Arun Muralidhar, Managing Director

Innovations in Pension Fund Management
Agenda

• **Market outlook and impact on clients**
  - Keys to success for a plan sponsor
  - Asset allocation case studies
    - Inclusion of hedge funds and leverage (asset-only)
    - asset-liability studies (comparison with mean-variance analysis)
    - managing under-funded schemes (importance of contribution policies)
  - Risk measurement versus risk management
  - Performance
    - attribution
    - risk-adjustment
    - manager selection
An adverse pension event of historic proportions

S&P 500 vs. Citibank Government/Corporate (trailing 1 year excess return)

2003 was good but pension plans are still recovering
The largely domestic bias helped U.S. clients through 2000

Actual long-term returns and risks

Ten years ended December 2000.
Funded status fell in the U.S.A. before the market collapsed

Average funded ratio for corporate pension plans with assets between $400 million and $1 billion

Source: Compustat/JP Morgan Investment Management
# Historical and future returns in Japan – difficult times ahead

## Historical Index Return/Risk *(in JPY)*
(Period: 1994/1-2003/12)

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Annualized Return</th>
<th>Expected Return(*)</th>
<th>Annualized Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflation</td>
<td>-0.01%</td>
<td>0.37%</td>
<td>1.2%</td>
</tr>
<tr>
<td>Domestic Cash</td>
<td>0.50%</td>
<td>0.50%</td>
<td>0.7%</td>
</tr>
<tr>
<td>Domestic Bond</td>
<td>3.23%</td>
<td>1.00%</td>
<td>3.8%</td>
</tr>
<tr>
<td>Domestic Equity</td>
<td>-0.83%</td>
<td>6.00%</td>
<td>17.5%</td>
</tr>
<tr>
<td>Foreign Bonds (Unhedged)</td>
<td>7.91%</td>
<td>3.00%</td>
<td>12.2%</td>
</tr>
<tr>
<td>Foreign Bonds (Hedged)</td>
<td>2.64%</td>
<td>2.00%</td>
<td>3.7%</td>
</tr>
<tr>
<td>Foreign Equity (Unhedged)</td>
<td>10.44%</td>
<td>7.00%</td>
<td>18.3%</td>
</tr>
<tr>
<td>Foreign Equity (Hedged)</td>
<td>9.95%</td>
<td>4.61%</td>
<td>15.4%</td>
</tr>
<tr>
<td>US High Yield Bond (Unhedged)</td>
<td>7.72%</td>
<td>4.48%</td>
<td>15.0%</td>
</tr>
<tr>
<td>Emerging Bond (Unhedged)</td>
<td>12.98%</td>
<td>6.56%</td>
<td>22.0%</td>
</tr>
<tr>
<td>Emerging Equity (Unhedged)</td>
<td>3.28%</td>
<td>7.81%</td>
<td>26.1%</td>
</tr>
</tbody>
</table>

(*) These Expected Returns are hypothetical estimates.

Some are based on Japanese Pension Fund Association's estimates which are obtained by Building Block calculation. In this calculation, the risk premium of each asset class is estimated from historical average return of last 32 years. And some modifications are made to this PFA's estimates.

Others are estimated assuming that price of risk is constant.

(**) Hedged Index is not available, so local index is alternatively used in calculating statistics of Foreign Equity Hedged.

Source: SGPM
Future looks less attractive for the US and Japan.

Comparing 12 Month LIBOR

Funds will need to be innovative to meet obligations.

Source: Bloomberg
Agenda

• Market outlook and impact on clients

**Keys to success for a pension plan**

• Asset allocation case studies
  – Inclusion of hedge funds and leverage (asset-only)
  – asset-liability studies (comparison with mean-variance analysis)
  – managing under-funded schemes (importance of contribution policies)

• Risk measurement versus risk management

• Performance
  – attribution
  – risk-adjustment
  – manager selection
A pension fund is a very complex entity

Raises many issues about risk, contributions, surplus and objectives
Keys to success – good process

- Set Objectives
  - Establish Strategic Asset Allocation & Funding Policies
    - Manage Assets to Add Alpha
      - Risk Measurement and Management
        - Performance Attribution & Risk-Adjusted Performance
          - Reward Skill-based Activities
What do pension plans struggle with?

<table>
<thead>
<tr>
<th>Barriers to excellence</th>
<th>Cited</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poor process</td>
<td>98%</td>
</tr>
<tr>
<td>Inadequate resources</td>
<td>48</td>
</tr>
<tr>
<td>Lack of focus or of clear mission</td>
<td>43</td>
</tr>
<tr>
<td>Conservatism</td>
<td>35</td>
</tr>
<tr>
<td>Insufficient skills</td>
<td>35</td>
</tr>
<tr>
<td>Inadequate technology</td>
<td>13</td>
</tr>
</tbody>
</table>


Important to have good investment and research staff
The pension fund balance sheet

- **Current Assets**
- **Future Contributions**
- **Future Returns**

\[ \text{Funded ratio} = \frac{\text{assets}}{\text{liabilities}} \]
Pension fund objectives – can be very complex

- Funding policy
  - funded ratio (level and volatility)
  - contribution rate (level and volatility)

- Investment policy
  - expected return and risk
  - performance relative to benchmarks
  - performance relative to peers
  - guaranteed rate of return
  - impact on net income, net equity etc.

Simple mean-variance analysis will struggle
Plan’s key objectives and the associated potential risks

<table>
<thead>
<tr>
<th>Plan objectives</th>
<th>Potential risks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimize required contributions</td>
<td>Funded status may deteriorate</td>
</tr>
<tr>
<td>Preserve funded status</td>
<td>Increased contributions help</td>
</tr>
<tr>
<td>Minimize income statement impact</td>
<td>Long-run return may be sacrificed</td>
</tr>
</tbody>
</table>

Some objectives can conflict with others
# Identifying and ranking objectives – an example

<table>
<thead>
<tr>
<th>Objective</th>
<th>Relative importance</th>
<th>Targets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximize expected return</td>
<td>First</td>
<td>10%</td>
</tr>
<tr>
<td><strong>Asset-liability management</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Funded ratio</td>
<td>Second</td>
<td>100%</td>
</tr>
<tr>
<td>- Contribution rate and volatility</td>
<td>Third</td>
<td>10%</td>
</tr>
<tr>
<td>- Pension income</td>
<td>Fourth</td>
<td>maintain</td>
</tr>
<tr>
<td>- Real rate of return</td>
<td>Fifth</td>
<td>4%</td>
</tr>
<tr>
<td><strong>Performance</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Relative to peers</td>
<td>Sixth</td>
<td>+/- 2% pa</td>
</tr>
<tr>
<td>- Relative to benchmark</td>
<td>Seventh</td>
<td>+/- 3% pa</td>
</tr>
</tbody>
</table>
Example of a good benchmark – clear specification

<table>
<thead>
<tr>
<th>Asset class</th>
<th>Benchmark</th>
<th>Target (%)</th>
<th>Range (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S. Equities</td>
<td>Wilshire 5000</td>
<td>50</td>
<td>40-60</td>
</tr>
<tr>
<td>Non-U.S. Equities</td>
<td>MSCI EAFE</td>
<td>20</td>
<td>10-30</td>
</tr>
<tr>
<td>U.S. Fixed Income</td>
<td>Salomon BIG</td>
<td>10</td>
<td>5-15</td>
</tr>
<tr>
<td>Non-U.S. Fixed Income</td>
<td>Salomon World</td>
<td>5</td>
<td>0-10</td>
</tr>
<tr>
<td>Private Equities</td>
<td>Brinson Partners</td>
<td>6</td>
<td>2-8</td>
</tr>
<tr>
<td>Real Estate</td>
<td>NCREIF Property</td>
<td>6</td>
<td>3-10</td>
</tr>
<tr>
<td>Cash</td>
<td>6 Month LIBOR</td>
<td>3</td>
<td>0-5</td>
</tr>
</tbody>
</table>

The benchmark provides the “beta” relative to liabilities!
Implementation of an investment policy

Active vs. Passive Mgmt.
Internal vs. External Mgmt.
Derivative Instruments
Structuring Portfolios (Style: Large/Small Value/Growth Balanced/Specialist)
Overlay for TAA
Currency Management

Clients need to be creative to meet return targets

Keys to Success
## The M³ of pension fund risks – Measure, Monitor & Manage

<table>
<thead>
<tr>
<th>Measure</th>
<th>Asset-liability risk (Committee)</th>
<th>Tactical risk (Staff)</th>
<th>Active risk (Managers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measure</td>
<td>Funded ratio/contribution rate</td>
<td>Tracking error or Value-at-Risk</td>
<td>Tracking error or Value-at-Risk</td>
</tr>
<tr>
<td>Monitor</td>
<td>Annually</td>
<td>Monthly/Daily</td>
<td>Monthly</td>
</tr>
<tr>
<td>Manage</td>
<td>Strategic allocations and funding policy</td>
<td>Asset allocations</td>
<td>Manager allocations</td>
</tr>
</tbody>
</table>
Attribution – should reflect how decisions are made

Quarter to December 31, 2000

<table>
<thead>
<tr>
<th>Category</th>
<th>Returns (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benchmark</td>
<td>2.0%</td>
</tr>
<tr>
<td>Staff-Asset Allocation</td>
<td>0.5%</td>
</tr>
<tr>
<td>Staff-Manager Selection</td>
<td>1.0%</td>
</tr>
<tr>
<td>External Managers</td>
<td>2.0%</td>
</tr>
<tr>
<td>Total Return</td>
<td>5.5%</td>
</tr>
</tbody>
</table>
Implementation issues – strong controls are necessary
Challenges – many decisions need good process

- Manage cash inflows and outflows
  - Contributions, benefits, dividends, coupons etc.
- Evaluate and improve rebalancing strategies
- Decide on manager allocations
- Tactical asset, country, sector or style allocation

Good decisions can add value;
Unmanaged decisions can increase risk and lower returns
Keys to Success

Process for effective management of pension assets

- Establish rules for managing assets (rebalancing, asset allocation etc.)
- Periodically monitor rules and update
- Have transparency to allow for good governance/oversight of decisions

**Beta (benchmark) risk is managed annually; alpha daily**

Source: Mcube Investment Technologies
Clearly identify the internal hierarchy of decision making

Portfolio

Asset Allocation
- Equity = 70%
- By Market
  - Growth/Value/Momentum
- Fixed Income = 15%
  - By Market
  - Govt./Corp.
- Cash/Other = 15%

Source: Mcube Investment Technologies
Want to create “alpha” from all levels of decision making

Total Portfolio

Asset Allocation Strategy

- Bonds
  - SSB BIG
- Equities
  - S&P500
- Cash
  - 1-mo LIBOR
- Alternatives/Currency
  - Alpha = 2.75%
  - Alpha = 2%
  - Alpha = 0.5%
  - Alpha = 1%

Equity Strategy

- Small Cap
  - Russell 2000G
- Large Cap
  - S&P500

Manager Rule

- Passive
  - (Russell 2000 G)
- Active
  - (Manager A)

Source: Mcube Investment Technologies
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  - asset-liability studies (comparison with mean-variance analysis)
  - managing under-funded schemes (importance of contribution policies)
- Risk measurement versus risk management
- Performance
  - attribution
  - risk-adjustment
  - manager selection
Two choice variables – asset allocation and contribution policy

A very dynamic inter-active process – jointly optimize asset allocation and contribution policy
Mean-variance analysis is deficient

- Naïve approach of maximizing return for given risk is clearly wrong
- Changing the objective to maximize surplus (Assets – Liabilities) ignores the complexity of the pension fund objectives
- Analyses are extremely sensitive to parameter choice (two portfolios near each other on an efficient frontier can be very different in composition).
- Unable to handle objectives over long and short horizons
- Unable to jointly optimize asset allocation and contribution policy
- Unable to develop dynamic asset allocation and contribution policy strategies
- Unable to handle derivatives
Case Study 1 (role of hedge funds) - Initial client objectives

- Objective is to maximize return for benchmark risk

- 11% annual standard deviation is benchmark investment board is comfortable with (return of 8-9%)

- No leverage

- Liquidity not a key consideration

- Emerging markets, high yield, currency overlay and other alternative investments are tactical at investment manager level and not part of strategic allocation

In this case, we ignore liabilities
Target benchmark

- **Global Fixed Income**: 15%
- **Fixed Income**: 35%
- **U.S. Equity**: 35%
- **Non-U.S. Equity**: 15%

**Equity Range**: 55% - 45%

**Fixed Income range**: 45% - 55%

*Source: ORTEC Consultants*
Revised objectives

• Maximize return subject to risk

• Minimize the probability of annualized return < 3% (inflation) over the 10 year horizon = RISK

• Try to keep asset allocations within class consistent (i.e., equities)

• Consider hedge funds

• Consider leverage

Hedge fund = generic reference to uncorrelated alpha strategies
Efficient frontiers with hedge funds – more is better

Source: ORTEC Consultants
Leverage could be beneficial – could deliver same value as HFIs (but does not help with risk)

Source: ORTEC Consultants
Improve efficiency by adding hedge funds

Current asset mix:
- GLBN: 50%  
  Av Ann Cum Return y10 = 8.06%
- USEQ: 35%  
  Cum Return at Risk y 10 (99%) = 2.69%
- INTEQ: 15%  
  Cum Return at Risk y 10 (95%) = 4.14%
- HEDGE: 0%

Alternative asset mix:
- GLBN: 45%  
  Av Ann Cum Return y10 = 8.45%
- USEQ: 31.5%  
  Cum Return at Risk y 10 (99%) = 3.36%
- INTEQ: 13.5%  
  Cum Return at Risk y 10 (95%) = 4.76%
- HEDGE: 10%

Free optimization

Client’s Risk Measure

Source: ORTEC Consultants
Restrictions can be harmful – prevents risk reduction

(e.g., US Equity>=35%, Int’l Equity>=15%)

Source: ORTEC Consultants
Conclusions for Case Study 1

- Client’s current asset mix is on, or near, the Markowitz-efficient frontier if hedge funds are not taken into account.

- Client can increase the return on their portfolio without increasing the risk by introducing uncorrelated alpha strategies.

- Alternative asset allocation has lower risk profile and a higher expected return.

- Leverage can also improve to a higher efficient frontier. To achieve the effect of 10% hedge funds you have to leverage 20%.
Agenda

• Market outlook and impact on clients

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• Asset allocation case studies
  – Inclusion of hedge funds and leverage (asset-only)
  – **asset-liability studies (comparison with mean-variance analysis)**
    – managing under-funded schemes (importance of contribution policies)

• Risk measurement versus risk management

• Performance
  – attribution
  – risk-adjustment
  – manager selection
## Objectives, targets, risk measures, and weaknesses

<table>
<thead>
<tr>
<th>Objective</th>
<th>Target level</th>
<th>Risk measure</th>
<th>Weaknesses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset perspective</td>
<td>Maximize return</td>
<td>Minimize volatility</td>
<td>Uncoupled assets and liabilities</td>
</tr>
<tr>
<td>Preserve funded status</td>
<td>Expected funded ratio</td>
<td>Mean of funded ratio in lowest quintile</td>
<td>Increased contributions help meet this goal</td>
</tr>
<tr>
<td>Minimize contributions</td>
<td>50&lt;sup&gt;th&lt;/sup&gt; percentile of present Value of contributions</td>
<td>Mean contribution in highest quintile</td>
<td>Funded status may deteriorate over time</td>
</tr>
<tr>
<td>Minimize income Statement</td>
<td>Expected pension expense</td>
<td>Mean pension expense of highest quintile</td>
<td>Long-run return may be sacrificed</td>
</tr>
<tr>
<td>Minimize Net Equity Impact</td>
<td>Funded ratio</td>
<td>ABO Funded Ratio versus PBO</td>
<td>Increase contributions</td>
</tr>
</tbody>
</table>

---

Asset-Liability (vs. Mean-Variance)
Framework for analysis – case study on foreign exposures

Looking only at the international component

Asset-only

<table>
<thead>
<tr>
<th>Asset expected return</th>
<th>Asset risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

25% hedged*

Better

Worse

Asset liability

<table>
<thead>
<tr>
<th>Average Contribution Rate</th>
<th>Funded ratio risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>High</td>
<td>High</td>
</tr>
</tbody>
</table>

25% hedged*

Better

Worse

Foreign Exposures

CAD
Comparing asset-only to asset-liability analyses – could get different results

Looking only at the international component

<table>
<thead>
<tr>
<th>Asset-only</th>
<th>Asset liability</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>

- **Asset expected return**
  - High: Unhedged* - A (BETTER)
  - Low: 25% hedged* - B (WORSE)
  - Low: 50% hedged* - C (WORSE)

- **Asset risk**
  - Low: 25% hedged* - B (BETTER)
  - Low: 50% hedged* - C (WORSE)

- **Funded ratio risk**
  - High: 50% hedged* - C (WORSE)
  - Low: Unhedged* - A (BETTER)

- **Average Contribution Rate**
  - Low: 25% hedged* - B (BETTER)
  - Low: Unhedged* - A (BETTER)

- **Foreign Exposures**
  - CAD
More than 30% abroad is beneficial, but different hedge ratios

Looking only at the international component
Active currency management benefits from ALM perspective

Important to look at “alpha” relative to liabilities!
Extensions in ALM studies – derivatives, leverage, dynamism

- World Bank studied extending standard techniques by using derivatives, allowing for leverage and making dynamic asset allocation (or contributions)

- Derivatives were used to try to guarantee a funded status at year end
  - Looked at both static and dynamic derivative strategies

- Allowed for leverage (constraints on asset limits are arbitrary)

- Alternatively, change asset allocation (view-neutral) and contribution policy based on funded status
  - Example: Allocation to equities = 15% + 0.2*Funded Status in previous period
Framework for strategy comparison

- Contribution reduction
- Risk reduction
- 100% Funded ratio downside deviation (risk)

WORSE strategies

BETTER strategies

An investment strategy

Average contribution rate

Asset-Liability (vs. Mean-Variance)
Extensions in ALM studies – derivatives, leverage, dynamism

- Static allocation: Fixed portfolio allocation over the simulation window
- Dynamic allocation: allocation to equity depends on funded ratio
- Static derivative: buy annual put on equity at-the-money
- Dynamic derivative: buy annual put – strike price set to ensure a return on equity to target full funding (limit to 10% of the equity allocation)
- Leverage: allow allocations of assets/cash to be as low as –100%
Dynamic allocation is better than derivatives

Asset-Liability (vs. Mean-Variance)

100% Funded ratio downside deviation

Static derivative

Dynamic derivative

Static strategy

Static strategy (with leverage)

Dynamic strategy

Dynamic strategy (with leverage)
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  - manager selection
Case study of an under-funded European fund

• Initial position
  – Funded ratio = 63% on a Projected Benefit Obligation basis
  – Approximately 50% in Equity
  – Assumed equity risk premium = 2.5%; bond return = 4.7%

• Three contribution policy options
  – (A) base case or FIXED LEVEL: 176 mio E per year from 2003 till 2010
  – (B) alternative or HIGH: 603 mio E in 2002, plus 203 E per year till 2010
  – (C) flexible or DYNAMIC: from 2003 till 2010: max 406 mio E; min 0 E

• Risk is defined as follows:
  – Want a probability of 5% PBO at Risk in 2010 (%PBO)
  – Minimize the probability that funded ratio in 2010 smaller than 90%

In severe underfunding, contribution policy is more important than asset allocation

Source: ORTEC Consultants
How flexible contributions can be beneficial

↑ Solvency Risk

Flexible Financing

60% equities

40% equities

50% equities

30% equities

20% equities

0% equities

Source: ORTEC Consultants

Asset-Liability (Underfunded Scheme)
Flexibile contributions important to improve funded status

Contribution policy: A: base or FIXED (left); B: HIGH (mid); C: flexible or DYNAMIC (right)
Flexibile contributions important to reduce risk

5%PBO at Risk in 2010 (%PBO)

Expected Surplus

Source: ORTEC Consultants
Summary of asset allocation case studies

- Must integrate assets and liabilities; objectives are critical
- Dynamic asset allocation policies are critical to the success of funds
- Leverage can also be beneficial, but may not be permitted because of regulations
- While higher contributions is possible, it is expensive for companies. Instead, flexible contribution policies will also lead to efficiency gains, especially if underfunded
- Some derivative strategies can be helpful in protecting surplus
- Uncorrelated alpha strategies can lower asset-liability risk

Mean-variance models are deficient for this analysis
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• Risk measurement versus risk management

- Performance
  - attribution
  - risk-adjustment
  - manager selection
## Pension fund risks – measurement and management

<table>
<thead>
<tr>
<th>Responsibility</th>
<th>Asset-Liability Risk</th>
<th>Tactical &amp; Benchmark Risk</th>
<th>Manager/Active Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oversight Committee</td>
<td>Annually</td>
<td>Internal Staff</td>
<td>Managers</td>
</tr>
<tr>
<td>Annually</td>
<td>Monthly</td>
<td>Monthly</td>
<td></td>
</tr>
<tr>
<td>Strategic Allocations &amp; Funding Policy</td>
<td>Tactical Allocations</td>
<td>Manager Allocations</td>
<td></td>
</tr>
</tbody>
</table>
The tracking error tree (standard deviation of excess returns)

Investment Benchmark

2%

Actual Portfolio

Tracking error = risk relative to benchmark (standard deviation of excess returns)
The risk tree – evaluating the decisions of internal staff

- Investment Benchmark: 1.28%
- Extended Policy: ρ = -0.36
- Actual Portfolio: 1.68%

Staff decisions were negatively correlated to external managers
The risk tree – liability risk is most critical

Liabilities

Investment Benchmark

Extended Policy

Actual Portfolio

Active management can lower asset-liability risk; what about returns?
Risk management is about making conscious decisions

- **Portfolio**
  - **Equity = 70%**
    - By Market
    - Growth/Value/Momentum
  - **Fixed Income = 15%**
    - By Market
    - Govt./Corp.
  - **Cash/Other = 15%**

**Manager Selection**

**Asset Allocation**

**Sector/Regional**

**Style Selection**
Risk management = good decisions going forward

- An Investment Rule is a criteria that is established to drive ongoing investment decisions
- Rules are often based upon an economic rationale
- Rules are validated based on historical behaviour of assets and relevant economic variables
- Establishes a discipline in investment decisions, removing emotion, and implicit decision making
- Rules can be extremely simple – need not be complex to add/save alpha
Rules improve process and performance

• A Rule involves 3 key aspects:
  - **What to Do:** Rebalance, Buy, Sell, Hold or Allocate
  - **When to Do It:** Timing Based on Condition
  - **How Much to Do:** A Little or Lot

• Typically, look to see If a condition is met, Then take an action to either Buy or Sell
  - **If** allocation to stocks **exceeds** benchmark weight by 5%; **Then** rebalance immediately to benchmark weight
  - **If** market goes up by 1%/day, **Then** buy 2% more stocks, **Else If** it goes up by 2%/day- **Then** buy 5%
Types of investment rules

- Rebalancing rules
- Technical rules
- Fundamental rules
- Technical variations of fundamental rules
- Other Rules (e.g. Timing/Seasonality, etc.)

Need good process to capture alpha or not lose alpha
Combining portfolio structure with (bottom up) rules

Analyze, Evaluate and Monitor Decisions

Develop Portfolio Decisions
- Develop Rule Hypothesis for Decisions
- Identify Data to Test Rules/Strategies
- Construct Rules and Strategies

Establish Portfolio Structure and Decision Process

Source: Mcube Investment Technologies
Agenda

• Market outlook and impact on clients
• Keys to success for a plan sponsor
• Asset allocation case studies
  – Inclusion of hedge funds and leverage (asset-only)
  – asset-liability studies (comparison with mean-variance analysis)
  – the case of underfunded plans
• Risk measurement and management

• **Performance**
  – attribution
  – risk-adjustment
  – manager selection
Performance attribution

- Helps understand sources of return
- Evaluate if these contributors are commensurate with risks
- Facilitate decision-making on
  - tactical asset allocation (i.e., stocks versus bonds, international versus domestic)
  - benchmark decisions (small cap or value bias)
  - manager selection
  - manager allocations
Traditional attribution method

\[ r_A \]

\[ r_B \]

\[ r_P \]

Active Managers

Benchmark Risk

Policy

TAA

\[ WP \]

\[ WA \]

Total return
A more effective method – a decision-based approach

\[ r_A \quad \text{Manager value-added} \quad \text{Manager selection} \quad \text{Total return} \]

\[ r_B \quad \text{Benchmark risk} \]

\[ r_P \quad \text{Policy} \quad \text{TAA} \]

\[ w_P \quad w_A \]
How attribution can help improve performance
Measures of performance

- Unadjusted measures
  - portfolio return
  - benchmark return
  - excess return

- Risk-adjusted measures
  - Sharpe ratio
  - information ratio
  - $M^2$ performance
  - $M^3$ performance
  - SHARAD measure
How to calculate these measures

- **Unadjusted measures**
  - Excess return = Portfolio return - Benchmark return

- **Risk-adjusted measures**
  - Sharpe ratio = Excess over risk free rate/standard deviation of portfolio
    - higher the ratio, the better the investment opportunity
  - Information ratio = Excess over benchmark/standard deviation of excess returns
    - higher the ratio, better the manager
  - $M^2$ return = extended Sharpe ratio (expressed in basis points)
  - $M^3$ return = extended $M^2$ ratio; corrects for degree of correlation

*M$^2$ and $M^3$ are in %; provide information about portfolio construction*
An evaluation of the $M^2$ measure
An underperforming portfolio has a higher risk adjusted return

Information ratio is a bad measure of performance!!
Normalize for differences in standard deviation

Riskless asset

Return

r(RAP)

Market risk

Standard deviation

Panel I: Portfolio leveraged to have same risk as market

Panel II: Active portfolio

Panel III: Correlation risk

Panel IV: Benchmark

Standard deviation of unlevered portfolio

Must normalize appropriately for risk or make bad decisions
The correlation-adjustment – normalize for tracking error

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<th>Standard deviation (%)</th>
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<th>r(RAP) (%)</th>
<th>TE(basic) (%)</th>
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Get a totally different ranking of external managers
## Ranking portfolios using different methods

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<th>Skill using raw returns</th>
<th>M² or Sharpe</th>
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Many different methods of risk-adjustment

- Manage portfolio yourself – Sharpe, information ratio or M²
- Have someone else manage and you have a tracking error budget – M³
- Worried about skill – M³
- None of these measure tell you much about consistency. No clear pattern emerges if you select managers on this basis (using a 5 year period) and test on the next 5 years

How should clients select managers given different objectives?
Manager selection – a new approach

- Problems with current rating systems
- A new rating framework
- Benefits of the new approach
Problems with current rating systems

- Risk adjustment not intuitive
- Not adaptable to individual investment objectives
- Cannot adapt rating system to portfolio of funds
- Do not evaluate luck vs. skill of fund managers
- Multiple investment horizons not transparent
Wide disparity in skill across similarly rated funds

Excess over S&P 500 versus confidence in skill - 10 years ending Aug 1999

Source: Mcube Investment Technologies
A new rating framework

• 3 Alphabet rating system ranking 3 separate performance measures.
• A rating is best; F rating is worst for each measure.
• Incorporates ratings assigned to multiple time horizons.
• Separate rating for “confidence in skill” measure.
• Proprietary adjustment for risk – better than other measures.
• Can evaluate multiple fund portfolios.

Source: Mcube Investment Technologies
Can rate on performance and skill over multiple horizons or...

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Source: Mcube Investment Technologies
## Risk-adjusted performance and skill or...

### Manager Selection

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Source: Mcube Investment Technologies
## Skill and risk-adjusted performance

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Source: Mcube Investment Technologies
And multiple fund portfolios (combining with fund 5 and 10)

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<th>M^3 Score</th>
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Multiple manager portfolios have better characteristics

Source: Mcube Investment Technologies
Benefits of new rating system

- Simple for investor - allows for user-specified objectives
- Shows the evolution of performance over different time horizons
- Shows the critical confidence in skill of fund manager
- Allows for selection of multiple funds within context of portfolio

Source: Mcube Investment Technologies
Summary – focus on the keys to success and good process

- Set Objectives
  - Establish Strategic Asset Allocation & Funding Policies
  - Manage Assets to Add Alpha
  - Risk Measurement and Management
  - Performance Attribution & Risk-Adjusted Performance
  - Reward Skill-based Activities
Appendix

Thanks to:
Arikawa-san (SGPM)
Tsumagari-san (World Bank)
Yabuuchi-san (RSAM)
And other staff at SGPM, FX
Concepts, World Bank and RSAM
Where should a fund take risk?

- Which asset class *on average* provides the best alpha?
- Should managers be constrained?
- What bets have paid off?
- The Greater Fool Theory of Asset Management
Where should a fund take risk?

Tracking error vs. excess returns (net of fees)

- US Equity Large Cap
- US Fixed Income
- High Yield
- Non-US Equity EAFE
- Non-US Equity EAFE - Japan Lite
- Emg Mkt Equities
- Non-US Fixed Income
- US Equity Small Cap
- US Equity Mid Cap
- Non-US Fixed Income - Japan Lite
The Wilshire U.S. large cap universe – zero average alpha

From 12/87 to 12/97
Should managers be constrained?
The case for conservative management

*Wilshire U.S. Fixed Income Universe*
The Greater Fool Theory of Asset Management

- If average alpha is zero, must believe that another sponsor is selecting a bad manager if you think you are selecting a good manager.

- The average alpha in international came from a bet on Japan – will the markets give the same opportunity in the future?

- Does not negate the case for active management – just need to be careful about managing managers.

- Results hold across countries and databases.