Principles of Asset Allocation

S.D = standard deviation

1. INTRODUCTION

Two separate decisions for a diversified multi-asset class portfolio includes:

- Asset allocation decision – translating the client's goals & constraints into an appropriate portfolio.
- Implementation decision – determining specific investments

2. DEVELOPING ASSET-ONLY ASSET ALLOCATION

2.1 MVO Overview

- MVO requires 3 inputs: i) returns, ii) risks and iii) related assets' pairwise correlations.
- Risk-adjusted exp. return = $U_m = E(R_m) - 0.005\ \lambda\ \sigma^2_m$
- *Common Constraints are 'budget constraint'* & 'no negative or short position'.
- To estimate risk aversion, determine investor's risk preference & risk capacity
- 'Global min. variance portfolio', has the lowest risk & is located at the far left of the efficient frontier.
- 'Max. expected return portfolio' is the portfolio at the far right of the frontier. If no constraints, the max. exp. return portfolio allocates 100% in the single asset with the highest expected return.
- MVO is a single-period framework

2.2 Monte Carlo Simulation

- is a statistical tool
- generates a no. of strategic asset allocations using random scenarios for variables such as: returns, inflation, time frame etc.
- delivers more realistic outcome
- helps to evaluate the strategic asset allocation for multi-period time horizon.
- incorporates effectively the effects of Δ in financial markets, trading or rebalancing costs & taxes.
- complements MVO by tackling the limitations of MVO.

2.3 Criticisms of MVO

- outcomes are sensitive to small Δ in inputs.
- highly concentrated asset classes.
- focuses on the mean and variance of returns only.
- may fail to properly diversify the sources of risk.
- does not consider the economic exposures of liabilities.
- not useful for multi-period objectives.
- does not take into account trading/rebalancing costs and taxes.

2.4 Addressing the Criticisms of MVO

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2.5 Allocating to Less Liquid Asset Classes

Including less liquid asset classes in the optimization is challenging as indexes fail to gauge aggregate performance of asset class: the characteristics of assets differ significantly because of idiosyncratic (co. specific) risk.

2.6 Risk Budgeting

- finding optimal risk budget to maximize return per unit of risk.

Some key computations for risk budgeting:

- Marginal contribution to risk ($MCTR_i$) = (Beta of Asset Class *i* relative to Portfolio) x (Portfolio S.D)
- Absolute contribution to risk ($ACTR_i$) = $Asset\ class\ weight_i$ x $MCTR_i$
- Portfolio S.D = Sum of ACTR = $\sum_i^n ACTR$
- % contribution to total S.D = $\frac{ACTR_i}{Portfolio\ S.D}$
- Ratio of excess return to MCTR = $\frac{(Expected\ Return - R_f)}{MCTR}$

2.7 Factor-Based Asset Allocation

focuses on optimization to an opportunity set consisting of investment factors (fundamental or structural)

2.4.1 Reverse Optimization

- technique for reverse engineering the expected returns implicit in a diversified portfolio.
- works opposite to MVO
- inputs are: optimal asset allocation weights (derived from the optimization process), covariances & λ,
- outputs are: expected returns.

2.4.2 Black-Litterman Model

combines investor's expected returns forecasts with reverse-optimized returns and makes MVO process more useful.

2.4.3 Adding Constraints beyond the Budget Constraints:

- to incorporate real-world constraints into the optimization process
- to overcome MVO problems regarding input quality, input sensitivity, concentrated allocations.

2.4.4 Resampled MVO

combines MVO with Monte-Carlo simulation and addresses the issues of input uncertainty, estimation error, and diversification associated with traditional MVO.

2.4.5 Other Non-Normal Optimization Approaches:

More sophisticated techniques are trying to overcome MVO challenges by incorporating non-normal return distribution & by using other risk measures such as value-at-risk etc.

3. DEVELOPING LIABILITY-RELATIVE ASSET ALLOCATION

3.1 Characterizing the Liabilities

- Fixed vs. contingent cash flows
- Legal vs. quasi-liabilities
- Duration and convexity of liability cash flows
- Value of liability relative to the size of the sponsoring organization
- Factors driving future liability cash flows (inflation, discount rate, economic changes, risk premium)
- Timings Considerations
- Regulations affecting liability cash flow calculations

3.2 Approaches to Liability-relative Asset Allocation

3.2.1 Surplus Optimization

$U_m^{ALM} = E(R_{S,m}) - 0.005\lambda\sigma^2(R_{s,m})$

Steps for surplus optimization

- Select asset classes & the time period
- Estimate E(R) & S.D
- Add investor constraints.
- Estimate the correlation matrix and volatilities for asset classes & liabilities.
- Compute surplus efficient frontier
- Select the desired portfolio mix

3.2.2 Hedging/Return-Seeking Portfolio Approach

- **Two-portfolio approach:** hedging portfolio & surplus portfolio.
- several variants of two-portfolio approach when there is no +ve surplus

3.2.3 Integrated Asset-liability Approach:

- jointly optimizes asset and liability decisions.
- Useful for banks, long-short hedge funds, insurance or reinsurance

3.2.4 Comparing the Approaches:

Surplus Optimization	Hedging/Return-seeking Portfolio	Integrated Asset-Liability Portfolio
Simple, ext. of asset-only MVO	Simple, separating assets in two buckets	Complex
Linear correlation	Linear/non-linear correlation	Linear/non-linear correlation
All levels of risk,	Conservative level of	All levels of risk
Assumptions similar to Markowitz model.	Can be constructed using a factor model	Can be constructed using a factor model
Any funded ratio	+ve funded ratio for basic approach	Any funded ratio
Single period	Single Period	Multiple Period

3.3 Examining the Robustness of Asset Allocation Alternatives

- 'What if' sensitivity analysis
- Scenario analysis
- simulation analysis

3.4 Factor-Modeling in Liability Relative Approaches:

Liability cash flows typically count on multiple factors or uncertainties. The two primary factors are inflation & future economic conditions.

4. DEVELOPING GOALS-BASED ASSET

4.1 The Goals-Based Asset Allocation Process

Two essential parts of this process are:
1. creating portfolio module
2. matching each goal with suitable sub-portfolios.

- Advisors usually apply pre-established models that best serve the purpose.
- Different modules represent different features e.g. implied risk/return tradeoffs, liquidity concerns, eligibility of some asset-classes or strategies.

4.2 Describing Client Goals

The advisor estimates the amount allocated for each goal and the asset allocation that will apply to that sum and then selects the suitable module

4.3 Constructing Sub-Portfolios

Distinguish b/w cash flow based-goals (for which cash flows are defined) and labeled goals (for which investor is unclear about the need).

4.4 The Overall Portfolio

The overall asset allocation is aggregation of individual exposures

4.5 Revisiting the Module

- Because of constraints, the resultant frontier is not therefore, following concerns are crucial.
  i. Liquidity concerns
  ii. Non-normal return distribution
  iii. Include drawdown controls
- Regularly revise: modules & investor constraints

4.6 Periodically Revisiting the Overall Asset Allocation Process in Detail:

- Time horizons are generally rolling concepts
- Portfolios, typically, outperform the discount rate and resultant excessive assets need rebalancing

4.7 Issues related to the Goals-Based Asset Allocation

Managing more than one policy for each client,
Handling portfolios on day-to-day
Satisfying regulatory requirements of treating all clients equivalently

5. HEURISTICS AND OTHER APPROACHES TO ASSET ALLOCATION

Some other offhand techniques for asset allocation

- **120 minus your age rule**
  120 minus age = equity allocation
- **60/40 stock/bond heuristic**
- **Endowment Model or Yale model**
  allocates large portion to non-traditional investments (private equity, real-estate)
- **Risk Parity** (each asset class should contribute evenly to the overall portfolio risk). Mathematically:

$$w_i \times Cov(r_i, r_P) = \frac{1}{n}\sigma_P^2$$

- **The 1/N rule** involves allocating equal % to each of (N) asset classes.

6. PORTFOLIO REBALANCING IN PRACTICE

Factors & their relation with corridor width	Effect on optimal width of corridor (all else equal)
Transaction costs +ve	↑ transsaction cost, wider the corridor
Risk tolerance +ve	↑ risk tolerance, wider the corridor
Correlation with the rest of the portfolio +ve	↑ correlation, wider the corridor
Volatility of the rest of the portfolio -ve	↑ volatility, narrower the corridor