Asset Allocation and Related Decisions in Portfolio Management (1)

CFA三级培训项目

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1. Asset Allocation Principles

Economic Balance Sheet

- **Economic balance sheet**
  - Conventional/Financial assets and liabilities
  - Additional/Extended assets and liabilities
    - ✓ Relevant in making asset allocation decisions but not appear on conventional balance sheets

Assets	Liabilities and Net worth
Financial assets	*Financial liabilities*
Domestic equity	Short-term borrowing
Extended assets	*Extended liabilities*
PV of expected future contributions	PV of expected future support
	Net worth
	Economic net worth

Approaches to Asset Allocation

- **Liability-relative: Distinctions between liabilities for an institutional investor and goals for an individual investor**
  - Liabilities of institutional investors are legal obligations or debts, whereas goals, such as meeting lifestyle or aspirational objectives, are not;
  - Whereas institutional liabilities, such as life insurer obligations or pension benefit obligations, are uniform in nature (all of a single type), an individual's goals may be many and varied;
  - Liabilities of institutional investors of a given type (e.g., the pension benefits owed to retirees) are often numerous and so, through averaging, may often be forecast with confidence. In contrast, individual goals are not subject to the law of large numbers and averaging;

Asset Class

- **Criteria for specifying asset classes for the purpose of asset allocation**
  - Assets within an asset class should be relatively homogeneous;
  - Asset classes should be mutually exclusive;
  - Asset classes should be diversifying;
  - The asset classes as a group should make up a preponderance of world investable wealth;
  - Asset classes selected for investment should have the capacity to absorb a meaningful proportion of an investor's portfolio.

Risk Factors

- **Factor-based asset allocation**
  - Modeling using asset classes as the unit of analysis tends to obscure the portfolio's sensitivity to overlapping risk factors;
- **The process of Factor-based asset allocation**
  - Specify risk factors and the desired exposure to each factor;
  - Describe asset classes with respect to their sensitivities to each of the factors;
  - isolate exposure to the risk factor;
  - Map back a choice of risk exposures in factor space to asset class space for implementation;

2. SAA and Rebalancing

Strategic asset allocation

- **Strategic asset allocation / Policy portfolio**
  - an asset allocation that is expected to be effective in achieving an asset owner's investment objectives, given his or her investment constraints and risk tolerance, as documented in the investment policy statement
- **Optimal asset allocation**

$$\underset{\text{by choice of asset class weights } \omega_i}{\text{Maximize}} \quad E[U(W_T)] = f(W_0, \omega_i, \text{asset class return distribution}, \text{degree of risk aversion})$$

$$\text{subject to} \sum_{i=1}^{n} \omega_i = 1$$

- **Utility function**
  - Mean-variance utility: $U = E(r_p) - \frac{1}{2}\lambda\sigma_p^2$
- **Optimal allocation to the risky asset**

$$\omega^* = \frac{1}{\lambda}\left(\frac{\mu - r_f}{\sigma^2}\right)$$

Strategic implementation choices

- **Passive/Active Spectrum**

MOST PASSIVE (indexing to market weights)	Use of information on asset classes, investment factors, and individual investments increases is often quantified by → Increasing tracking risk relative to benchmark → → Increasing active share relative to benchmark →	MOST ACTIVE (unconstrained mandates)

- **Factors influencing where to invest on the passive/active spectrum**
  - Available investments;
  - Scalability of active strategies being considered;
  - The feasibility of investing passively while incorporating client-specific constraints(e.g. ESG investing criteria);
  - Beliefs concerning market informational efficiency;
  - The trade-off of expected incremental benefits relative to incremental costs and risks of active choices;
  - Tax status;

Strategic considerations in rebalancing

- **Strategic considerations**

Considerations	Rebalancing ranges
Transaction costs	Higher costs, wider ranges
Risk-aversion	More risk-averse, narrower ranges
Asset class correlation	Less correlated, narrower ranges
Beliefs in momentum favor/ mean reversion	Beliefs in momentum, wider ranges; Mean reversion, narrower ranges
Liquidity	Illiquid investments complicate rebalancing, commonly wider ranges
Volatility	Higher volatility makes divergences from the strategic asset allocation more likely, thus narrower ranges
Taxes	Encourage asymmetric and wider rebalancing ranges, for example, 25%->(24%,28%)

3. AO:MVO Approach

Asset-Only: MVO

- **Strengths**
  - Most common and widely used
  - Basis for more sophisticated approaches
- **Weaknesses**
  - The outputs (asset allocations) are **highly sensitive to small changes in the inputs;** (other approaches)
  - The asset allocations tend to be **highly concentrated in a subset** of the available asset classes; (other approaches)
  - Investors are often concerned with characteristics of asset class returns such as **skewness and kurtosis** that are not accounted for in MVO; (Non-normal optimization approaches)
  - While the asset allocations may appear diversified across assets, the sources of **risk may not be diversified**; (Risk budgeting)
  - MVO allocations may have no direct connection to the factors affecting any **liability or consumption streams**;
  - MVO is **a single-period framework** that does not take account of trading/ rebalancing costs and taxes.

Asset-Only: Factor-based Model

- **The factors** are typically similar to the fundamental (or structural) factors in widely used multi-factor investment models. Typical factors used in asset allocation include size, valuation, momentum, liquidity, duration (term), credit, and volatility.
  - Returns can be combined from shorting large-cap stocks and going long small-cap stocks, for an example, "Size factor return = Small-cap stock return – Large-cap stock return".
  - Standard deviations represent the volatility of different factors' return.
  - Pair-wise correlations *with the market and with one another* are generally low. Constructing factors in this manner *removes most market exposure* from the factors because of the short positions that offset long positions.

4. ALM & Goal-based Approach

Surplus optimization

- It involves adapting asset-only mean–variance optimization to an efficient frontier based on **the volatility of surplus by substituting surplus return for asset return** over any given time horizon, all else equal.
  - Is a straightforward extension of the asset-only portfolio model
  - The objective function is $U_{LR\mathrm{m}} = E(\mathrm{R}_{s,m}) - 0.005\lambda\sigma^2_{(\mathrm{R}_{s,m})}$
  - Where, Surplus Return = (Change in asset value – Change in liability value)/(Initial asset value)
- **Expected returns and variances of liabilities**
  - We assume that the liabilities have the same expected returns and volatilities as US corporate bonds;
  - An alternative approach is to deploy a set of underlying factors that drive the returns of the assets.

Hedging/Return-seeking Portfolio Approach

- In this approach, the liability-relative asset allocation task is divided into two parts, thus this approach is also called **two-portfolio approach**.
  - We distinguish as "**basic**" the two-portfolio approach in the case in which there is **a surplus**
    - ✓ In the basic case, the first part of the asset allocation task consists of hedging the liabilities through a hedging portfolio. In the second part, the surplus (or some part of it) is allocated to a return-seeking portfolio, which can be **managed independently** of the hedging portfolio (e.g. using MVO).
  - And as "**variants**" the approach as applied when there is **not a positive surplus**
    - ✓ A partial hedge, whereby capital allocated to the hedging portfolio is reduced in order to generate higher expected returns
    - ✓ And dynamic versions whereby the investor increases the allotment to the hedging portfolio as the funding ratio increases.

Hedging/Return-seeking Portfolio Approach

- **Compared to basic approach**
  - These variants do not hedge the liabilities to the full extent possible given the assets and thus are **less conservative** than the basic approach discussed above.
  - Still, there can be benefits to a partial hedge when the sponsor is able to **increase contributions** if the funding ratio does not increase in the future to 1 or above.
- **An essential issue involves the composition of the hedging portfolio**
  - The designated cash flows can be hedged via cash flow matching, duration matching, or immunization, e.g. frozen DB pension plan.
  - What's the most important is the hedging portfolio must include assets whose returns are driven by the same factors that drive the returns of the liabilities.

Goals-based Asset Allocations

- **Process:**
  - Disaggregates the investor's portfolio into a number of *sub-portfolios*, each of which is designed to fund an *individual goal* (or "mental account") with its own time horizon and required probability of success.
  - Two fundamental parts
    - ✓ The first centers on the creation of portfolio modules;
    - ✓ While the second involves identifying client goals and matching each of these goals to the appropriate sub-portfolio of a suitable asset size.

	Institutions	Individuals
Goals	Single	Multiple
Time horizon	Single	Multiple
Risk measure	Volatility (return or surplus)	Probability of missing goal
Return determination	Mathematical expectations[a]	Minimum expectations
Risk determination	Top-down/bottom-up	Bottom-up
Tax status	Single, often tax-exempt	Mostly taxable

5. Risk Parity & Risk Budgeting

Risk Budgeting and Risk Parity

- **A risk budget** is simply a particular allocation of portfolio risk. The goal of risk budgeting is to maximize return per unit of risk—whether overall market risk or active risk.
- The **risk budgeting process** is the process of finding an optimal risk budget.
  - The marginal contribution to total risk (MCTR) identifies the rate at which risk would change with a small (or marginal) change in the current weights.

$$MCTR_i = \beta_i \times \sigma_p$$

  - The absolute contribution to total risk (ACTR) for an asset class measures how much it contributes to portfolio return volatility.

$$ACTR = w_i \times MCTR = w_i \times \beta_i \times \sigma_p$$

  - Excess return=expected return - risk-free rate
    - ✓ Sometimes, it is based on reverse-optimized returns.

Risk Budgeting and Risk Parity

- An asset allocation is optimal when the ratio of excess return (over the risk-free rate) to MCTR is the same for all assets and matches the Sharpe ratio of the tangency portfolio.
  - ✓ **Ratio of excess return to MCTR**=(Expected return – Risk-free rate)/MCTR
  - ✓ Critically, beta takes account not only of the asset's own volatility but also of the asset's correlations with other portfolio assets.

➢ The **objective of risk budgeting** in asset allocation is to use risk efficiently in the pursuit of return. A risk budget specifies the total amount of risk and how much of that risk should be budgeted for each allocation.

Risk Budgeting and Risk Parity

- **Risk parity**
  - **Risk parity portfolio**
    - ✓ A risk parity asset allocation is based on the notion that each asset (asset class or risk factor) should contribute equally to the total risk of the portfolio for a portfolio to be well diversified.

$$w_i \times Cov\left(r_i, r_p\right) = \frac{1}{n}\sigma_p^2 \qquad ACTR = w_i\beta_i\sigma_p = \frac{1}{\mathrm{n}}\sigma_p$$

  - **Construct the overall portfolio**
    - ✓ Deriving a risk parity–based asset allocation (risk parity portfolio)
    - ✓ Borrow or to lend so that the overall portfolio corresponds to the investor's risk appetite.

Risk Budgeting and Risk Parity

- In this case, each asset class contributed 0.8%, resulting in an asset allocation with a total standard deviation of 6.41%. In this example, 5/8 of total risk comes from equity asset classes and 3/8 comes from fixed-income asset classes.

Asset Class	Weight	Marginal Contribution to Total Risk (MCTR)	ACTR	Percentage Contribution to Total Standard Deviation	Reverse-Optimized Total Returns
US large-cap equities	7.7%	10.43%	0.80%	12.50%	6.47%
US mid-cap equities	6.1	13.03	0.80	12.50	7.33
US small-cap equities	5.9	13.61	0.80	12.50	7.52
Non-US developed market equities	5.6	14.38	0.80	12.50	7.78
Emerging market equities	4.5	17.74	0.80	12.50	8.89
Non-US bonds	15.5	5.17	0.80	12.50	4.72
US TIPS	23.9	3.36	0.80	12.50	4.12
US bonds	30.8	2.60	0.80	12.50	3.86
Total	100.0%		6.41%	100.00%	5.13%

6. Asset Allocation Constrains

Asset Allocation for the Taxable Investor

After-Tax Portfolio Optimization

- The return will be affected by the tax:
  - ✓ $r_{at} = r_{pt}(1 - t)$
    - r_{at} = the expected after-tax return
    - r_{pt} = the expected pre-tax (gross) return
    - t = the expected tax rate
- If the expected return composed by different integral:
  - ✓ $r_{at} = p_d r_{pt}(1 - t_d) + p_a r_{pt}(1 - t_{cg})$
    - pd = the proportion of rpt attributed to dividend income
    - pa = the proportion of rpt attributed to price appreciation
    - td = the dividend tax rate
    - tcg = the capital gains tax rate

Example

- Consider a portfolio with a 50% allocation to equity, where equity returns are subject to a 25% tax rate. A tax-exempt investor may establish a target allocation to equities of 50%, with an acceptable range of 40% to 60% (50% plus or minus 10%). What the range should be for a taxable investor who would like to achieve the same target equity allocation.

- **Correct answer:**
  - $10\% \div (1-25\%) = 13.3\%$

    $50\% \pm 13.3\%$
  - A taxable investor with the same target equity allocation can achieve a similar risk constraint with a range of 37% to 63% (50% plus or minus 13%).

It's not an end but just the beginning.

The failures and reverses which await men - and one after another sadden the brow of youth - add a dignity to the prospect of human life, which no Arcadian success would do. -- Henry David Thoreau.

尽管失败和挫折等待着人们，一次次地夺走青春的容颜，但却给人生的前景增添了一份尊严，这是任何顺利的成功都不能做到的。

问题反馈

- 如果您认为金程**课程讲义/题库/视频**或其他资料中**存在错误，欢迎您告诉我们**，所有提交的内容我们会在最快时间内核查并给与答复。
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    - ✓ 问题所在科目（若未知科目，请提供章节、知识点）和页码
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