Foundations of Asset Management
Goal-based Investing the Next Trend

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Agenda

• Goal-based approach to investment management
• Setting the correct goal and objective function for investment management
• Two-stage investment management process:
  1. Create the maximum Sharpe-ratio risky portfolio, Optimal Combination of Risky Assets (OCRA); and
  2. Apply dynamic trading strategies between OCRA and the risk-free asset and/or use derivatives to optimize the portfolio for its specific goal
• Goal-based investing may improve performance over standard generic investing strategies, even when both have the same underlying OCRA

• Creating OCRA
• Market cap-weighted portfolio: foundation of the optimal combination of risky assets (OCRA)
• Failure of the CAPM implies market portfolio is not OCRA and therefore alpha exists relative to the passive market portfolio benchmark
• Sources of alpha: seeking to create superior performance over the market portfolio
• Traditional alpha versus financial-services alpha: performance and sustainability
  – Functions served by financial institutions as part of the financial ecosystem
• Traditional alpha versus dimensional alpha: performance and sustainability
  – The search for dimensional alpha
  – A case study exploring a potential new dimension of risk: illiquidity
Goal-Based Approach to Investment Management
A solution-focused perspective

- Determine the appropriate objective function for the portfolio before optimization

- Example: liability-driven investing with the goal of repaying targeted liabilities according to a time schedule, as in a defined-benefit pension fund covering the promised retirement benefits of plan members

- Example: an insurance company has sold a deferred annuity and has the goal of having 100% of the funding needed to pay the promised income on the annuity at the time it begins payouts.

- Example: A DC managed account. Goal is to accumulate enough funds to purchase an inflation-protected retirement income for life adequate to sustain the late-in-work-life standard of living for each member of the defined-contribution retirement plan

- Example: Goal is four-years tuition, room and board at a university within a selected classification beginning when each child is 18 years old.

- Example: Sovereign wealth fund goal derived from its role in an integrated A/L management perspective on meeting the overall economic goals set for the sovereign

- Not Examples: target-date retirement funds; 70-30 rebalancing portfolio strategy between equities and fixed-income; earning an expected return equal to the Consumer Price Index plus 3.00%
Domain of Investment Management

Stages of production process for a specified investment goal

- Components of max-Sharpe-ratio risky assets-only portfolio
  - Risk modulation through hedging or leveraging risky portfolio
  - Constrained asset holdings
  - OCRA market timing active management

- Diversification risk modulation

Passive Benchmark Market Portfolio Efficient Diversification

Active Asset-Class Allocation Macro Sector Market Timing Non-CAPM Equilibrium

Superior Performing Micro Aggregate Excess-Return Portfolio “Alpha Engines”

Super Efficient Max Sharpe Ratio Portfolio of Risky Assets

(Optimal Combination of Risky Assets)

Optimal Mean-Variance Portfolio

Combine with State-Variable Hedging Portfolios

Alter Shape of Returns on Underlying Optimal Portfolio to Fit Goal

Structured Efficient Form of Returns to the Portfolio

- Tailor payoffs to specific goal
  - Dynamic portfolio strategies and derivatives to create nonlinear payoffs
  - Risk modulation with Insurance or non-linear leverage
  - Pre-programmed dynamic trading
  - “Building block” state-contingent securities to create specialized payout patterns
- Expropriation efficient
- Regulatory efficient
- Liquidity tradeoff
- Transaction cost efficient
Transform Shape of Optimal-Portfolio Payoffs to Fit the Goal

Dynamic portfolio strategies and derivatives

- Insurance and non-linear leverage
- Transform Payoff Pattern to fit precise preferences: custom design
Using Goal-Based Investing to Improve Performance
Funding a Deferred Annuity Liability for an Insurance Co. or Pension Fund

Dynamic portfolio strategy focused on the goal of funding 100% of the annuity income

Goal-based portfolio:
- seeks to maximize the chances of achieving the promised income goal, subject to a minimum funded income constraint
- dynamically manages risk of not achieving the goal
- Once goal is achieved takes as much risk as possible out of the portfolio
- General portfolio has no specified goals and employs standard asset allocation rules
- A goal-based dynamic strategy will significantly outperform standard asset allocation strategies measured in terms of the specific goal for which the dynamic strategy was optimized

Hypothetical example to illustrate the potential performance improvement from applying goal-based investing
Constructing the Optimal Combination of Risky Assets (OCRA)

Start with the market cap-weighted passive index for maximum diversification.

If CAPM does not hold, then it is possible to increase the Sharpe ratio over the passive benchmark; thus “alphas” from active management exist but they must be identified.

Three different sources of alpha:
- Market information inefficiency: traditional alpha
- Market frictions and institutional rigidities: financial-services alpha
- Other systematic risks in addition to market-portfolio beta: dimensional alpha

The passive and active components are combined to create OCRA.
Failure of CAPM Implies Alpha Exists for Market Portfolio Benchmark

Sources of alpha: traditional alpha, financial services alpha, dimensional alpha

Possible reasons for CAPM failure:

I. Empirical Deviations from CAPM Black, Jensen and Scholes (1972); Fama and MacBeth (1973); Fama/French (1992)

II. Market Information Inefficiency: Traditional Alpha

III. Market Frictions: Affected by Technology, Institutions, and Regulation
    • Institutional rigidities from regulation or charter/prospectus restrictions/requirements
    • Taxes and accounting rules
    • Leverage inefficiency; borrowing constraints
    • Short-sale restrictions and cost
    • Stock loan limitation and tracking requirements

IV. Other Dimensions of Risk besides Market Beta
    • Hedging roles for securities in addition to diversification
    • Uncertainty about the future investment opportunity set; i.e., changing interest rates, volatility and Sharpe ratio risks
    • Uncertainty about human capital labor income

V. More-Complete Equilibrium Asset Pricing Models: Multiple Betas and Risk Dimensions with Risk Premiums

\[
\bar{R}_j = R_f + \sum_{k=1}^{m} \beta_{jk} [\bar{E}_k - R_f]
\]

• Where \( \beta_{jk} \) is the (theoretical) multiple-regression coefficient from regressing the return on security \( j \) on the returns on the “m” dimension portfolios, “E1,...,Em”

• Intertemporal Capital Asset Pricing Model (Merton 1973,1975)
• Arbitrage-Pricing Theory Asset Pricing Model (Ross 1976)
• Consumption-based Capital Asset Pricing Model (Breeden 1979)
• Fama/French (1992) 3- or 4-Factor Model (reduced-form model)
Market Cap-Weighted Index Portfolio is Always an Important Component of the Optimal Combination of Risky Assets

\[ R = R_f + S\sigma \]

\[ S = \text{Sharpe Ratio} \]

\[ \bar{R}_\rho = R_f + \beta_\rho \left( \bar{R}_M - R_f \right) + \alpha_\rho \]
Traditional Active Management Designed to Enhance Portfolio Performance

ASSET-CLASS ALLOCATION: MACRO-SECTOR MARKET TIMING “LONG-SHORT” COMBINATIONS TO CHANGE FRACTIONAL ALLOCATIONS FROM BENCHMARK WEIGHTS

<table>
<thead>
<tr>
<th>Asset Class</th>
<th>Benchmark Weight</th>
<th>Long (Short) Incremental</th>
<th>Revised Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Small-Cap Equity</td>
<td>5%</td>
<td>+5%</td>
<td>10%</td>
</tr>
<tr>
<td>Mid-Cap Equity</td>
<td>10%</td>
<td>0%</td>
<td>10%</td>
</tr>
<tr>
<td>Large-Cap Equity</td>
<td>30%</td>
<td>(10%)</td>
<td>20%</td>
</tr>
<tr>
<td>Emerging Market Equity</td>
<td>15%</td>
<td>(5%)</td>
<td>10%</td>
</tr>
<tr>
<td>Domestic Fixed-Income</td>
<td>30%</td>
<td>5%</td>
<td>35%</td>
</tr>
<tr>
<td>Real Estate</td>
<td>10%</td>
<td>5%</td>
<td>15%</td>
</tr>
</tbody>
</table>

| Total                     | 100%             | 0%                       | 100%           |

- Engine #1 U.S. Risk Arbitrage Hedge Fund
- Engine #2 Technical Analysis of Equities Fund
- Engine #3 Fundamental Analysis of Equities Fund
- Engine #4 Foreign Currency Forecast Fund
- Engine #5 Private Equity Fund
- Engine #N Mortgage-back Security Relative Value Fund

Optimal weighting

- Security analysis
- Technical analysis
- Proprietary derivative-security pricing models

Goal: Super-Performing Micro Aggregate Excess-Return Portfolio
Superior and Sustainable Investment Performance
Traditional alpha vs. financial-services alpha

Traditional alpha: market informational inefficiency
- Depends on being faster, smarter, better models or better information inputs
- Is it sustainable? Is it scalable?
  Compares the fees, expenses, and trading costs society pays to invest in the US stock market with an estimate of what would be paid if everyone invested passively. Averaging over 1980 to 2006, finds that investors spend 0.67% of the aggregate value of the market each year searching for superior returns. Society’s capitalized cost of price discovery is at least 10% of the current market cap. Under reasonable assumptions, the typical investor would increase his average annual return by 67 basis points over the 1980 to 2006 period if he switched to a passive market portfolio.

Financial-services alpha: intermediation of institutional rigidities and market frictions
- Depends critically on being lightly regulated, with highly skilled professionals who can identify which rigidities are binding; diagnose which security prices are impacted by the rigidities; devise an efficient trading strategy to provide “the other side” of the trade to alleviate the impact of the rigidity on affected institutions; and earn an intermediation fee in the form of the excess return on the strategy. Other helpful but not essential advantages: strong credit-standing, long-horizon, flexible liquidity needs, large pool of assets, reputational capital, and sponsorship value.
- Is it sustainable? Is it scalable?
- Hedge funds with light regulation have a comparative advantage vs. regulated institutions in intermediating institutional rigidities, which defines their functional purpose in the financial “ecosystem”.

Superior and Sustainable Investment Performance

Traditional alpha vs. dimensional alpha

**Dimensional alpha:**

- In the CAPM equilibrium, the market portfolio is the OCRA for mean-variance investors, and those investors hold the same risky portfolio of assets. However, in more complete equilibrium models, investors use securities to hedge other dimensions of risk in addition to the overall market risk. So in general, investors will not hold the same proportions of risky assets, and thus the market portfolio will not be mean-variance efficient [aka OCRA], and the CAPM will fail.

- The existence of alphas relative to the passive market benchmark is entirely consistent with perfect-market and efficient-market conditions, and these alphas are long-run sustainable because these are risks that, on balance, investors are willing to pay a risk premium to avoid.

- While theoretical structural models suggest the potential identity of these other dimensions of risk, the search for these dimensions with alphas has been largely empirical, resulting in reduced-form models with surrogate dimensions and factors, rather than the actual structural ones. Well-known examples of factors that appear to have significant alphas over long time periods and across geopolitical borders are size of company [small – large], ratio of book-to-market value [high – low], ratio of profits-to-market value, and possibly liquidity [low – high].

- Alphas from identified dimensions of risk with risk premiums are called “dimensional alphas.”
The Search for Dimensional Alpha

Empirical dimensions of risks with risk premiums
- Fama/French (1992): Market, Size, and Value
- Other: Profitability, Momentum, and Illiquidity

Conditions for evaluation of candidates for a dimension of risk with a risk premium
- *Apriori* reasoning supported by financial economic theory, consistent with information-efficient market
- *Persistent*: statistically significant risk premium over very long history [~50+ years]
- *Pervasive*: statistically significant risk premium across geopolitical borders
- *Continuous*: the risk premium observed in proportion to exposure to the dimension, across all securities
- *Robust*: possible to identify exposure to dimension which is not sensitive to precise parameter estimates
- *Implementation*: exposure to the dimension implemented in a scalable, cost-effective and reliable fashion
A Case Study Exploring a Potential New Dimension of Risk: Illiquidity

Relation between illiquidity risk factor and hedge fund returns 1994–2010
Performance attribution between traditional alpha and dimensional alpha

<table>
<thead>
<tr>
<th>Strategy</th>
<th>Alpha w/o Liq.</th>
<th>T-Stat Alpha</th>
<th>Alpha with Liq.</th>
<th>t-stat alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convertible Arbitrage</td>
<td>7.23%</td>
<td>2.82</td>
<td>3.07%</td>
<td>1.58</td>
</tr>
<tr>
<td>Dedicated Short</td>
<td>-1.27%</td>
<td>0.84</td>
<td>-1.48%</td>
<td>0.98</td>
</tr>
<tr>
<td>Emerging Markets</td>
<td>12.48%</td>
<td>4.25</td>
<td>5.23%</td>
<td>2.21</td>
</tr>
<tr>
<td>Equity Market Neutral</td>
<td>6.07%</td>
<td>4.11</td>
<td>1.65%</td>
<td>1.44</td>
</tr>
<tr>
<td>Event Driven</td>
<td>8.65%</td>
<td>2.74</td>
<td>6.38%</td>
<td>1.61</td>
</tr>
<tr>
<td>Fixed Income Arbitrage</td>
<td>9.47%</td>
<td>3.27</td>
<td>4.33%</td>
<td>2.07</td>
</tr>
<tr>
<td>Global Macro</td>
<td>10.98%</td>
<td>3.63</td>
<td>3.29%</td>
<td>1.08</td>
</tr>
<tr>
<td>Long/Short Equity</td>
<td>10.07%</td>
<td>3.06</td>
<td>4.53%</td>
<td>0.78</td>
</tr>
<tr>
<td>Managed Futures</td>
<td>4.10%</td>
<td>1.54</td>
<td>3.82%</td>
<td>1.82</td>
</tr>
<tr>
<td>Multi-Strategy</td>
<td>7.39%</td>
<td>2.28</td>
<td>3.09%</td>
<td>1.53</td>
</tr>
</tbody>
</table>

Cumulative Returns Liquidity-Event Risk Portfolio
1994–2010

References


