RISK MANAGEMENT: PLAN

- Risk measurement as a passive approach
- Risk control as a defensive approach
- Risk management as an active tool for portfolio management
  » Applications
- Implications for asset management
Evolution of Risk Management

Passive:

Reporting risk:
- disclosure to shareholders
- management reports
- regulatory requirements

Defensive:

Controlling risk:
- setting risk limits
  (desk level and firm-wide)

Active:

Allocating risk:
- performance evaluation
- capital allocation
- strategic business decisions

(1) RISK MEASUREMENT:
A PASSIVE APPROACH

- Measurement of total portfolio risk, ideally forward-looking and using current positions
- Commonly based on:
  Value-at-Risk (VAR), or
  Volatility or Tracking Error Volatility (TEV)
(2) **RISK CONTROL: A DEFENSIVE APPROACH**

- In trading portfolios, “risk limits” are allocated and enforced at the group and desk levels
- In investment portfolios, “risk budgets” are allocated at the asset class and fund levels

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**RISK CONTROL: Allocation of Risk Limits**

- **Business Area**
  - VAR-Limit: $100 m

- **Business Group A**
  - VAR-Limit: $60 m
  - Unit A1
    - VAR-Limit: $30 m
  - Unit A2
    - VAR-Limit: $25 m
  - Unit A3
    - VAR-Limit: $20 m

- **Business Group B**
  - VAR-Limit: $65 m
  - Unit B1
    - VAR-Limit: $45 m
  - Unit B2
    - VAR-Limit: $40 m
RISK CONTROL: Monitoring VAR

Dealing with a sudden increase in VAR:
- Is a trader taking big bets? (e.g. Common Fund)
- Are different managers taking similar bets? Acting independently, they could all increase exposure to one particular sector (e.g. technology)
- Are the markets suddenly more volatile?

(3) RISK MANAGEMENT: AN ACTIVE APPROACH

- Risk management should be integrated with the portfolio management process to extract maximum performance
- This leads to better portfolio management decisions:
  1. Improve the risk/return profile of the portfolio
  2. Allocate funds to managers—Risk budgeting
  3. Provide tools for investing in new managers
- From defensive to offensive risk management
Active Risk Management Applications

(1)
Improve the Risk/Return Profile of the Portfolio

VAR Tools

- **Marginal VAR**: the change in portfolio VAR resulting from taking an additional unit of exposure to a given factor
  \[ \Delta \text{VAR}_i = \frac{\partial \text{VAR}}{\partial x_i} = \beta_i \]
- **Risk allocation**: an exhaustive attribution of total risk to each factor by component VAR
- **Component VAR**: marginal VAR times position
  \[ \text{VAR}_p = \text{CVAR}_1 + \text{CVAR}_2 + ... \]
  \[ \text{CVAR}_i = \Delta \text{VAR}_i \times x_i \]
- **VAR contribution**: component VAR in percent
**VAR Tools: Example**

<table>
<thead>
<tr>
<th>Position</th>
<th>Volatility</th>
<th>Individual VAR</th>
<th>Marginal Component</th>
<th>Total VAR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Can.Dol</strong></td>
<td>$2,000,000</td>
<td>5%</td>
<td>$165,000</td>
<td>0.0528</td>
</tr>
<tr>
<td><strong>Euro</strong></td>
<td>$1,000,000</td>
<td>12%</td>
<td>$198,000</td>
<td>0.1521</td>
</tr>
<tr>
<td><strong>Sum</strong></td>
<td>$3,000,000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Undiversified VAR: $363,000  
Diversification effect: $105,262  
Diversified VAR: $257,738  

**VAR Decomposition**
Risk Management as an Active Tool

CALPERS Example

Contribution to Absolute Risk

Source: www.calpers.ca.gov

CALPERS Example

Absolute Risk
Relative Risk
Contribution to Relative Risk
Marginal Relative Risk
Contribution to Absolute Risk
Marginal Absolute Risk
Risk-Return Trade-Off

Risk Management as an Active Tool

From Risk Measurement to Portfolio Optimization

- All MV efficient portfolios B must be such that expected returns on all assets satisfy:
  \[ E(R_i) - R_f = \beta_i [E(R_B) - R_f] \]

- To go from the current position to an efficient portfolio, sort all assets by the ratio of excess return to marginal VAR (or beta):
  \[ T\text{-ratio} = \frac{E(R_i) - R_f}{[VAR \beta_i]} \]

- Invest in asset with highest T-ratio

- At optimum, all T-ratios are equal
Improve Risk/Return Profile: CALPERS Example

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>US Equity</td>
<td>40.4%</td>
<td>59.4%</td>
<td>1.47</td>
<td>5%</td>
<td>3.4%</td>
</tr>
<tr>
<td>Int'l Equity</td>
<td>23.7%</td>
<td>26.3%</td>
<td>1.11</td>
<td>6%</td>
<td>5.4%</td>
</tr>
<tr>
<td>Global Fixed</td>
<td>25.6%</td>
<td>-0.3%</td>
<td>-0.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Real Estate</td>
<td>5.1%</td>
<td>6.0%</td>
<td>1.18</td>
<td>3%</td>
<td>2.6%</td>
</tr>
<tr>
<td>Alternatives</td>
<td>4.7%</td>
<td>8.6%</td>
<td>1.83</td>
<td>6%</td>
<td>3.3%</td>
</tr>
<tr>
<td>Cash</td>
<td>0.5%</td>
<td>0.0%</td>
<td>0%</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100.0%</strong></td>
<td><strong>100.0%</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Increase Int'l Equ., e.g. +5% taken from R.E.
- New portfolio has higher ER=+15bp, lower risk=−33bp

Active Risk Management Applications

(2)
Allocate Funds to Managers:
Risk Budgeting
RISK BUDGETING WITH ACTIVE MANAGERS

- Risk budgeting should account for manager skill
- Risk is controlled by imposing tracking-error volatility \( \text{TEV}=x \omega \) limits on active managers, where \( \omega \) is the manager TE volatility, and \( x \) is the weight allocated to manager \( i \)
- For each manager, the limit should reflect the value added (\( \alpha \)) and risk--information ratio (ignoring systematic risk)

\[
\text{IR}=\frac{\alpha}{\omega}
\]

Allocation of TEV Limits (1)

- Assume \( N \) active decisions are independent
- Define \( \alpha \) and \( \text{TEV} \) in relation to the portfolio
- Choose allocation of TEVs (or weights \( x_i \) given a tracking error \( \omega_i \)) to maximize the IR of the portfolio:

\[
\text{MAX}_{x_1,x_2,...} = \frac{\alpha_p}{\text{TEV}_p}, \quad \alpha_p = \sum_i x_i \alpha_i = \sum_i x_i (\text{IR}_i \times \omega_i)
\]

subject to: \( \text{TEV}_p^2 = \sum_i x_i^2 \omega_i^2 \)
Allocation of TEV Limits (2)

- At the optimum, the ratio of the marginal contribution to alpha to the marginal contribution to risk must be equal for all assets
- Solution is:
  $$ (x_i, \omega_i)^* = \frac{\text{IR}_i}{\sqrt{\sum_i \text{IR}^2_i}} \cdot \text{TEV}_P $$
- Allocation is proportional to each IR (assumed positive)

Allocation of TEV Limits (3)

- At the optimum,
  $$ \text{IR}^*_P = \sqrt{\sum_i \text{IR}^2_i} $$
- Maximum IR is higher than average IR, and also increases with number of decisions
  - when all bets have same IR=IC, we have
  $$ \text{IR}^*_P = IC \sqrt{N} $$
  which is the fundamental law of active management (the information ratio is the product of information coefficient times square root of breadth)
Allocation of TEV Limits: An Example

<table>
<thead>
<tr>
<th>Portfolio</th>
<th>Information Ratio:</th>
<th>Tracking Error Vol:</th>
<th>Value Added:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>IR</td>
<td>IR^2</td>
<td>IR / IRp</td>
</tr>
<tr>
<td>Asset allocation</td>
<td>0.250</td>
<td>0.0625</td>
<td>31.6%</td>
</tr>
<tr>
<td>Stock selection</td>
<td>0.500</td>
<td>0.2500</td>
<td>63.2%</td>
</tr>
<tr>
<td>Currency allocation</td>
<td>0.250</td>
<td>0.0625</td>
<td>31.6%</td>
</tr>
<tr>
<td>Fixed income</td>
<td>0.500</td>
<td>0.2500</td>
<td>63.2%</td>
</tr>
<tr>
<td><strong>Sum:</strong></td>
<td>0.6250</td>
<td>0.1897%</td>
<td>7.59%</td>
</tr>
<tr>
<td><strong>Portfolio:</strong></td>
<td>0.791</td>
<td>4.00%</td>
<td>3.16%</td>
</tr>
</tbody>
</table>

Active Risk Management Applications

(3)
Provide Tools for Investing in New Managers or Markets
### The Rationale for Emerging Managers

- In the hedge fund industry, emerging managers provide superior returns
  - This is supported by empirical evidence, after adjusting for backfill bias

  1. Incentives effects are stronger for younger managers (due to higher marginal value of incentives, and over a longer lifetime)
  2. Emerging managers are more nimble, with lower asset base and less market impact


### Issues with Emerging Managers

- Emerging managers are more exposed to operational risk, which causes 50% of closures
  - Attrition rate is around 5% (HFR), 9%(CSFB) annually, which is high
  - Attrition rate is even higher for smaller funds

- Emerging managers have no track record
  - Difficult to evaluate performance and risk profile

Risk Management as an Active Tool

Number of Hedge Funds Launched, Liquidated

- **Number Launched**
- **Number Liquidated**

Source: HFR

Risk Management as a Tool for Investing in Emerging Managers

- How can we take advantage of the skills of emerging managers?
- **Portfolio transparency**
  - Full reporting of positions on a regular basis
  - This mitigates many of the issues with investing in emerging managers

Benefits of Portfolio Transparency

- Verification of NAVs, prices checked against independent sources (noise vs. bias)
- Construction of forward-looking risk measures based on current positions (total risk, contribution to portfolio risk, concentration, systematic risk, sector exposures)
- Monitoring changes in style, using risk measures and other behavioral characteristics (turnover, static vs. actual returns)
- More meaningful discussions with the manager about the investment process

ACTIVE RISK MANAGEMENT

Implications for the Portfolio Management Process
Implications for Asset Management

- There will be higher allocations to active risk (alpha), lower allocations to market risk (beta)
- Increased importance of alpha strategies, overlays (GTAA, currency, commodities..) and hedge funds
- Convergence between alpha strategies moving into the net long space and traditional managers moving into the shorting space
- The asset management function will be reorganized into a centralized risk-centric function plus alpha and beta management

Target Allocations of Leading Endowments

<table>
<thead>
<tr>
<th></th>
<th>Harvard</th>
<th>Yale</th>
<th>Stanford</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public Equity</td>
<td>31%</td>
<td>26%</td>
<td>40%</td>
</tr>
<tr>
<td>Fixed Income</td>
<td>8%</td>
<td>6%</td>
<td>12%</td>
</tr>
<tr>
<td>Hedge Funds</td>
<td>17%</td>
<td>23%</td>
<td>15%</td>
</tr>
<tr>
<td>Private Equity</td>
<td>13%</td>
<td>17%</td>
<td>10%</td>
</tr>
<tr>
<td>Real Est., Commod.</td>
<td>31%</td>
<td>28%</td>
<td>23%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>10-Year Returns</td>
<td>15.0%</td>
<td>17.2%</td>
<td>14.8%</td>
</tr>
<tr>
<td>Assets</td>
<td>$29B</td>
<td>$18B</td>
<td>$15B</td>
</tr>
</tbody>
</table>

Source: 2006 reports
New approach gets hedge fund returns with traditional risk

More 120/20, 130/30 strategies offered to pension funds

By Barry J. Bess

FLORENCE, N.J. — A new actor equity management approach is being tested by advocates as offering a better chance to outperform benchmark indices and achieve hedge fund-like alpha without transparency or the fees which keep the risk level of traditional portfolios.

A growing number of asset managers have begun offering the approach — mostly called a 120/20 or 130/30 strategy — to pension funds in the last year. Jacob Levy Equity Management Inc., Florence, N.J., already has received $3.7 billion in invest-ments and commitments from pension funds this year since it began offering its 120/20 strategy, according to a recent press release.

UBS Global Asset Management, Chicago, has $500 million in assets, a 130/30 strategy since it began in September, said Scott Edelman, executive director of hedge fund products.

In the past year, Arcadia Global Investments, Goldman Sachs Asset Management, INVECO JPMorgan Asset Management and State Street Global Advisors also began offering 120/30, 130/30 or similar strategies (Pensions & Investments, Sept. 5, 2005).

The strategy overcomes a disadvantage that traditional active equity managers have in trying to outperform benchmarks like the Standard & Poor’s 500 or the Russell 2000 because they cannot underweight securities they expect to underperform enough to achieve significant results.

Because only about 15 stocks in the Standard & Poor’s 500, the Russell 1000 or the Russell 3000 have an index weight greater than 1%, future long-only active eq-
In November 2006, CALPERS instituted a new program: “macro overlay account”, for the entire fund and using cash-market and derivatives instruments. The goal is “to efficiently reduce risk and to attempt to generate additional returns”.

1. Rebalancing will reduce risk by moving weights closer to policy targets.
2. Tactical will incorporate market views.

The program directly reports to the CIO.
CONCLUSIONS (1)

- Risk measures were initially developed for reporting, a passive application.
- Their uses have expanded to control risk, a defensive application.
- Risk management, however, has much greater potential when used as an active (offensive) tool for portfolio management.

CONCLUSIONS (2)

- Risk management can be used:
  - to improve the risk/return profile of the portfolio.
  - to allocate capital across managers (risk budgeting with information ratios).
  - to deal with new managers and markets.
- This risk-centric approach should be leading to fundamental changes in the portfolio management process.