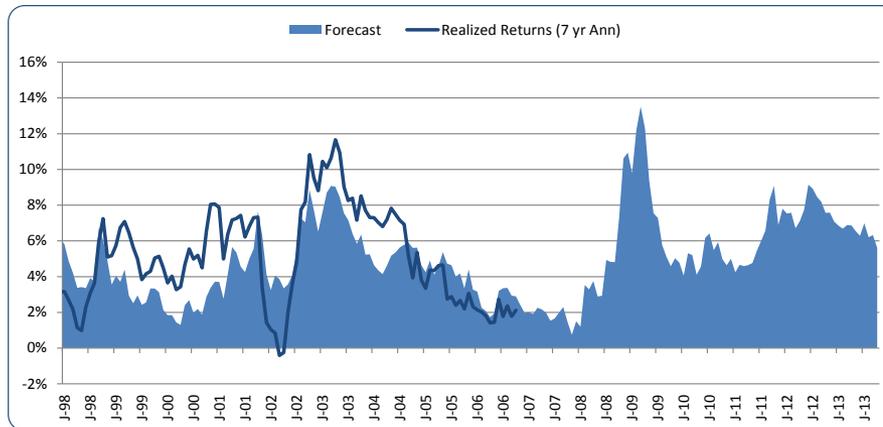
- 46 Portfolio CUSUM Signals to date:
 - 32 buys, 13 sells, 2 pending
- **Results are encouraging:**
 - Managers that received a “Buy” rating outperformed the benchmark by 0.8% on average over the next 12 months
 - Managers that received a “Sell” rating underperformed the benchmark by -2.2% on average over the next 12 months

Key Risk Signals

4. Valuation Signals

- Long-term asset class valuation models are used to monitor divergence between asset classes

Valuation Forecast - Global Equity, Simple Average over All Countries



Methodology

Valuation Signals uses valuation models for to forecast long-term asset class returns.

- Universe: 21 country equity markets, 6 nominal bond and inflation linked markets
- Buy/sell trade is initiated when an expected return difference of 7% or greater (annualized) between two asset classes exists
- Trade is held for 48 months or when difference reverts to 2%

| 5 Most Recent Valuation Signals | Date | Return Following Signal ¹ |
|---|----------|--------------------------------------|
| Buy China (Equity) Sell Germany (Equity) | Jul - 13 | 2.0% |
| Buy China (Equity) Sell Switzerland (Equity) | Jul - 13 | 5.3% |
| Buy Japan (Equity) Sell Brazil (Equity) | Dec - 12 | 34.8% |
| Buy China (Equity) Sell Brazil (Equity) | Sep - 12 | 20.8% |
| Buy UK (Equity) Sell US Large Cap (Equity) | Jun - 12 | (5.7)% |

2013 Priorities

| | Priority | Result |
|------------|--------------------------------------|---|
| Budgeting | 1 Natural Resources | Review portfolio fit and develop benchmark for this new Trust Allocation |
| | 2 Private Markets Risk Model | Develop detailed quantitative risk modeling of Private Markets assets |
| | 3 Tracking Error | Investigate past usage of Trust tracking error risk budget and consider current usage |
| Strategies | 4 Currency Hedging | Research currency hedging for the Trust portfolio |
| | 5 Integrate Risk Signals | Integrate risk signals (bubbles, valuation, environmental) into the TAA process |
| | 6 Low Volatility with Overlay | Transition paper portfolio to a research allocation funded portfolio |
| | 7 Reinsurance | Identify reinsurance investments and portfolio fit for Stable Value Hedge Funds portfolio |
| | 8 Risk Parity | Transition internal paper portfolio to a research allocation funded portfolio |
| Monitoring | 9 Political Risk Model | Research a political risk model |
| | 10 Private Equity Currency Risk | Research currency exposure and potential hedging strategies for private equity portfolio [Note: Private Equity benchmark changed in policy in October 2013] |
| | 11 Real Estate Interest Rate Risk | Research interest rate exposure and potential hedging strategies for real estate portfolio |
| | 12 Repo Investments | Research and adjust if necessary use of repos in securities lending investing pool |

Items **highlighted in blue** were presented in detail to the Board during 2013

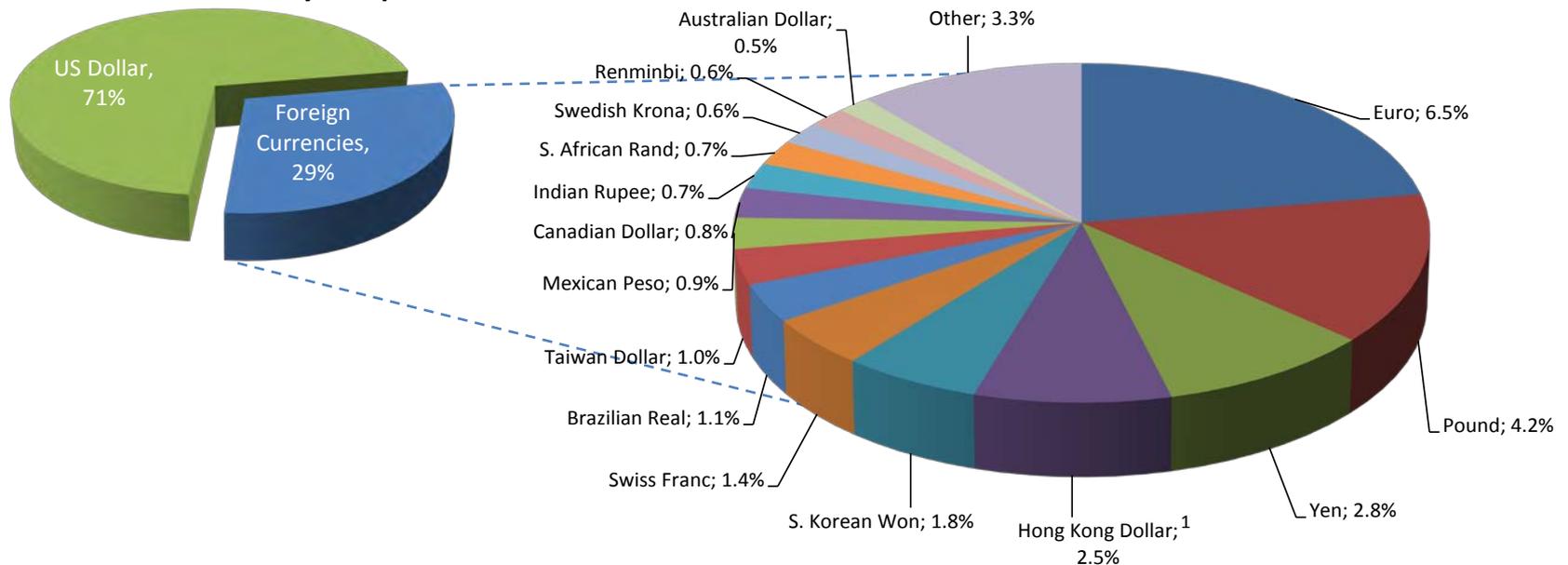
Items **highlighted in green** will be discussed further in this presentation on the following slides

2013 Priorities

1. Currency Hedging

- Objective
 - Review currency hedging alternatives for the Trust

- Trust Currency Exposure



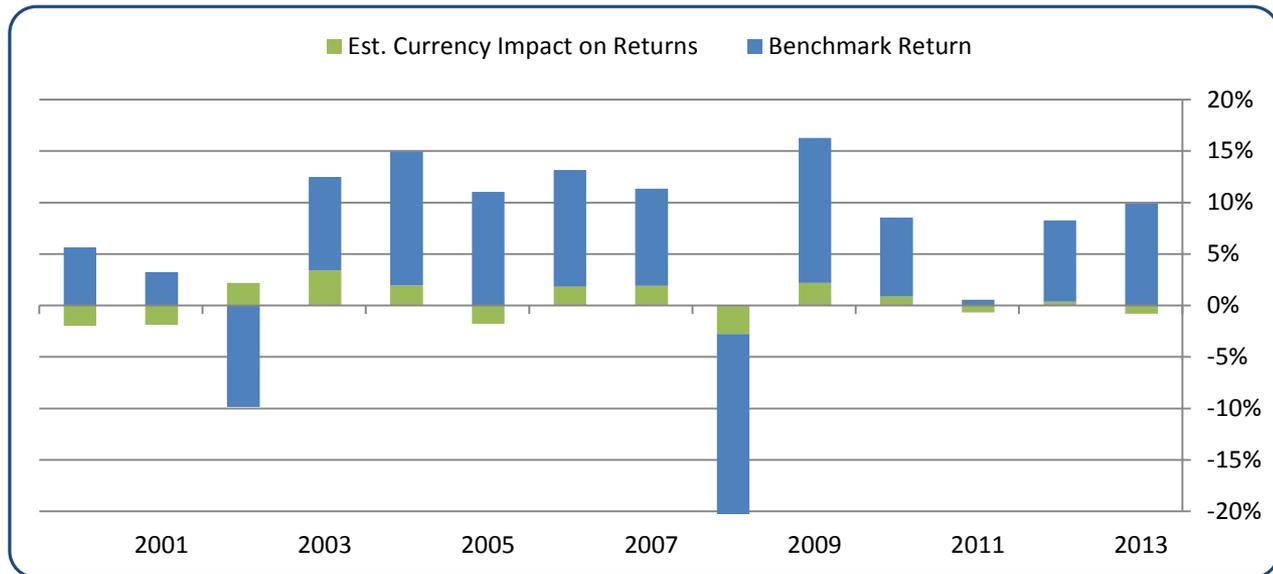
Note: Currency exposure shown as a percentage of Trust and sums to 29%

- 29% of Trust in non-US dollar denominated assets
- Top 10 currencies account for 78% of total currency exposure

2013 Priorities

1. Currency Hedging

- Currency Impact on Trust Benchmark



Best Year:
+3.2% (2003)

Worst Year:
-2.7% (2008)

| | Annualized Return | Volatility | Sharpe Ratio |
|----------|-------------------|------------|--------------|
| Unhedged | 5.6% | 7.1% | 0.49 |
| Hedged | 5.3% | 6.3% | 0.51 |

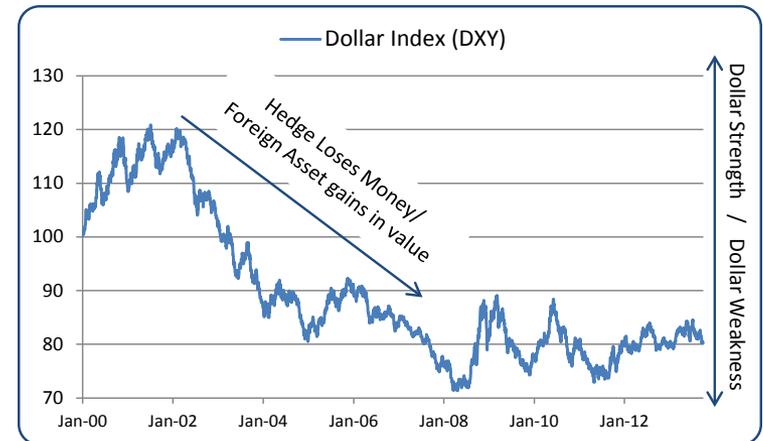
- If the Trust were fully hedged against currency exposure, both **returns and volatility would have been lower** with a **marginally higher Sharpe Ratio**

2013 Priorities

1. Currency Hedging

• Why Hedge?

- U.S. investors with foreign-denominated currency investments have generally benefitted from a weaker dollar since 2000
- A risk for the Trust is that the dollar appreciates and foreign-denominated holdings lose value



• Currency Hedging Options

| Option | Protect Against Rising Dollar | Impact on Trust Volatility | Impact on Tracking Error to Benchmark | Impact on Tracking Error to Peers |
|----------------------------------|-------------------------------|----------------------------|---------------------------------------|-----------------------------------|
| 1. Maintain Un-hedged benchmarks | No | Same | None | None |
| 2. Change Policy Hedge Ratios | Yes | Reduce | None | Increase |
| 3. Systematic Hedging Program | Partial | Partial reduction | Increase | Partial Increase |

• Proposal

- A systematic currency hedging program is in research and development (option 3)
- Paper portfolio is targeted to launch first quarter 2014
- Program to provide hedge against dollar strength but will generate tracking error in comparison with un-hedged benchmark

2013 Priorities

2. Political Risk Model

- Objective: create a country political risk monitor
- We have aggregated information from four research providers into seven categories of political risk:

| Category | Description |
|---|---|
| 1. Research Provider Recommended Composites | How do the research providers rate this country? |
| 2. Consistency | What is the likelihood that the current state persists? |
| 3. Economic Development | How vulnerable is the economy? |
| 4. Government Effectiveness | How successful is the government at establishing rule of law? |
| 5. Internal Conflict | Are there social/economic conditions that create instability? |
| 6. Physical Conflict | What is the likelihood of physical conflict? |
| 7. Sovereignty | How much can the country control its governance and finance? |

- These seven categories are equally weighted and normalized to create the TRS Political Risk Index

2013 Priorities

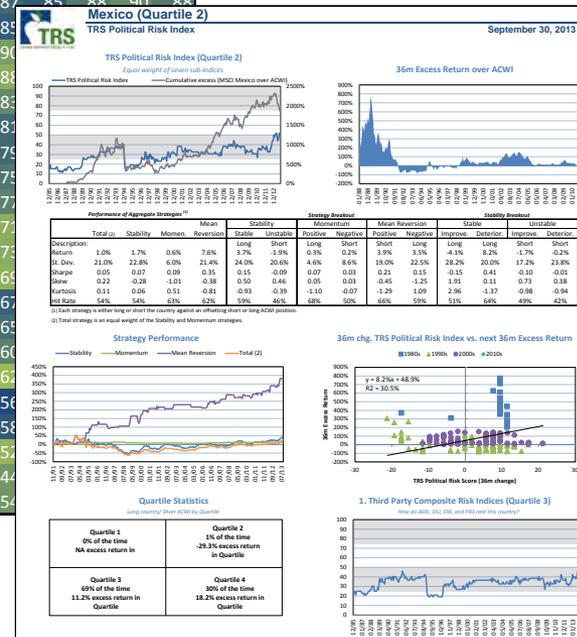
2. Political Risk Model

- 53 country political risk coverage
- 7 categories of political risk monitored
- Political Risk considered during due diligence process for foreign investments

TRS Political Risk Heat Map

| Country | 11 11 | 12 11 | 1 12 | 2 12 | 3 12 | 4 12 | 5 12 | 6 12 | 7 12 | 8 12 | 9 12 | 10 12 | 11 12 | 12 12 | 1 13 | 2 13 | 3 13 | 4 13 | 5 13 | 6 13 | 7 13 | 8 13 | 9 13 | 10 13 |
|----------------|-------|-------|------|------|------|------|------|------|------|------|------|-------|-------|-------|------|------|------|------|------|------|------|------|------|-------|
| Singapore | 100 | 100 | 100 | 100 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 | 98 |
| Switzerland | 98 | 98 | 98 | 98 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 98 | 98 | 98 |
| Norway | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 | 96 |
| Germany | 81 | 88 | 87 | 92 | 92 | 94 | 94 | 94 | 94 | 94 | 94 | 94 | 94 | 94 | 94 | 94 | 94 | 94 | 94 | 94 | 94 | 94 | 94 | 94 |
| Canada | 92 | 94 | 94 | 90 | 90 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 | 92 |
| Austria | 88 | 90 | 88 | 87 | 85 | 85 | 87 | 83 | 83 | 83 | 85 | 85 | 87 | 90 | 88 | 87 | 87 | 87 | 87 | 87 | 87 | 87 | 87 | 87 |
| Taiwan | 90 | 87 | 85 | 88 | 87 | 85 | 88 | 85 | 85 | 85 | 83 | 83 | 83 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 | 85 |
| Netherlands | 94 | 92 | 92 | 94 | 94 | 90 | 90 | 85 | 90 | 90 | 90 | 88 | 88 | 87 | 87 | 88 | 90 | 90 | 90 | 90 | 90 | 90 | 90 | 90 |
| Sweden | 83 | 85 | 83 | 83 | 83 | 88 | 88 | 90 | 88 | 88 | 88 | 90 | 90 | 88 | 90 | 90 | 88 | 88 | 88 | 88 | 88 | 88 | 88 | 88 |
| United States | 75 | 77 | 77 | 79 | 79 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 | 81 |
| Finland | 85 | 83 | 90 | 88 | 87 | 83 | 83 | 87 | 87 | 87 | 87 | 85 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 83 | 81 | 81 | 81 | 81 |
| Australia | 87 | 81 | 79 | 77 | 81 | 77 | 77 | 77 | 79 | 79 | 79 | 79 | 79 | 79 | 79 | 79 | 79 | 79 | 79 | 79 | 79 | 79 | 79 | 79 |
| Belgium | 79 | 79 | 81 | 81 | 77 | 79 | 79 | 79 | 77 | 77 | 79 | 77 | 77 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 |
| Denmark | 73 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 75 | 77 | 77 | 77 | 77 | 77 | 77 | 77 | 77 | 77 | 77 | 77 | 77 |
| Chile | 69 | 71 | 71 | 71 | 71 | 71 | 71 | 71 | 71 | 71 | 73 | 73 | 73 | 73 | 73 | 71 | 73 | 73 | 73 | 71 | 71 | 71 | 71 | 71 |
| Malaysia | 71 | 73 | 73 | 73 | 73 | 73 | 73 | 73 | 73 | 73 | 71 | 71 | 71 | 71 | 71 | 73 | 71 | 71 | 71 | 73 | 73 | 73 | 73 | 73 |
| South Korea | 60 | 63 | 63 | 60 | 63 | 62 | 62 | 62 | 62 | 60 | 62 | 62 | 62 | 69 | 69 | 69 | 67 | 67 | 67 | 67 | 67 | 67 | 67 | 67 |
| Japan | 77 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 67 | 67 | 69 | 69 | 69 | 63 | 67 | 67 | 69 | 69 | 69 | 69 | 69 | 69 | 69 | 69 |
| United Kingdom | 67 | 65 | 65 | 67 | 65 | 67 | 65 | 65 | 65 | 65 | 67 | 67 | 65 | 65 | 65 | 65 | 63 | 63 | 63 | 65 | 65 | 65 | 65 | 65 |
| China | 63 | 60 | 62 | 63 | 60 | 60 | 60 | 60 | 60 | 62 | 60 | 60 | 63 | 60 | 60 | 60 | 60 | 58 | 58 | 60 | 60 | 60 | 60 | 60 |
| Israel | 52 | 54 | 56 | 54 | 56 | 56 | 54 | 56 | 56 | 56 | 58 | 58 | 58 | 56 | 58 | 56 | 56 | 60 | 60 | 60 | 60 | 60 | 60 | 60 |
| France | 62 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 58 | 56 | 56 | 56 | 58 | 56 | 58 | 58 | 58 | 56 | 56 | 56 | 56 | 56 | 56 |
| Ireland | 58 | 62 | 60 | 62 | 62 | 65 | 67 | 67 | 69 | 69 | 63 | 63 | 60 | 62 | 62 | 62 | 62 | 62 | 62 | 62 | 62 | 62 | 62 | 62 |
| Philippines | 31 | 37 | 37 | 31 | 31 | 31 | 31 | 31 | 38 | 38 | 38 | 40 | 40 | 48 | 46 | 52 | 46 | 46 | 52 | 52 | 52 | 52 | 52 | 52 |
| Czech Republic | 37 | 35 | 38 | 37 | 33 | 33 | 33 | 33 | 37 | 37 | 42 | 44 | 44 | 50 | 48 | 50 | 52 | 52 | 44 | 44 | 44 | 44 | 44 | 44 |
| Mexico | 56 | 56 | 54 | 56 | 54 | 54 | 56 | 54 | 54 | 54 | 52 | 52 | 52 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 | 54 |

Country Tearsheet

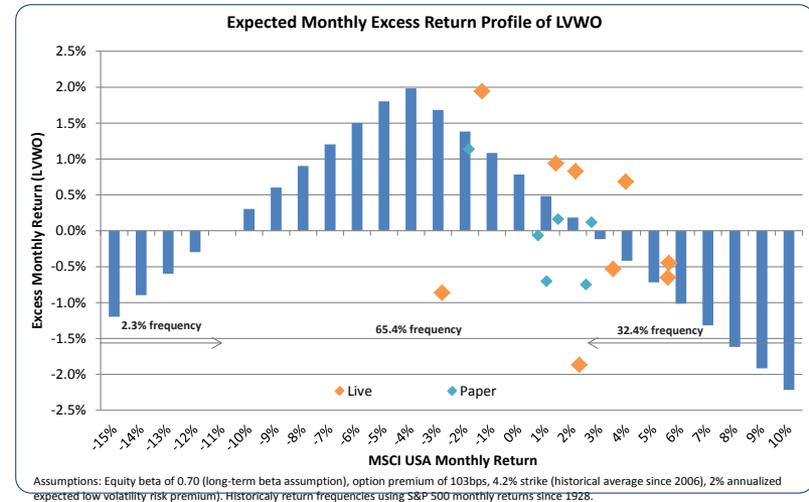


2013 Priorities

3. Research Portfolios: Low Volatility with Overlay and Internal Risk Parity

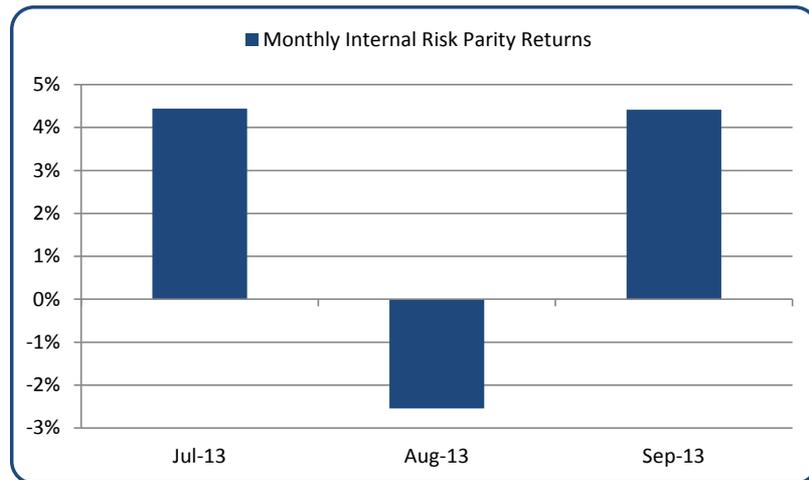
• Low Volatility with Overlay

- Portfolio launched January 2013
- \$100 million funding
- Return of +19.9%
- Excess return of -0.3%
- Performance vs. peers of +3.2%



• Internal Risk Parity

- Portfolio launched July 2013
- \$100 million funding
- Return of +6.3%
- Excess Return of +4.6%
- Performance vs. peers of +1.4%



2014 Priorities (Preliminary)

| | Priority | Description |
|------------|------------------------------|---|
| SAA | 1 Strategic Asset Allocation | Assist in the 2014 strategic asset allocation process |
| Strategies | 2 Integrate Risk Signals | Integrate risk signals (bubbles, valuation, environmental) into the TAA process |
| Budget | 3 Risk Factors | Develop a risk factor attribution process for the total Trust |
| | 4 Liquidity | Quantify the value of Trust liquidity |
| Monitoring | 5 Hedge Fund Risk Proxying | Research potential improvements to hedge fund risk proxy process |

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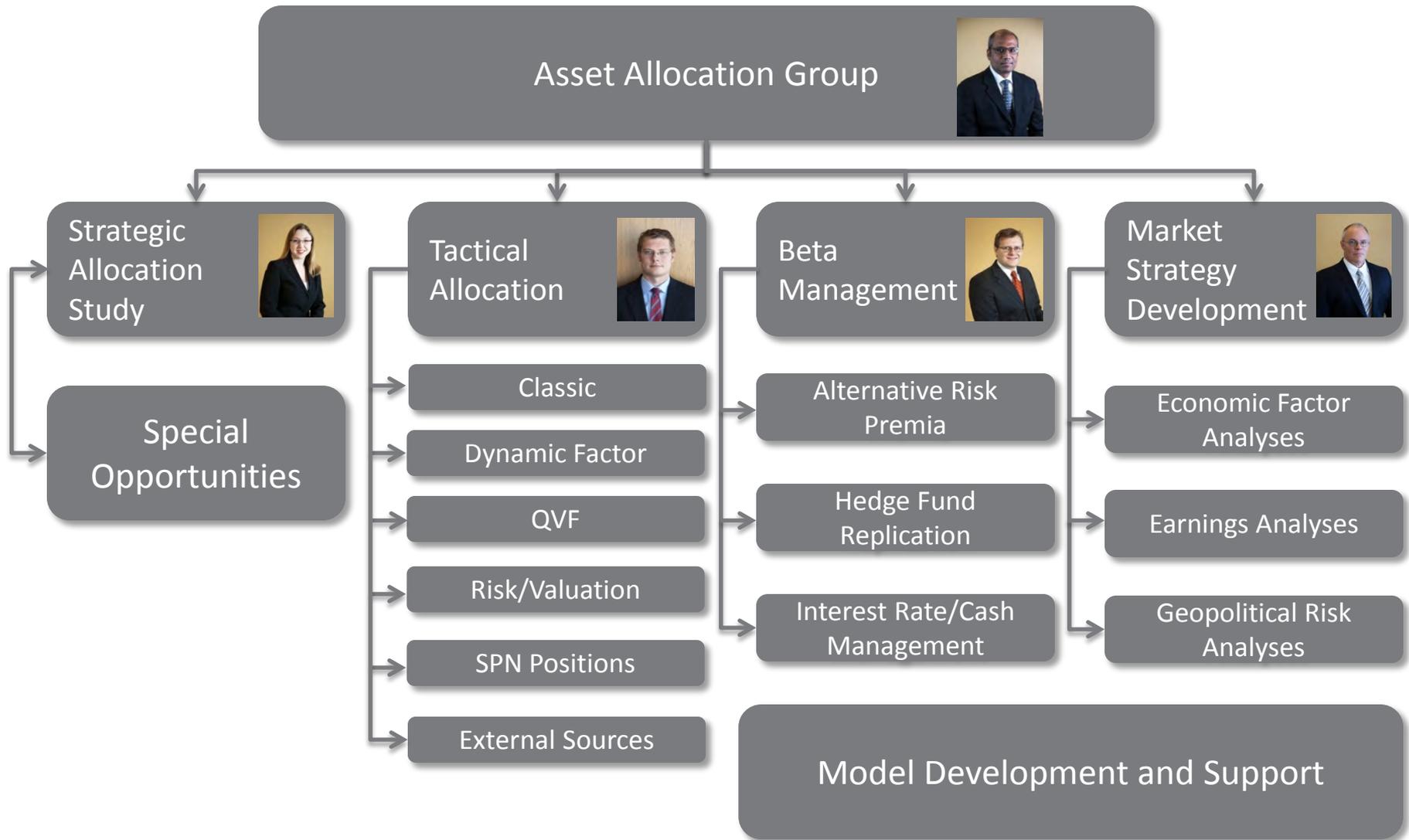
Asset Allocation

Mohan Balachandran
Senior Managing Director
December 2013

Agenda

- Organizational Structure and Purpose
- Strategic Asset Allocation
- Special Opportunities
- Tactical Asset Allocation
- Beta Replication Strategies
- Market Strategies
- Database Development/Maintenance
- 2014 Priorities (Preliminary)

Asset Allocation Group



Asset Allocation Group



Mohan Balachandran, PhD
Sr. Managing Director
PhD, Physics, Brown University

Asset Allocation Group Highlights

Four PhDs
Nine Masters Degrees
Three CFAs
Two CAIAs



Ashley Baum, CFA, CPA
Special Opportunities/SAA
MPA and BBA, UT Austin



Tim Jones, PhD
Tactical Asset Allocation
PhD, Economics, UT Austin



Matt Talbert, PhD
Beta Management,
PhD, Economics, UT Austin



Curt Rogers, CFA, CAIA, FRM
Market Strategy
MBA, UT Austin
MS, Engineering, MIT



Komson Silapachai, CFA
Sr. Associate
BA, Texas A&M University



Jean-Benoit Daumerie
Sr. Associate
MBA, Rice University
BS, Engineering, U Penn



Ken Standley, CAIA Associate
BA, Economics, The George Washington University



Jingshan Fu, PhD
Investment Manager
PhD, Harvard University



Hasim Mardin
Contractor
FX, Rates
MS, Economics, UT Austin



Patrick Zerda
Associate
MPA and BBA, UT Austin



Jonathan Leake
Associate
Quantitative Strategies
MA and BA, Texas A&M University



Sibe Wen
Contractor
MS, Statistics
UT Austin



Daniel Ting
Associate
BBA, Finance and Economics, UT Austin



Babette Ruiz
Team Support

Strategic Asset Allocation

Asset Allocation Group

Strategic Asset Allocation



Ashley
Baum

Management
Committee

Gabriel, Roeder, Smith
& Company

Hewitt EnnisKnupp

- Periodic policy review
 - Asset allocation
 - Risk boundaries
 - Market conditions
- Projected timeline
 - Research – January-May
 - Intermediate reports – April and June
 - Final recommendation – September
- Objectives
 - Review market conditions
 - Refine policy, if appropriate
 - Maximize long-term returns within prudent risk parameters

Strategic Asset Allocation

Current Situation

| TRS Trust Valuation | FY 2013 (Aug 13) | FY 2012 (Aug 12) | Change |
|---|---------------------|---------------------|--------|
| Funded Ratio | 80.8% | 81.9% | -1.1% |
| Unfunded Accrued Liability | \$28.9 B | \$26.1 B | +2.8 B |
| Texas Credit Rating | AAA | AA + | + |
| TRS Pension / TX State GDP ¹ | 10.0% | 10.2% | -0.2% |

Source: GRS, US Bureau of Economic Analysis
¹ TX State GDP + TRS Pension Fund

| Key Facts | |
|---|----------|
| Duration of Liabilities | 24 years |
| Benefit Payments | \$8.5 B |
| Member/State Contributions ² | 6.8% |
| Net Payout Ratio ³ | 3.3% |

² 8.6% Annual Required Contribution Rate
³ As a % of Current Assets-

Trust Actuarial Asset Value:
\$117.4 Billion

GRS 30-year Asset Growth Rate:
3.6%

GRS 30-year Liability Growth Rate:
4.1%

| Expected Passive Returns – By Portfolio | | |
|---|------------------------|---------------------|
| | Intermediate Return | Long-Term Return |
| Global Equity | 6.4% | 10.2% |
| Stable Value | 3.0% | 4.5% |
| Real Return | 5.3% | 7.6% |
| TRS Total⁴ | 4.7% | 7.8% |

| Long-Term Risk-Adjusted Portfolio Returns | |
|---|-------------------|
| Total Trust Expected Return | 8.8% ⁵ |
| Projected Risk | 12.9% |
| Projected Sharpe Ratio | 0.68 |

GOALS: Long-Term Sustainability of TRS Pension System, Optimal Long-Term Investment Return



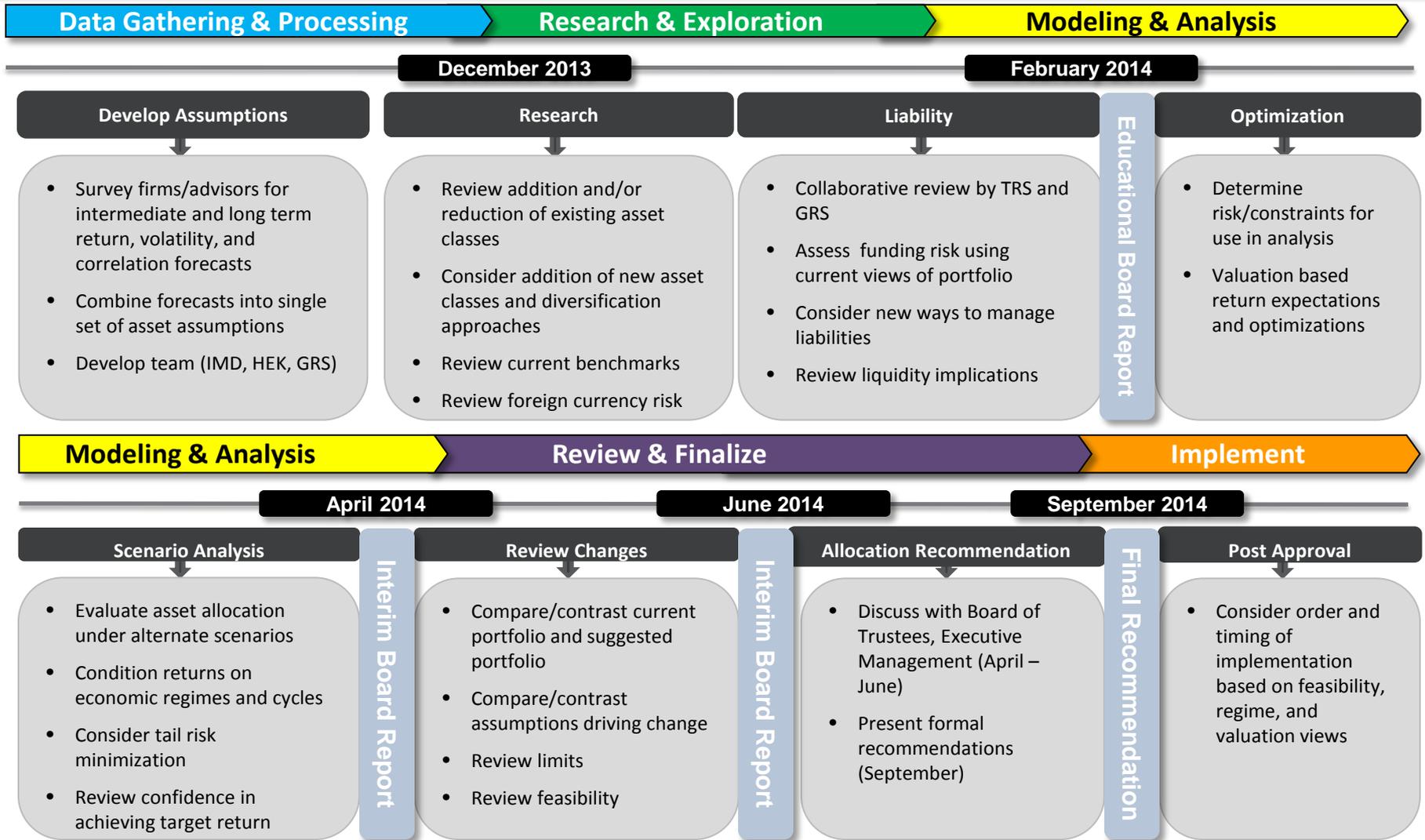
Source: Risk and Return forecasts are from JP Morgan, GMO and TRS IMD

⁴Assumes Policy allocation of 61% Global Equity/ 18% Stable Value / 21% Real Return

⁵Long-Term Passive Return (+) 100 bps of Alpha

Strategic Asset Allocation

2014 SAA Processes Map



Strategic Asset Allocation

2014 Action Items and Considerations

Key Secular Issues

- Low interest rates
- Deleveraging cycle
- Equity risk premium
- Trends in globalization, energy, healthcare and IT

Key Implementation and Policy Issues

Fixed Income

- Duration
- Use of credit
- Bond substitutes

Equity

- Public vs. Private markets
- Domestic vs. International
- Currency hedging

Optimal Liquidity Policy

- Liquidity provision
- Liquidity risk management

Risk Metrics and Parameters

- Measurement
- Management

Optimal Use of TRS IMD Competitive Advantages:

- Large size
- Unlevered portfolio
- Long-term capital
- Liquid assets

New Research:

- Infrastructure
- Enhanced risk management
- Risk parity

Special Opportunities

Asset Allocation Group

Special Opportunities



Ashley
Baum

SPN &
External Public

Private Markets

Objectives:

- Access unique investments
 - 8-12% return
 - Moderate risk
 - Moderately illiquid
 - Unique structure
- Recent examples
 - Investment in Argentinian sovereign debt
 - Kinder Morgan warrants
- Surveys
 - IMD Investment Network
 - IMD Intra-Portfolio Trends

Tactical Asset Allocation

Asset Allocation Group

Tactical Asset Allocation



Tim Jones:
QVF

Curt Rogers:
Classic TAA and
Dynamic Factors

Jase Auby:
Bubbles, Valuation,
Environmental

David Veal:
SPN

Objectives:

- Annualized Alpha of 25 basis points on Total Trust (~\$300M)
- Public markets only

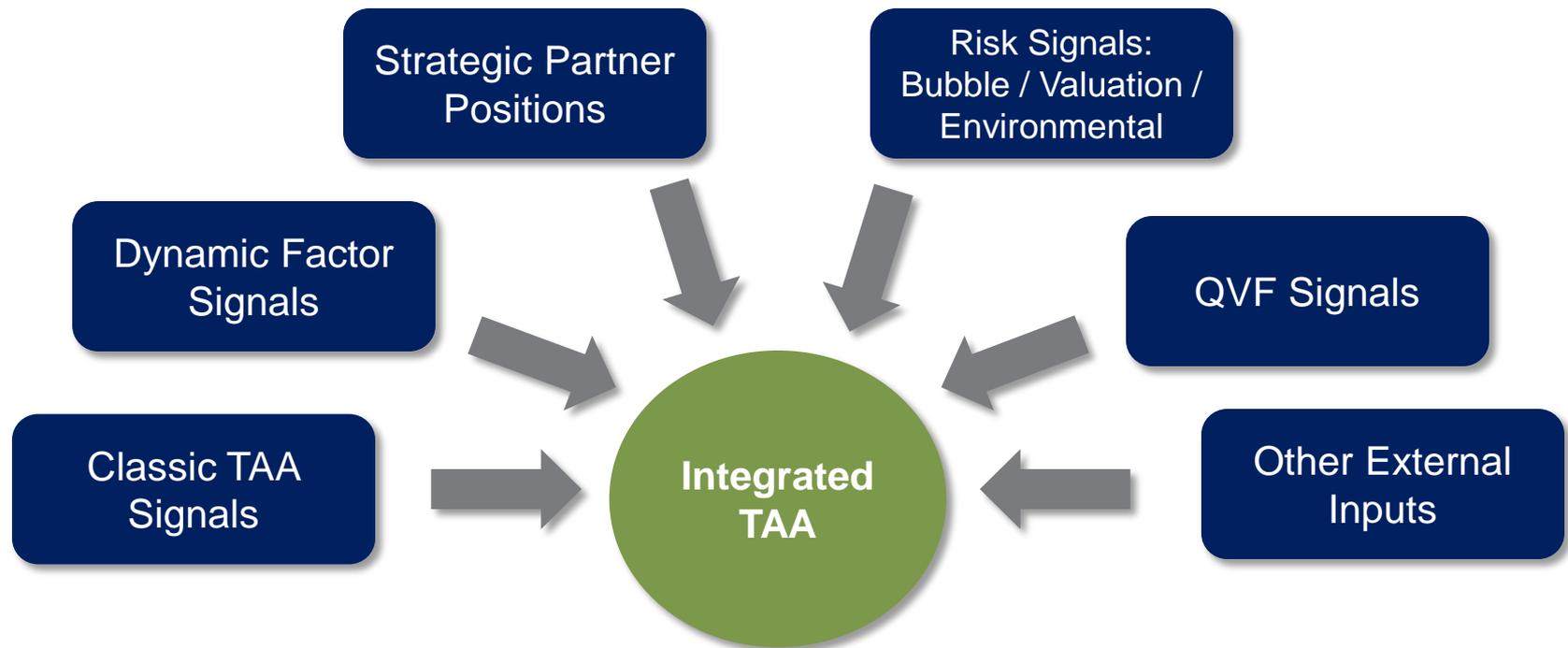
2014 Priorities:

Enhance process through integration of multiple IMD models and methodologies

- Better diversification
- High Sharpe ratio
- Full use of IMD resources

Integrated Tactical Asset Allocation

Goal: Combine existing processes and systems into one unified portfolio



Classic TAA

Trust Level Alpha (Basis Points)

As of September 30, 2013

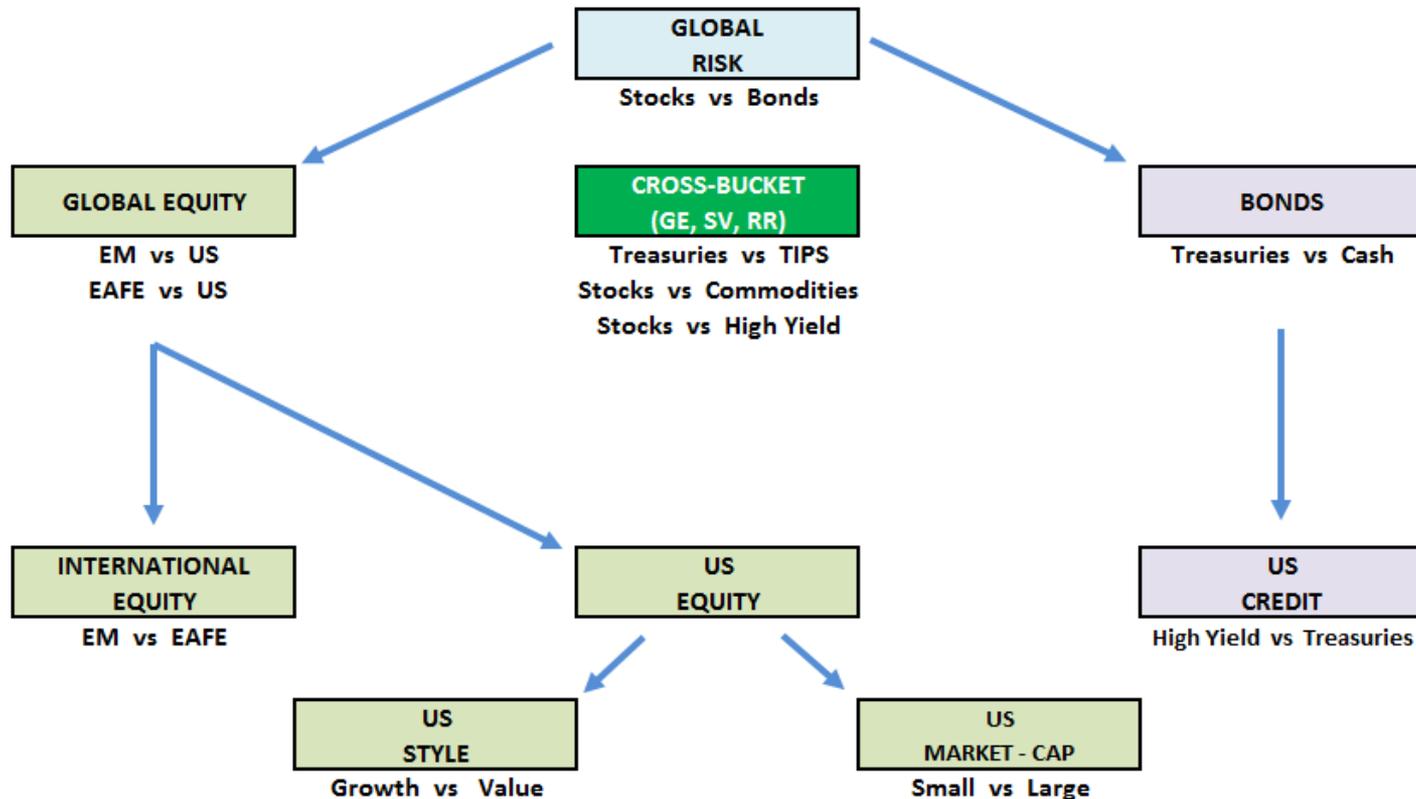
| Asset Class | 2013 | Inception to Date |
|---------------------|-----------|-------------------|
| US Large Cap Growth | -6 | 4 |
| US Large Cap Value | 3 | 0 |
| US Small Cap | 1 | -12 |
| Non-US Developed | -8 | 8 |
| Emerging Markets | -3 | 10 |
| US Treasuries | 7 | 9 |
| Credit | -1 | 20 |
| US TIPS | -2 | 0 |
| Commodities | 0 | -3 |
| REITs | 0 | 0 |
| TOTAL | -9 | 36 |



TAA Performance as measured at the fund level in Trust-level basis points
All performance measured as of 9/30/2013

Classic TAA Decision Tree

- With 11 asset class pair models
- Factor-based, updated monthly



Additional IMD Models and Resources Developed

As of September 30, 2013

| Model/Process | Alpha (bps) | | Inception Date | Correlation to Classic TAA |
|--|-------------------|-------|----------------|----------------------------|
| | 2013 ⁴ | ITD | | |
| Strategic Partnership Positions ¹ | + 267 | + 63 | September 2008 | -0.03 |
| Dynamic Factor Model (DF) ² | + 28 | + 28 | May 2013 | 0.40 |
| Quantitative Vector Fund (QVF) ³ | + 858 | + 142 | October 2010 | 0.29 |

Additional Risk Models:

Bubble Monitor

Environmental Indicators

Intermediate Valuation Signals

¹ SPN Alpha measured as excess performance over the SPN benchmark

² Dynamic Factor is managed as an overlay to the entire trust and Alpha is measured as basis points of performance at the trust level

³ QVF is managed with a risk base of between \$100-500 M over its live period and Alpha is calculated as performance against its risk base in each period

⁴ Returns are calculated on a Trailing-12 Month Basis

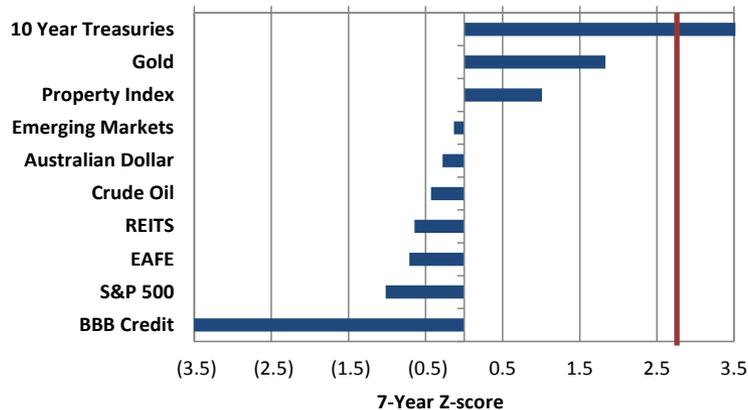
Strategic Partner Positions / Bubble Signals

SPN Positioning

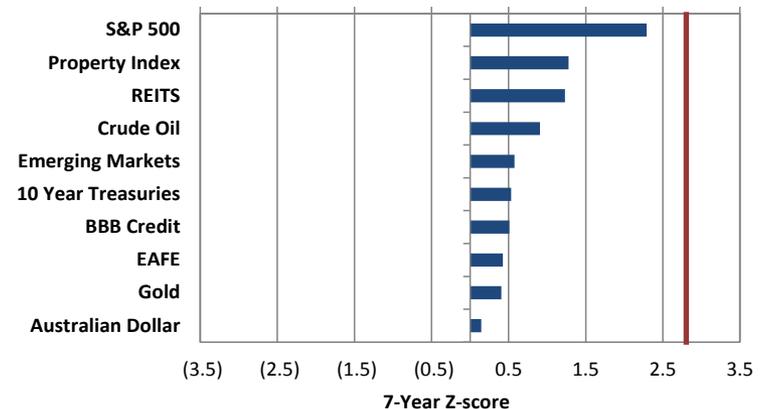
| | Large Cap | Small Cap | Developed Ex-US | Emerging Markets | LT Treasuries | Non \$ Sovereign Debt | Credit | Inflation Linked Bonds | Commodities | REITS |
|-----------|-----------|-----------|-----------------|------------------|---------------|-----------------------|--------|------------------------|-------------|-------|
| 9/30/2012 | 0.4% | -0.2% | 1.9% | 1.3% | -0.1% | 4.6% | 3.5% | -0.5% | -0.6% | -0.4% |
| 9/30/2013 | 1.4% | 0.8% | 4.6% | 0.5% | -1.5% | -0.5% | 5.8% | -1.5% | -0.8% | -0.7% |

Bubble Signals

Bubble Level Monitor: December 2008



Bubble Level Monitor: September 2013



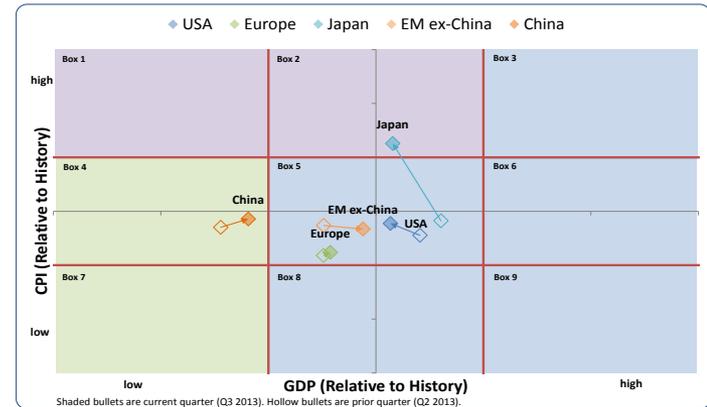
Environmental / Valuation Signals

Environmental

December 2008



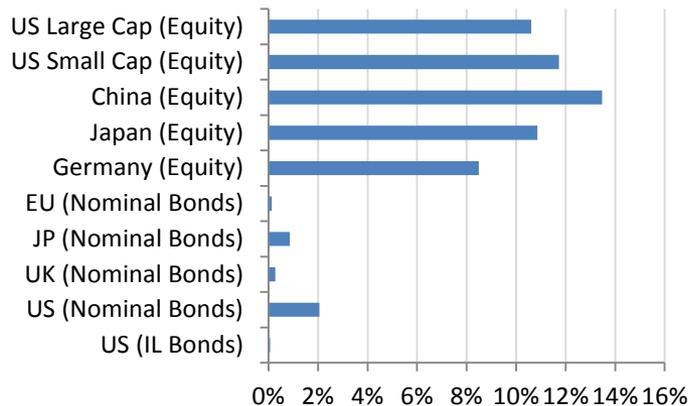
Current



Intermediate Term Valuation Models

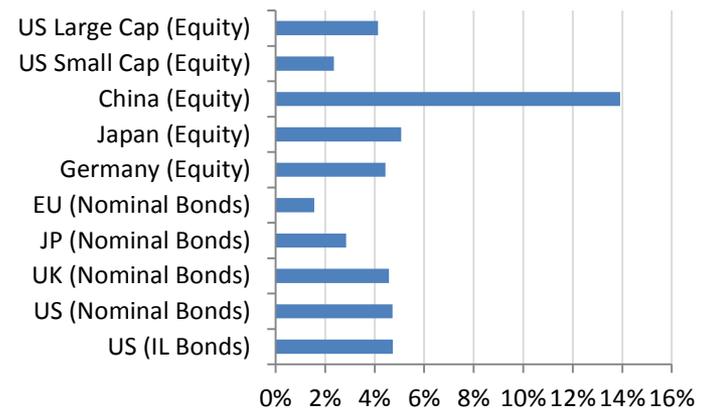
December 2008

Annualized Expected Return Forecasts (Real)

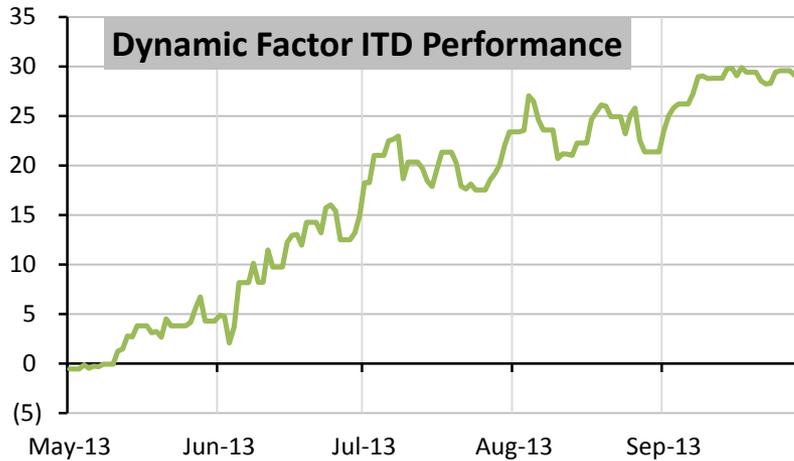


Current

Annualized Expected Return Forecasts (Real)



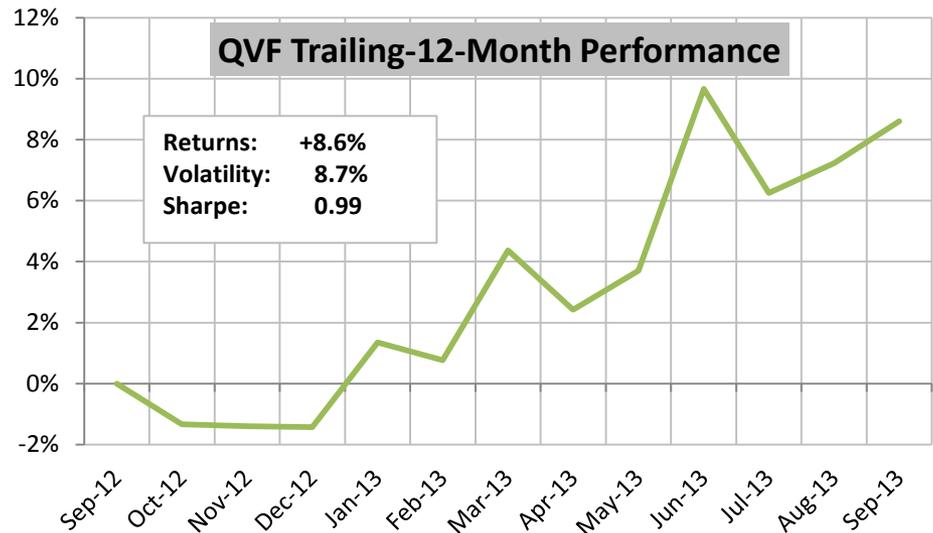
Dynamic Factor and QVF



DF Performance assuming 100% weight for entire year

Dynamic Factor, assuming a 100% weight, would have returned +28 bps

QVF is +8.6% over the past 12 months



Integrated TAA

Process

| Standardized Forecast Inputs | Optimize Neutral Allocation | Certify Operations Controls | Implement and Manage |
|---|---|--|---|
| <ul style="list-style-type: none">• Classic• Dynamic factor• QVF• SPN• Bubble• Environmental | <ul style="list-style-type: none">• Sharpe ratio• Scenario analysis• Tail risk(s)• Policy constraints• Judgment | <ul style="list-style-type: none">• Reporting• Trading• Counterparty | <ul style="list-style-type: none">• Integrated signals• Additional transparency• Professional reporting and feedback loop |
| Q4 2013 | | | Q1 2014 |

Beta Management

Asset Allocation Group

Beta Management



Matt
Talbert

Bernie Bozzelli:
Trading Group

Komson Silapachai:
Interest Rate Team

Objectives:

- Effective passive portfolio management
- Alpha generation through low tracking error strategies
- Professional management of TRS liquidity
- Prudent securities lending
- New research

Assets:

- Strategic Beta (\$22.5 Billion)

Portfolio Performance

As of September 30, 2013

| | \$(In Billions) | Return | | Alpha | | Tracking Error ¹ |
|--|-----------------|--------------------|-------|--------------------|-------------------|-----------------------------|
| | | 1 YR | 3 YR | 1 YR | 3 YR | |
| Passive Portfolios | | | | | | |
| Long Treasuries | \$14.0 | -10.3% | 4.0% | 0.3% | 0.3% | 8 |
| US TIPS | \$5.6 | -5.9% | 4.2% | 0.2% | 0.2% | 12 |
| Large Cap | \$0.4 | 23.8% | | 2.8% | | 8 |
| Small Cap | \$0.3 | 31.1% | | 0.5% | | 1 |
| Non-US Developed | \$0.0 | 22.5% | | 1.1% | | 5 |
| Emerging Markets | \$1.5 | 0.4% | | -0.6% | | 70 |
| Directional Hedge Funds ⁴ | \$0.6 | 2.2% | 6.25% | -4.4% | 1.5% ⁴ | 330 |
| Active Beta² | | | | | | |
| Enhanced Commodities (ECAS) ³ | \$0.5 | -1.1% ³ | | | | 3% vol |
| Quantitative Vector Fund (QVF) | \$0.4 | 8.6% | 1.4% | | | 10% vol |
| Classic TAA | \$0.0 | | | -0.1% ⁵ | | |
| Dynamic Factor TAA | \$0.0 | | | 0.0% ⁶ | | |
| Research and Development | | | | | | |
| Risk Premia | n/a | | | | | |
| Currency Carry | n/a | | | | | |

¹ Predicted tracking error in basis points

² ECAS and QVF capital allocations expressed as Risk Base, Classic and DF TAA are overlays on entire Trust

³ YTD Return

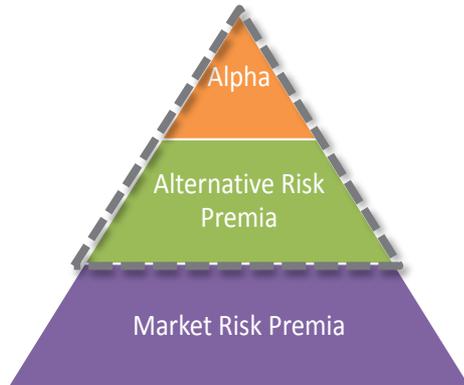
⁴ Inception Return (10/3/2011)

⁵ P/L divided by average market value over past 12 months

⁶ P/L divided by quarter-to-date average Trust market value

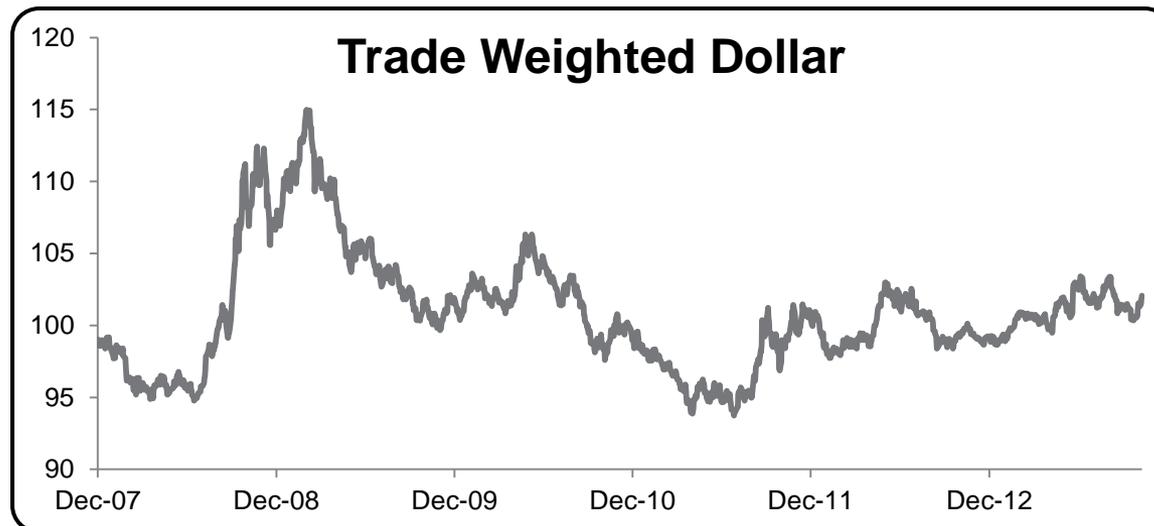
Alternative Risk Premia and Currency

Pyramid of Return Sources



Categories of Alternative Risk Premia

| | |
|----------------------------|--|
| Value | The tendency for relatively cheap assets to outperform relatively expensive ones |
| Momentum | The tendency for an asset's recent relative performance to continue in the near future |
| Carry | The tendency for higher-yielding assets to provide higher returns than lower yielding assets |
| Defensive | The tendency for lower risk and higher-quality assets to generate higher risk-adjusted returns |
| Liquidity Provision | Generates returns by providing liquidity to benchmarked investors |



Market Strategy

Asset Allocation Group

Market Strategy



Curt
Rogers

Management
Committee

External Research
Providers

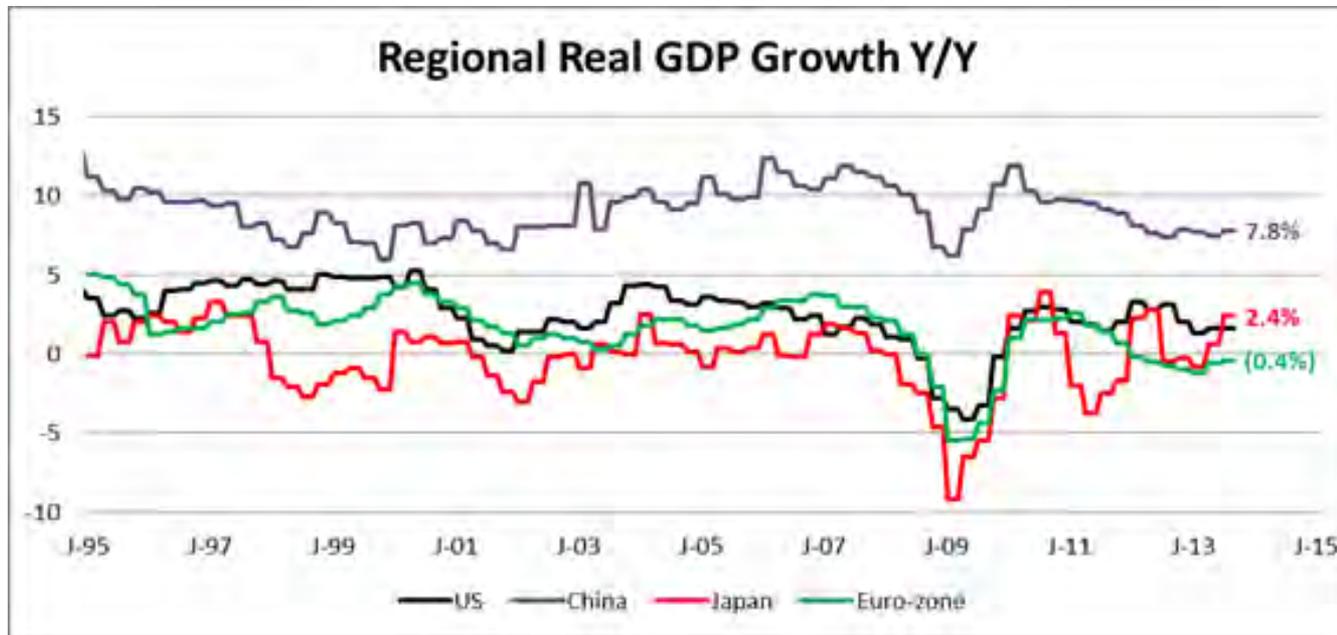
Objectives:

- Improve IMD analysis of key global trends
 - Regional economics
 - Monetary policy
 - Global earnings
 - Geo-political factors
- Model development/research
- Database development/maintenance

Market Strategy

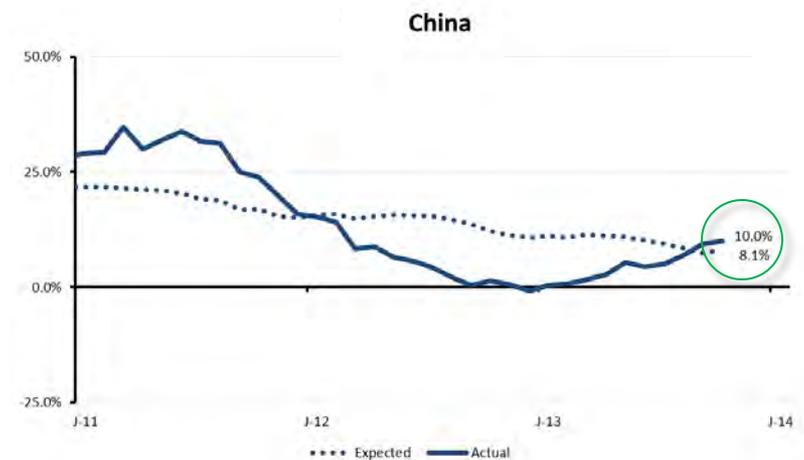
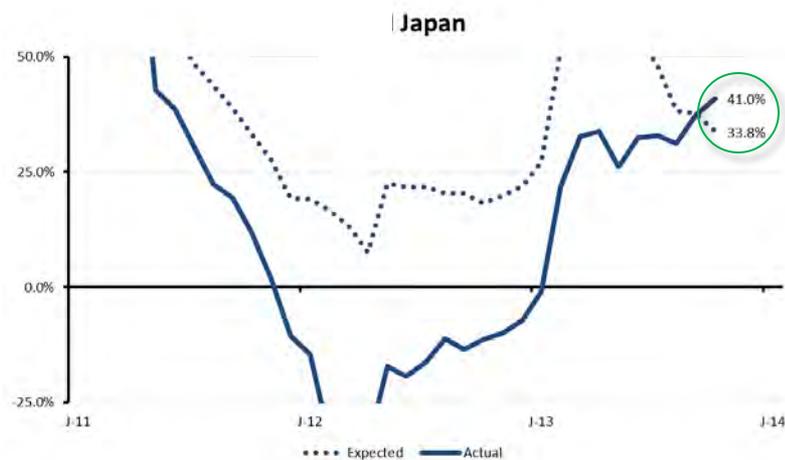
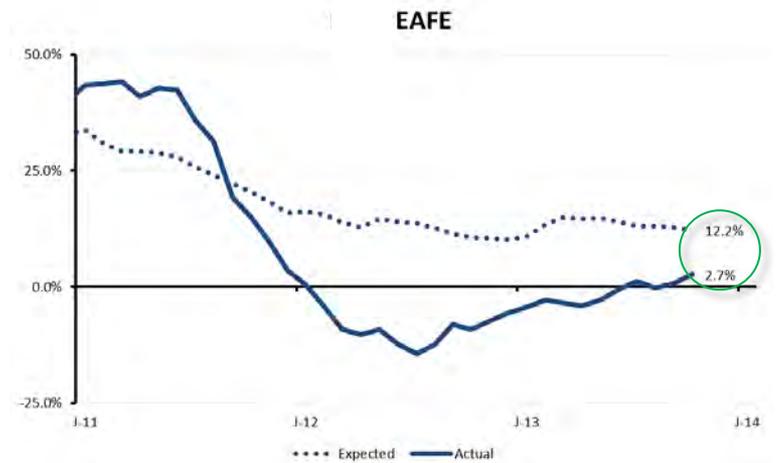
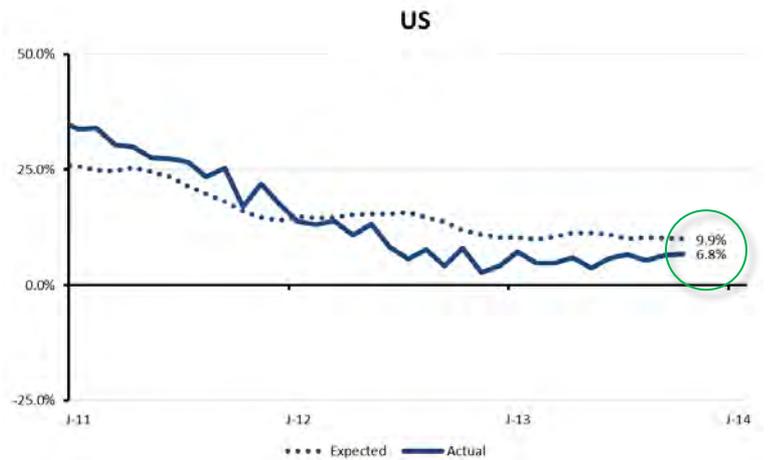
- Regional GDP Growth

- Japan has made the most progress in 2013
- Europe, as a whole, is now close to positive growth
- US and China have remained relatively stable in 2013



Market Strategy

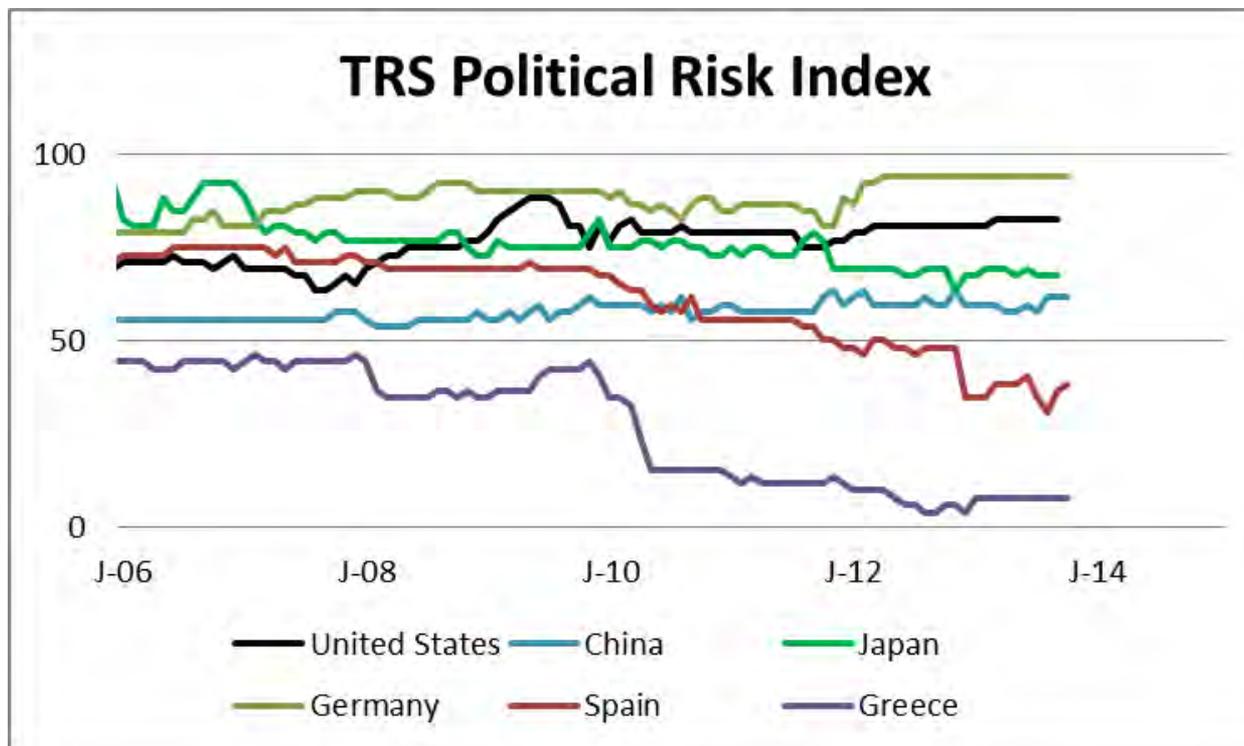
- Relative Earnings Growth vs. Consensus



Market Strategy

- Political Risk Model

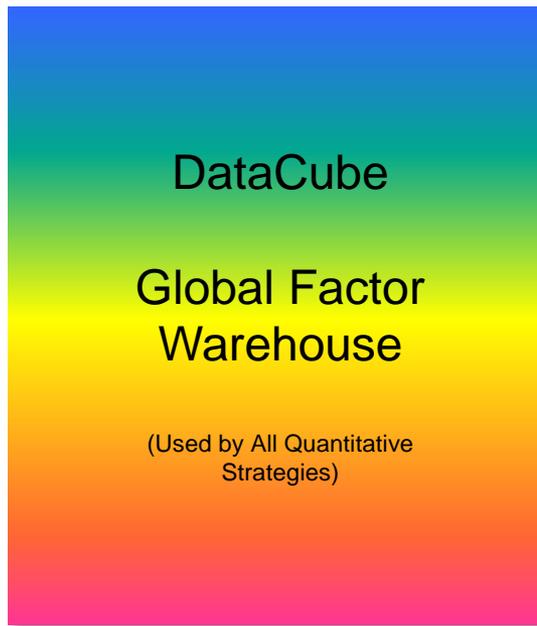
- Greece and Spain deteriorate during the European crisis
- China, US and Germany have stayed relatively constant at “low” levels
- Japan deteriorated slightly in 2012



Risk
Increasing

Model Development and Support

“DataCube” Factor Universe



- TRS database managing 1,300+ factors
 - Refreshed daily
 - One-stop “data” shopping for all quant strategies
 - Data are pulled from a number of sources including DataStream, State Street and other sources
- Global Factors from 21 Countries
 - 13 Developed
 - 8 Emerging
- Classified into 8 Factor “Buckets”
 - Equity Fundamentals 350 Factors (valuation, earnings growth, ...)
 - Macro-Economics 344 Factors (GDP, industrial production, ...)
 - Equity Markets & Flows 212 Factors (equity index returns, ...)
 - Interest Rates 171 Factors (market and central bank)
 - Consumer-Related 154 Factors (income, spending, ...)
 - Labor 71 Factors (payrolls, unemployment, ...)
 - Government 53 Factors (budget deficit)
 - Currencies 15 Factors (foreign vs US Dollar)

VII. 2014 Priorities

| # | 2014 Goals |
|---|--|
| 1 | Complete review of Strategic Asset Allocation and make final recommendations by September 2014 |
| 2 | Effectively identify unique Special Opportunities for the Trust |
| 3 | Integrate IMD's valuation model into a single allocation system |
| 4 | Continue to manage and enhance IMD's Beta Replication and value creation capabilities |
| 5 | Initiate a new Market Strategies system |
| 6 | Enhance and maintain a proprietary and comprehensive research database |
| 7 | Retain, recognize and reward employees who create value, enhance processes and operate consistently with the IMD Culture |

APPENDIX

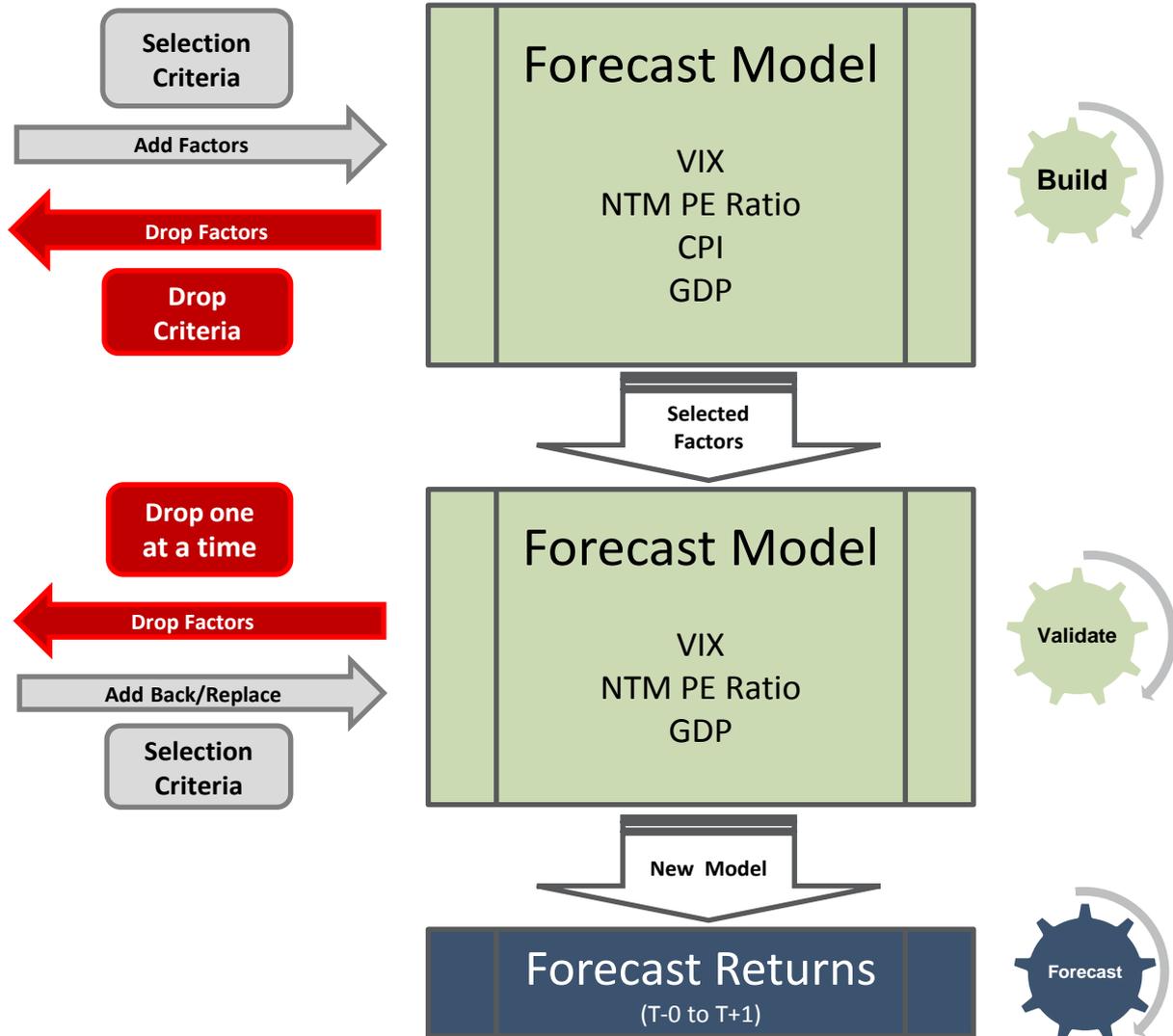
Appendix - TAA

Dynamic Factor Model-Building Methodology

DataCube



Dynamic Factor



Appendix - TAA

Dynamic Factor Selection

- For “Stocks vs Bonds” (January, 2011 to June, 2013)
 - Most frequently selected factor types:
 - Earnings and dividends
 - Inflation
 - Fiscal
 - Most frequently selected countries:
 - Australia (proxy for China and commodities)
 - United Kingdom
 - Spain

