Behavioral Finance

CFA三级培训项目

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Topic in CFA Level III

Session	Content
Study Session 1-2	ETHICS & PROFESSIONAL STANDARDS (1)&(2)
Study Session 3	**BEHAVIORAL FINANCE**
Study Session 4	CAPITAL MARKET EXPECTATIONS
Study Session 5	ASSET ALLOCATION AND RELATED DECISIONS IN PORTFOLIO MANAGEMENT
Study Session 6	DERIVATIVES AND CURRENCY MANAGEMENT
Study Session 7-8	FIXED-INCOME PORTFOLIO MANAGEMENT (1)&(2)
Study Session 9-10	EQUITY PORTFOLIO MANAGEMENT (1)&(2)
Study Session 11	ALTERNATIVE INVESTMENTS FOR PORTFOLIO MANAGEMENT
Study Session 12-13	PRIVATE WEALTH MANAGEMENT (1)&(2)
Study Session 14	PORTFOLIO MANAGEMENT FOR INSTITUTIONAL INVESTORS
Study Session 15	TRADING, PERFORMANCE EVALUATION, AND MANAGER SELECTION
Study Session 16	CASES IN PORTFOLIO MANAGEMENT AND RISK MANAGEMENT

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Behavioral Finance

➢ **Success Keys:**
  ● Remember Key Words
  ● Study Some Cases of These Key Words
  ● Explain the Key Words in One Sentence

➢ **Recommendations**
  ● Much of the terminology is redundant in that more than one term can mean the same thing. Many of the concepts are overlapping, and most of the questions depend heavily on comprehending the terminology. Your focus should be on understanding the basic meaning of each term as given in the material.

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Framework

Behavioral Finance

- ➢ **SS3: Behavioral Finance**

  - R7 The Behavioral Finance Perspective

  - R8 The Behavioral Biases of Individuals

  - R9 Behavioral Finance and Investment Processes

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Reading 7

The Behavioral Finance Perspective

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Traditional Finance vs. Behavioral Finance

➤ Within traditional finance, individuals are assumed to be risk-averse, self-interested utility maximizers. (**rational**). Traditional finance further hypothesizes that, at the market level, **prices incorporate and reflect all available and relevant information**.

➤ Behavioral finance **includes behavioral economics, investor psychology, behavioral science, experimental economics, and cognitive psychology**. The variety of approaches taken to examine investor behavior adds to the confusion about what is meant by behavioral finance. (**normal**)

- ● **behavioral finance micro (BFMI)** examines behaviors or biases that distinguish individual investors from the rational actors envisioned in neoclassical economic theory.
  - ✓ BFMI questions the perfect rationality and decision-making process of individual investors.
- ● or **behavioral finance macro (BFMA)** considers market anomalies that distinguish markets from the efficient markets of traditional finance.
  - ✓ BFMA questions the efficiency of markets.

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Decision-Making Process

➢ To provide a framework for understanding the implications of the decision-making process for financial market practitioners, we will use an approach, developed by decision Theorist, Howard Raiffa.

➢ **He uses the terms <u>normative analysis</u>, <u>descriptive analysis</u>, <u>prescriptive analysis</u>.**

- ● **Normative analysis** is concerned with the rational solution to the problem at hand. It defines an ideal that actual decisions should strive to approximate.
- ● **Descriptive analysis** is concerned with the manner in which real people actually make decisions.
- ● **Prescriptive analysis** is concerned with practical advice and tools that might help people achieve results more closely approximating those of normative analysis.

➢ **Traditional finance** assumptions about behavior as normative**.**

➢ **Behavioral finance** explanations of behaviors as descriptive**.**

➢ **Efforts to use behavioral finance in practice as prescriptive.**

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Cognitive Errors or Emotional Biases

➢ **Behavioral biases can be categorized as cognitive errors or emotional biases.**

- **Cognitive errors** stem from basic statistical, information-processing, or memory errors; cognitive errors may be considered to result from reasoning based on faulty thinking.

- **Emotional biases** stem from impulse or intuition; emotional biases may be considered to result from reasoning influenced by feelings.

➢ **Behavioral biases, cognitive or emotional, may cause decisions to deviate from the rational decisions of traditional finance.**

Tra. Finance Perspectives on Indiv. Behavior

➢ **Traditional finance concepts maybe thought of as normative, indicating how people and markets should behave.**

➢ **Investors are assumed to be rational investors**
- make decisions consistent with **utility theory**;
- and revise expectations (update beliefs) consistent with **Bayes' formula**.

➢ **They are further assumed to be self-interested and risk-averse, to have access: to perfect information, and to process all available information in an unbiased way.**

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Utility Theory

➢ **To maximize utility, a rational investor will make decisions conforming to the four axioms of utility: completeness, transitivity, independence, and continuity.**

- **Completeness**: Choices and preferences are known.
  - ✓ The individual is aware of all available choices and can value and assign preferences to each, such that between any two choices, the individual prefers one over the other or is indifferent between them.
- **Transitivity**: Rankings are applied consistently.
  - ✓ If the investor prefers choice X to choice Y and prefers choice Y to choice Z, the investor will prefer choice X to choice Z.

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Utility Theory

➤ **Independence: Utilities are additive and divisible.**
- Adding choice Z to both X and Y will not affect the preference ranking of X and Y. If, for example, the investor prefers X to Y and we add Z to both choices, the investor will prefer (X + Z) over (Y + Z).
- Also, assuming the investor prefers X to Y, if any portion, p, of Z is added to X and Y, the investor's preference ranking does not change. The investor will prefer (X + pZ) to (Y + pZ).
- If the ranking is based on the size of the proportion, the choices are not independent.

➤ **Continuity: Indifference curves are smooth and unbroken.**
- Assume there are three choices, L, M, and N, such that the investor prefers L to M and M to N. There must be a combination of L and N (portions a and b) that makes the investor indifferent between (aL + bN) and M.
- This ensures that indifference curves are unbroken (i.e., continuous).

Bayes' Formula

➢ **The Formula is:**

$$P(A|B) = \frac{P(B|A)}{P(B)} * P(A)$$

where

        =conditional probability of event A given B. It is the updated probability of A given the new information B.

$P(A|B)$

        =conditional probability of B given A. It is the probability of the new information B given A.

$P(B|A)$

        =prior (unconditional) probability of information B.

$P(B)$ = prior probability of event A, without new information B. This is the base rate of base probability of event A.

$P(A)$

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Making Decisions in A Perfect Word

➤ **In a perfect world, when people make decisions under uncertainty, they are assumed to do the following:**

- Adhere to the axioms of utility theory;
- Behave in such a way as to assign a probability measure to possible events;
- Incorporate new information by conditioning probability measures according to Bayes' formula;
- Choose an action that maximizes the utility function subject to budget constraints (consistently across different decision problems) with respect to this conditional probability measure.

➤ **Homo economics or rational economic man (REM): Principles of perfect rationality, perfect self-interest, and perfect information govern REM's economic decisions.**

Risk Averse

➢ **Expected utility theory** generally assumes that individuals are risk-averse. This means that an individual may refuse a fair wager. (a wager with an expected value of zero), and also implies that his utility functions are concave and show diminishing marginal utility of wealth;

➢ Given two choices—investing to receive an expected value with certainty or investing in an uncertain alternative that generates the same expected value—someone who **prefers to invest to receive an expected value with certainty rather than invest in the uncertain alternative that generates the same expected value is called risk-averse**;

➢ Someone who is indifferent between the two investments is called **risk-neutral**;

➢ Someone who prefers to invest in the uncertain alternative is called **risk-seeking**;

➢ In traditional finance, individuals are assumed to be **risk-averse**.

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Utility Function of Wealth

➢ **A concave utility function** means that utility increases at a decreasing rate with increases in wealth; the risk-averse individual has a diminishing marginal utility of wealth. **A convex utility function** means that utility increases at an increasing rate with increases in wealth; the risk-seeking individual has an increasing marginal utility of wealth. The **degree** of risk aversion can be measured by the curvature of the utility function.

Utility Function of

Risk-Neutral Individual

Utility (U)

Utility Function of Risk-Averse Individual (diminishing marginal utility of wealth)

Utility (U)

Utility Function of Risk-Seeking Individual (increasing marginal utility of wealth)

Utility (U)

Wealth (W)

Wealth (W)

Wealth (W)

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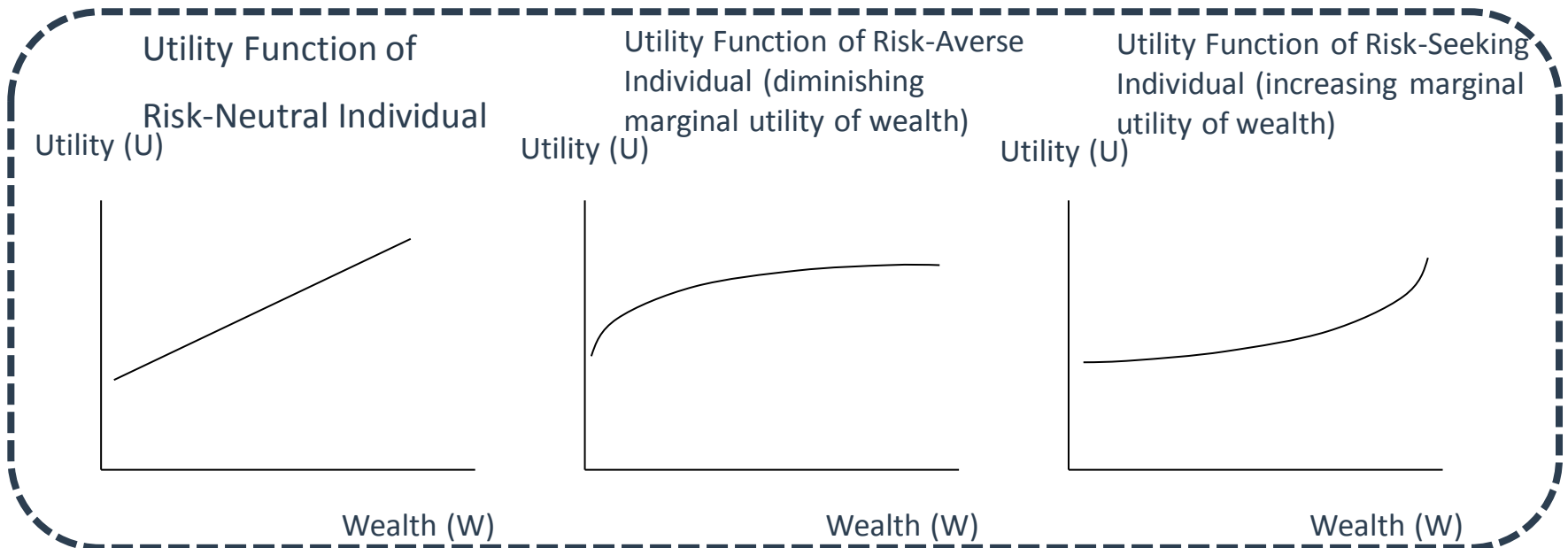
Challenges to Traditional Finance and the REM

➢ **Those who challenge REM do so by attacking the basic assumptions of perfect information, perfect rationality, and perfect self-interest. Some of the behavioral challenges to REM include:**

- **Bounded rationality** assumes that individuals' choices are rational but are subject to limitations of knowledge and cognitive capacity, and do not behave with perfect rationality;

- **People have difficulty prioritizing short-term (spending) goals** over long-term (spending versus saving) goals and do not behave with perfect self-interest;

- It is intuitively obvious that many economic **decisions are made in the absence of perfect information** and do not behave with perfect information (monetary policy);

- **Wealth utility functions** may not always be concave as assumed by utility theory, and individuals can sometimes exhibit risk seeking behavior.

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Challenges to Utility Maximization

➢ **Indifference curve** analysis may incorporate budget lines or constraints, which represent restrictions on consumption that stem from resource scarcity;

➢ If the two items are **perfect substitutes**, then the individual is willing to trade one for the other in a fixed ratio; then, the **indifference curve** is a line with a constant slope reflecting the marginal rate of substitution;

➢ If the two items are **perfect complements**, then the curve would be L-shaped. An additional amount of either good adds no extra utility because the goods are only used in combination;

➢ **Risk plays an important part in making utility-maximizing decisions**.

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Challenges to Attitudes Toward Risk

➢ Assuming that individuals are risk-averse and that utility curves are concave and exhibit diminishing marginal utility seems reasonable, but observed **behaviors are not always consistent with the assumption of an individual who is constantly risk-averse**.

- Such as buying lottery tickets and buying insurance, in which expected utility is low but people (even with low incomes) participate in the purchase;

- If an investment offers a few extremely large prizes, its attractiveness is increased far beyond the aggregate value of the prizes.

  ✓ Those with less income prefer either certainty or a risk that offers a small chance of a large gain to a risk that is moderate;

  ✓ Middle-income people are more likely to be attracted by small, fair gambles.

➢ **Risk evaluation is reference-dependent**, meaning risk evaluation depends in part on the wealth level and circumstances of the decision maker. **It is not necessarily true that an individual's utility function has the same curvature consistently**:

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Friedman-Savage double-inflection utility function

U

Concave
Risk Averse

Convex
Risk Seeking

Concave
Risk Averse

Z

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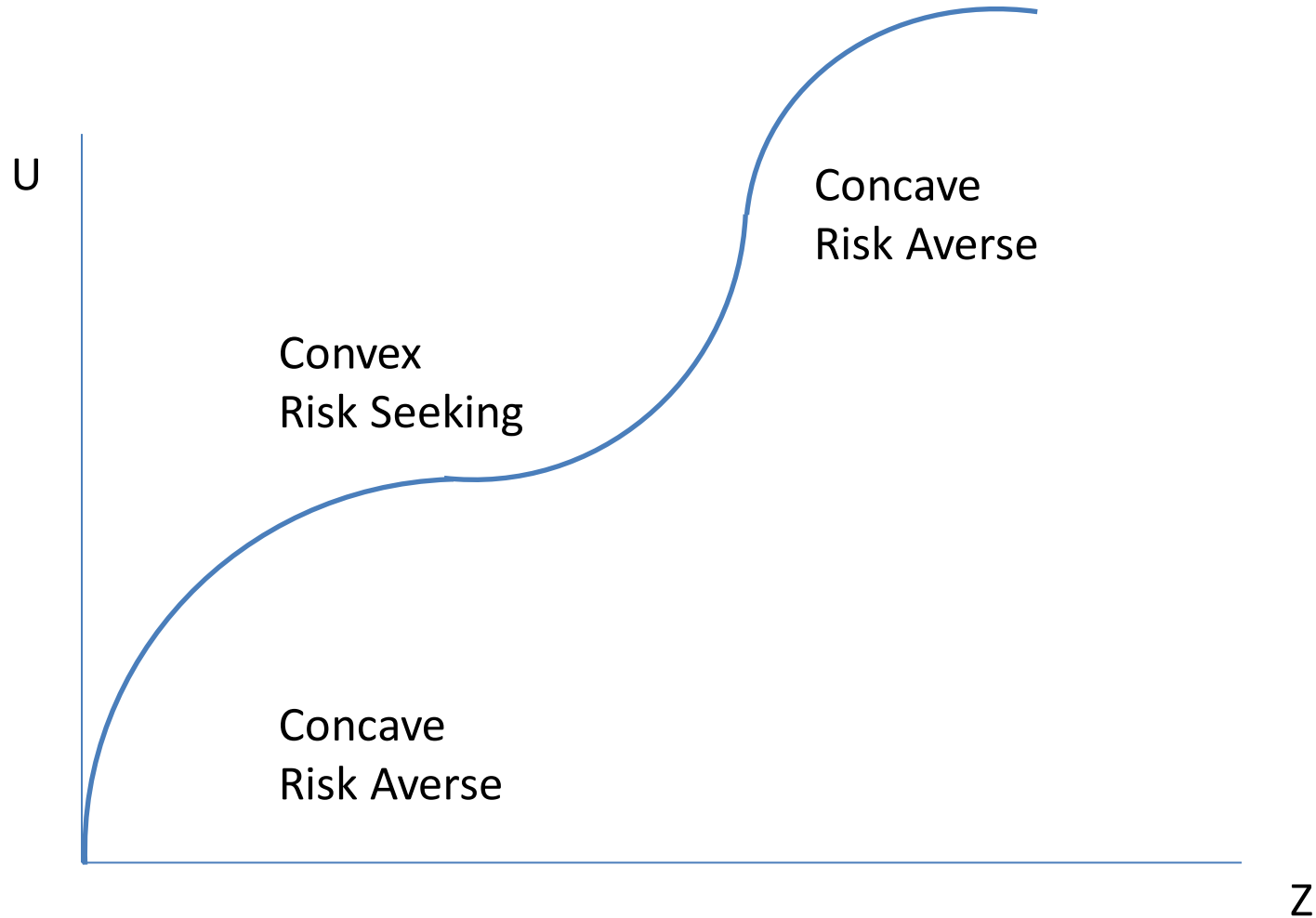
Neuro-Economics

➢ **Neuro-economics** combines neuroscience, psychology, and economics in attempting to explain how humans make economic decisions;

➢ **Neuro-economics attempts** to bridge the gap between research on decision behavior and economic theory by understanding the brain activity of judgment and making choices;

➢ It is the amygdala that creates a "**fight or flight**" response during a sudden event or trauma. For investors, the amygdala may be responsible for a panicked response rather than an analytical response to a dropping market;

➢ Although neuro-economics research is interesting and may provide further insights into individual economic decision making; **its effect on economic theory remains to be seen**.

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Development of the Theory

Pascal: "expected"

Bernoulli:
Value $\diamondsuit$ price
Utility $\diamondsuit$ estimate

Franck Knight
Risk $\diamondsuit$ measurable
Uncertainty $\diamondsuit$ not

Bounded
Rationality

Neumann & Morgenstern
Maximize expected utility

Savage:
Subjective expected utility

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Decision Theory-Traditional Finance

➢ **Decision theory** is concerned with identifying values, probabilities, and other uncertainties relevant to a given decision and using that information to arrive at a theoretically optimal decision. The development of the decision theory is as following**.**

- The initial focus of decision theory was on **expected value**;

- **Expected value** of an item is based on its price, which is the same for everyone because the price depends only on the item itself. **Expected utility** of an item is based on the worth assigned to it by the person making the estimate;

- Frank Knight defines **risk** as randomness with knowable probabilities and **uncertainty** as randomness with unknowable probabilities;

- **The theories of von Neumann and Morgenstern and Savage (SEU)** extend the scope of expected utility theory to situations in which only subjective probabilities are available.

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Bounded Rationality

➢ **Bounded rationality**: recognizing that people are not fully rational when making decisions and do not necessarily optimize but rather satisfice (defined below) when arriving at their decisions;

- **Satisficing** ("satisfy" & "suffice") is finding an acceptable solution as opposed to optimizing, which is finding the best (optimal) solution;
- The optimal solution is the one that maximizes the utility realizable from the situation.

➢ Decision makers may choose to **satisfice rather than optimize** because the cost and time of finding the optimal solution can be very high;

➢ **When aspirations are reached, people tend to adjust the aspirations upward; when aspirations are not reached, people tend to adjust downward;**

➢ **Decisions are made progressively until the goal state is achieved**: The first decision is made to get one step closer to the goal state, the next decision results in getting still closer to the goal, and decisions continue to be made until the goal state is met. Another example is the **divide-and-conquer procedure**.

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Prospect Theory-Behavioral Finance

➢ **Prospect theory has been proposed as an alternative to expected utility theory;**

➢ **Prospect theory assigns value to gains and losses (changes in wealth), rather than to final wealth, and probabilities are replaced by decision weights;**

➢ **The value function is defined by the deviations from a reference point and is normally concave for gains (implying risk aversion), convex for losses (risk-seeking), and steeper for losses than for gains (loss aversion).**

- Investors are assumed to **place a greater value on a loss than on a gain of the same amount**;
- Given a potential loss and gain of equal sizes, the **increase in utility associated with the potential gain is smaller than the decrease in utility (i.e., disutility) associated with the potential loss**;
- Investors tend to **fear losses** and can become risk seeking (assume riskier positions) in an attempt to avoid them.

Value Function

Reference Point

Losses

Gains

Value

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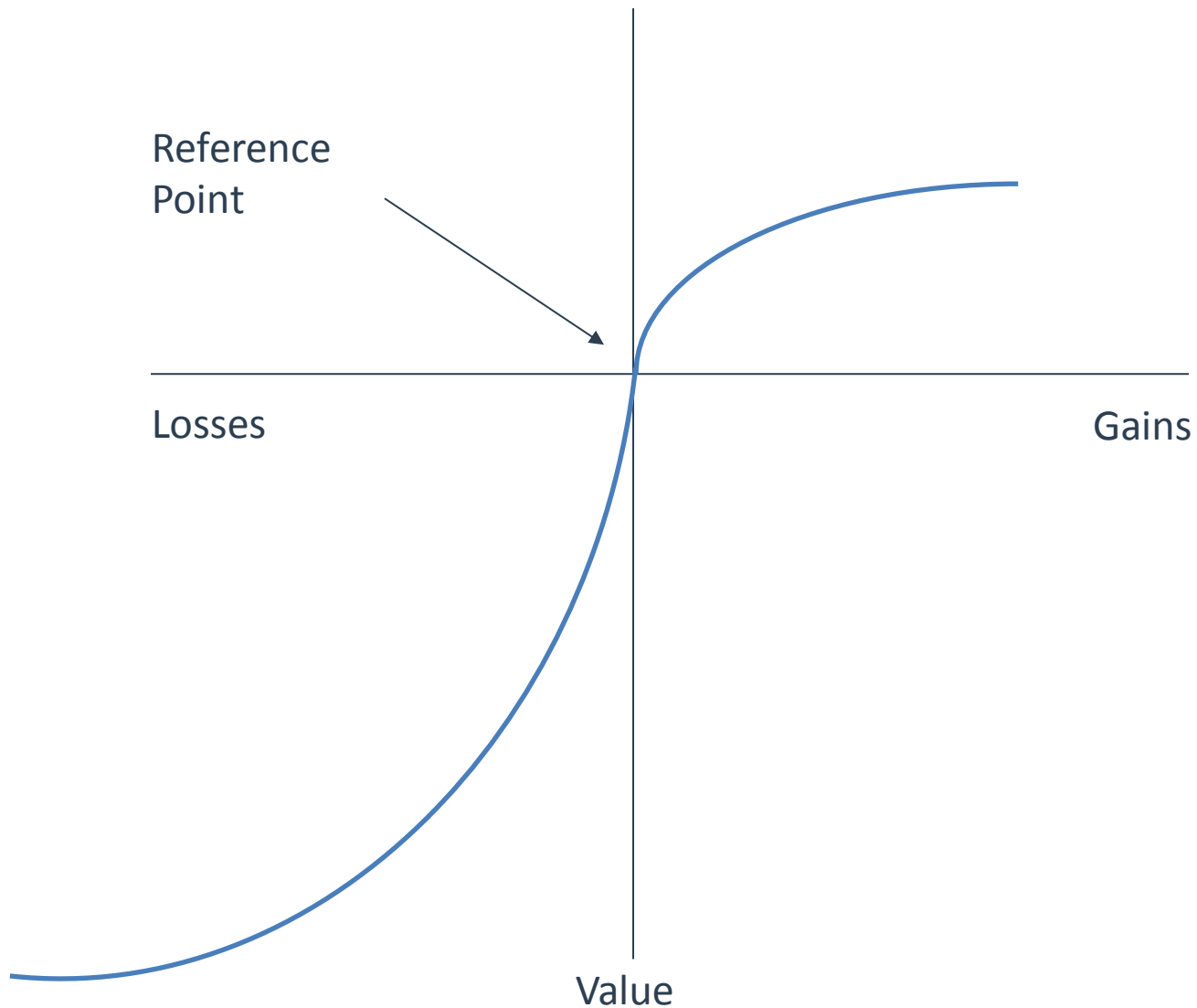
Prospect Theory-Editing Process

➢ **In prospect theory**, based on **descriptive analysis** of how choices are made, there are two phases to making a choice: an **early phase** in which prospects are framed (or edited) and a **subsequent phase** in which prospects are evaluated and chosen.

➢ **Depending on the number of prospects, there may be up to six operations in the editing process:**
- **Codification**: People perceive outcomes as gains and losses rather than final states of wealth or welfare. A gain or loss is, of course, defined with respect to some reference point.
- **Combination**: Prospects are simplified by combining the probabilities associated with identical gains or losses.
- **Segregation**: The riskless component of any prospect is separated from its risky component.
  - ✓ For example, a prospect initially coded as (300, 0.8; 200, 0.2) is decomposed into a sure gain of (200, 1.0) and a risky prospect of (100, 0.8; 0, 0.20). The same process is applied for losses.

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Prospect Theory-Editing Process

- **Cancellation:** Cancellation involves discarding common outcome probability pairs between choices.
  - ✓ For example, the pairs (200, 0.2; 100, 0.5; 20, 0.3) and (200, 0.2; 300, 0.4; −50, 0.4) are reduced to (100, 0.5; 20, 0.3) and (300, 0.4; −50, 0.4).
- **Simplification:** Prospects are likely to be rounded off.
  - ✓ A prospect of (0.51, 0.49) is likely to be seen as an even chance to win 50. Also, extremely unlikely outcomes are likely to be discarded or assigned a probability of zero.
- **Detection of dominance:** Outcomes that are strictly dominated are scanned and rejected without further evaluation.

Prospect Theory-Evaluation Phase

➢ **In the evaluation phase of prospect theory**, people behave as if they compute a value (utility) function based on the potential outcomes and their respective probabilities and then choose the alternative that has a higher utility. Kahneman and Tversky assume the following formula:

$$U = w(p_1)v(x_1) + w(p_2)v(x_2) + \cdots$$

- Where:
    - ✓ x_1, x_2 … are the potential outcomes
    - ✓ p_1, p_2 … their respective probabilities
    - ✓ v is a function that assigns a value to an outcome
    - ✓ w is a probability-weighting function
- The probability-weighting function expresses the fact that people tend to overreact to small probability events but underreact to mid-sized and large probabilities.
- The value function is s-shaped; moreover, as its asymmetry implies, given the same variation in absolute value there is a bigger impact of losses than of gains (loss aversion).

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Short Comment

- ➤ **Utility theory** assumes risk aversion, prospect theory assumes loss aversion.

- ➤ **Bounded rationality** relaxes the assumptions of perfect information and maximizing expected utility.

- ➤ **Prospect theory** further relaxes the assumption of risk aversion and instead proposes loss aversion. Prospect theory is suited to analyzing investment decisions and risk. It focuses on the framing of decisions as either gains or losses and weighting uncertain outcomes.

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Traditional Finance vs Behavioral Finance

Traditional Finance Assumes:	Behavioral Finance Assumes:
Unlimited perfect knowledge	Capacity limitations on knowledge
Utility maximization	Satisfice
Fully rational decision making	Bounded rationality. Cognitive limits on decision making
Risk aversion	Loss averse

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Traditional Perspectives on Market Behavior

➢ **Markets fully, accurately, and instantaneously incorporate all available information into market prices**;

➢ Underlying market efficiency is the assumption that market participants are rational economic beings, always acting in **their own self-interest** and **making optimal decisions** by trading off costs and benefits weighted by statistically correct probabilities and marginal utilities.

  ● The efficient market hypothesis requires that agents have rational expectations.

Types	Assumption	Implication
Weak-Form EMH	Market info.	Technical Analysis ✕
Semi Strong-Form EMH	Public info.	Fundamental Analysis ✕
Strong-Form EMH	All info.	Nobody can win the market

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Studies in Support of the EMH

- ➢ **Support for the Weak Form of the EMH.**
  - ● **Roberts (1959)**: If the stock market behaved like a mechanically imperfect roulette wheel, people would notice the imperfections and, by acting on them, remove them;
  - ● **Fama (1965)** concludes that daily changes in stock prices had nearly zero positive correlation;
  - ● **Samuelson (1965)** emphasizes the randomness of stock prices.
- ➢ **Malkiel (1973) provides credence to the idea of random stock price movements.**
- ➢ **Support for the Semi-Strong Form of the EMH.**
  - ● **Fama et al. (1969)** study finds that the market begins to anticipate a stock split more than two years before it actually happens and incorporates the consequences of the split the day it is announced;
  - ● **Alfred Cowles (1933)** finds no evidence that the professional investors are able to outperform the market;
  - ● **Jensen (1967)** study demonstrates the ineffectiveness of professional investors.

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Studies Challenging the EMIL Anomalies

➢ **Fundamental Anomalies**
- **Size effect:** This test indicates that stocks of **small-sized firms tend to outperform** stocks of large-sized firms;
- **Value effect:** refers to the **finding that value stocks** those with lower price-to-earnings (P/E), lower market-to-book (M/B), and higher dividend yields have outperformed growth stocks (those with higher P/E, higher M/B, and lower dividend yields).

➢ **Technical Anomalies**
- Moving Averages
- Trading Range Break (Support and Resistance).

➢ **Calendar Anomalies**
- January effect.

➢ **Conclusions:** market efficiency is not black or white, but rather **gray**. Many analysts believe that such U.S. large-capitalization stocks as GE and Microsoft are quite efficient, but U.S. small-capitalization and international stocks offer more opportunities for outperformance.

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The Behavioral Finance Perspective

➢ **Discuss four behavioral finance models that attempt to explain the behavior of individuals and markets and their implications for portfolio construction:**

- consumption and savings
- behavioral asset pricing
- behavioral portfolio theory
- adaptive markets hypothesis.

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Consumption and Savings

➢ **Traditional finance assumes investors make conscious decisions to save and consume in a pattern that meets both their short- and long-term goals.**

➢ **Shefrin and Thaler (1988) propose an alternative theory incorporating behavioral finance assumptions.**

- **Framing** refers to the way a question is asked or the way information is presented and can affect the way individuals perceive a choice and view its alternatives;
- **Self-control** refers to an individual's ability to think rationally when making consumption/savings decisions. **Self-control bias** refers to an individual's tendency to place a much greater value on current consumption than on future goals;
- **Mental accounting** refers to individuals' tendencies to mentally place goals into different "files". This ignores the fact that wealth is interchangeable.

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Classifying Wealth

➢ The **behavioral life-cycle model** assumes individuals classify their wealth as **current income**, **currently owned assets**, or **present value of future income**. Classifying wealth this way has implications for how or when it is consumed. An individual's marginal propensity to consume, for example, is greatest with current income.

- If wealth is classified as **current income**, the individual is more likely to use it to meet current spending needs and desires;

- Any excess current income over current spending is saved and becomes currently owned assets (e.g., a savings account). Once classified as **currently owned assets**, the individual is somewhat less likely to spend it;

- Finally, individuals are least likely to spend out of wealth classified as **future income**.

➢ **This is where framing affects the individuals' consumption patterns.**

- For example, a one-time cash flow, such as a bonus or tax refund, can be mentally classified (framed) as current income, current assets, or possibly even future income.
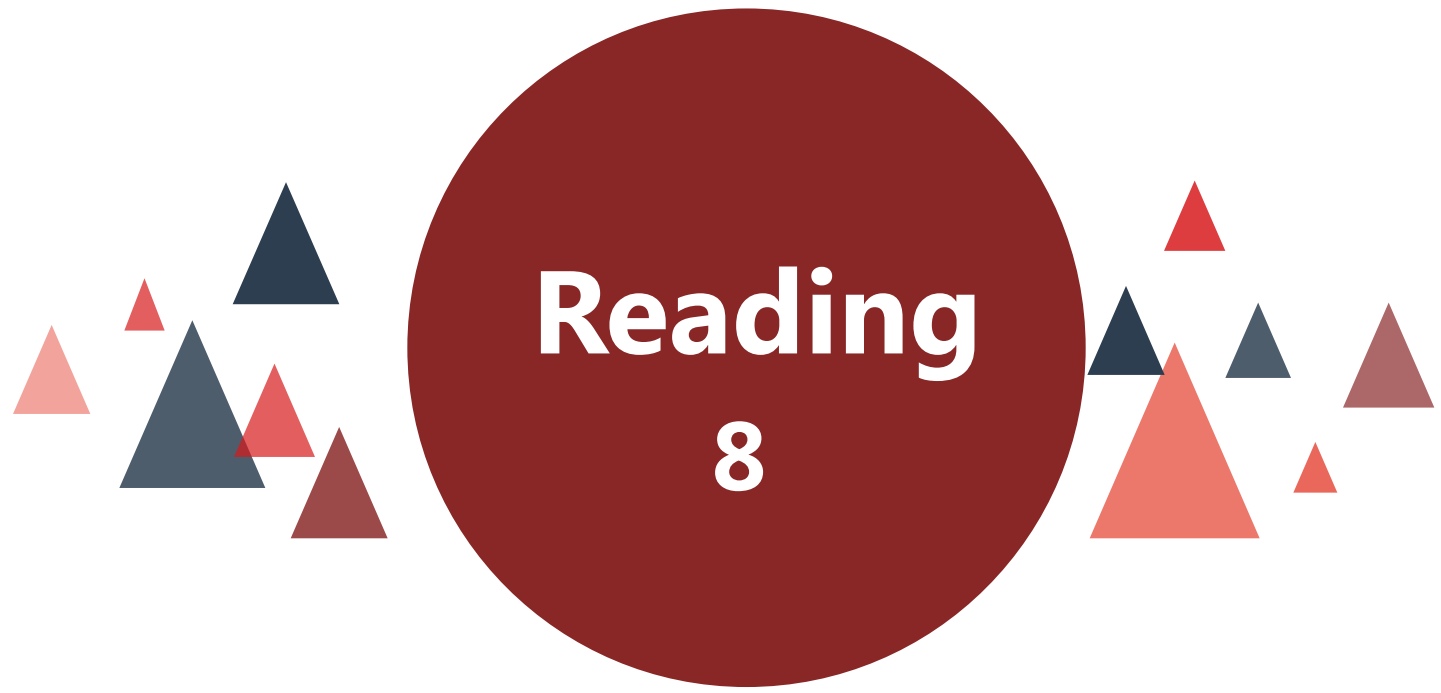
Behavioral Asset Pricing

➢ **Traditional perspective** assumes that perfectly rational investors make wealth-maximizing decisions at all times using all available information (e.g., CAPM).

➢ **The behavioral asset pricing model:** The discount rate on security is the sum of the risk-free rate and fundamental premiums (corresponding to efficient prices) and a **sentiment premium** (reflecting sentiment-based risk)

   ● **The discount rate on security = risk-free rate + fundamental risk premium + sentiment premium**.

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Behavioral Portfolio Theory (BPT)

➢ The optimal portfolio under BPT can differ from the perfectly diversified portfolio of Markowitz. **Investors construct their portfolios in layers** and expectations of returns and attitudes toward risk vary between the layers.

- First, the allocation to different layers depends on investor goals and **the importance assigned to each goal**. For example, if high importance is assigned to an upside potential goal, then the allocation of funds to the layer with the highest upside potential will be greater than if high importance is attached to minimizing potential downside losses.
- Second, **the allocation of funds within a layer** to specific assets will depend on the goal set for the layer. If a higher goal is set, then the assets selected for the layer are likely to be riskier or more speculative in nature.
- Third, **the number of assets chosen for a layer** depends on the shape of the investor's utility function. Thus, the greater the concavity of the utility curve, the greater the number of securities included in a layer.
- Fourth, concentrated positions in some securities may occur if investors believe they have an **informational advantage** with respect to the securities.
- Fifth, investors reluctant to realize losses (**loss-averse**) may hold higher amounts of cash so that they do not have to meet liquidity needs by selling assets that may be in a loss position.
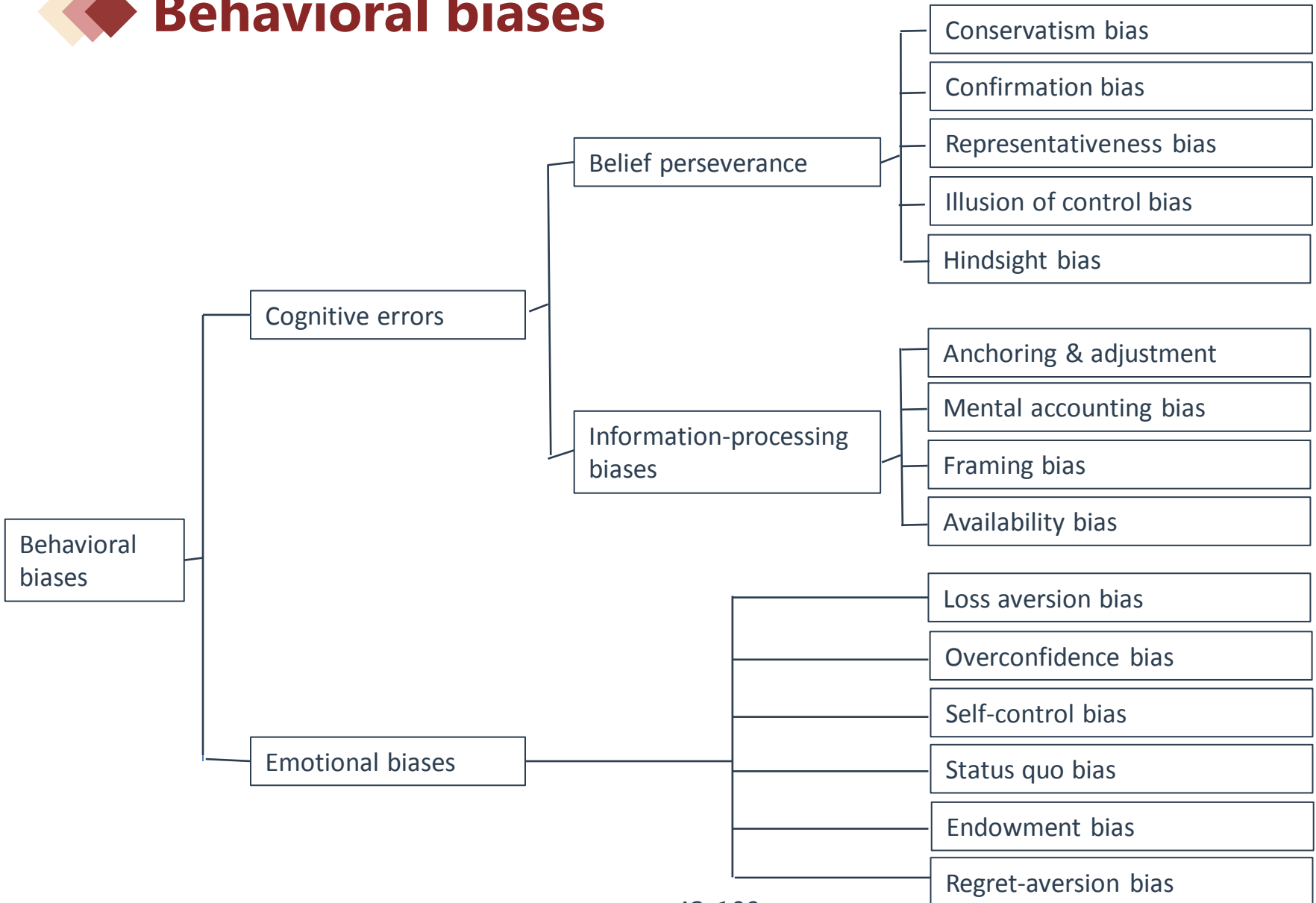
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Adaptive Markets Hypothesis

➢ **Under the AMH**, the successful participant will adapt to the changed environment and develop new heuristics. **Success** is defined as survival rather than as having maximized expected utility.

➢ **Five implications of the AMH are:**
- The relationship between risk and reward **varies over time** (risk premiums change over time) because of changes in risk preferences and such other factors as changes in the competitive environment;
- Active management can add value by exploiting arbitrage opportunities;
- **Any particular investment strategy will not consistently do well** but will have periods of superior and inferior performance;
- **The ability to adapt and innovate is critical for survival**;
- Survival is the essential objective. In other words, recognizing that things change, **the survivors will be those who successfully learn and adapt to changes.**

Reading 8

The Behavioral Biases of Individuals

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Behavioral biases

```
Behavioral
biases
├── Cognitive errors
│   ├── Belief perseverance
│   │   ├── Conservatism bias
│   │   ├── Confirmation bias
│   │   ├── Representativeness bias
│   │   ├── Illusion of control bias
│   │   └── Hindsight bias
│   └── Information-processing biases
│       ├── Anchoring & adjustment
│       ├── Mental accounting bias
│       ├── Framing bias
│       └── Availability bias
└── Emotional biases
    ├── Loss aversion bias
    ├── Overconfidence bias
    ├── Self-control bias
    ├── Status quo bias
    ├── Endowment bias
    └── Regret-aversion bias
```

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Cognitive Errors and Emotional Biases

➤ **Behavioral biases** may be categorized as either cognitive errors or emotional biases.

➤ **Cognitive errors** are due primarily to faulty reasoning and could arise from a lack of understanding proper statistical analysis techniques, information processing mistakes, faulty reasoning, or memory errors.

- Cognitive errors are more easily corrected for because they stem from faulty reasoning rather than an emotional predisposition.
- Cognitive errors can be further classified into two categories:
  - ✓ **belief perseverance biases**
  - ✓ **and information-processing biases**.

➤ **Emotional biases** stem from impulse or intuition; emotional biases tend to result from reasoning influenced by feelings.

- Emotional biases are harder to correct for because they are based on feelings, which can be difficult to change.

➤ To moderate a bias is to recognize the bias and to attempt to reduce or even eliminate the bias within the individual.

➤ To adapt to a bias is to recognize and accept the bias and to adjust for the bias rather than to attempt to moderate the bias.

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Cognitive Errors: Belief Perseverance

➢ **Belief perseverance is the tendency to cling to one's previously held beliefs irrationally or illogically.**

- **Conservatism bias**. people <u>maintain their prior views</u> or forecasts by <u>inadequately incorporating new information</u>;

- **Confirmation bias**. Individuals tend to notice only information that agrees with their perceptions or beliefs. <u>They look for confirming evidence while discounting or even ignoring evidence that contradicts</u> their beliefs or their perceptions;

- **Representativeness bias**. people <u>tend to classify new information based on past experiences and classifications</u>. This bias occurs because people attempting to derive meaning from their experiences tend to classify objects and thoughts into personalized categories; **Two forms: base rate neglect, sample-size neglect.**

- **Illusion of control.** <u>people tend to believe that they can control or influence outcomes when, in fact, they canno</u>t. expectancy of a personal success probability inappropriately higher than the objective probability would warrant;

- **Hindsight bias.** a bias with selective perception and retention aspects. People <u>may see past events as having been predictable</u> and reasonable to expect.

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Cognitive Errors: Information Processing

➢ **Describing how information may be processed and used illogically or irrationally in financial decision making.**

- **Anchoring and adjustment**. the use of a psychological heuristic influences the way people estimate probabilities. When required to estimate a value with unknown magnitude, people generally begin by envisioning some initial default number an "anchor" which they then adjust up or down to reflect subsequent information and analysis;

- **Mental accounting bias**. people treat one sum of money differently from another equal-sized sum based on which mental account the money is assigned to;

- **Framing bias**. a person answers a question differently based on the way in which it is asked (framed);

- **Availability bias**. people take a heuristic (sometimes called a rule of thumb or a mental shortcut) approach to estimating the probability of an outcome based on how easily the outcome comes to mind.

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Emotional Biases 1

➢ **Emotional biases are harder to correct** for than cognitive errors because they originate from impulse or intuition rather than conscious calculations. In the case of emotional biases, it may only be possible to recognize the bias and adapt to it rather than correct for it.

- **Loss aversion bias**. people <u>tend to strongly prefer avoiding losses as opposed to achieving gains</u>. A number of studies suggest that, psychologically, **losses are significantly more powerful than gains**;
- **Overconfidence bias**. <u>people demonstrate unwarranted faith in their own intuitive reasoning</u>, judgments, and/or cognitive abilities. This overconfidence may be the result of overestimating knowledge levels, abilities, and access to information.
  - ✓ **Prediction overconfidence** leads to underestimating risk and setting confidence intervals too narrow. **Certainty overconfidence** relates to over-stated probabilities of success;
  - ✓ **Self-attribution bias**, the combination of **self-enhancing bias** and **self-protecting bias**, contributes to overconfidence. By **self-enhancing**, individuals take all the credit for their successes. By **self-protecting**, they place the blame for failure on someone or something else.

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Emotional Biases 2

- **Self-control bias.** people <u>fail to act in pursuit of their long-term, overarching goals because of a lack of self-discipline</u>. There is an inherent conflict between short-term satisfaction and achievement of some long-term goals.

- **Status quo bias.** an <u>emotional bias in which people do nothing (i.e., maintain the "status quo") instead of making a change</u>. People art generally more comfortable keeping things the same than with change and thus do not necessarily look for opportunities where change is beneficial.

- Endowment bias. <u>people value an asset more when they hold rights to it than when they do not.</u> Endowment bias is inconsistent with standard economic theory, which asserts that the price a person is willing to pay-for a good should equal the price at which that person would be willing to sell the same good.

- **Regret-aversion bias** <u>occurs when market participants do nothing out of excess fear that actions could be wrong.</u> Simply put, people try to avoid the pain of regret associated with bad decisions.

Short Comment

➢ **Status quo, endowment and regret-aversion** are very closely related.

- Status quo is maintaining a choice out of inertia.
- Endowment bias arises when some intangible value unrelated to investment merit is assigned to a holding.
- Regret-aversion is just what it says, if you make a change and it goes badly you will feel bad about it so do nothing and then you are not to blame.

➢ All three can lead to the same result (keep what you have) but the reason for doing so is slightly different.

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Cog. Errors – Belief Perse. - Conservatism Bias

➢ **As a result of conservatism bias, FMPs(financial market participants) may do the following:**

- Maintain or be slow to update a view or a forecast, even when presented with new information.

- Opt to maintain a prior belief rather than deal with the mental stress of updating beliefs given complex data.

➢ The effect of conservatism bias may be corrected for or reduced by <u>properly analyzing and weighting new information</u>. The first step is to be aware that a bias exists.

➢ The higher the cognitive cost(the effort involved in processing the information and updating the beliefs), the less likely information will be processed and beliefs updated.

➢ Information that is cognitively inexpensive (easily processed) may receive a higher weighting, otherwise may receive a lower weighting.

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Cog. Errors – Belief Perse. - Confirmation Bias

➢ **As a result of confirmation bias, FMPs may do the following:**

- Consider only the positive information about an existing investment and ignore any negative information about the investment.

- Develop screening criteria and ignore information that either refuses the validity of the screening criteria or supports other screening criteria.

- Under-diversify portfolios, leading to excessive exposure to risk. FMPs may become convinced of the value of a single company and its stock.

- Hold a disproportionate amount of their investment assets in their employing company's stock because they believe in their company and are convinced of its favorable prospects.

➢ The effect of confirmation bias may be corrected for or reduced by actively seeking out information that challenges your beliefs.

- For example, if investment selections are based on criteria confirming an existing belief, it is usually advisable to obtain supporting information to assure that a good investment is being made.

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Cog. Errors - Representativeness Bias

➢ **As a result of representativeness bias FRMs may do the following:**
  - Adopt a view or a <u>forecast based almost exclusively on new information or a small sample</u>. This situation may also result in high investment manager turnover as the investor changes investment managers based on short-term results.
  - Update beliefs using simple classifications rather than deal with the mental stress of updating beliefs given complex data.

➢ Investors ignore the laws of probability to satisfy their need for patterns. FMPs need to be aware of statistical mistakes they may be making and constantly ask themselves if they are overlooking the reality of the investment situation being considered.

➢ <u>The following questions should help FMPs avoid</u> the futility of chasing returns and also help them select appropriate investments. How does the fund under consideration perform relative to similarly sized and similarly styled funds? What is the tenure of the managers and advisers at the fund? Are the managers well-known and/or highly regarded? Has the fund consistently pursued its strategy, or has its style drifted during different market conditions?

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2008 Template for Question 2

Donaldson's statement	Select the behavioral finance concept best exhibited in each of Donaldson's three statements. Note: No behavioral finance concept can be used more than once. (circle one)	Explain how the behavioral finance concept you selected affects Donaldson's investment decision making.
• "I read a newspaper article reporting that commercial property values in the city have increased 14 percent annually since 2000. • According to the article, the average commercial property in the city sold for $1.5 million last year. • This makes me very happy because I just purchased a piece of commercial property last month. There is no doubt that it will be a good investment."	Naïve diversification Overconfidence **Representativeness** Regret avoidance Self-control	• Donaldson may have bought late in the cycle, but believes that commercial property values will continue to increase. • Donaldson, by relying on the representativeness heuristic, has become overly optimistic about a past winner.

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Cog. Errors – Illusion of Control Bias

➢ **As a result of illusion of control bias, FMPs may do the following:**

- Traders especially online traders, believe that they have "control" over the outcomes of their investments, which leads to <u>excessive trading</u>

- Lead investors <u>to inadequately diversify portfolios</u>.

➢ **There are some useful guidelines to help investors detect and overcome illusion of control bias.**

- The first and most basic idea is that investors need to recognize that successful investing is a probabilistic activity.

- Second, it is advisable to <u>seek contrary viewpoints</u>.

- Finally, it is critical to <u>keep records</u>. Once you have decided to move forward with an investment, an effective way to prevent illusions of control is to maintain records of your transactions, including reminders outlining the rationale behind each trade. Write down some of the important features of each investment that you make, and emphasize those attributes that you have determined to be in favor of the investment's success.

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Hindsight Bias

➤ **As a result of hindsight bias, FMPs may do the following:**

- Overestimate the degree to which they predicted an investment outcome, thus giving them a false sense of confidence

- Cause FMPs to unfairly assess money manager or security performance. For example, a given manager may have followed his or her strategy faithfully, and possibly even ranked near the top of the relevant peer group, but the investment results may be disappointing compared to another segment of the market or the market as a whole.

➤ FMPs need to be aware of the possibility of hindsight bias and ask such questions as, "Am I re-writing history or being honest with myself about the mistakes I made?"

➤ FMPs need to <u>carefully record and examine their investment decisions</u>, both good and bad, to avoid repeating past investment mistakes.

➤ Expectations must be managed; there will inevitably be periods when even good managers underperform the broader market. Education is critical here. It is important that all investment managers be evaluated relative to appropriate benchmarks and peer groups.

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Anchoring & Adjustment

➢ **As a result of anchoring and adjustment bias,** FMPs may stick too closely to their original estimates when new information is learned.

➢ The primary action FMPs can take is to consciously ask questions that may reveal an anchoring and adjustment bias. Examples of such questions include, "Am I holding onto this stock based on rational analysis, or am I trying to attain a price that <u>I am anchored to, such as the purchase price or a high water mark?</u>"

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Mental Accounting Bias

➤ **As a result of mental accounting bias, FMPs may do the following:**
  ● Neglect opportunities to reduce risk by combining assets with low correlations. This approach can lead to suboptimal aggregate portfolio performance.
  ● Irrationally distinguish between returns derived from income and those derived from capital appreciation.

➤ **An effective way to detect and overcome mental accounting behavior** that causes investors to place money in discrete investment "buckets" is to recognize the drawbacks of engaging in this behavior.
  ● **The primary drawback** is that correlations between investments are not taken into account when creating an overall portfolio.
  ● With regard to the income versus total return issue, an effective way to manage the tendency of some FMPs to treat investment income and capital appreciation differently is to **focus on total return**.
    ✓ FMPs should learn the benefits of integrating the two sources of return, allocating sufficient assets to lower income investments to allow principal to continue to grow even after inflation.

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Cog. Errors – Info. Processing – Framing Bias

➢ **As a result of framing bias, FMPs may do the following:**

- Misidentify risk tolerances because of how questions about risk tolerance were framed; <u>may become more risk-averse when presented with a gain frame of reference and more risk-seeking when presented with a loss frame of reference.</u> This may result in suboptimal portfolios.

- Choose suboptimal investments, even with properly identified risk tolerances, based on how information about the specific investments is framed.

- Focus on short-term price fluctuations, which may result in excessive trading.

➢ <u>Framing bias is detected by asking such questions</u> as, "Is the decision the result of focusing on a net gain or net loss position?" When making decisions, FMPs should try to eliminate any reference to gains and losses already incurred; instead, they should focus on the future prospects of an investment.

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Availability Bias 1: Four Causes

➢ **Retrievability:** If an answer or idea comes to mind more quickly than another answer or idea, the first answer or idea will likely be chosen as correct even if it is not the reality;

➢ **Categorization:** When solving problems, people gather information from what they perceive as relevant search sets. Different problems require different search sets, which are often based on familiar categorizations. If it is difficult to come up with a search set, the estimated probability of an event may be biased.

➢ **Narrow range of experience:** This bias occurs when a person with a narrow range of experience uses too narrow a frame of reference based upon that experience when making an estimate.

➢ **Resonance:** People are often biased by how closely a situation parallels their own personal situation.

● For example, jazz music lovers are likely to overestimate how many people listen to jazz music. On the other hand, people who dislike jazz music are likely to overestimate the number of people who dislike jazz music.

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Availability Bias 2

➢ **As a result of availability bias, FMPs may do the following:**

- Choose an investment, investment adviser, or mutual fund based on advertising rather than on a thorough analysis of the options.

- Limit their investment opportunity set. This may be because they use familiar classification schemes.

  - ✓ Fail to diversify.
  - ✓ Fail to achieve an appropriate asset allocation.

➢ To overcome availability bias, investors need to develop an appropriate investment policy strategy, carefully research and analyze investment decisions before making them, and focus on long-term results;

➢ **Such questions as,** "Did you hear about the stocks on Bloomberg, read about them in the Wall Street Journal, see them on CNBC, or receive a sell-side research report?" and "Am I buying or selling a group of investments because of some recent market event or trend without doing adequate analysis?"; "Did you choose investments based on your familiarity with the industry or country?" and "Did you choose your investments because you like the companies' products?"

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Emotional Biases – Loss Aversion Bias 1

➢ **As a result of loss-aversion bias, FMPs may do the following:**

- Hold investments in a loss position longer than justified by fundamental analysis. FMPs hold losing investments in the hope that they will return to break even.

- Sell investments in a gain position earlier than justified by fundamental analysis. FMPs sell winning investments because they fear that their profit will erode.

- Limit the upside potential of a portfolio by selling winners and holding losers.

- Trade excessively as a result of selling winners. Excessive trading has been shown to lower investment returns.

- Hold riskier portfolios than is acceptable based on the risk/return objectives of the FMP. This is caused by the sale of investments that are winners and the retention of investments that are losers. FMPs may accept more risk in their portfolios than they would if they had based their decision on risk/return objectives and fundamental analysis.

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Emotional Biases – Loss Aversion Bias 2

➢ **Myopic loss aversion:** As a possible explanation for the equity premium puzzle, a phenomenon that describes the anomalously higher historical real returns of stocks over government bonds. Investors evaluate their portfolios on an annual basis and as a result <u>overemphasize short term gains and losses and weigh losses more heavily than gains</u>. The overemphasis on short term losses results in a higher than theoretically justified equity risk premium.

➢ A disciplined approach to investment based on fundamental analysis is a good way to alleviate the impact of the loss-aversion bias.

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Example: 2015 Question 11-A

> Pablo Rodriquez is an advisor at a brokerage firm with retail clients who are active traders. He acquires four clients from Carla Chee, an advisor who is retiring from the firm. Over the years, Chee regularly surveyed her clients to detect any behavioral biases in their investment decision-making processes. She determined that her clients routinely exhibited the biases summarized in Exhibit 1.

Exhibit 1
Chee Clients: Behavioral Biases

Client	Bias
Client 1	Regret-aversion
Client 2	Loss-aversion
Client 3	Mental accounting
Client 4	Framing

Rodriquez believes that clients act primarily on the basis of their biases. He meets with the clients to evaluate Chee's assessments of their biases.

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Example: 2015 Question 11-A

> **Client 1 and Client 2:**
> Rodriquez asks Client 1 and Client 2 to consider two equities, Uno Inc. and Deux Co., which each had purchased for their respective portfolios. The purchase price and current price are shown in Exhibit 2. Neither equity pays dividends.

Exhibit 2
Selected Equity Holdings
(in USD)

Equity	Purchase Price	Current Price
Uno Inc.	55	66
Deux Co.	60	48

ANSWER QUESTION 11-A IN THE TEMPLATE PROVIDED ON PAGE 71.

A. **Determine**, assuming Chee's bias assessments are correct, which action (buy additional shares, take no action, sell) each client will most likely choose for each of the following equities:
   I.   Uno Inc.
   II. Deux Co.
   Justify each response.
   Note: Consider each client (Client 1 and Client 2) and each equity independently.

(12 minutes)

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Example: 2015 Question 11-A

Client (Bias)	Equity	Determine, assuming Chee is correct, which action each client will most likely choose for each of the following equities. (circle one)	Justify each response.
Client 1 (Regret-aversion)	Uno Inc.	buy additional shares take no action (sell)	■ An investor with a regret-aversion bias tends to avoid making a decision out of fear that the decision will turn out poorly. Client 1 would likely take no action, in order to avoid the regret that would come from missing further price appreciation in Uno.
	Deux Co.	buy additional shares take no action (sell)	■ An investor with a regret-aversion bias wants to avoid the pain of regret resulting from a poor investment decision. Client 1 would likely take no action in order to avoid the regret that would come from missing a possible recovery in the price of Deux.

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Example: 2015 Question 11-A

Client 2 (Loss-aversion)	Uno Inc.	buy additional shares take no action ~~sell~~	■ An investor with a loss-aversion bias tends to suffer from the disposition effect, which is the tendency to realize gains early and delay recognizing losses. The investor feels the impact of a loss much more strongly than the impact of a similar gain. The investor may also sell the strong performer to avoid any further perceived risk, regardless of potential future price appreciation. Client 2 is likely to sell Uno to recognize the 20% gain.

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Example: 2015 Question 11-A

Client 2 (Loss-aversion)	Deux Co.	buy additional shares take no action ~~sell~~	■ An investor with a loss-aversion bias tends to suffer from the disposition effect, which is the tendency to realize gains early and delay recognizing losses. The investor often holds investments in a loss position in the hope that they will return to break even, despite the potential risk of even further price declines. Client 2 would likely take no action and hope to recover the 20% loss in Deux.

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Emotional Biases – Overconfidence Bias

➢ **As a result of overconfidence bias, FMPs may do the following:**

- Underestimate risks and overestimate expected returns.

- Hold poorly diversified portfolios.

- Trade excessively.

- Experience lower returns than those of the market.

➢ <u>FMPs should review their trading records,</u> identify the winners and losers. A conscious review process will force them to acknowledge their losers, because a review of trading activity will demonstrate not only the winners but also the losers.

➢ This review will also identify the amount of trading. When FMPs engage in too much trading, they should be advised to keep track of every investment trade and then calculate returns. This exercise will demonstrate the detrimental effects of excessive trading. Because overconfidence is also a cognitive error, more complete information can often help FMPs understand the error of their ways.

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Example: 2008

2008--Guideline Answer: Template for Question 2		
Donaldson's statement	Select the behavioral finance concept best exhibited in each of Donaldson's three statements. Note: No behavioral finance concept can be used more than once. (circle one)	Explain how the behavioral finance concept you selected affects Donaldson's investment decision making.
• "My father was a buy-and-hold investor but I am an active trader. To keep trading costs low, I use an online brokerage firm. I have done well investing in technology companies because I know the industry."	Naïve diversification **Overconfidence** Representativeness Regret avoidance Self-control	• Donaldson knows the technology industry and he considers himself an expert investor. Overconfidence frequently leads to excessive trading and underperformance.

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Emotional Biases – Self-Control Bias

➢ **As a result of self-control bias, FMPs may do the following:**

- <u>Save insufficiently for the future</u>.

- <u>Accept too much risk in their portfolios</u> in an attempt to generate higher returns. In this attempt to make up for less than adequate savings, the capital base is put at risk.

- <u>Cause asset allocation imbalance problems</u>. For example, some FMPs prefer income-producing assets in order to have income to spend. This behavior can be hazardous to long-term wealth because income-producing assets may offer less total return potential.

➢ People have a strong desire to consume today, which can be counterproductive to attaining long-term financial goals. FMPs should ensure that a proper investment plan is in place and should have a personal budget.

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Emotional Biases – Status Quo Bias

➢ **As a result of status quo bias, FMPs may do the following:**

- Unknowingly maintain portfolios with risk characteristics that are inappropriate for their circumstances.

- Fail to explore other opportunities.

➢ Status quo bias may be exceptionally strong and difficult to overcome. **Education is essential**. FMPs should quantify the risk-reducing and return-enhancing advantages of diversification and proper asset allocation.

- For example, with a concentrated stock position, showing what can happen to overall wealth levels if the stock collapses may persuade an FMP to diversify.

Emotional Biases – Endowment Bias

➢ **As is the case with status quo bias, endowment bias may lead FMPs to do the following:**

- Fail to sell off certain assets and replace them with other assets.

- Maintain an inappropriate asset allocation. The portfolio may be inappropriate for investors' levels of risk tolerance and financial goals.

- Continue to hold classes of assets with which they are familiar. FMPs may believe they understand the characteristics of the investments they already own and may be reluctant to purchase assets with which they have less experience. Familiarity adds to owners' perceived value of a security.

➢ Inherited securities are often the cause of endowment bias. In the case of inherited investments, an FMP should ask such a question as, "If an equivalent sum to the value of the investments inherited had been received in cash, how would you invest the cash?"

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Emotional Biases – Regret Aversion Bias

➢ **As a result of regret-aversion bias, FMPs may do the following:**

- <u>Be too conservative in their investment choices as a result of poor outcomes on risky investments in the past.</u> This behavior can lead to long-term underperformance and potential failure to reach investment goals.

- <u>Engage in herding behavior</u>. FMPs may feel safer in popular investments in order to limit potential future regret. It seems safe to be with the crowd, and a reduction in potential emotional pain is perceived.

  - ✓ Regret aversion may lead to <u>preference for stocks of well-known companies</u> even in the face of equal risk and return expectations. Choosing the stocks of less familiar companies is perceived as riskier and involves more personal responsibility and greater potential for regret.

➢ In overcoming regret-aversion bias, education is essential. FMPs should quantify <u>the risk-reducing and return-enhancing advantages of diversification and proper asset allocation.</u> With proper diversification, FMPs will accept the appropriate level of risk in their portfolios depending, of course, on return objectives.

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Example: 2008

Template for Question 2		
Donaldson's statement	Select the behavioral finance concept	Explain how the behavioral finance concept you selected affects Donaldson's investment decision making.
"I am holding a large position in Omega Corporation with a large unrealized loss. Omega's stock price declined last year when reported sales and earnings failed to meet analyst expectations. I took advantage of the decline to increase my position. Omega sales growth has continued to slow over the last year, but I believe the stock is still a good investment."	Naïve diversification Overconfidence Representativeness **Regret avoidance** Self-control	Donaldson's reluctance to sell his losing position reflects both regret avoidance and belief perseverance. To avoid the stress associated with admitting a mistake, he hopes the stock will recover. Despite new information (slowing sales and lower than expected sales and earnings), Donaldson has held onto his beliefs. He has increased his position rather than admit a mistake by taking the loss.

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Investment Policy and Asset Allocation

➢ **Attempts are made to either mitigate behavior biases or accommodate them. Goals-based investing, for example, recognizes that individuals are subject to loss aversion and mental accounting.**

➢ **Goals-based investing approach**
  ● Financial advisers using this approach will typically first get their clients to consider their obligations and needs. The advisers will then estimate how much should be invested in low-risk (capital preservation) assets to meet those needs and obligations.
  ● Next, riskier assets are considered to attain priorities and desires.
  ● Finally, even riskier assets are added to meet aspirational goals.

➢ **Typically, investors will end up having a diversified portfolio using this approach, but the resulting portfolio may not be efficient from a traditional finance perspective.**

Behaviorally Modified Asset Allocation

➢ Behaviorally modifying a portfolio simply means constructing is according to the investor's behavioral risk and return preferences. **The construction of the modified portfolio considers the investor's emotional and cognitive behavioral biases and current wealth**;

➢ **As a general rule, the wealthier the client, the more her behavioral biases can be accommodated (adapted to); the less wealthy, the more mitigated (moderated).**

➢ **Another general rule is that cognitive errors should be mitigated (moderated) and emotional biases should be accommodated (adapted to)**;

➢ The client's wealth should be determined by considering total wealth relative to lifestyle. **The lower the client's standard of living risk, the greater the client's effective wealth and the greater the ability to accommodate behavioral biases**.

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Suggested Deviation From A Rational Portfolio

	Cognitive bias	Emotional Bias
High wealth/ low SLR	• Modest changes • +/— 0 to 5% maximum per asset class	• Larger changes • +/— 0 to 10% maximum per asset class
Low wealth/ high SLR	• close to the rational asset allocation • +/— 0 to 2% maximum per asset class	• Modest changes • +/— 0 to 5% maximum per asset class

*SLR – standard of living risk

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Example: 2018

➤ Sara has a high standard of living risk. And her questionnaire indicates that her potential behavioral bias is representativeness.

➤ Beech provides John with a mean-variance optimized portfolio. Based on John's standard of living risk and his potential behavioral bias, Beech also produces a behaviorally modified portfolio. The asset class weights of the modified portfolio differ from those of the optimized portfolio by +/− 10%. Beech then repeats the process for Sara, preparing both a mean-variance optimized portfolio and a behaviorally modified portfolio.

Determine the most likely amount by which the asset class weights of Sara's two portfolios will differ.

(circle one)

less than +/− 10%	equal to +/− 10%	greater than +/− 10%

Justify your response.

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Example: 2018
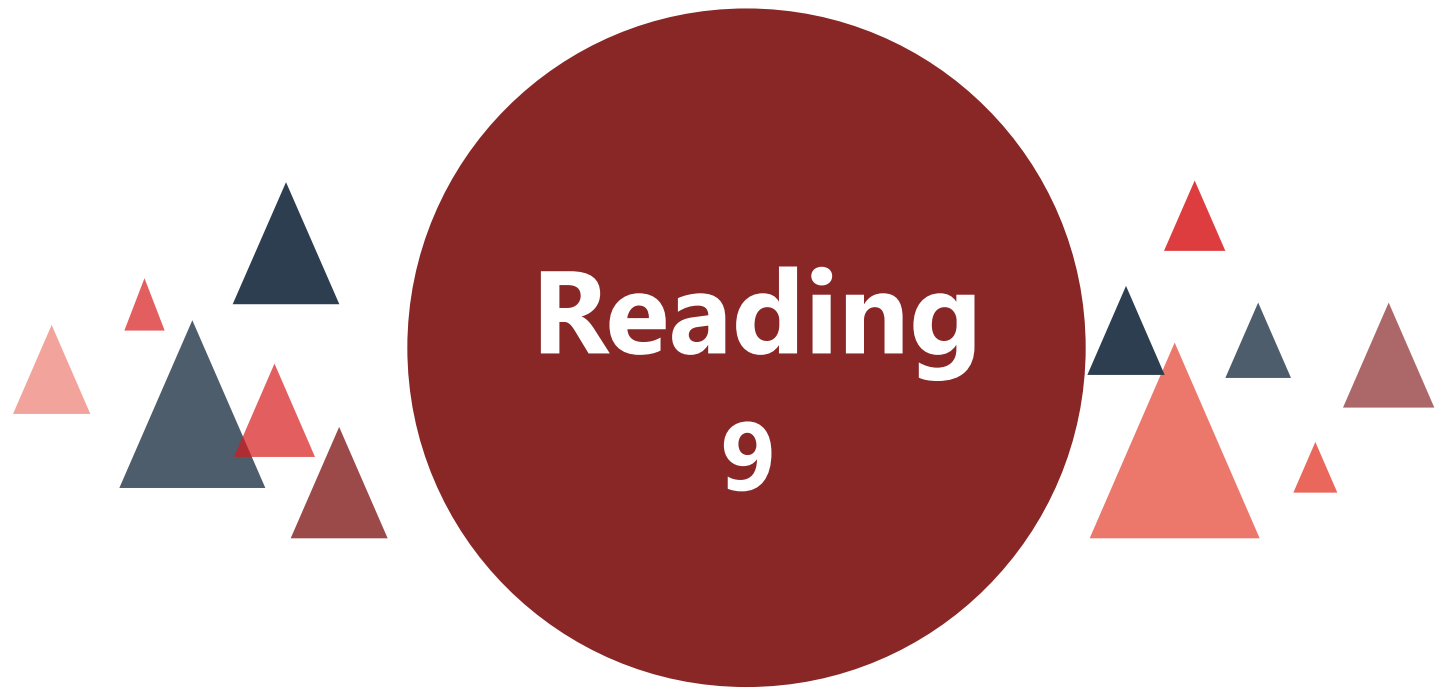
- The decision to moderate or adapt to a client's behavioral biases depends on two factors: the standard of living risk / level of wealth (high or low) and the type of bias (emotional or cognitive).

- Sara, with a high standard of living risk, is at risk of failing to achieve her goals, so her behaviorally modified portfolio should be closer to a mean-variance optimized portfolio. In addition, because her bias is cognitive (representativeness), better information can help to correct it (i.e., moderating the bias is more likely to be successful). As such, with the appropriate education, Sara should be able to adjust her behavior and tolerate a portfolio that more closely matches a rational (mean-variance optimized) allocation. This would lead Sara to have a portfolio with less than a + / − 10% difference in her asset class weights to the rational allocation.

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Suggested Deviation From A Rational Portfolio

➢ It is important to recognize the relative differences between these cases.

- The case requiring the least adjustment to the rational portfolio is a low wealth level client with cognitive bias.

  ✓ Here, the low wealth investor needs to modify his or her behavior to reach his or her financial goals, and with appropriate education and information, he or she should be able to adjust behavior to match the rational allocation.

- The case that will likely require the most adjustment per asset class is emotional bias at high wealth level.

  ✓ The rationale for such a potentially high adjustment is that a wealthy investor with emotional bias may need substantial flexibility because emotional biases are difficult to correct; a high wealth level permits flexibility.

- The "middle of the road" cases are the high wealth level with cognitive biases and the low wealth level with emotional biases.

  ✓ The rationale for this adjustment is that there is a need to both adapt to and moderate behavioral biases, and the offsetting that takes place likely requires a modest adjustment.

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Reading 9

Behavioral Finance and Investment Processes

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Classifying Investors into Behavioral Types

➢ At the individual level, all market participants, whether they are less knowledgeable individual investors or experienced money managers, may **act irrationally**; in other words, all market participants may deviate from the behavior that is assumed in traditional financial theory. **Some of these deviations have been identified and categorized as behavioral biases.**

➢ We will now review two models of investor psychographics from the 1980s. One model was proposed in **Barnewall two-way** (1987) and the other in **Bailard, Biehl, and Kaiser** (1986). We will then move to more recent models of investor behavior. For example, **Pompian** (2008) introduces a behavioral alpha (BA) approach.

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Barnewall Two-Way Behavioral Model

➢ **Barnewall distinguishes two relatively simple investor types: passive and active.**

- **Passive investors** are defined as those investors who have become wealthy passively

  - ✓ For example, by inheritance or by risking the capital of others rather than risking their own capital (managers who benefit when their companies do well are examples of the latter category). Passive investors have a greater need for security than they have tolerance for risk.

- **Active investors** are individuals who have been actively involved in wealth creation through investment, and they have risked their own capital in achieving their wealth objectives. Active investors have a higher tolerance for risk than they have need for security.

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Ballard, Biehl, and BB&K Five-Way Model 1

➢ **The Bailard, Biehl, and Kaiser (BB&K) model classifies investor personalities along two axes:**

- One axis is called the "confident–anxious" axis, which deals with how confidently the investor approaches life, regardless of whether it is his approach to his career, his health, or his money.

- The other is called the "careful–impetuous" axis, which deals with whether the investor is methodical, careful, and analytical in his approach to life or whether he is emotional, intuitive, and impetuous.

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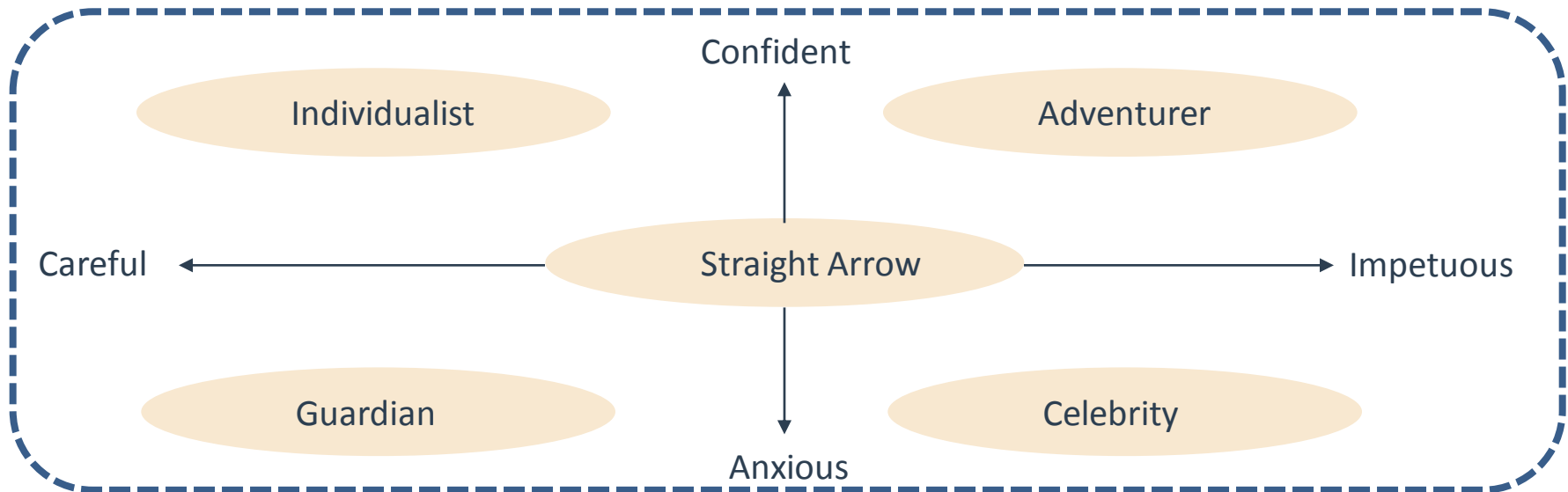
Ballard, Biehl, and BB&K Five-Way Model 1

- **Individualist**
- Independent and confident
- Like to make their own decisions but only after careful analysis
- Pleasant to advise because they will listen and process information rationally.

- Adventurer
- May hold highly undiversified portfolios
- Confident and willing to take chances
- Makes their own decisions
- Makes them reluctant to take advice
- Challenge for an investment adviser.

- Straight Arrow
- Sensible and secure
- Willing to take on some risk in the expectation of earning a commensurate return.

- Guardian
- Cautious and concerned about the future
- May seek advice from those they perceive as being more knowledgeable than themselves

- Celebrity
- Like to be the center of attention
- May hold opinions about some things but to a certain extent recognize their limitations
- May be willing to seek and take advice about investing.

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Pompian Behavioral Model 1

➢ **In recent years, there have been additional developments in the practical application of behavioral finance.**

➢ **Pompian (2008) introduces a behavioral alpha (BA) approach.**

- Interview the client and identify active or passive traits and risk tolerance;

- Plot the investor on the active/passive and risk tolerance scale;

- Test for behavioral biases;

- Classify the investor into a behavioral investor type.

➢ **Passive Preserver and the Active Accumulator suffer mainly from emotional biases. The Friendly Follower and Independent Individualist suffer mainly from cognitive biases and need education and information to make better decisions.**

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Pompian Behavioral Model 2

General type	Passive		Active	
Risk tolerance	Low		High	
Investment style	Conservative	Moderate	Growth	Aggressive
Bias types	Emotional	Cognitive	Cognitive	Emotional
BITs	**Passive Preserver (PP)**	**Friendly Follower (FF)**	**Independent Individualist (II)**	**Active Accumulator (AA)**
Emotional bias	Endowment Loss aversion Status quo Regret aversion	Regret aversion	Overconfidence and self-attribution	Overconfidence Self-control
Cognitive bias	Mental accounting Anchoring and adjustment	Availability Hindsight Framing	Conservatism Availability Confirmation Representativeness	Illusion of control

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Pompian Behavioral Model 4 – BITs 1

➢ **Passive Preserver**, place a great deal of emphasis on financial security and preserving wealth rather than taking risks to grow wealth

- May not be financially sophisticated

- May be difficult to advise because they are driven mainly by emotion.

➢ **The Friendly Follower** are passive investors with a low to medium risk tolerance who tend to follow leads from their friends, colleagues, or advisers when making investment decisions.

- May be difficult to advise because they often overestimate their risk tolerance.

  - ✓ Advisers need to handle FFs with care because they are likely to say yes to advice that makes sense to them without adequately considering the risk involved.

- FF biases are mainly cognitive, education on the benefits of portfolio diversification is usually the best course of action.

  - ✓ Advisers should challenge FF clients to be introspective and provide data-backed support for recommendations.

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Pompian Behavioral Model 4 – BITs 2

➢ **The Independent Individualist** is an active investor with medium to high risk tolerance who is strong-willed and an independent thinker.

- Independent Individualists may be difficult clients to advise because of their independent mindset, but they are usually willing to listen to sound advice when it is presented in a way that respects their intelligence.

➢ **The Active Accumulator** The Active Accumulator is the most aggressive behavioral investor type. These clients are usually entrepreneurial and want to be heavily involved in the investment decision-making process.

- Active Accumulators may be the most difficult clients to advise. They like to control, or at least get deeply involved in, the details of investment decision making.

- The best approach to dealing with these clients is to take control of the situation. Advisers need to prove to the client that they have the ability to make wise, objective, and long-term decisions and can communicate these results in an effective way.

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Limitations of Classifying Investors into BITs

➢ Individuals may exhibit both cognitive errors and emotional biases;

➢ Individuals may exhibit characteristics of multiple investor types;

➢ Individuals will likely go through behavioral changes as they age;

➢ Individuals are likely to require unique treatment even if they are classified as the same investor type because human behavior is so complex;

➢ Individuals act irrationally at different times and without predictability.

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The Client/Adviser Relationship

➢ **Every successful relationship shares a few fundamental characteristics, including the following as outlined by Pompian (2006). Behavioral finance can enhance these areas.**

- The adviser understands the client's financial goals and characteristics. These are considered when developing the investment policy statement.

- The adviser maintains a systematic (consistent) approach to advising the client.

- The adviser invests as the client expects.

- The relationship benefits both client and adviser.

➢ **However, it is important to recognize the limitations of risk tolerance questionnaires.**

- Risk tolerance questionnaires can also generate dramatically different results when administered repeatedly to the same individual, but with slight variations. Such imprecision arises primarily from variations in wording.

- Another critical drawback of risk tolerance questionnaires is that many advisers

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Portfolio Construction - DC plan

➢ **Behavioral biases may affect how investors construct portfolios from the securities available to them. Some useful evidence on the portfolio selection decisions of individual investors comes from defined-contribution (DC) pension plans. In particular, investment decisions in US 401(k) plans have been investigated in a number of studies.**

- **Status quo bias** refers that they tend not to change their asset allocations through time, even though it might be assumed that their tolerance for risk and other circumstances would be changing or no transaction costs.

- There is also substantial evidence that shows inertia leads plan participants to **stick with default options** in terms of contribution rates and investment funds. In many cases, the default funds will be cash or money market funds, with low risk but also low rates of return.

- Some companies have introduced "autopilot" strategies to counteract the inertia that plan participants frequently exhibit. For example, **target date funds** automatically switch from risky assets to fixed-income assets as the plan member nears the intended retirement date.

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DC Plan - Investing in Company Stock

➢ **Naive diversification—**dividing contributions equally among available funds irrespective of the underlying composition of the funds.

- In one experiment, one group of subjects is given the choice between a stock (equities) fund and a bond fund and a second group of subjects is given a choice between a stock fund and a balanced (50 percent stock, 50 percent bond) fund. The average asset allocation to equities is higher for the second group because in each group, the mode is to allocate assets evenly between the two funds available for selection.

- However, they do find evidence of members following **a conditional 1/n strategy**, by allocating equally among their chosen subset of funds. In other words, once they have selected their funds, they allocate the invested amount equally among the chosen funds.

➢ **Regret may play a role in explaining naïve diversification strategies.**

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DC Plan - Investing in Company Stock

➢ **Explanations given for investment in employer's stock include the following:**

- **Familiarity** and **overconfidence** effects: Employees underestimate risk because of familiarity with the employing company and overconfidence in their estimates of the company's performance.

- **Naïve extrapolation of past returns**: Plan members at companies whose stock has done well in the past may expect this performance to continue and hence wish to hold company stock in their account.

- **Framing and status quo** effect of matching contributions

- **Loyalty effects**: Employees may be willing to hold employer's stock to assist the company, as they perceive it.

- Financial incentives: Employees might rationally invest in employer's stock when there are financial incentives for them to do so.

Portfolio Construction – Excess Trading

➢ **The evidence of member inertia in DC plans is in contrast to evidence of individuals with retail investment accounts. Investors with retail accounts appear to be more active traders.**

- Excessive trading appears to be driven by overconfidence. **Overconfident** investors may falsely think that they have the knowledge and insight to make profitable trades, and trade actively to benefit from these insights.

- The frequent traders not only had higher transaction costs because of excessive trading but also experienced opportunity losses because of **the disposition effect** that investors tend to sell winners and hold on to losers.

➢ **Home bias**

- Members can diversify internationally as well as across asset classes.

- A large body of literature exists showing that many investors maintain a high proportion—often 80 percent or more—of their investments in securities listed in their own country.

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Example: 2004

Maclin's three statements	Identify the behavioral finance concept most directly exhibited in each of Maclin's three statements	Explain how each behavioral finance concept is affecting Maclin's investment decision-making
"I will not sell any of my company stock because I know my company and I believe it has excellent prospects for the future."	Familiarity	Maclin is evaluating his holding of company stock based on his familiarity with the company rather than on sound investment and portfolio principles. Company employees, because of this familiarity, may have a distorted perception of their own company, assuming a "good company" will also be a good investment. Irrational investors believe an investment in a company with which they are familiar will produce higher returns and have less risk than non-familiar investments.

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Behavioral Portfolio vs Mean Variance Portfolio

➢ **Mean-variance portfolio are constructed as a whole, and only the expected return and the variance of the entire portfolio matter.**

- Covariance between assets is crucial in determination of the variance of the portfolio.

➢ **Behavioral portfolios are constructed not as a whole but layer by layer, where each layer is associated with a goal and is filed with securities that correspond to that goal.**

- As a result of a mental accounting bias in which people treat one sum of money differently from another sum based on which mental account the money is assigned to, investments are allocated to discrete layers without regard for the correlations among these investments.

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Behavioral Portfolio vs Mean Variance Portfolio

➢ **Advisers and portfolio managers constructing an investment policy statement for or with a client may wish to consider behavioral portfolio theory.**

- For example, they can clarify which mental accounts the client has and what attitude toward risk prevails for each one.

- A base layer of low risk assets may be intended as "protection from poverty," whereas a higher layer of risky assets represents "hopes for riches."

- Upside-potential layer contains, for example, foreign stocks, aggressive growth funds, IPOs, lottery tickets; downside-potential layer contains, for example, T-bills, CDs, money market funds.

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Analyst Forecasts & Behavioral Finance

➢ **How behavioral factors impact security analysts:**

- Overconfidence in forecasting skills

- Influence of company's management on analysis

- Analyst biases in conducting research

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Overconfidence

➢ **Overconfidence bias is a bias in which people demonstrate unwarranted faith in their own intuitive reasoning, judgments, and/or cognitive abilities. This overconfidence may be the result of overestimating knowledge levels, abilities, and access to information.**

- **Illusion of knowledge bias:** people generally do a poor job of estimating probabilities but believe they do it well because they believe that they are smarter and more informed than they actually are;

- **Illusion of control bias:** which is a tendency of analysts to try to control what cannot be controlled;

- **Self-attribution bias:** in which people take credit for successes and assign responsibility for failures;

- **Representativeness:** in which analysts judge the probability of a forecast being correct by considering how much the outcome resembles overall available data;

- **Availability bias:** which involves individuals giving undue weight to more accessible, readily recalled information.

- **Hindsight bias:** ego defense mechanism;

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Influence by Company Management

➢ **Analysts should remember that company management is also susceptible to behavioral biases. Framing, anchoring and adjustment, and availability are important cognitive biases.**

- **Framing** is a cognitive bias in which the same problem is assessed differently depending on how information or a question is presented;

- **Anchoring** means that the framework for interpreting and analyzing the available information can be influenced disproportionately by an initial, default position or "anchor". **Adjustments** from the anchor tend to insufficiently incorporate new information;

- **Availability** is a cognitive bias that involves individuals giving undue weight to more accessible, readily recalled information.

➢ **Analysts should also recognize the possibility of a self-attribution bias in company executives that arises from the impact of incentive compensation on company reporting.**

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Analyst Biases in Conducting Research

➢ **Confirmation bias,** a cognitive bias, is the tendency for people to misread evidence as additional support for an initial hypothesis.

➢ **The gamblers' fallacy,** a misunderstanding of probabilities in which people wrongly project reversal to a long-term mean, is a related cognitive bias. Investment professionals, and strategists in particular, can suffer from this cognitive bias. **It reflects a faulty understanding about the behavior of random events, expecting reversals to occur more frequently than actually happens.**

➢ The tendency of analysts to recommend high-growth and low-yield stocks typically reflects a failure to incorporate the base rate or effect of the environment in which a company operates. This situation may reflect a **representativeness bias**.

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BF vs Committee Decision Making

➢ **Many investment decisions are made by groups or committees rather than by individuals acting alone.**

➢ **Social proof** is a bias in which individuals are biased to follow the beliefs of a group. Analysts may wrongly favor the judgment or endorsement of others, often without being fully aware that they are doing so.

➢ **Committees are often made up of individuals with similar backgrounds who are likely to approach decisions in a similar way.**

➢ **Techniques for Structuring and Operating Committees to Address Behavioral Factors :**

- A committee is made up of members from diverse backgrounds;

- Members are independent enough to express and support their own views rather than falling into line with the views of others;

- The chair should actively encourage alternative opinions so that all perspectives are covered.

BF vs Market Behavior

➤ Over time, academic papers have broadened the understanding of market efficiency. However, this understanding still does not explain some persistent market patterns. **Behavioral finance does offer some explanation of these exceptions to market efficiency, and focuses on the biases that contribute to these anomalies.**

- The efficient market hypothesis does not rule out small abnormal returns before fees and expenses are taken into account. Closed-end fund discounts, for example, typically do not offer a profitable strategy to trade when transaction costs are allowed for;
- Some apparent anomalies may be explained by the small samples involved, a statistical bias in selection or survivorship, or data mining that overanalyzes data for patterns and treats spurious correlations as relevant;
- Also, from time to time, markets can present temporary disequilibrium behavior, unusual features that may survive for a period of years but ultimately disappear;
- Some of these market features may be attributed to rational behavior that is not captured by accepted pricing models. Investor response to the effect of taxes might be an example of this issue.

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Momentum

➢ **Momentum or trending effects,** in which future price behavior correlates with that of the recent past. Typically in the short term, up to two years, there is a positive correlation, but for longer periods of two to five years returns are negatively correlated and revert to the mean.

➢ **Herding** occurs when a group of investors trade on the same side of the market in the same securities, or when investors ignore their own private information and act as other investors do.

● The availability bias in this context is also called the **recency effect**, which is the tendency to recall recent events more vividly and give them undue weight.

➢ **Regret** is the feeling that an opportunity has been missed, and is typically an expression of hindsight bias.

● This response creates a **trend-chasing effect**. In terms of selecting investments, investors have a bias to buy investments they wish they had owned the previous year.

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Bubbles and Crashes

➢ **Periods of significant overvaluation or undervaluation can persist for more than one year, rather than rapidly correcting to fair value;**

➢ **Bubbles and crashes appear to be panics of buying and selling;**

➢ **A continuous rise in an asset price is fuelled by investors' expectations of further increase; asset prices become decoupled from economic fundamentals.**

➢ **A more objective modern definition specifies periods when a price index for an asset class trades more than two standard deviations outside its historic trend.**

● A crash would typically be a fall of 30 percent or more in asset prices in a period of several months. Some bubbles and crashes will reflect rapid changes in economic prospects that investors failed to anticipate.

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Bubbles and Crashes - Biases

➢ **Investor behavior in bubbles:**
- Investors often exhibit symptoms **of overconfidence**; overtrading, underestimation of risks, failure to diversify, and rejection of contradictory information;
- The overconfidence and excessive trading that contribute to a bubble are linked to **confirmation bias** and **self-attribution bias**;
- **Hindsight bias**, in which individuals can reconstruct prior beliefs and deceive themselves that they are correct more often than they truly are. This bias creates the feeling of "I knew it all along."
- Overconfidence involves an **illusion of knowledge**. Investors would be better off not trading on all the available information, which includes noise or non-relevant information.
- The **disposition effect** recognizes that investors are more willing to sell winners, which can encourage excess trading.
- There can also be a **confirmation bias** to select news that supports an existing decision or investment.

➢ **As a bubble unwinds, there can be underreaction that can be caused by anchoring when investors do not update their beliefs sufficiently. As a bubble unwinds, investors may initially be unwilling to accept losses. In crashes, the disposition effect encourages investors to hold on to losers and postpone regret.**

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Value and Growth

➢ **Value stocks** are typically characterized by low price-to earnings ratios, high book-to-market equity, and low price-to-dividend ratios. **Growth stock** characteristics are generally the opposite of value stock characteristics.

➢ Fama and French note that **value stocks outperformed growth stocks** in 12 of 13 major markets during the 1975–1995 period.

➢ Fama and French also identified that **small-capitalization stocks outperformed large-cap stocks** in 11 of 16 markets.

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Value and Growth - Bias

➢ **The halo effect** extends a favorable evaluation of some characteristics to other characteristics.

- A company with a good growth record and good previous share price performance might be seen as a good investment, with higher expected returns than its risk characteristics merit. This view is a form of **representativeness** that can lead investors to extrapolate recent past performance into expected returns. **Overconfidence** can also be involved in predicting growth rates, potentially leading growth stocks to be overvalued.

➢ **The home bias** anomaly, by which portfolios exhibit a strong bias in favor of domestic securities in the context of global portfolios.

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It's not an end but just the beginning.

"There are only two creatures," says a proverb, "who can surmount the pyramids-the eagle and the snail."

俗话说：“能登上金字塔的生物，只有两种------鹰和蜗牛。”

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Asset Allocation and Related Decisions in Portfolio Management

CFA三级培训项目

讲师：Jcy

Topic in CFA Level III

Session	Content
Study Session 1-2	ETHICS & PROFESSIONAL STANDARDS (1)&(2)
Study Session 3	BEHAVIORAL FINANCE
Study Session 4	CAPITAL MARKET EXPECTATIONS
Study Session 5	**ASSET ALLOCATION AND RELATED DECISIONS IN PORTFOLIO MANAGEMENT**
Study Session 6	DERIVATIVES AND CURRENCY MANAGEMENT
Study Session 7-8	FIXED-INCOME PORTFOLIO MANAGEMENT (1)&(2)
Study Session 9-10	EQUITY PORTFOLIO MANAGEMENT (1)&(2)
Study Session 11	ALTERNATIVE INVESTMENTS FOR PORTFOLIO MANAGEMENT
Study Session 12-13	PRIVATE WEALTH MANAGEMENT (1)&(2)
Study Session 14	PORTFOLIO MANAGEMENT FOR INSTITUTIONAL INVESTORS
Study Session 15	TRADING, PERFORMANCE EVALUATION, AND MANAGER SELECTION
Study Session 16	CASES IN PORTFOLIO MANAGEMENT AND RISK MANAGEMENT

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◉ **Framework**

Asset Allocation and Related Decisions in Portfolio Management

➢ **SS5: Asset Allocation and Related Decisions in Portfolio Management**

- R12: Overview of Asset Allocation

- R13: Principles of Asset Allocation

- R14: Asset Allocation with Real-World Constraints

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Reading

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Overview of Asset Allocation

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Framework

1. Investment governance

2. Economic balance sheet

3. Asset allocation approaches

    • Asset only

    • Liability Relative

    • Goal based

4. Strategic asset allocation

5. Strategic implementation choices

6. Strategic considerations in rebalancing

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1. Investment Governance

➤ **Investment governance**
- The organization of decision-making responsibilities;
- Oversight of processes;
- Ensure decisions are made with the necessary skills and capacity;

➤ **Differences with management**

Governance	Management
■ Clarifying the mission ■ Creating a plan ■ Reviewing progress toward achieving long- and short-term objectives	■ The execution of the plan to achieve the agreed-on goals and objectives

➤ **Levels within governance hierarchy**
- Governing investment committee
- Investment staff
- Third-party resources

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Investment Governance

➢ **The governance audit**

- **Purpose:** ensure that the established policies, procedures, and governance structures are effective.

- **Performed by:** independent third party

➢ **Good governance**

- Ensures the durability or survivability of the investment program

  ✓ Avoid decision-reversal risk

  ✓ Consider the effect of investment committee member and staff turnover on the durability of the investment program

  ✓ Prevent key person risk

- Assures accountability

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2. 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

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Economic Balance Sheet

➤ **Extended portfolio assets**

- **For individual investors**
    - ✓ **Human capital** (The PV of future earnings)
    - ✓ The PV of pension income
    - ✓ The PV of expected inheritances
- **For institutional investors**
    - ✓ Underground mineral resources
    - ✓ The PV of future intellectual property royalties

➤ **Extended portfolio liabilities**

- **For individual investors**
    - ✓ The PV of future consumption
- **For institutional investors**
    - ✓ The PV of prospective payouts for foundations

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Example

> The Laws have worked their entire careers at Whorton Solutions (WS), a multinational technology company and they have two teenage children who will soon begin college.

> The Laws have an investment portfolio consisting of $800,000 in equities and $450,000 in fixed-income instruments. 80% of the equity portfolio consists of shares of WS. The Laws also own real estate valued at $400,000, with $225,000 in mortgage debt. The Laws' pre-retirement earnings from WS have a total present value of $1,025,000, and their future expected consumption expenditures have a total present value of $750,000.

> The Laws express a very strong desire to fund their children's college education expenses, which have an estimated present value of $275,000. The Laws also plan to fund an endowment at their alma mater in 20 years, which has an estimated present value of $500,000.

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Example

> Using the economic balance sheet approach, the Laws' economic net worth is *closest* to:
>   A. $925,000
>   B. $1,425,000
>   C. $1,675,000
> **Correct Answer: A.**

Assets		Liabilities and Net worth	
Financial assets		*Financial liabilities*	
Fixed income	450,000	Mortgage debt	225,000
Real estate	400,000	*Extended liabilities*	
Equity	800,000	Children's education	275,000
Extended assets		Endowment funding	500,000
Human capital	1,025,000	PV of consumption	750,000
		Economic Net worth	925,000

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Economic Balance Sheet

➤ Exhibit 3 illustrates a typical path for the **composition of an individual's economic balance sheet** from age 25 through age 65.

Exhibit 3 Human Capital (HC) and Financial Capital (FC) relative to Total Wealth

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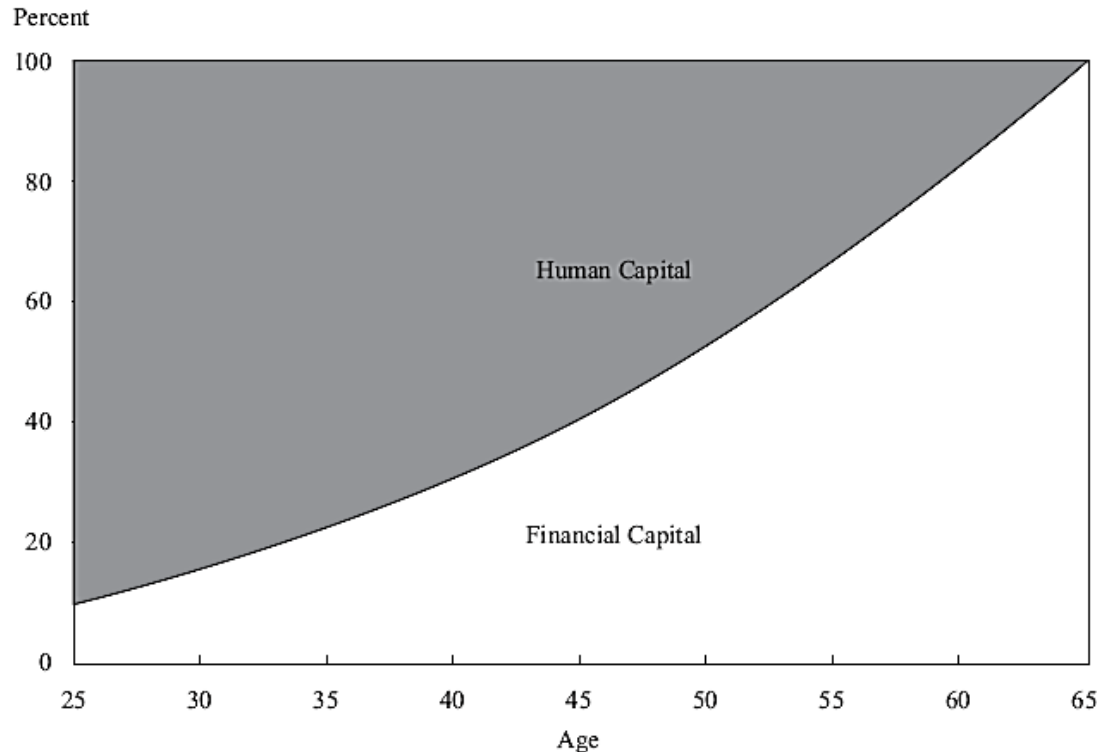
Economic Balance Sheet

➢ **Life-cycle balanced funds** (also known as **target date funds**) are examples of investments that seek to coordinate **asset allocation with human capital**.

Exhibit 4 Glide Path of Target Date Investment Funds In One Family

Assumed Age	Equity Allocation	Bond Allocation
25	85%	15%
35	82	18
45	77	23
55	63	37
65	49	51

Note: Allocations as of 31 December 2009.
Source: Based on data in Idzorek, Stempien, and Voris (2013).

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3. Approaches to Asset Allocation

➢ **Three broad approaches to asset allocation**
- **Asset-only:** Mean–variance optimization (MVO)
  - ✓ focus solely on the asset side of the investor's balance sheet
- **Liability-relative:** Funding liabilities
  - ✓ provide for the money to pay liabilities when they come due
  - ✓ **Liability-driven investing (LDI)** is an investment industry term that generally encompasses asset allocation that is focused on funding an investor's liabilities
- **Goals-based:** Achieving the goals
  - ✓ specify asset allocations for sub-portfolios, each of which is aligned to specified goals ranging from supporting lifestyle needs to aspirational
  - ✓ **Goals-based investing (GBI)** is an investment industry term that encompasses the asset allocation focused on addressing an investor's goals

3.1 Distinctions Between Liabilities

➢ **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.

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3.2 Relevant Objectives

Asset Allocation Approach	Relation to Economic Balance Sheet	Typical Objective	Typical Uses and Asset Owner Types
Asset-only	Does not explicitly model liabilities or goals	Maximize Sharpe ratio for acceptable level of volatility	Liabilities or goals not defined and/or simplicity is important ■ Some foundations, endowments ■ Sovereign wealth funds ■ Individual investors
Liability-relative	Models legal and quasi-liabilities	Fund liabilities and invest excess assets for growth	Penalty for not meeting liabilities high ■ Banks ■ Defined benefit pensions ■ Insurers
Goals-based	Models goals	Achieve goals with specified required probabilities of success	Individual investors

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3.3 Risk Concepts

➢ **Asset-only**

- Primary measure of risk: volatility (standard deviation) of portfolio return
- Other risk sensitivities:
  - ✓ Risk relative to benchmarks: tracking risk (tracking error)
  - ✓ Downside risk
    - ▪ semi-variance
    - ▪ peak-to-trough maximum drawdown
    - ▪ measures focusing on the extreme (tail) segment of the downside: Value at risk (VaR)

➢ **Liability-relative**

- Shortfall risk
- Volatility of contributions needed to fund liabilities

➢ **Goal-based**

- Maximum acceptable probability of not achieving a goal

3.4 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**.

Example

> In reviewing a financial plan written by the Laws' previous adviser, Raye notices the following asset class specifications.
>   - <u>Equity: US equities</u>
>   - Debt: Global investment-grade corporate bonds and real estate
>   - Derivatives: Primarily large-capitalization foreign equities
> <u>The previous adviser's report notes the asset class returns on equity and derivatives are highly correlated.</u> The report also notes the asset class returns on debt have a low correlation with equity and derivative returns.
> Raye believes the previous adviser's **specification for debt** is incorrect given that, for purposes of asset allocation, asset classes should be:
>   A. diversifying.
>   B. mutually exclusive.
>   C. relatively homogeneous.
> **Correct Answer: C**

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3.5 Risk Factor

➢ **Asset-based asset allocation**
  ● Modeling using asset classes as the unit of analysis tends to obscure the portfolio's sensitivity to overlapping risk factors;
    ✓ Risk factor exposures may overlap across multiple asset classes. The overlaps help explain the correlation of asset classes.
➢ **Use multifactor risk models** have been labeled "**factor-based asset allocation**" can be used for asset allocation by creating factor portfolios.
➢ **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;
  ● Construct factor portfolios that isolate exposure to the risk factor;
  ● Map back a choice of risk exposures in factor space to asset class space for implementation.

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Risk Factor

➤ **How risk factor exposures can be achieved by long and short positions or use existing instrument.**

- **Inflation.** Going long nominal Treasuries and short inflation-linked bonds isolates the inflation component.

- **Credit spread.** Going long high-spread credit bond and short Treasuries/government bonds isolates credit exposure.

- **Duration.** Going long 10+ year Treasuries and short 1–3 year Treasuries isolates the duration exposure being targeted.

- **Real interest rates.** Inflation-linked bonds provide a proxy for real interest rates.

- **US volatility.** VIX (Chicago Board Options Exchange Volatility Index) futures provide a proxy for implied volatility.

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Example

> An investment adviser is concerned that the asset allocation approach followed by his client's previous financial adviser resulted in an overlap in risk factors among asset classes for the portfolio. To address his concern regarding the previous adviser's asset allocation approach, he should assess his client's portfolio using:

A. a homogeneous and mutually exclusive asset class–based risk analysis.

B. a multifactor risk model to control systematic risk factors in asset allocation.

C. an asset class–based asset allocation approach to construct a diversified portfolio.

> **Correct Answer: B**

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3.6 Global Market Portfolio

➢ **Global market portfolio** sums all investable assets (global stocks, bonds, real estate, and so forth) held by investors, and reflects the balancing of supply and demand across world markets.

- Minimize non-diversifiable risk
- As a reference point for a highly diversified portfolio
- The available portfolio that makes the most efficient use of the risk budget
- Mitigate investment biases, such as home-country bias

➢ **Global market-value weighted portfolio should be considered as a baseline asset allocation.**

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4. 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**

$$\underset{\text{by choice of asset class weights } w_i}{\text{Maximize}} E[U(W_T)] = f\begin{pmatrix} W_0, w_i, \text{asset class return distributions,} \\ \text{degree of risk aversion} \end{pmatrix}$$

subject to $\sum_{i=1}^{n} w_i = 1$ *and any other constraints on* w_i

➢ **Utility function**

- Mean-variance utility:

$$U = E(r_p) - \frac{1}{2}\lambda\sigma_p^2$$

Strategic Asset Allocation

➢ **Optimal Choice in the Simplest Case**

- The simplest asset allocation decision problem involves one risky asset and one risk-free asset.

- Let λ, μ, r_f, and $σ^2$ represent, respectively, the investor's degree of risk aversion, the risk asset's expected return, the risk-free interest rate, and the variance of return. With mean–variance utility, the **optimal allocation to the risky asset, w***, can be shown to equal:

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

- The allocation to the risky asset is inversely proportional to the investor's risk aversion and directly proportional to the risk asset's expected return per unit of risk (represented by return variance).

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Example: 2018 Q9-A

> An investment adviser is counseling a client who recently inherited €1,200,000 and who has above-average risk tolerance (λ = 2). The exhibit below shows three alternative strategic asset allocations.

	Investor's Forecasts	
Asset Allocation	Expected Return	Standard Deviation of Return
A	10.00%	20%
B	7.00%	10%
C	5.25%	5%

> Based only on Goddard's risk-adjusted expected returns for the asset allocations, which asset allocation would she prefer?

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Example

> **Solution:**

Using the utility function $U = E(r_p) - \frac{1}{2}\lambda\sigma_p^2 = E(r_p) - \frac{1}{2}\times 2 \times \sigma_p^2 = E(r_p) - \sigma_p^2$

The client's utility for Asset Allocations A, B, and C are as follows:

U_A=10.0%-(20%)^2=6.0%

U_B=7.0%-(10%)^2=6.0%

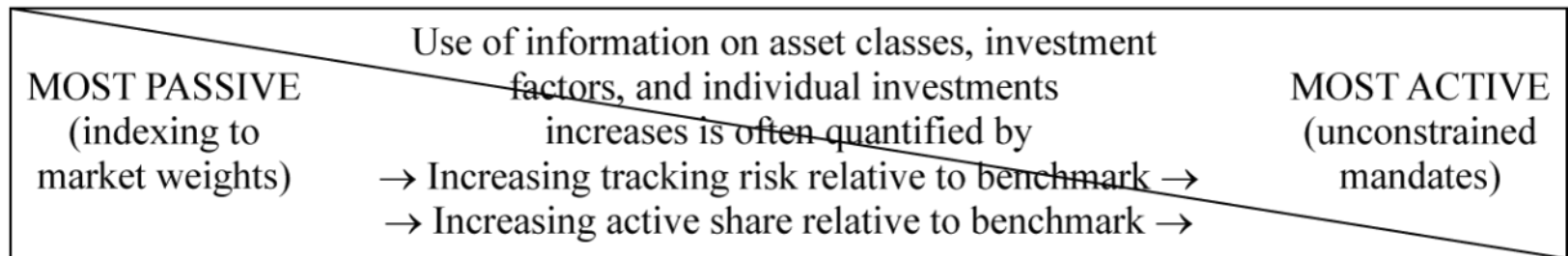U_C=5.25%-(5%)^2=5.0%

The client would be <u>indifferent between A and B</u> based only on their common perceived certainty-equivalent return of 6%.

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5. Strategic Implementation Choices

➢ **Two dimensions of passive/active choices**
- Passive/active management of the strategic asset class weights;(whether to deviate from the SAA tactically or not)
- Passive and active management of allocations to asset classes.

➢ **Passive/Active Management of Allocations to Asset Classes**
- Passive does not react to changes in the investor's CME or insights into individual investments;
- Active will respond to changing CME or insights resulting in changes to portfolio composition.

➢ **Tactical asset allocation (TAA) and dynamic asset allocation (DAA)**
- **Tactical asset allocation (TAA)** involves deliberate short-term deviations from the strategic asset allocation;
- **Dynamic asset allocation (DAA):** a strategy incorporating deviations from the strategic asset allocation that are motivated by longer-term valuation signals or economic views.

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Strategic Implementation Choices

➤ **Passive/Active Spectrum**

	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 PASSIVE (indexing to market weights)		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.

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6. Strategic Considerations in Rebalancing

➢ **Rebalancing** is the discipline of adjusting portfolio weights to more closely align with the strategic asset allocation.

➢ **Approaches to rebalancing**

- Calendar rebalancing: on a periodic basis
- Percent-range rebalancing (range-based rebalance)
  - ✓ Trigger points or Rebalance range (or corridor)

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Strategic Considerations in Rebalancing

➤ **Factors affecting the optimal corridor width of an asset class (Without weighing costs and benefits in the abstract)**

- ● **Positively related to optimal corridor width**
  - ✓ **Transaction costs**: High transaction costs set a high hurdle for rebalancing benefits to overcome.
  - ✓ **Risk tolerance**: Higher risk tolerance means less sensitivity to divergences from the target allocation.
  - ✓ **Correlation with the rest of the portfolio**: When asset classes move in sync, further divergence from target weights is less likely.
- ● **Inversely related to optimal corridor width**
  - ✓ **Volatility of the rest of the portfolio**: Higher volatility makes large divergences from the strategic asset allocation more likely.
  - ✓ An asset class's own volatility: Higher volatility makes large divergence from the strategic asset allocation more likely.

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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 in case further divergence
Beliefs in momentum favor/ mean reversion	Beliefs in momentum, wider ranges; Mean reversion, narrower ranges
Liquidity	Illiquid investments, typically associated with larger trading costs, encourage 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%)

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Strategic Considerations in Rebalancing

➢ **Frequency of the portfolio valued**

- The narrower corridor, the more frequent rebalance

- The more frequent the monitoring, the greater the precision in implementation

- More frequent rebalancing, higher cost

➢ **Fully or partially correcting**

- Rebalance back to target weights

- Rebalance to range edge

- Rebalance halfway between the range-edge trigger point and the target weight

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Strategic Considerations in Rebalancing

➢ **Disciplined rebalancing has tended to reduce risk while incrementally adding to returns.**
  ● Rebalancing earns a diversification return.
    ✓ The compound growth rate of a portfolio is greater than the weighted average compound growth rates of the component portfolio holdings (given positive expected returns, positive asset weights, and sufficiently low transaction costs).
  ● Rebalancing earns a return from being short volatility.
    ✓ In the case of a portfolio consisting of a risky asset and a risk-free asset, the return to a rebalanced portfolio can be replicated by creating a buy-and-hold position in the portfolio, writing out-of-the-money puts and calls on the risky asset, and investing the premiums in risk-free bonds.
    ✓ As the value of puts and calls is positively related to volatility, such a position is called being short volatility (or being short gamma, by reference to the option Greeks).

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Reading 13

Principles of Asset Allocation

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Framework

1. Developing asset-only asset allocations
   - MVO
     - Process
     - Corner portfolio
     - Criticisms of MVO
   - Addressing the Criticisms of MVO
     - Add constraints
     - Resampled MVO
     - Reverse optimization
     - Black-Litterman model
     - Non-normal optimization
     - Factor-based model
     - MCS
2. Developing liability-relative asset allocation
3. Developing goals-based asset allocations
4. Heuristics and other approaches
5. Risk budgeting and Risk Party

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1.1 Asset-Only: MVO

➢ MVO requires three sets of inputs: returns, risks (standard deviations), and pair-wise correlations for the assets in the opportunity set, and the objective function expressed as follows:

$$U_{\mathrm{m}} = E(\mathbf{R}_m) - 0.005\lambda\sigma_{\mathrm{m}}^2$$

➢ There are some issues to consider:
- Non-constraint vs no negative weights;
  - ✓ The simplest optimization places no constraints on asset class weights except the budget constraint that weights sum to 1.
  - ✓ The non-negativity constraint leads to corner-portfolio EF.
- Only risky asset vs separating out cash and cash equivalent as risk-free asset (non-constraint).
  - ✓ Cash is treated as risky asset → risky-asset EF
  - ✓ Cash and cash equivalent are treated as risk-free assets → linear EF (CML)

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Corner Portfolio

➢ **With short sale restrictions**, the frontier changes from a smooth curve to one with corner portfolios

➢ A **corner portfolio** is formed when the weights of an asset go from zero to positive or vice versa

  ● No negative weights

➢ We can approximate the standard deviation for an efficient portfolio given those of **adjacent corner portfolios**

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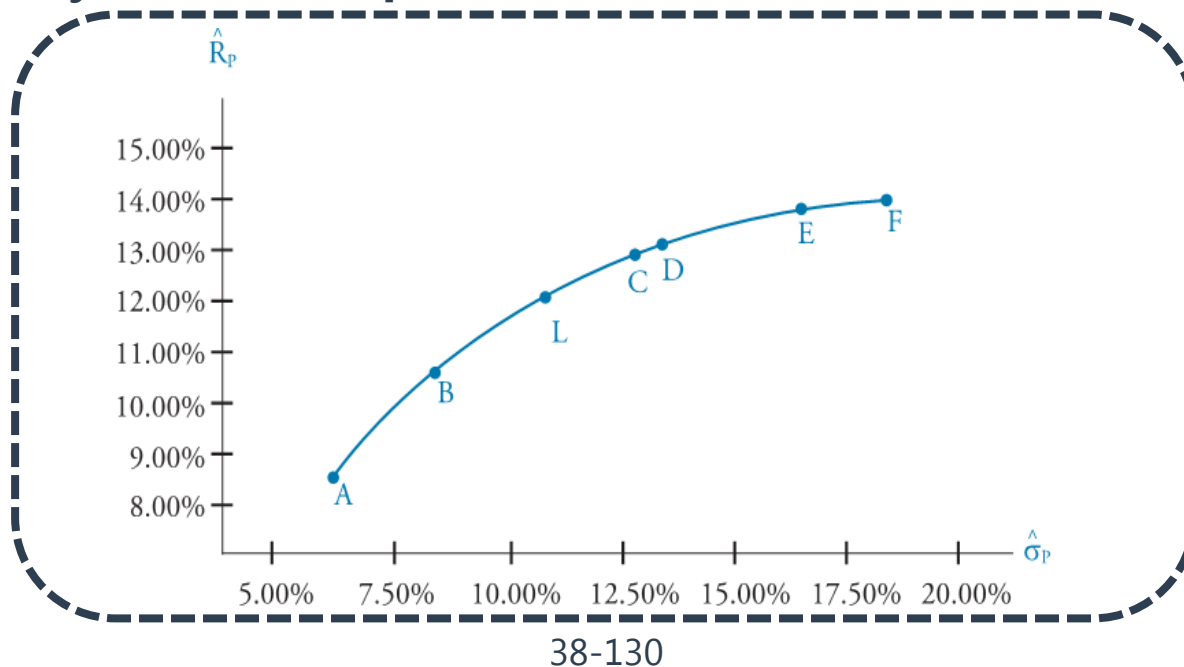
Example

➤ An endowment's return objective is 7%, which includes a spending rate of 3%

➤ Given the corner portfolio returns on the next slide and assuming no short sales, **determine the standard deviation and asset weights for the portfolio that will meet their objective**.

Corner Portfolio	E(R)	σ	Sharpe Ratio	Asset A Weight	Asset B Weight	Asset C Weight
1	9%	16%	0.436	100%	0%	0%
2	7.5%	11.5%	0.478	80%	20%	0%
3	5.5%	7.7%	0455	0%	40%	60%
4	5.3%	7.6%	0.434	0%	0%	100%

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Example

> **Asset Class Contributions**
> - Portfolio 2 and 3 are adjacent corner portfolios.
>   - ✓ $\omega_2 \times 7.5\% + \omega_3 \times 5.5\% = 7\%$, $\omega_2 + \omega_3 = 1$
>   - ✓ Calculate: $\omega_2 = 75\%, \omega_3 = 25\%$
> - To calculate how much the strategic portfolio invests in assets A, B, and C, use the 75/25 weights in Corner Portfolios 2 and 3:
>   - ✓ $\omega_A = 75\% \times 80\% + 25\% \times 0\% = 60\%$
>   - ✓ $\omega_B = 75\% \times 20\% + 25\% \times 40\% = 25\%$
>   - ✓ $\omega_C = 75\% \times 0\% + 25\% \times 60\% = 15\%$
>
> **Estimating the Standard Deviation**
> - The approximate standard deviation of the portfolio is a weighted average of the standard deviations of Corner Portfolios 2 and 3:
> - σ_P = 0.75(0.115) + 0.25(0.077)
> σ_P = 0.1055 = 10.55%
> - Note that the estimate is an upper it to the true standard deviation
>   - ✓ Does not account for diversification (correlation)

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Corner Portfolio

➢ **Introducing a Risk-Free Asset**

- If there is a **risk-free asset** available, combining it with the corner portfolio with the **highest Sharpe ratio** can increase the investor's utility
  - ✓ This is equivalent to combining the risk-free asset with the tangency portfolio
  - ✓ In capital market theory, the market portfolio (i.e., the tangency portfolio) has the highest available Sharpe ratio of any portfolio on the efficient frontier
- If the return on the corner portfolio with highest Sharpe ratio is greater than the required return, hold positive weights of the corner portfolio and the risk free asset
- If its return is less than the required return, borrow at the risk-free rate to lever up the return
  - ✓ This assumes no restrictions on leverage

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Example

> **Calculating the Portfolio Weights**
>
> - In our example, **Corner Portfolio 2 has the highest Sharpe ratio**
> - Given a return objective of 7%, risk-free rate of 2%, solve for the weights of Corner Portfolio 2 and R_F:
>
> $$0.07 = 0.075w_2 + 0.02(1 - w_2)$$
> $$w_2 = 0.909; \ w_{RF} = 0.091$$
>
> - Put 90.9% of the value of the portfolio in Corner Portfolio 2 and 9.1% in the risk-free asset
>
> **Calculating the Standard Deviation**
>
> - the portfolio standard deviation is determined as follow:
>
> $$\sigma_P = 0.909(0.115) + 0.091(0)$$
> $$\sigma_P = 0.1045 = 10.45\%$$

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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**; (**Factor-based model**)
- MVO allocations may have no direct connection to the factors affecting any **liability or consumption streams**; (**ALM**)
- MVO is **a single-period framework** that does not take account of trading/rebalancing costs and taxes. (**MCS**)

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Asset-Only: MVO

➢ **Efficient Frontier Asset Allocation Area Graph—Base Case**

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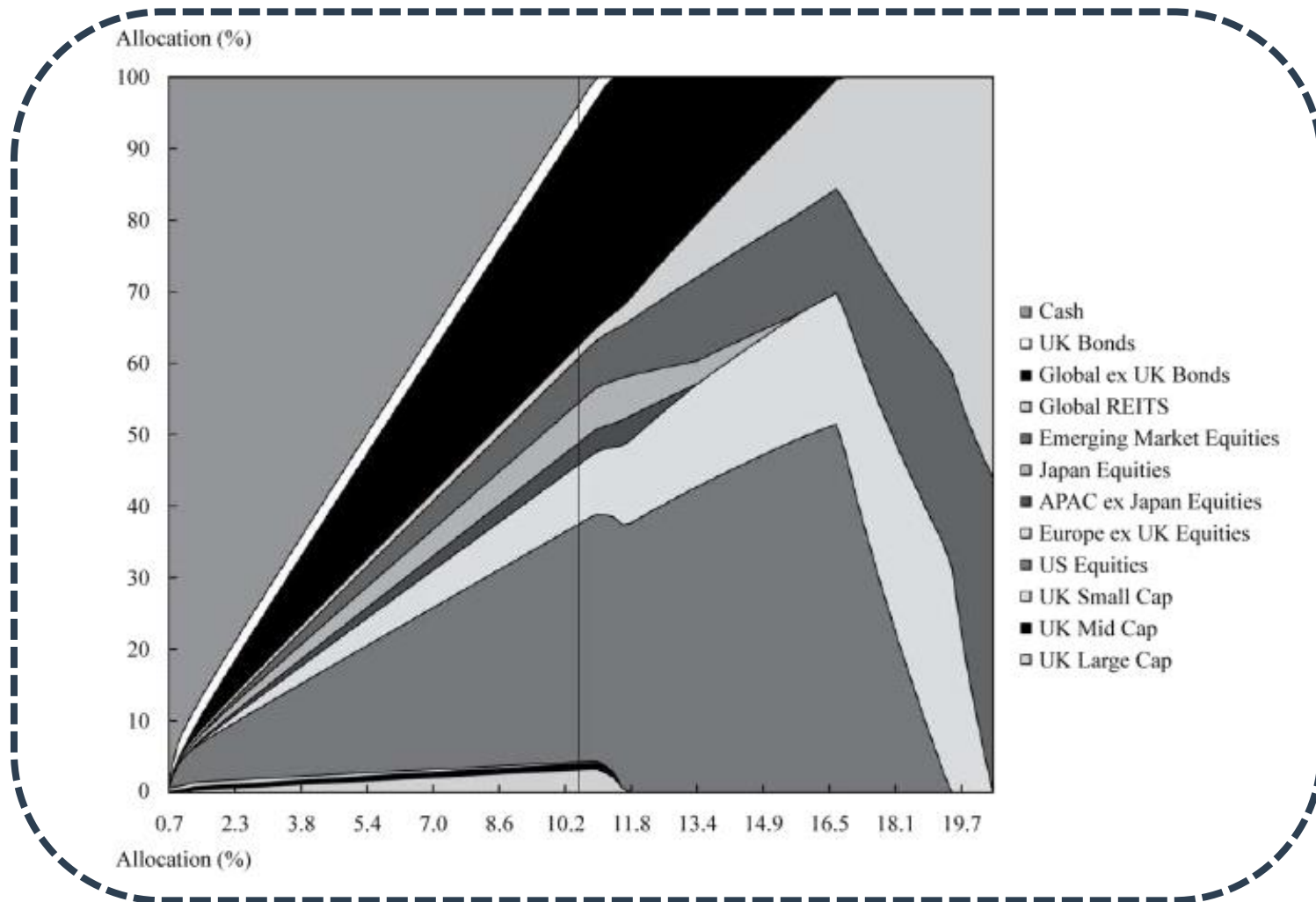
Asset-Only: MVO

➢ **Efficient Frontier Asset Allocation Area Graph—Changed Expected Returns**
  ● Increased the expected return of Asia Pacific ex Japan equities from 8.5% to 9.0% and decreased the expected return of Europe ex UK equities from 8.6% to 8.1%

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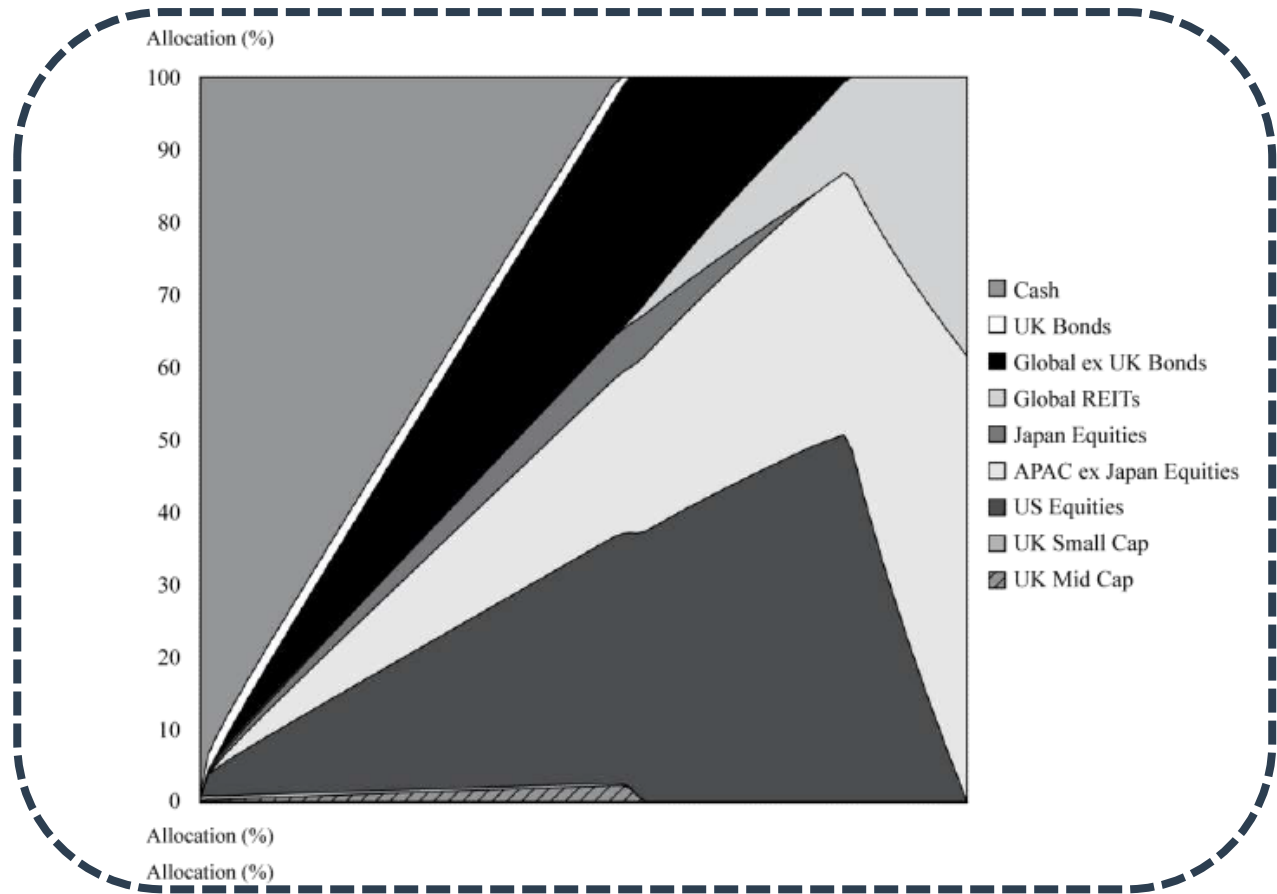
1.2 Addressing Criticisms - Adding Constraints

➢ There are two primary reasons (**advantage**) practitioners typically apply additional constraints:

- To incorporate real-world constraints into the optimization problem ;
- And to help overcome some of the potential shortcomings of mean–variance optimization elaborated above (input quality, input sensitivity, and highly concentrated allocations).

➢ **Disadvantage**: If a very large number of constraints are imposed, one is no longer optimizing but rather specifying an asset allocation through a series of binding constraints.

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Addressing Criticisms - Adding Constraints

➢ When running an optimization, in addition to the typical budget constraint and the non-negativity constraint, one can impose additional constraints.

- **Specify a set allocation to a specific asset**
    - ✓ 30% to real estate or 5% to private equity
- **Specify an asset allocation range for an asset**
    - ✓ The emerging market allocation must be between 5% and 20%.
- **Specify an upper limit, due to liquidity considerations**
    - ✓ Such as private equity or hedge funds
- **Specify the relative allocation of two or more assets**
    - ✓ The allocation to emerging market equities must be less than the allocation to developed equities

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1.3 Addressing Criticisms - Resampled MVO

➢ Resampled mean–variance optimization **combines Markowitz's mean– variance optimization framework with Monte Carlo simulation** and, all else equal, leads to more-diversified asset allocations.

- Resampling uses MCS to estimate a large number of potential capital market assumptions for MVO, which lead to an equal number of MVO frontiers, also referred to as simulated frontiers.

- The resulting asset allocations, or portfolio weights, from these simulated frontiers are saved and averaged (using a variety of methods), and, eventually, for the **resampled frontier**.

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Addressing Criticism - Resampled MVO

➢ **Criticisms including the following:**

- Some frontiers have concave "bumps" where expected return decreases as expected risk increases;

- The "riskier" asset allocations are over-diversified;

- The asset allocations inherit the estimation errors in the original inputs; and

- The approach lacks a foundation in theory.

Efficient Frontier Asset Allocation Area Graph, Returns with Resampling

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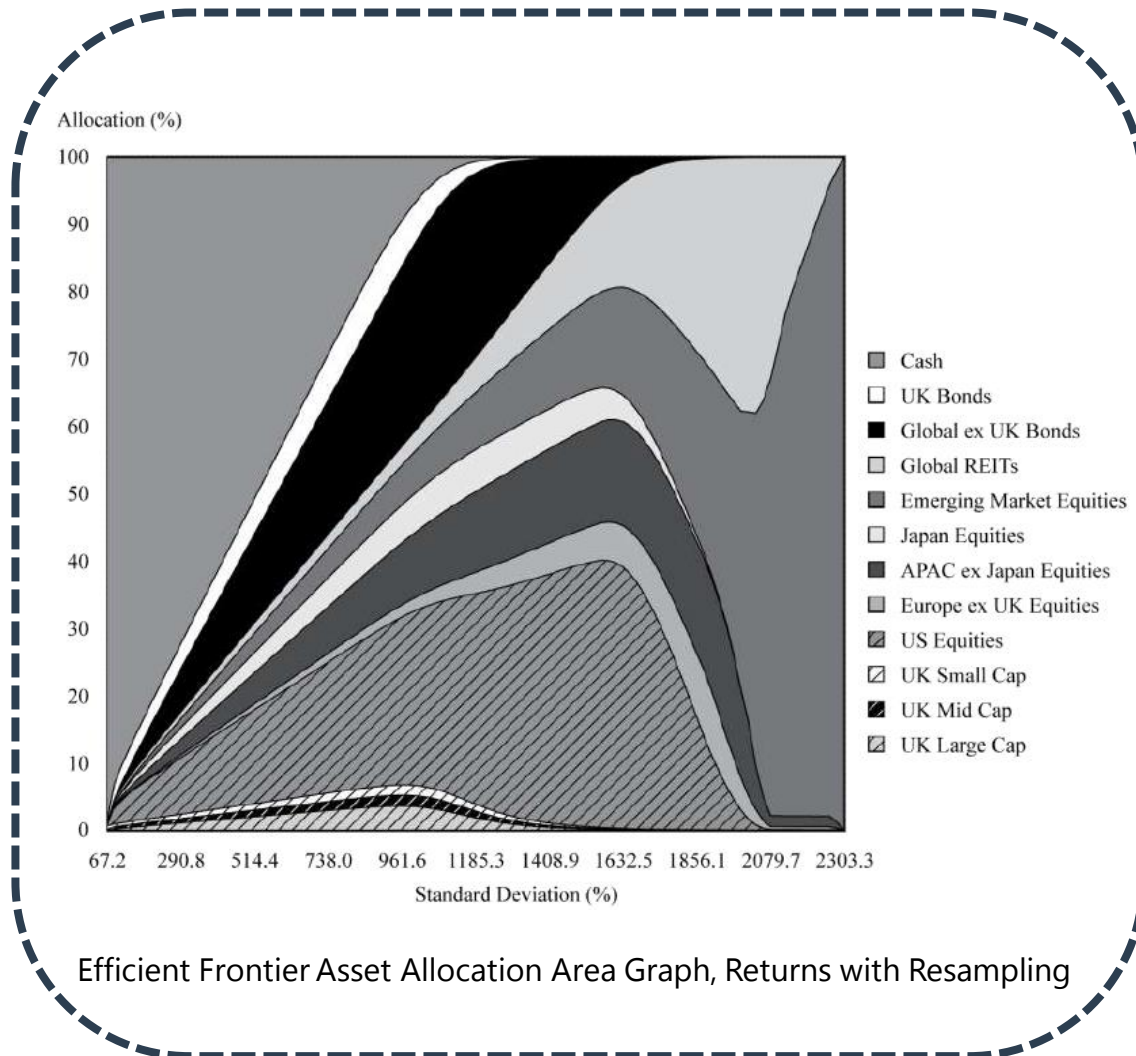
1.4 Addressing Criticisms - Reverse Optimization

➤ **Reverse optimization** is a powerful tool that helps explain the implied returns associated with any portfolio. It can be used to estimate expected returns for use in a forward-looking optimization.

➤ Reverse optimization takes as its **inputs a set of asset allocation weights of global market portfolio** that are assumed to be optimal and with additional inputs of covariance and the risk aversion coefficient, solves for expected returns (also called **implied returns**).

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Addressing Criticisms - Reverse Optimization

➢ The process is depicted below.

```
┌─────────────────────────────┐        ┌──────────────────────────────┐        ┌────────────────────────┐
│          Inputs             │        │        Reverse MVO           │        │        Outputs         │
│  • Assumed optimal          │        │  • Maximize utility          │        │  • Implied returns     │
│    asset allocations        │───────▶│  • Subject to constraint(s)  │───────▶│                        │
│  • Variances                │        │                              │        │                        │
│  • Covariances              │        └──────────────────────────────┘        └───────────┬────────────┘
│    (correlations)           │                                                             │
│  • Risk aversion factor     │                                                             │
│  • Constraints              │                                                             ▼
└─────────────────────────────┘                                                ┌────────────────────────┐
                                                                                │         Inputs         │
┌─────────────────────────────┐        ┌──────────────────────────────┐        │  • Implied returns     │
│          Outputs            │        │            MVO               │        │  • Variances           │
│  • Revised asset            │        │  • Maximize utility          │        │  • Covariances         │
│    allocations              │◀───────│  • Subject to constraint(s)  │◀───────│    (correlations)      │
│  • Portfolio expected       │        │                              │        │  • Risk aversion       │
│    return                   │        └──────────────────────────────┘        │    factor              │
│  • Portfolio variance       │                                                │  • Constraints         │
└─────────────────────────────┘                                                └────────────────────────┘
```

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Addressing Criticisms - Reverse Optimization

➢ Some practitioners will find the link between reverse optimization and CAPM equilibrium elegant.

- First, use the weights associated with the asset classes (or various indexes) to form a working version of the global market portfolio;

- And use the beta of each asset relative to our working version of the global market portfolio;

- Then to infer what expected returns would be if all assets were priced by the CAPM according to their market beta. Where, we assume a risk-free rate of 2.5% and a global market risk premium of 4%;

- Run a new MVO.

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1.5 Addressing Criticisms - BL Model

➤ The **Black–Litterman model** has helped make the MVO framework more useful. It **enables investors to combine their unique forecasts of expected returns** with reverse optimized returns in an elegant manner.
  - Starts with excess returns (in excess of the risk-free rate) produced from reverse optimization;
  - And then provides a technique for altering reverse-optimized expected returns in such a way that they reflect an investor's own distinctive views.
  - A new MVO is run.

➤ Deriving expected returns by reverse optimization or by reverse optimization tilted toward an investor's views on asset returns (the Black-Litterman model) is one means of addressing the tendency of MVO to produce efficient portfolios that are not well diversified.

➤ **Reverse optimization and the Black–Litterman model** address the issue of MVO's sensitivity to small differences in expected return estimates by anchoring expected returns to those implied by the asset class weights of a proxy for the global market portfolio.

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Addressing Criticisms - BL Model

Exhibit 13   Comparison of Black–Litterman and Reverse-Optimized Returns

Asset Class	Reverse-Optimized Returns	Black–Litterman Returns	Difference
UK large cap	6.62%	6.60%	−0.02%
UK mid cap	6.92	6.87	−0.05
UK small cap	7.08	7.03	−0.05
US equities	7.81	7.76	−0.05
Europe ex UK equities	8.62	8.44	−0.18
Asia Pacific ex Japan equities	8.53	8.90	0.37
Japan equities	6.39	6.37	−0.02
Emerging market equities	8.96	9.30	0.33
Global REITs	9.02	9.00	−0.01
Global ex UK bonds	4.03	4.00	−0.03
UK bonds	2.94	2.95	0.01
Cash	2.50	2.50	0.00

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Examples
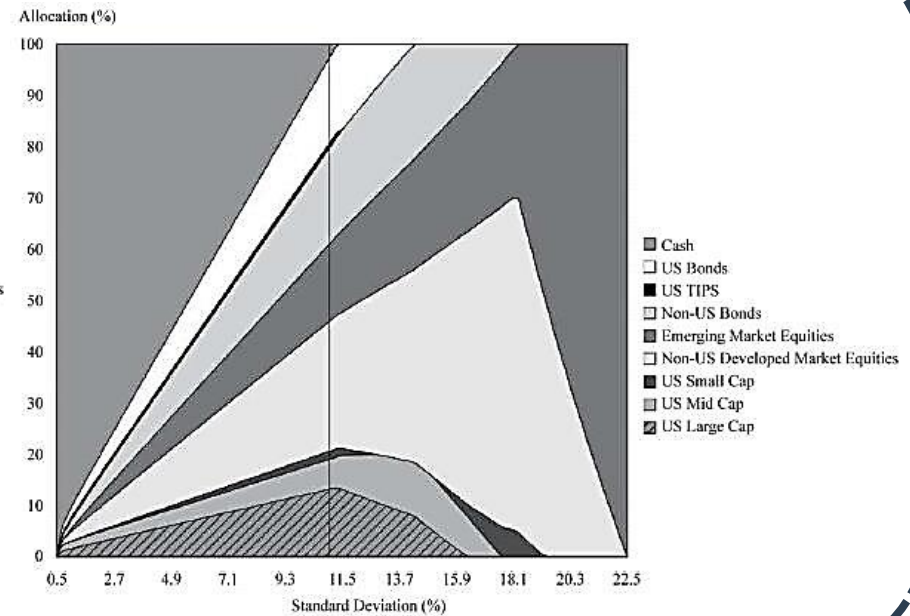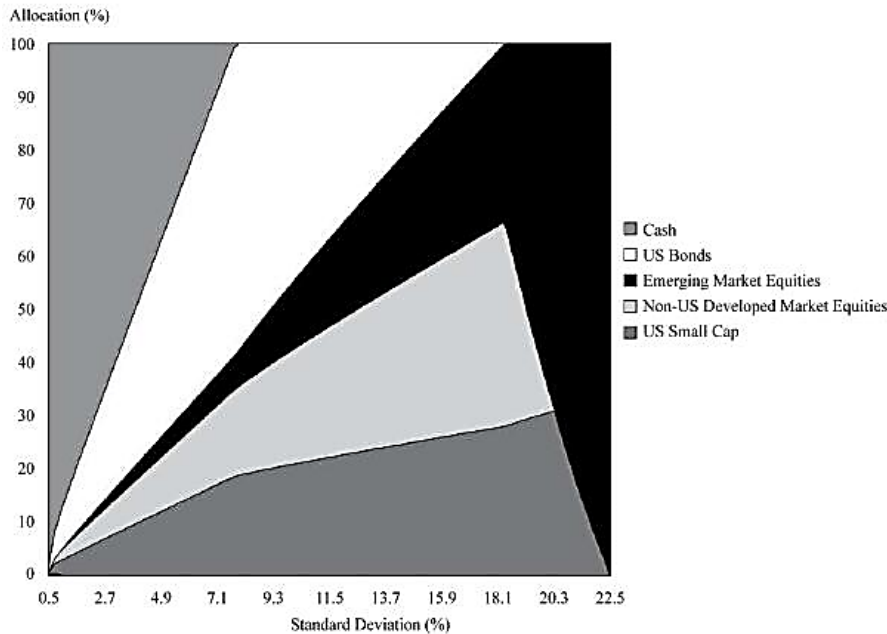
➤ Identify three techniques that the asset allocations in Panel B might have incorporated to improve the characteristics relative to those of Panel A.

- To achieve the better-diversified efficient frontier shown in Panel B, several methods might have been used, including reverse optimization, the Black–Litterman model, and constrained asset class weights.

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1.6 Addressing Criticisms-Non-Normal Optimization

➢ **A normal distribution** is fully explained by the first two moments because the skewness and (excess) kurtosis of the normal distribution are both zero.

➢ Unfortunately, variance or standard deviation is an incomplete measure of risk when returns are not normally distributed. Investor preferences may go beyond the first two moments (**mean and variance**) of a portfolio's return distribution. The third and fourth moments are, respectively, skewness and kurtosis.

  - **Skewness** measures the degree to which return distributions are asymmetrical
  - **Kurtosis** measures the thickness of the distributions' tails (i.e., how frequently extreme events occur)

➢ A number of variations of these more sophisticated optimization techniques have been put forth, most of them **consider the non-normal return distribution characteristics** and use a more sophisticated definition of risk, such as:

  - Mean–semivariance optimization
  - Mean–conditional value-at-risk optimization
  - Mean–variance-skewness optimization
  - Mean–variance-skewness-kurtosis optimization

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1.7 Asset-Only: Factor-Based Model

➢ Factor-based asset allocation also requires three sets of inputs: returns, risks (standard deviations), and pair-wise correlations for **these factors in the opportunity set**, in order to get an optimized solution.

- MVO and more sophisticated approaches that overcome some of the limitations or weaknesses of as applied to an opportunity set consisting of traditional, non-overlapping asset classes.

- An alternative approach used by some practitioners is to move away from an opportunity set of asset classes to an opportunity set consisting of investment factors, or factor-based asset allocation.

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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.

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Asset-Only: Factor-Based Model

Factor/Asset Class	Factor Definition	Compound Annual Factor Return	Standard Deviation	Total Return	Standard Deviation
Treasury bonds	Long-term Treasury bonds			7.77%	5.66%
Market	Total market return – Cash	7.49%	16.56%	12.97	17.33
Size	Small cap – Large cap	0.41	10.15	5.56	10.65
Valuation	Value – Growth	0.68	9.20	5.84	9.76
Credit	Corporate – Treasury	0.70	3.51	5.87	3.84
Duration	Long Treasury bonds – Treasury bills	4.56	11.29	9.91	11.93
Mortgage	Mortgage-backed – Treasury bonds	0.30	3.38	5.45	3.83
Large growth	—	—	—	12.64	19.27
Large value	—	—	—	13.23	16.52
Small growth	—	—	—	12.30	25.59
Small value	—	—	—	14.54	19.84
Mortgage-backed sec.	—	—	—	8.09	6.98
Corporate bonds	—	—	—	8.52	7.52
Treasury bonds	—	—	—	7.77	5.66
Cash	—	—	—	5.13	1.23

1.8 Asset-Only: MCS

➤ **Monte Carlo simulation complements** MVO by addressing the limitations of MVO as a **single-period** framework.

➤ MCS can help **paint a realistic picture of potential future outcomes**, including the likelihood of meeting various goals, the distribution of the portfolio's expected value through time, and potential maximum drawdowns.

➤ Monte Carlo simulation can effectively **grapple with a range of practical issues** that are difficult or impossible to formulate analytically.

- **Rebalancing and taxes**: In the multi-period world, rebalancing triggers the realization of capital gains and losses. Given a specific rebalancing rule, different SAAs will result in different patterns of tax payments.

- **Path dependent**: Investors save/deposit money in and spend money out of their portfolios; thus, in the more typical case, terminal wealth is path dependent because of the interaction of cash flows and returns.

1.9 Liquidity Considerations

➢ **Definition**

- **Liquid asset classes**: such as publicly listed equities and bonds.

- **Less liquid asset classes**: such as direct real estate, infrastructure, and private equity.

➢ **When make asset-allocation decisions, there are two problems for the less liquid asset classes:**

- Due to the lack of accurate indexes, it is more challenging to make capital market assumptions for these less liquid asset classes

- Even if there were accurate indexes, there are no low-cost passive investment vehicles to track them.

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Liquidity considerations

➤ **In addressing asset allocation involving less liquid asset classes, practical options include the following:**

- (1) Exclude less liquid asset classes from the asset allocation decision and then consider real estate funds, infrastructure funds, and private equity funds as potential implementation vehicles when fulfilling the target strategic asset allocation.

- (2) Include less liquid asset classes in the asset allocation decision and attempt to model the inputs to represent the specific risk characteristics associated with the likely *implementation vehicles*.

- (3) Include less liquid asset classes in the asset allocation decision and attempt to model the inputs to represent the highly diversified characteristics associated with the true asset classes.

  - ✓ Use listed real estate indexes, listed infrastructure, and public equity indexes that are deemed to have characteristics similar to their private equity counterparts to help estimate the risk of the less liquid asset classes and their correlation with the other asset classes in the opportunity set.

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Framework

1. Developing asset-only asset allocations
2. Developing liability-relative asset allocation
   - Surplus optimization
   - Hedging\return-seeking portfolio
   - Integrated asset-liability approach
3. Developing goals-based asset allocations
4. Heuristics and other approaches
5. Risk budgeting and Risk Party

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2. Liability-relative Asset Allocations

➤ Liability-relative asset allocation is aimed at the general issue of rendering decisions about asset allocation in conjunction with the investor's liabilities.

- Liability-relative investors view assets as an inventory of capital, which is available to achieve goals and to pay future liabilities.
- Were developed in **an institutional investor** context, but these ideas have also been applied to individual investors.
  - ✓ Because many large institutional investors possess legal liabilities and operate in regulated environments in which an institution's inability to meet its liabilities with current capital has serious consequences.

➤ **Liability-relative Asset Allocations Methods include:**
- Surplus optimization
- Hedging/Return-seeking Portfolio Approach
- Integrated asset-liability Approach

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2.1 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.

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Surplus Optimization

➢ Asset liability management (ALM) considers the allocation of assets with respect to a given liability or set of liabilities.

➢ The ALM approach maximize the difference (the surplus) between assets and liabilities at each level of risk (much like the efficient frontier represents the maximum return at each level of risk).
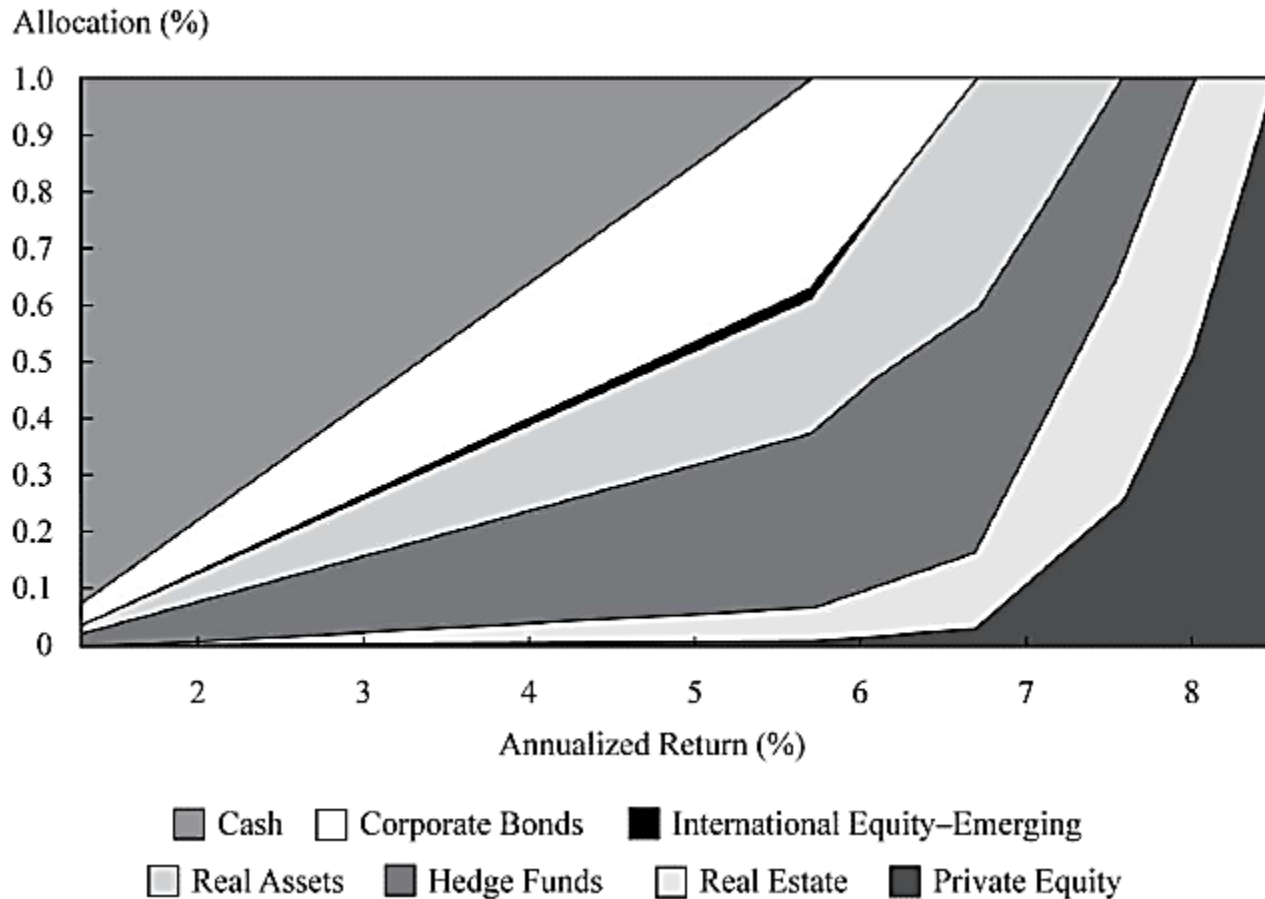
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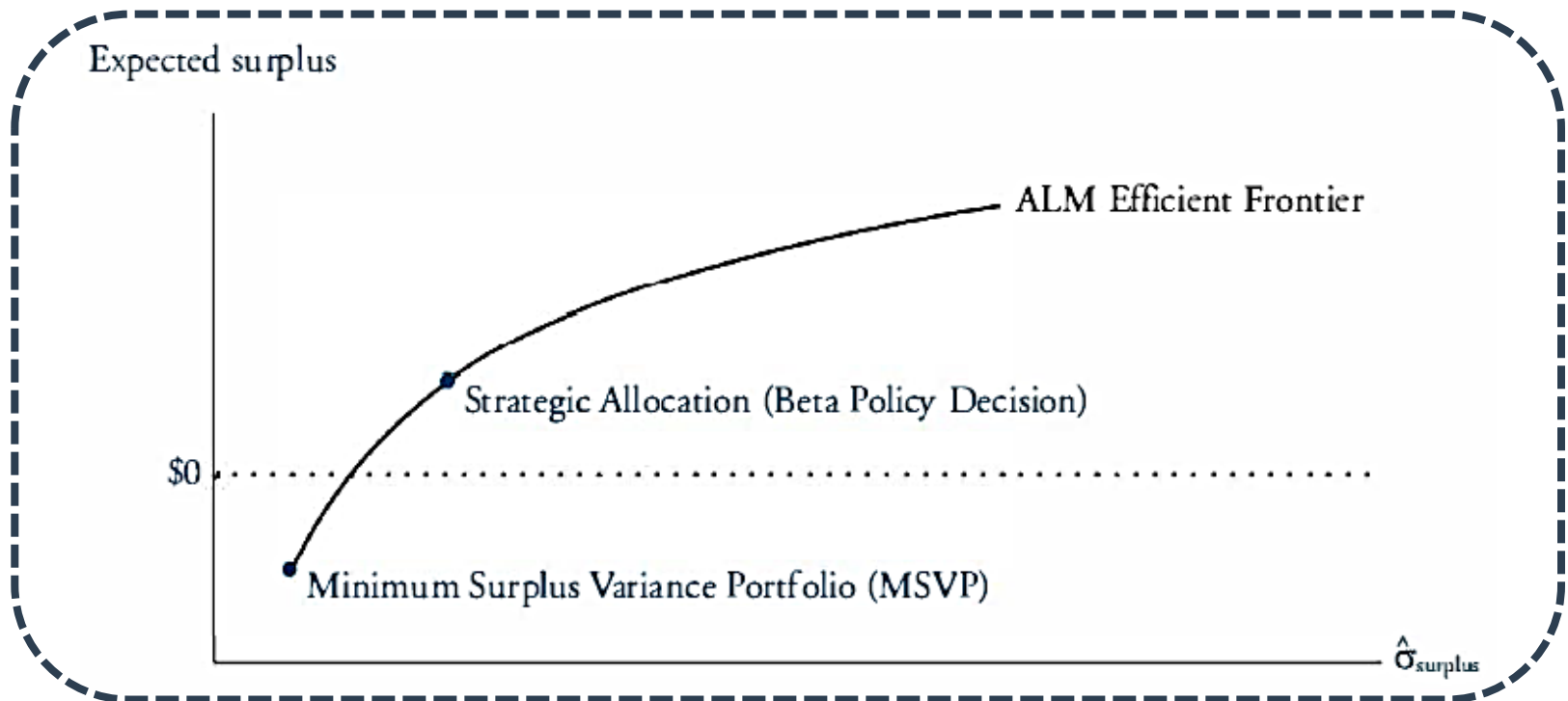
Surplus Optimization

➤ **Surplus Efficient Frontier Asset Allocation**

Exhibit 29. Surplus Efficient Frontier Asset Allocation Area Graph

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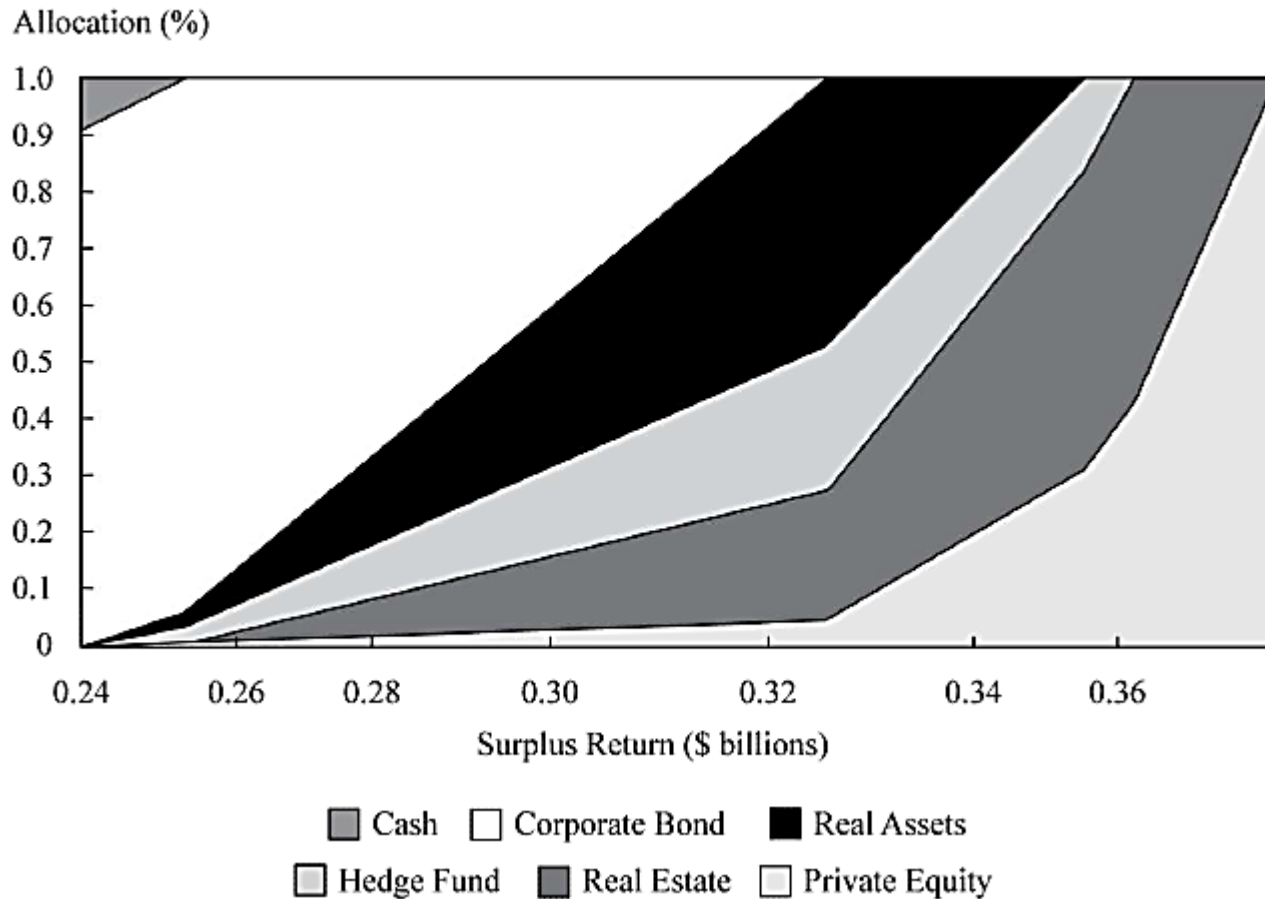
Surplus Optimization

➢ **Asset-Only Efficient Frontier Asset Allocation**

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Surplus Optimization

➢ **The comparison between the two asset mixes (asset-only and surplus):**
  - The asset mixes are very different on the **conservative side** of the two frontiers.
    - ✓ The most conservative mix for the **surplus efficient frontier** consists mostly of the US corporate bond index because it results in the lowest volatility of surplus over the one-year horizon.
    - ✓ In contrast, the most conservative mix for the **asset-only efficient frontier** consists chiefly of cash.
  - The two asset mixes (asset-only and surplus) become similar as the degree of risk aversion decreases, and they are identical for the most aggressive portfolio (private equity).
  - Bonds disappear from the frontier about halfway between the most conservative and the most aggressive mixes.

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2.2 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.

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Hedging/Return-Seeking Portfolio Approach

➢ **Limitations and ways of addressing these problems:**

- First, **if the funding ratio is less than 1, the investor cannot create a fully hedging portfolio** unless there is a sufficiently large positive cash flow (contribution).
  - ✓ In this case, the sponsor might increase contributions enough to generate a positive surplus.
  - ✓ Or applications of variants of the two-portfolio approach are possible, such as partial hedge variant.
- A second barrier occurs when a **true hedging portfolio is unavailable**. An example involves losses due to weather-related causes, such as hurricanes or earthquakes.
  - ✓ In these cases, the investor might be able to partially hedge the portfolio with instruments that share some of the same risks. The investor has "basis risk" when imperfect hedges are employed.
  - ✓ As an aside, the investor might be able to set up a contract with someone who, for a fee, will take on the liability risk that cannot be hedged. Insurance contracts have this defining characteristic.

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Example: 2018 Q9-B

> Sarzi was recently hired as the investment advisor for the ZTA Corporation pension fund. The current market value of the pension fund's assets is USD 10 billion, and the present value of the fund's liabilities is USD 8 billion. The fund has been managed using an asset-only approach, but Sarzi recommends that the risk-averse ZTA board of directors consider adopting a liability-relative method, specifically the hedging/return-seeking portfolio approach.

> Sarzi assumes that the returns of the fund's liabilities are driven by changes in the returns of index-linked government bonds. Exhibit presents three potential asset allocation choices for the pension fund.

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Example: 2018 Q9-B

Potential Asset Allocation Choices for ZTA Corporation's Pension Fund			
Asset Class	Allocation 1	Allocation 2	Allocation 3
Cash	30%	0%	5%
Index-lined government bonds	50%	80%	10%
Corporate bonds	10%	5%	25%
Equities	10%	15%	60%
Portfolio Statistics			
Expected return	3.5%	3.9%	6.4%
Expected standard deviation	6.8%	7.9%	12.1%

➤ **Determine** which asset allocation would be most appropriate for the pension fund given Sarzi's recommendation. **Justify** your response.

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Example: 2018 Q9-B

> **Correct Answer: Allocation B**
> The pension fund currently has a **surplus of USD 2 billion** (USD 10 billion – USD 8 billion) where USD 8 billion is the present value of the fund's liabilities.
> To adopt a hedging/return-seeking portfolio approach, the board would **first hedge the liabilities** by allocating an amount equal to the present value of the fund's liabilities, **USD 8 billion, to a hedging portfolio**. The hedging portfolio must include assets whose returns are driven by the **same factors** that drive the returns of the liabilities, which in this case are the **index-linked government bonds**. So, the board should **allocate 80%** (USD 8 billion / USD 10 billion) of the fund's assets to index-linked government bonds.
> The residual **USD 2 billion surplus** would then be invested into a **return-seeking portfolio**.
> **Allocation 2 is the most appropriate asset allocation** for the fund because it allocates 80% of the fund's assets to index-linked government bonds, and the remaining 20% of fund assets in a return-seeking portfolio consisting of corporate bonds and equities.

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2.3 Integrated Asset-Liability Approach

➢ The approach, integrating the liability portfolio with the asset portfolio, requires a formal method for selecting liabilities and for linking the asset performance with changes in the liability values.

- **The previous two approaches** are most appropriate when asset allocation decisions are made after, and relatively independently of, decisions regarding the portfolio of liabilities.
- However, the **integrated asset-liability approach** integrates and jointly optimizes asset and liability decisions.

➢ This approach can be implemented in a factor-based model, linking the assets and liabilities to the underlying driving factors.

➢ It has the potential to improve the institution's overall surplus.

➢ The capital required for this approach is often determined by reference to the output of integrated asset–liability systems in banks and property/casualty insurance and re-insurance companies.

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Comparing the approaches

➤ **Surplus optimization and the hedging/return-seeking portfolio**
- The **surplus optimization approach** links assets and the present value of liabilities through a correlation coefficient. The two-portfolio model does not require this input.
- Implementation of the **basic two-portfolio approach** depends on having an overfunded plan. A **variant of the two-portfolio approach** might be applied, however.
- **Surplus optimization** does not require an overfunded status. Both approaches address the present value of liabilities, but in different ways.

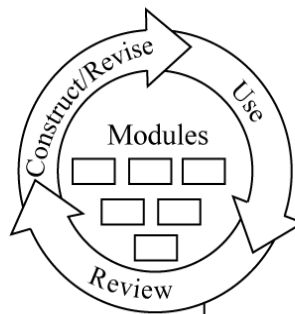| Surplus Optimization	Hedging/Return-Seeking Portfolios	Integrated Asset–Liability Portfolios
Simplicity	Simplicity	Increased complexity
Linear correlation	Linear or non-linear correlation	Linear or non-linear correlation
All levels of risk	Conservative level of risk	All levels of risk
Any funded ratio	Positive funded ratio for basic approach	Any funded ratio
Single period	Single period	Multiple periods

Framework

1. Developing asset-only asset allocations
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3. Goals-Based Asset Allocations

➢ **Goals-based asset allocation applies best to individuals who have multiple goals, time horizons, and urgency levels.**

➢ **The Goals-Based Asset Allocation Process**

- Describing Client Goals:
  - ✓ list all known 'needs' and 'wants'
  - ✓ Classify them in order of importance
  - ✓ Classify them as duration
- Constructing Sub-Portfolios or Select Old Sub-Portfolio
- The Overall Portfolio
- Revisiting the Module Process in Detail
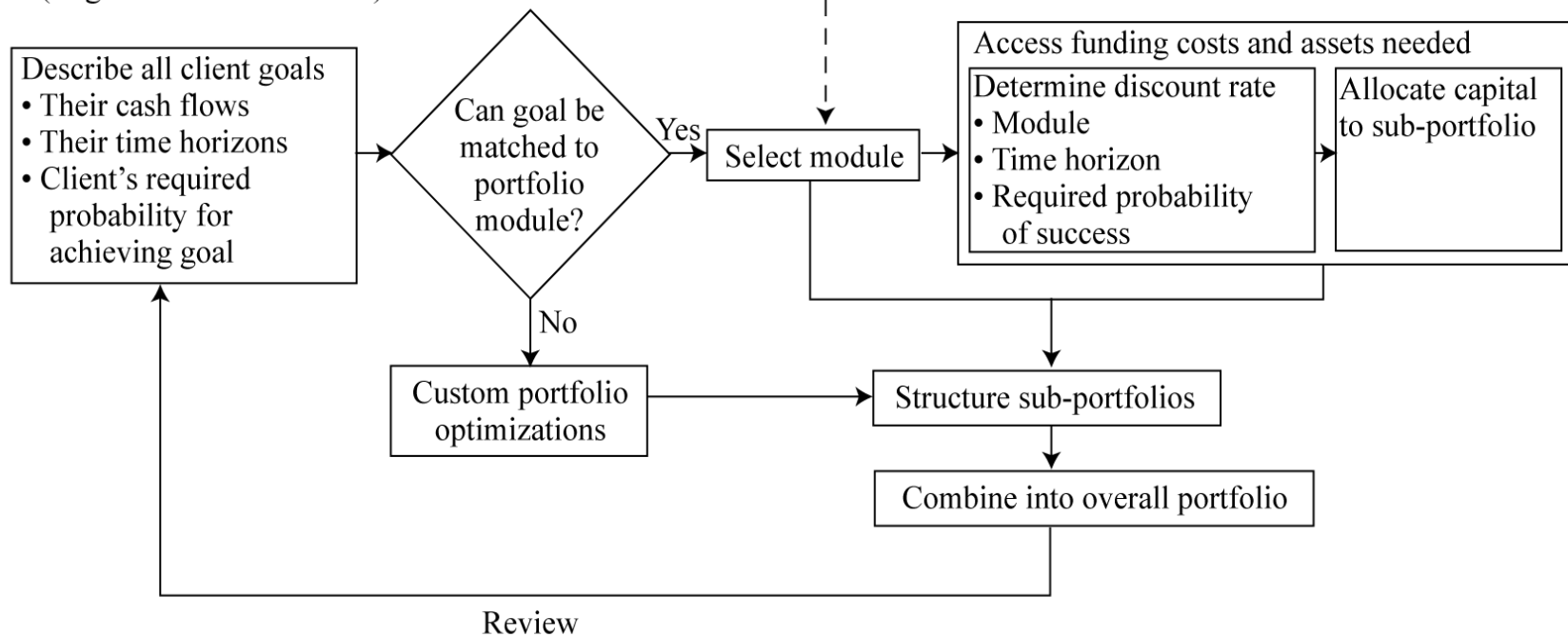- Periodically Revisiting the Overall Asset Allocation

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Module Construction and Revision

Construct/Revise

Use

Modules

Review

Module Process (Annual review/revision)

Client Process (Regular review/rebalance)

Describe all client goals
• Their cash flows
• Their time horizons
• Client's required probability for achieving goal

Can goal be matched to portfolio module?

Yes → Select module

No → Custom portfolio optimizations

Access funding costs and assets needed

Determine discount rate
• Module
• Time horizon
• Required probability of success

Allocate capital to sub-portfolio

Structure sub-portfolios

Combine into overall portfolio

Review

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Goals-Based - Constructing Sub-Portfolios

➢ **Allocate capital to sub-portfolios**

- According to each client goal, **pick the highest probability**- and horizon-adjusted discount rates to discount the expected cash flows, and then obtain the **lowest initially required capital** for each goal.

➢ **Excess capital**

- Think of additional goals
- Revisit their current goals
  - ✓ Bring the timing of payments forward
  - ✓ Raise their probability of success
- " Capital preservation "

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Example

> A client express a very strong desire to fund his children's college education expenses, which have an estimated present value of $275,000. The client have two teenage children who will soon begin college. The client also plans to fund an endowment at their alma mater in 20 years, which has an estimated present value of $500,000. The client tells his adviser he wants a high probability of success funding the endowment. The adviser recommends the client to follow a goals-based approach to asset allocation and offers three possible portfolios to consider. Selected data on the three portfolios are presented in the exhibit below.

	Cash	Fixed Income	Global Equities	Diversifying Strategies
Portfolio 1	35%	55%	10%	0%
Portfolio 2	10%	15%	65%	10%
Portfolio 3	10%	30%	40%	20%

Example

> Based on the exhibit, which portfolio *best* meets the client's education goal for their children?
> A. Portfolio 1
> B. Portfolio 2
> C. Portfolio 3

> **Correct Answer: A**
>
> Portfolio 1 best meets the Laws' education goal for their children. The estimated present value of the Laws' expected education expense is $275,000. Given that the children will be starting college soon, and the Laws have a very strong desire to achieve this goal, Portfolio 1, which stresses liquidity and stability, is most appropriate to meet the Laws' short-term education goal.

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Example

> Based on the exhibit, which portfolio *best* meets the client's goal to fund an endowment for their alma mater?
> A. Portfolio 1
> B. Portfolio 2
> C. Portfolio 3

> **Correct Answer: B**
> Portfolio 2 best meets the Laws' goal to fund an endowment for their alma mater in 20 years. In present value terms, the gift is valued at $500,000, with the Laws desiring a high probability of achieving this goal. Although slightly more conservative than the 75/25 global equity/bond mix, Portfolio 2 has a greater growth emphasis compared with Portfolios 1 and 3. Therefore, Portfolio 2 is best for funding the endowment at their alma mater given the goal's long-term horizon and the Laws' desire for a high probability of achieving it.

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Example: 2018 Q9-C

> Sarzi also advises James and Karen Rozeer, a married couple who recently retired with total assets of USD 10 million. The Rozeers have two goals they wish to achieve during their retirement:

> **Goal 1:** The Rozeers wish to have an 85% chance of transferring USD 7.5 million to their children in 10 years.

> **Goal 2:** The Rozeers wish to have a 75% chance of being able to donate USD 15 million to a charitable organization in 25 years.

> Sarzi recommends implementing a goals-based approach to construct a portfolio. He develops a set of sub-portfolio modules, which are presented in Exhibit. Sarzi suggests investing any excess capital in Module A.

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Example: 2018 Q9-C

"Highest Probability-and Horizon-Adjusted Return" Sub-Portfolio Modules Under Different Horizon and Probability Scenarios			
	Module A	**Module B**	**Module C**
Portfolio Characteristics			
Expected return	6.1%	7.5%	8.3%
Expected volatility	5.9%	7.9%	10.1%
Annualized Minimum Expectation Returns			
Time Horizon (years)	10		
Required Success			
85%	4.2%	5.0%	4.9%
75%	4.8%	5.8%	6.1%
Time Horizon (years)	25		
Required Success			
85%	4.9%	5.9%	6.2%
75%	5.3%	6.4%	6.9%

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Example: 2018 Q9-C

➢ **Construct** the overall goals-based asset allocation for the Rozeers given their two goals and Sarzi's suggestion for investing any excess capital. **Show** your calculations.
- Note: The answer should be the **percentage of total assets** to be invested in each module.

➢ **Correct Answer:**
- **Goal 1** has a time horizon of 10 years and a required probability of success of 85%. As a result, **Module B should be chosen because its 5.0% expected return is higher than the expected returns of all the other modules.** The present value of Goal 1, discounted using the 5.0% expected return, is calculated as:
  - ✓ N = 10, FV = –USD 7,500,000, I/Y = 5.0%; PV = USD 4,604,349 (or USD 4.60 million)
  - ✓ So, approximately **46.0%** of the total assets of USD 10 million (= USD 4.60 million / USD 10.00 million) should be allocated to Module B.

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Example: 2018 Q9-C

> **Correct Answer: (con't)**
> - **For Goal 2**, which has a time horizon of 25 years and a required probability of success of 75%, **Module C should be chosen because its 6.9% expected return is higher than the expected returns of all the other modules**. The present value of Goal 2, discounted using the 6.9% expected return, is calculated as:
>   - ✓ N = 25, FV = –USD 15,000,000, I/Y = 6.9%; PV = USD 2,829,102 (or USD 2.83 million)
>   - ✓ So, approximately **28.3% of the total assets** of USD 10 million (= USD 2.83 million / USD 10.00 million) should be allocated to Module C.
> - Finally, the **surplus** of USD 2,566,549 (= USD 10,000,000 – USD 4,604,349 – USD 2,829,102), representing **25.7%** (= USD 2.57 million / USD 10.00 million), should be **invested in Module A** following Sarzi's suggestion.

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Framework

1. Developing asset-only asset allocations
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4. Heuristic and Other Approaches

➤ **"120 minus your age" rule.**

● **120 – Age = Percentage allocated to stocks**, which leads directly to an age-based stock versus fixed income split.

● Although we are aware of no theoretic basis for this heuristic—or its older and newer cousins, "100 minus your age" and "125 minus your age," respectively - it results in a linear decrease in equity exposure that seems to fit the general equity glide paths associated with target-date funds, including those that are based on a total balance sheet approach that includes human capital.

Exhibit 44   Target-Date Funds and Age Heuristics (as of January 2016)

Total Equity Exposure (%)

Retirement Year

•••••••• 100 Minus Age   – – – 120 Minus Age
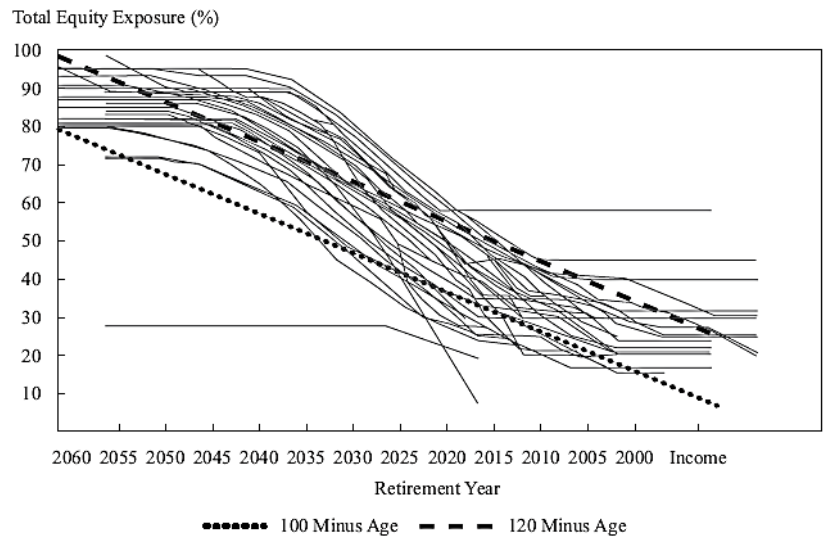
Heuristic and Other Approaches

➢ **60/40 stock/bond heuristic.**

- An asset allocation consisting of **60% equities** and **40% fixed income**.

- Equity allocation: supplying a long-term growth foundation; fixed-income allocation: risk reduction benefits

- There is some evidence that the global financial asset market portfolio is close to this prototypical 60/40 split.

➢ **1/N rule**

- In empirical studies comparing approaches, however, the 1/N rule has been found to perform considerably better, based on Sharpe ratios and certainty equivalents, than theory might suggest. One possible explanation is that the 1/N rule sidesteps problems caused by optimizing when there is estimation error in inputs.

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Heuristic and Other Approaches

➢ **Endowment model (Yale model)**

- High allocations to **non-traditional assets**
- Seeks to **earn illiquidity premiums**
- A commitment to active management
- Endowments with long time horizons are well positioned to capture.

Exhibit 46	Yale University Endowment Asset Allocation as of June 2014	
	Yale University	**US Educational Institution Mean**
Absolute return	17.4%	23.3%
Domestic equity	3.9	19.3
Fixed income	4.9	9.3
Foreign equity	11.5	22.0
Natural resources	8.2	8.5
Private equity	33.0	10.0
Real estate	17.6	4.2
Cash	3.5	3.5

Source: Yale University (2014, p. 13).

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Framework

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5.1 Risk Budgeting

➢ **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.

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

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

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Risk Budgeting

- 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**

➢ 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.

➢ **A risk budget is optimal when the ratio of excess return to marginal contribution to total risk is the same for all assets in the portfolio.**
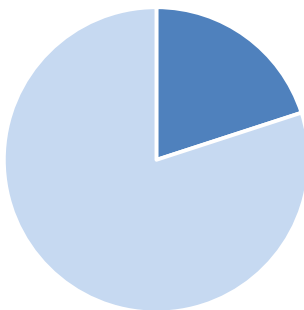
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5.2 Risk Parity

➢ 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**.

资产配置权重

资产风险贡献

传统配置

风险平价

■ 股票 ■ 债券

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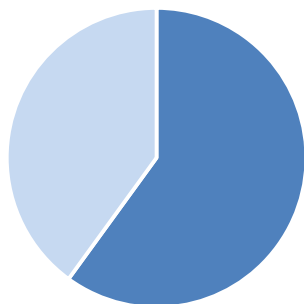
Risk Parity

➢ **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**.

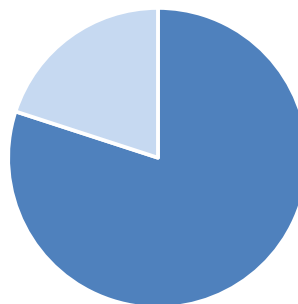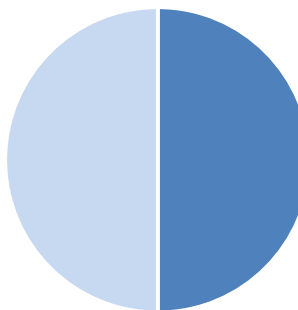$$ACTR = w_i \beta_i \sigma_p = \frac{1}{n} \sigma_p \qquad w_i \times Cov\left(r_i, r_p\right) = \frac{1}{n} \sigma_p^2$$

● **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.

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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%

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Risk Parity

➤ **Risk parity**

- **Advantage**

  ✓ The sources of risk are **diversified** (asset classes)

  ✓ Back tests of levered risk parity portfolios have produced promising results

- **Disadvantage**

  ✓ It ignores expected returns

  ✓ The contribution to risk is highly dependent on the formation of the opportunity set (fixed-income vs equity)

  ✓ Back tests argue that they suffer from look-back bias

  ✓ Dependent on the ability to use extremely large amounts of leverage at low borrow rates (which may not have been feasible)

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Risk Parity

➢ **Risk Parity**
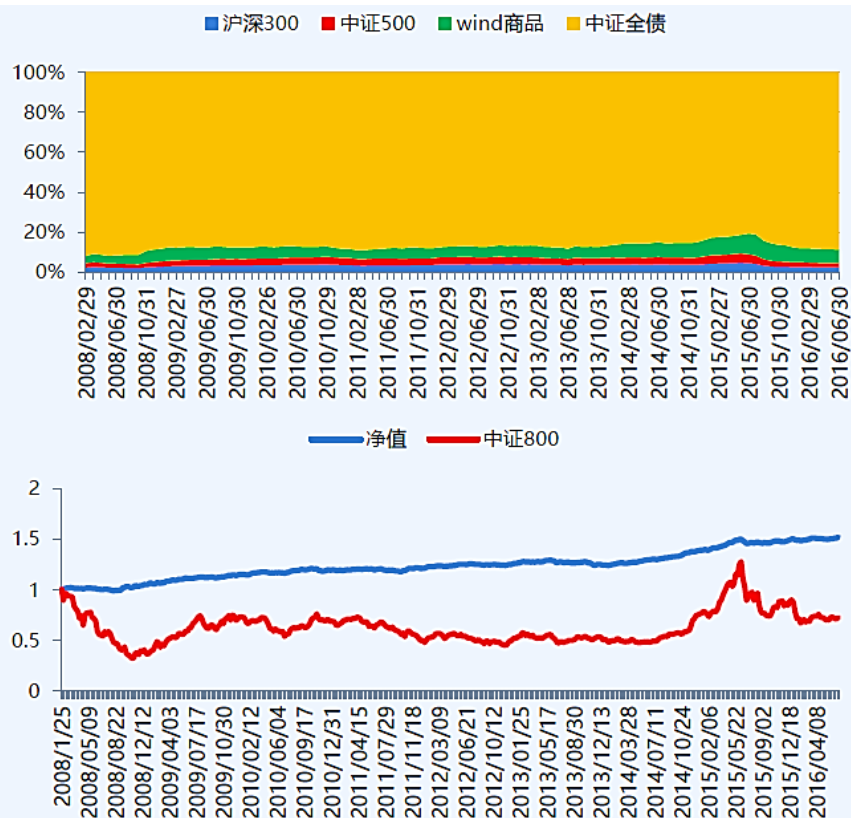
指数表现	多资产风险平价
年化收益率	5.08%
年化波动率	2.98%
夏普比率	1.03
最大回撤	4.06%
单次最大周换手	3.14%
平均周换手率	0.17%

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Example

1. **Consider two asset classes, A and B. Asset class A has two times the weight of B in the portfolio. Under what condition would B have a larger ACTR than A?**
    - Because $ACTR_i$ = (Weight$_i$)(Beta with respect to portfolio)$_i$(Portfolio return volatility), the **beta of B would have to be more than twice as large as the beta of A** for B to contribute more to portfolio risk than A.

2. **When is an asset allocation optimal from a risk-budgeting perspective?**
    - An asset allocation is optimal when the **ratio of excess return (over the risk-free rate) to MCTR is the same** for all assets.
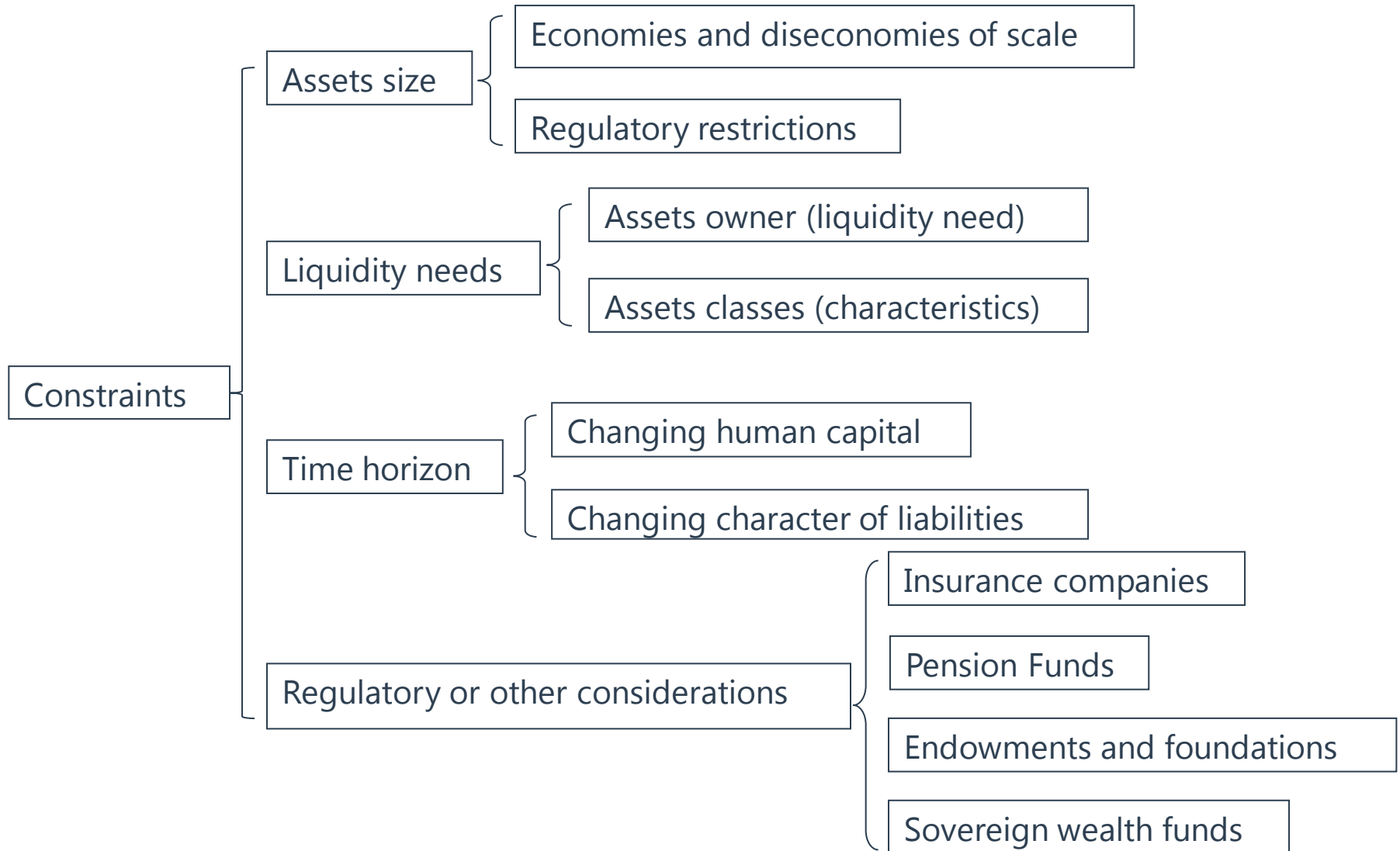
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Reading 14

Asset Allocation with Real-World Constraints

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Framework

1. Constraints on asset allocation.

2. Tax considerations in asset allocation.

3. Revisions to asset allocation.

4. Short-term shifts in asset allocation.

5. Behavioral biases and the methods of overcome them.

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1. Constraints in Asset Allocation

Constraints
- Assets size
  - Economies and diseconomies of scale
  - Regulatory restrictions
- Liquidity needs
  - Assets owner (liquidity need)
  - Assets classes (characteristics)
- Time horizon
  - Changing human capital
  - Changing character of liabilities
- Regulatory or other considerations
  - Insurance companies
  - Pension Funds
  - Endowments and foundations
  - Sovereign wealth funds

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1.1 Assets Size

➢ **Economies and diseconomies of scale**

- The **disadvantages** subject to **large assets** are:
  - ✓ The **illiquidity** occurred when invest in small-cap stocks, either buy or sell;
  - ✓ **Invest in small-cap stock** will cause the market **wildly fluctuate**;
  - ✓ Capital inflow may cause active investment managers to pursue **ideas outside of their core investment thesis**;
  - ✓ **Organizational hierarchies** may slow down decision making and reduce incentives.

- The **advantages** subject to **large assets** are:
  - ✓ Have sufficient size to build a **diversified portfolio** of investment strategies.

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Assets Size

➢ **Economies and diseconomies of scale**

- The **disadvantages** subject to **small assets** are:

  ✓ **Insufficient amount to meet the minimum requirement** for some investments;

  ✓ **Lower governance capacity-sophistication and manpower resource** - to develop the required knowledge base for complex asset classes and investment vehicles;

  ✓ **Higher internal management cost;**

  ✓ Many capital markets impose local legislation, **restricting investment in some assets with a given level of capital**;

  ✓ **Too small to diversify** across the range of asset classes.

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1.2 Liquidity

➤ **Different owners would have different liquidity needs.**

- **Banks** typically have **greater liquidity needs** to meet their daily operations.

- The same bank may have another **designated investment pool** one level removed from operating assets. This pool is able to handle some **illiquidity assets**.

- **Long-term investors** can generally exploit **illiquidity premiums**.

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Liquidity

➢ **Liquidity needs should be considered dynamically.**

- A **university** must consider its prospects for future enrollments and the extent to which it relies on tuition to meet operating needs.

- A **foundation** whose mission supports medical research in a field in which a break-through appears imminent may desire a higher level of liquidity to fund critical projects than would a foundation that supports ongoing community efforts.

- An **insurance company** whose business is **predominantly life** or auto insurance, where losses are actuarially predictable, can absorb more liquidity risk than a **property/casualty** reinsurer whose losses are subject to unpredictable events, such as natural disasters.

- **A family with several children nearing college-age** will have higher liquidity needs than a couple of the same age and circumstances with no children.

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1.3 Time Horizon

➢ **Changing human capital**

  ● When asset allocation considers such extended portfolio assets as human capital, the optimal allocation of financial capital can change through time.

➢ **Character of liabilities**

  ● The changing character of liabilities through time will also affect the asset allocation aligned to fund those liabilities.

    ✓ **For a firm**, the term structure of liabilities changes due to time lapses, new employments and resignations.

    ✓ **For a individual investor**, he/she may set several goals when he was young. Each goal reflects a liabilities. With the change of time, the goal may change as well.

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1.4 Regulatory and Other Considerations

➤ **Insurance Companies**
  - Insurers are most often highly focused on **matching assets to the projected**, probabilistic cash flows of the risks they are underwriting.
  - Some of the key considerations for insurance companies are **risk-based capital measures**, yield, liquidity, the potential for forced liquidation of assets to fund negative claims development, and credit ratings.
  - Allocations to certain **asset classes** are often constrained by a regulator.

➤ **Pension Funds**
  - Pension fund asset allocation decisions may be constrained by regulation and influenced by tax rules.
    - ✓ Some countries regulate **maximum or minimum percentages in certain asset classes**.
  - Pension funds are also subject to a wide array of funding, accounting, **reporting**, and tax constraints.

Regulatory and Other Considerations

➢ **Endowments and Foundations**

- Endowments and foundations are often established with the expectation that they will exist in perpetuity and thus can invest with a **long investment horizon**.

- Two categories of externally imposed constraints may influence the asset allocation decisions of an endowment or foundation.

  - ✓ **Tax incentives**: many countries provide tax benefits tied to **certain minimum spending requirements**.

  - ✓ **Credit considerations**: external factors may restrict the level of risk-taking in the portfolio.

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Regulatory and Other Considerations

➢ **Sovereign Wealth Funds(SWFs)**

- In addition to the broad constraints of asset size, liquidity, time horizon, and regulations, there may be cultural or religious factors which also **constrain the asset allocation choices**.

➢ **Environmental, social, and governance (ESG) considerations**

- Becoming increasingly important to institutional and individual investors alike.

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2.1 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:

  ✓ $r_{at} = p_d r_{pt}(1 - t_d) + p_a r_{pt}(1 - t_{cg})$

  - p_d = the proportion of r_{pt} attributed to dividend income
  - p_a = the proportion of r_{pt} attributed to price appreciation
  - t_d = the dividend tax rate
  - t_{cg} = the capital gains tax rate

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2.2 Asset Allocation for the Taxable Investor

➢ **After-Tax Portfolio Optimization**

- As the tax and tax loss carry forward exist, the expected volatility of will be reduced as well.

    ✓ $\sigma_{at} = \sigma_{pt}(1 - t)$

    - σ_{at} = the expected after-tax standard deviation
    - σ_{pt} = the expected pre-tax standard deviation

- **The correlations of asset classes will remain** after the charge of tax.

- As the expected return and after-tax standard deviation differ from the original data, the **optimal portfolio would change** as well.

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2.3 Asset Allocation for the Taxable Investor

➢ **Taxes and Portfolio Rebalancing**

- **The rebalancing ranges for a taxable portfolio can be wider than those of a tax-exempt portfolio with a similar risk profile:**

  ✓ $R_{at} = R_{pt}/(1 - t)$

  ✓ Where

  R_{at} = the after-tax rebalancing range

  R_{pt} = the pre-tax rebalancing range

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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%).

2.5 Asset Allocation for the Taxable Investor

➤ Aggregating assets across accounts with differing tax treatment requires modifying the asset value inputs to the portfolio optimization.

➤ **The after-tax value of assets in a tax-deferred account is defined by**

- $v_{at} = v_{pt}(1 - t_i)$

where

v_{at} = the after-tax value of assets

v_{pt} = the pre-tax market value of assets

t_i = the expected income tax rate upon distribution

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3. Revising the Strategic Asset Allocation

➢ All asset owners should **affirm annually** that the asset allocation remains appropriate given their needs and circumstances.

- **A change in goals**
  - ✓ Changes in business conditions such as organization supporting;
  - ✓ A change in the investor's personal circumstances.

- **A change in constraints**
  - ✓ Changes in the expected payments from the fund;
  - ✓ A significant cash inflow or unanticipated expenditure;
  - ✓ Changes in regulations governing donations or contributions;
  - ✓ Changes in time horizon resulting from the adoption of a lump sum distribution option at retirement;
  - ✓ Changes in asset size as a result of the merging of pension plans.

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Revising the Strategic Asset Allocation

- **A change in beliefs**
 - ✓ Investment beliefs are a set of guiding principles that govern the asset owner's investment activities.
    - ◆ A material change in the outlook for one or more of the asset classes may heavily influence the asset allocation outcome.
    - ◆ As new advisers or members join the Investment Committee, they bring their own beliefs and biases regarding certain investment activities.

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4. Short-Term Shifts in Asset Allocation

- ➤ **Tactical asset allocation (TAA) allows short-term deviations from SAA targets.**
  - Generating alpha through TAA decisions is dependent on successful market or factor timing rather than security selection.
- ➤ **Most common ways to evaluate TAA decisions**
  - A comparison of the Sharpe ratio realized under the TAA relative to the Sharpe ratio that would have been realized under the SAA;
  - Evaluating the information ratio;
  - The t-statistic of the average excess return of the TAA portfolio relative to the SAA portfolio;
  - Plotting the realized return and risk of the TAA portfolio versus the realized return and risk of portfolios along the SAA's efficient frontier.
    - ✓ (This approach is particularly useful in assessing the risk-adjusted TAA return.)

Short-Term Shifts in Asset Allocation

➢ **Two major approaches to TAA**

	TAA Approaches	
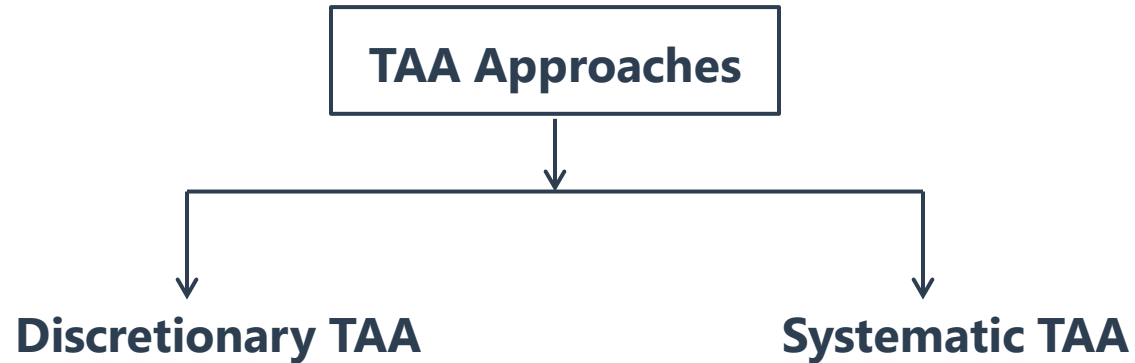
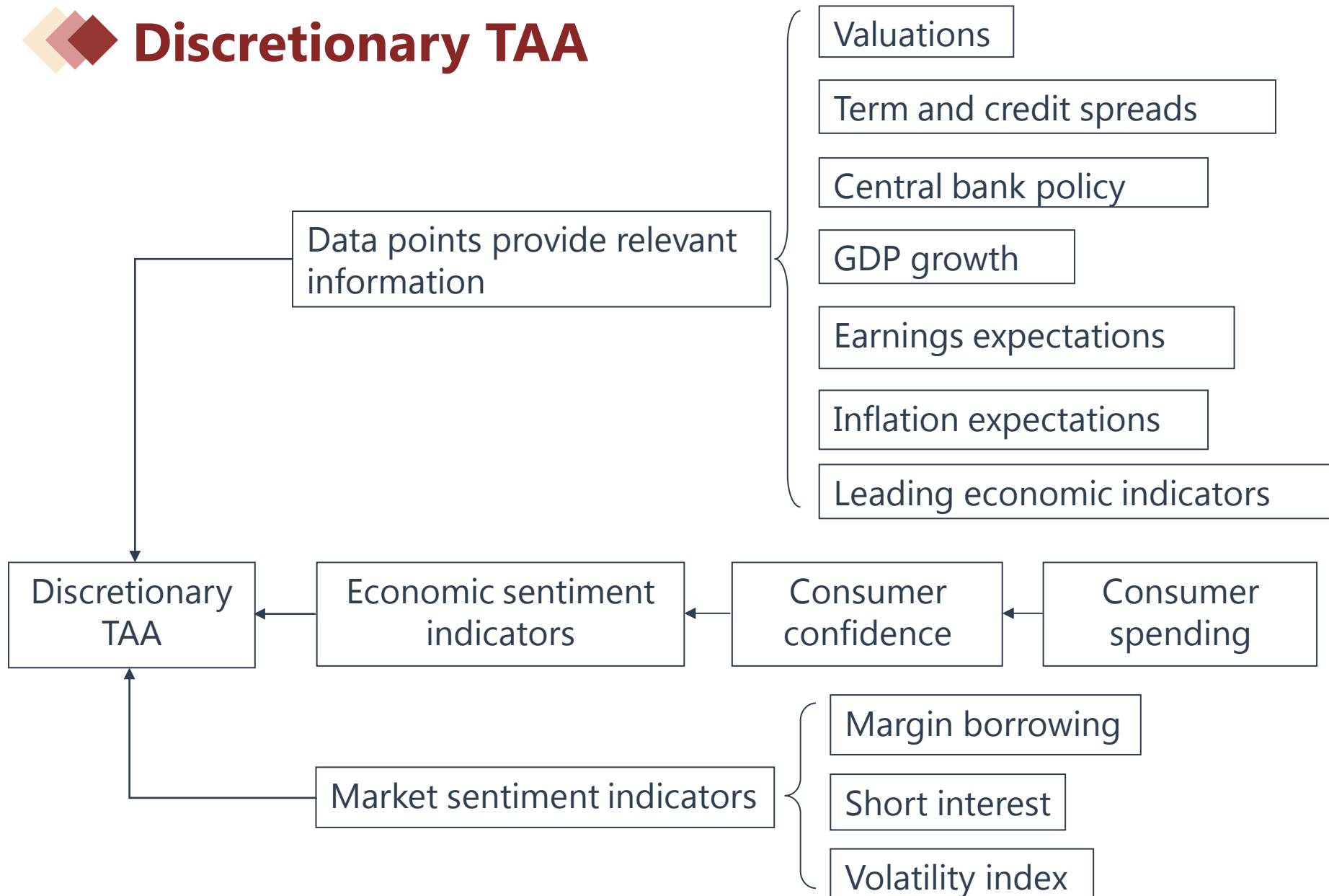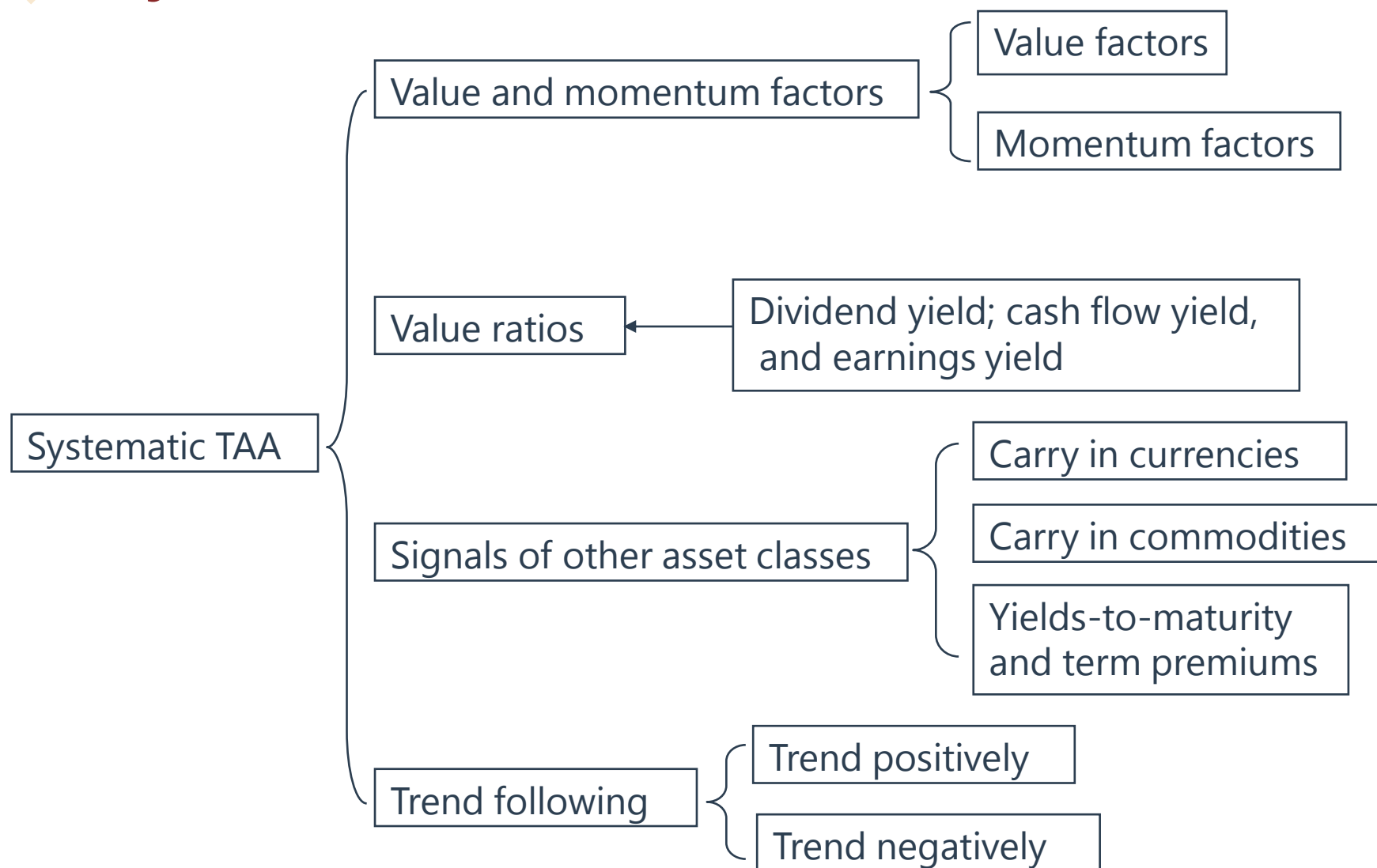|	**Discretionary TAA**	**Systematic TAA**
Definitions	Discretionary TAA is predicated **on the existence of manager skill** in predicting and timing short-term market moves away from the expected outcome for each asset class that is embedded in the SAA policy portfolio.	Using **signals**, systematic TAA attempts to capture asset class level return anomalies that have been shown to have some predictability and persistence.

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Discretionary TAA

Data points provide relevant information
- Valuations
- Term and credit spreads
- Central bank policy
- GDP growth
- Earnings expectations
- Inflation expectations
- Leading economic indicators

Discretionary TAA ← Economic sentiment indicators ← Consumer confidence ← Consumer spending

Market sentiment indicators → Discretionary TAA
- Margin borrowing
- Short interest
- Volatility index

122-130

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Systematic TAA

```
Systematic TAA
├── Value and momentum factors
│       ├── Value factors
│       └── Momentum factors
├── Value ratios ◄── Dividend yield; cash flow yield, and earnings yield
├── Signals of other asset classes
│       ├── Carry in currencies
│       ├── Carry in commodities
│       └── Yields-to-maturity and term premiums
└── Trend following
        ├── Trend positively
        └── Trend negatively
```

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5. Dealing with Behavioral Biases

➤ **Identify Anomalies**

- **Loss-aversion bias** is an emotional bias in which people tend to strongly prefer avoiding losses as opposed to achieving gains.

- **The illusion of control** is a cognitive bias - the tendency to overestimate one's ability to control events.

- **Mental accounting** is an information - processing bias in which people treat one sum of money differently from another sum based solely on the mental account the money is assigned to.

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Dealing with Behavioral Biases

➢ **Identify Anomalies**

- **Representative**, or **recency**, bias is the tendency to overweight the importance of the most recent observations and information relative to a longer-dated or more comprehensive set of long-term observations and information.

- **Framing bias** is an information-processing bias in which a person may answer a question differently based solely on the way in which it is asked.

- **Availability bias** is an information-processing bias in which people take a mental shortcut when estimating the probability of an outcome based on how easily the outcome comes to mind.

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Dealing with Behavioral Biases

➢ **How to deal with behavior biases**

- **Loss-aversion**: In goals-based investing, loss-aversion bias can be mitigated by framing risk in terms of shortfall probability or by funding high-priority goals with low-risk assets.

- **Illusion of Control**: The illusion of control can be mitigated by using the global market portfolio as the starting point in developing the asset allocation.

- **Mental Accounting**: Goals-based investing incorporates mental accounting directly into the asset allocation solution. Each goal is aligned with a discrete sub-portfolio, and the investor can specify the acceptable level of risk for each goal. Provided each of the sub-portfolios lies along the same efficient frontier, the sum of the sub-portfolios will also be efficient.

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Dealing with Behavioral Biases

➢ **How to deal with behavior biases**

- **Representative Bias**: The strongest defenses are an objective asset allocation process and a strong governance framework.

- **Framing Bias**: The framing effect can be mitigated by presenting the possible asset allocation choices with multiple perspectives on the risk/reward trade-off.

- **Availability Bias**: Familiarity bias (a bias stems from availability bias) can be mitigated by using the global market portfolio as the starting point in developing the asset allocation, where deviations from this baseline portfolio must be thoughtfully considered and rigorously vetted.

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Dealing with Behavioral Biases

➤ **To make sure the asset allocation decision is as objective as possible, managers should:**

- Employ a formal asset allocation process using the global market portfolio;

- Employ a strong governance structure;

- Bring a diverse set of views to the deliberation process;

- Have a clear stated mission-a common goal-and a commitment from committee members and other stakeholders.

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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。

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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。

➤ **如何告诉我们？**

  ● 将您发现的问题通过电子邮件告知我们，具体的内容包含：

    ✓ 您的姓名或网校账号

    ✓ 所在班级（eg.202105CFA三级长线无忧班）

    ✓ 问题所在科目（若未知科目，请提供章节、知识点）和页码

    ✓ 您对问题的详细描述和您的见解

  ● 请发送电子邮件至：academic.support@gfedu.net

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