

Portfolio Management

投资组合管理

Level I



王牌陈讲CFA

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□ 学神级别的开挂人生

- 中考、高考、研究生一路以第1名身份保送
- 本科阶段就读复旦大学财务金融系，GPA全系第一，获管理学学士学位和法学学士学位；研究生阶段就读复旦大学管理学院
- 以全优成绩通过CFA三个级别考试；一天时间以全优成绩同时通过FRM两个级别考试

□ 财经讲师的王牌之路

- 全职加入高顿财经前，就职于国有商业银行总行和华尔街投行，同时以兼职身份承担高顿CFA/FRM教学工作
- 逾12年教龄，CFA/FRM培训界的教父级人物，学员遍布全球



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现代投资组合理论

1. 单个资产的收益和风险

- Measurements of **return**
 - **Expected return** is the **estimated return** required by investors, so it is an **ex-ante** measure
 - **Historical return** is the actual return that was earned by investors, so it is an **ex-post** measure
- Measurements of **risk**
 - **Variance & standard deviation**

2. 投资者的风险偏好

- **Risk averse** (low risk tolerance)
 - Investors prefer **less risk** given certain expected return
 - Maximize return + **minimize risk**
- **Risk neutral**
 - Investors are **indifferent with the risk**
 - Maximize return **only**
- **Risk seeking** (high risk tolerance)
 - Investors get extra "utility" from the uncertainty
 - Maximize return + **maximize risk**

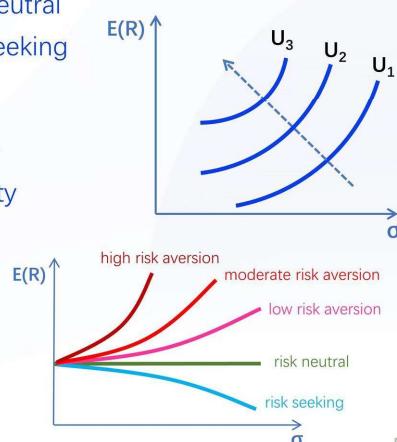
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3.1 效用函数

- **Utility function** reflects the relative satisfaction that an investor derives from different investment portfolios
- ◆ $U = E(R) - 0.5 \times A \times \sigma^2$
 - $A > 0$, when investor is **risk-averse**
 - $A = 0$, when investor is **risk-neutral**
 - $A < 0$, when investor is **risk-seeking**

3.2 无差异曲线

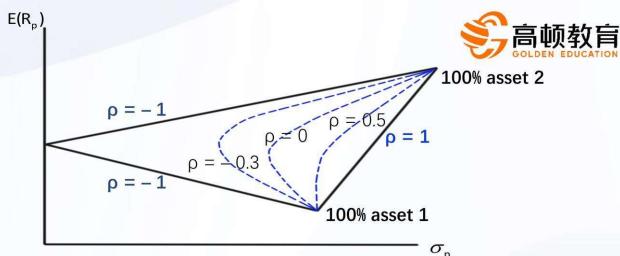
- **Indifference curve** plots the combinations of risk-return pairs that an investor would accept to maintain a given level of utility
- For a **risk-averse** investor:
 - The curves are **upward sloping** and **convex** because of **diminishing marginal utility of return**
 - As risk increases, an investor needs greater return to compensate for higher risk **at an increasing rate**



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4. 投资组合的收益和风险

- Return of the portfolio with two assets
 - ◆ $E(R_p) = w_1 R_1 + w_2 R_2$
- Risk of the portfolio with two assets
 - ◆ $\sigma_p^2 = w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 \text{Cov}(R_1, R_2) = w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 \sigma_1 \sigma_2 \rho_{1,2}$



① If $\rho = 1$ (**perfectly positive correlated**)

$$\bullet \quad \sigma_p = \sqrt{w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 \sigma_1 \sigma_2} = \sqrt{(w_1 \sigma_1 + w_2 \sigma_2)^2} = w_1 \sigma_1 + w_2 \sigma_2$$

② If $\rho < 1$ (**less perfectly correlated**)

$$\bullet \quad \sigma_p = \sqrt{w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 \sigma_1 \sigma_2 \rho_{1,2}} < w_1 \sigma_1 + w_2 \sigma_2$$

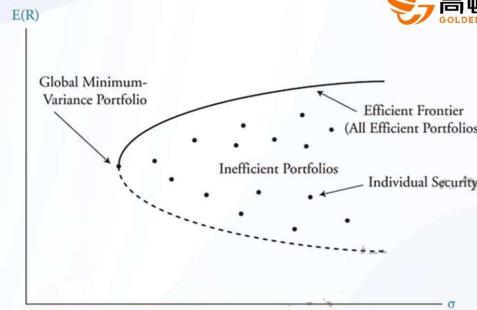
③ If $\rho = -1$ (**perfectly negative correlated**)

$$\bullet \quad \sigma_p = \sqrt{w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 - 2w_1 w_2 \sigma_1 \sigma_2} = \sqrt{(w_1 \sigma_1 - w_2 \sigma_2)^2} = |w_1 \sigma_1 - w_2 \sigma_2|$$

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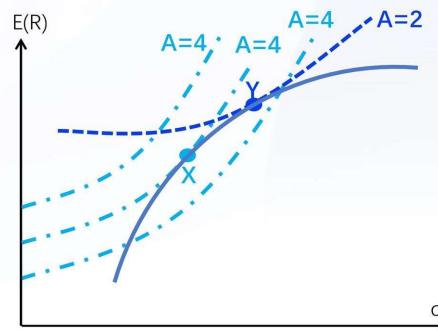
5.1 马科维茨有效前沿

- Minimum-variance frontier of risky assets
- Global minimum-variance point
- Efficient frontier of risky assets: portfolios above efficient frontier is **not achievable**, and portfolios below efficient frontier is **inefficient**



5.2 有效前沿上的最优投资组合

- Optimal portfolio along efficient frontier
 - Investor ($A=4$) should choose portfolio "X", the **tangent point of indifference** curve to efficient frontier
 - Less risk-averse investor ($A=2$) will select portfolio "Y" (more in risky asset)



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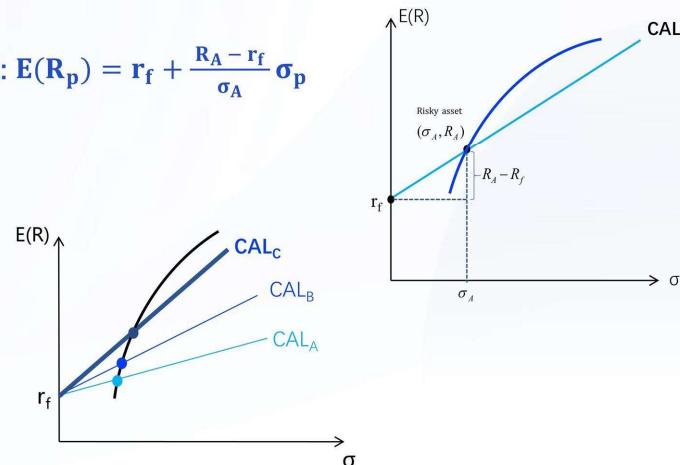
6.1 资本配置线 CAL

- Capital allocation line (CAL) represents the portfolios available to an investor through **combining the risk-free asset with one risky asset**

$$\begin{aligned} \text{◆ } E(R_p) &= w_A R_A + w_f r_f \\ \text{◆ } \sigma_p &= w_A \sigma_A \end{aligned}$$

$$\text{◆ } \text{CAL: } E(R_p) = r_f + \frac{R_A - r_f}{\sigma_A} \sigma_p$$

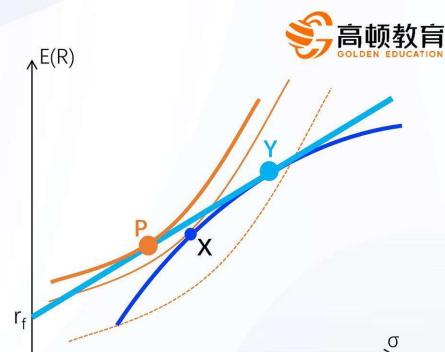
- CAL_C should be selected because it provides the **highest utility** among these three CALs
 - The **Sharpe ratio** of CAL_C is the highest



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6.2 最优资本配置线和最优投资组合

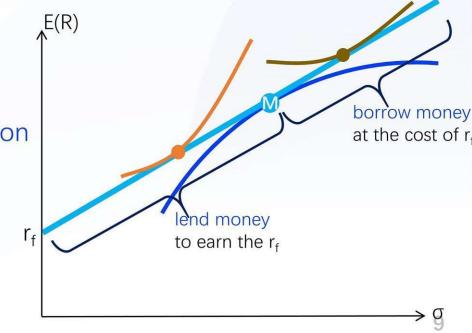
- Investor should choose "Y" as the **optimal risky portfolio**, which will be combined with risk-free asset
 - This CAL is the **optimal CAL** among all
- Portfolio "P" is the **optimal investor portfolio**



7. 资本市场线 CML

- All investors have **identical efficient frontier** and **identical optimal risky portfolio**, which is the **market portfolio (M)**
 - Assuming all investors have a **homogeneous expectation**
- Capital market line (CML) is a **special CAL** that includes all possible combinations of r_f asset and market portfolio

$$\text{◆ } \text{CML: } E(R_p) = r_f + \frac{R_M - r_f}{\sigma_M} \sigma_p$$



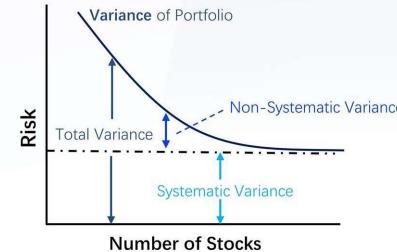
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8. 系统性风险与非系统性风险

- **Systematic risk** is the risk affects the entire market or economy, which **cannot be avoided** and is inherent in the overall market
- Caused by **macro factors**: interest rates, exchange risk, policy risk, etc.
- Measured by **Beta (β)** of the asset, which is a **measure of systematic risk** of an asset, representing how sensitive an asset's return is to the market as a whole

$$\blacklozenge \quad \beta_i = \frac{\text{Cov}(R_i, R_m)}{\sigma_m^2} = \frac{\rho_{i,m} \times \sigma_i \times \sigma_m}{\sigma_m^2} = \rho_{i,m} \times \frac{\sigma_i}{\sigma_m} \quad \blacklozenge \quad \beta_{\text{portfolio}} = \sum_{i=1}^n w_i \beta_i$$

- **Unsystematic risk** is the risk **can be reduced or eliminated** by holding well-diversified portfolios
 - Because diversification is cost-free, investors are **only rewarded for taking systemic risks**
 - In efficient market, only systemic risks should be priced



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9. 因子模型

- There are two types of **return generating model**

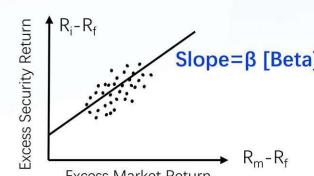
1. Multi-factor model

- ◆ $E(R_i) - r_f = \beta_{i,1} \times E(\text{Factor 1}) + \beta_{i,2} \times E(\text{Factor 2}) + \dots + \beta_{i,m} \times E(\text{Factor m})$
 - $\beta_{i,k}$ is the **sensitivity of excess return on risk factor k**
- **Macroeconomic factors**: E.g., GDP growth, inflation, consumer confidence
- **Fundamental factors**: E.g., earnings, earnings growth, firm size, research expenditures
- **Statistical factors**: **may or may not** have an economic or fundamental connection to returns

2. Single-index model

□ Security Characteristic Line (SCL)

- ① $E(R_i) - r_f = \beta_i \times E(\text{market risk premium})$
 $= \beta_i \times [E(R_M) - r_f]$
- ② **Market model**: $R_i = \alpha_i + \beta_i \times R_M + e_i$



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10.1 资本资产定价模型 CAPM 的前提假定

- Assumptions of **Capital Asset Pricing Model (CAPM)**
 - Investors are **risk averse**, utility-maximizing, **rational** individuals
 - Investor plan for the **same single holding period**
 - Investor have **homogeneous** expectations or beliefs
 - Investors are **price takers** ■ All investments are **infinitely divisible**
 - Markets are **frictionless**, including no additional cost and no taxes

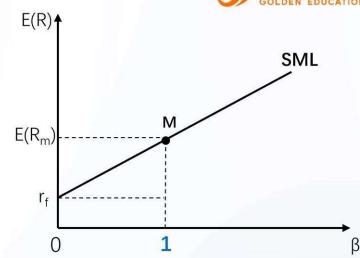
10.2 资本资产定价模型 CAPM

- ◆ $E(R_i) = r_f + \beta_i \times [E(R_M) - r_f]$
 - The expected return is **only measured by beta (systematic risk)**
 - Used for **assets valuation** by investors and **capital budgeting**

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11. 证券市场线 SML

- Security market line (SML) is the graphical representation of CAPM with beta on the x-axis and expected return on the y-axis
 - Intercept is r_f , slope is the market risk premium ($E(R_m) - r_f$)
- Any asset or portfolio that are **properly priced** plots on SML
Any asset or portfolio that are **overpriced** plots **below SML**
Any asset or portfolio that are **underpriced** plots **above SML**



	Capital Market Line (CML)	Security Market Line (SML)
Definition	All efficient portfolios	All properly priced assets or portfolios
Application	Used for asset allocation	Used for security selection
Formula	$E(R_p) = r_f + [E(R_m) - r_f] / \sigma_m \times \sigma_p$	$E(R_p) = r_f + \beta_p \times [E(R_m) - r_f]$
X-axis	Total risk (σ)	Systematic risk (β)
Slope	Market portfolio's Sharpe ratio	Market risk premium

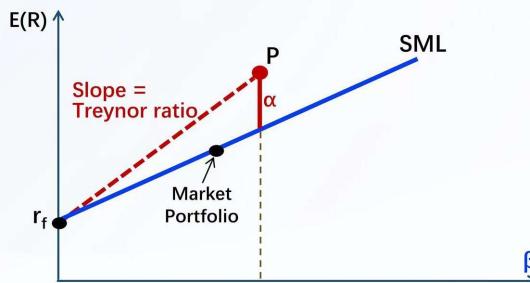
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12. 投资业绩评价指标

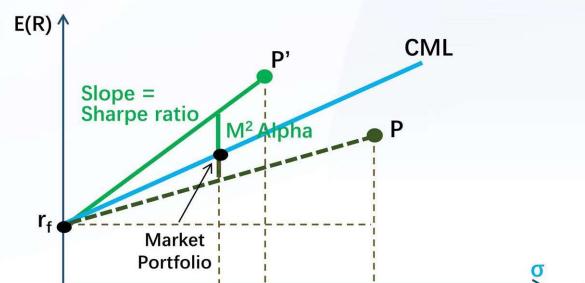
① Jensen's $\alpha_p = R_p - [r_f + \beta_i \times (E(R_m) - R_f)]$ ③ $M^2 = (R_p - r_f) \times \sigma_m / \sigma_p + r_f$
 $= r_f + \text{Sharpe Ratio}_p \times \sigma_m$

$$\begin{aligned} M^2 \text{ Alpha} &= M^2 - R_m \\ &= (R_p - r_f) \times \sigma_m / \sigma_p - (R_m - r_f) \end{aligned}$$

② Treynor ratio = $(R_p - r_f) / \beta_p$



④ Sharpe ratio = $(R_p - r_f) / \sigma_p$



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一. 现代投资组合理论【1-12】





投资组合管理概览

13.1 投资组合的作用

- **Portfolio** is a group of financial assets such as stocks, bonds, and cash equivalents, as well as the mutual, exchange-traded funds, etc.
- **Portfolio diversification** generally offer equivalent expected returns with lower overall volatility of returns, which helps investors avoid disastrous investment outcomes
- Portfolio approach to investing: evaluating individual securities in relation to their contribution to the risk and return of the whole portfolio

13.2 组合管理的步骤

3. Feedback

- | | | |
|--|---|---|
| 1. Planning | 2. Execution | 3. Feedback |
| <ul style="list-style-type: none"> ■ Understanding clients' needs ■ Developing the investment policy statement (IPS) | <ul style="list-style-type: none"> ■ Asset allocation ■ Security analysis ■ Portfolio construction | <ul style="list-style-type: none"> ■ Portfolio monitoring and rebalancing ■ Performance measurement and reporting |

14. 投资者的类型

- Individual investor
 - Individuals
 - Defined contribution pension plan
 - Individuals make specified contributions to pension plan
 - The benefits are not guaranteed
 - Individuals accept the investment risk and rewards
- Institutional investor

	Time Horizon	Liquidity Needs	Risk Tolerance
Defined benefit pension plan	long	low	high
Endowments & Foundations	long	low	high
Banks	short	high	low
Insurance companies <ul style="list-style-type: none"> • Life insurance • Property and casualty insurance 	long for life short for P&C	high for P&C low for P&C	low for P&C

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15.1 共同基金

- Open-end mutual funds
 - Investors can buy and redeem the mutual fund shares at net asset value (NAV)
 - Not fully invested as some cash kept for redemption
- Closed-end mutual funds
 - No new investments are accepted ■ Could be fully invested
 - Traded at a premium or discount to net asset value

15.2 交易所交易基金

- Exchange-traded funds (ETFs) can be bought and redeemed, or it can trade its share in the secondary market
 - Investors can buy and redeem with a basket of shares
 - Trading prices are close to the net asset value of the fund
 - ETFs are often having tax advantages over index mutual funds
 - Transaction costs are lower compared to mutual funds

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16. 资管行业简介

- An asset manager is commonly referred to as a **buy-side firm**, while a **sell-side firm** is a **broker/dealer**
- Active management:** eg. smart beta strategies
Passive management: replicate the returns of a market index
- Traditional management:** eg. long-only equity and fixed-income securities
 - Asset-based management fees
- Alternative management:** eg. hedge fund, private equity, venture capital strategies
 - Both management and performance fees
- Key trends in the asset management industry
 - Growth of passive investing ■ “Big data” in the investment process
 - Robo-advisers in the wealth management industry

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17. 投资策略声明 IPS

- Major components of **investment policy statement (IPS)**
1. Introduction: describes the client
 2. Statement of purpose
 3. Statement of duties and responsibilities
 4. Procedures
 5. **Investment objectives (RR)**
 - ① **Return objectives**: absolute return objectives vs. relative return objectives
 - ② **Risk objectives (risk tolerance)**: absolute risk objectives vs. relative risk objectives
 - ability to bear risk vs. willingness to bear risk
 6. **Investment constraints (TTLLU)**
 - ① **Time horizon**
 - ③ **Liquidity**: the potential need for cash
 - ② **Tax concerns**
 - ④ **Legal and regulatory**
 - ⑤ **Unique needs and preferences**
 7. Investment guidelines: execution policy and assets that are allowed to invest
 8. Evaluation and review
 9. **Appendices**: eg. **strategic asset allocation (SAA)**, rebalancing policy

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18. 资产配置

- Strategic asset allocation (SAA)**: use objectives and constraints from IPS and long-term capital market expectations to select an optimal portfolio
 - Specifications of **asset classes**
 - Correlations of returns of assets within an asset class should be relatively high
 - Correlations of returns between asset classes should be low
- Tactical asset allocation (TAA)**: deviations from SAA according to short-term market expectation, and security selection as permitted and appropriate

19. 构建资产组合的基本步骤

1. Use risk, return, and correlations among asset classes to construct an efficient frontier
2. Strategic asset allocation
3. **Tactical asset allocation**, and security selection as permitted and appropriate
4. Risk budgeting

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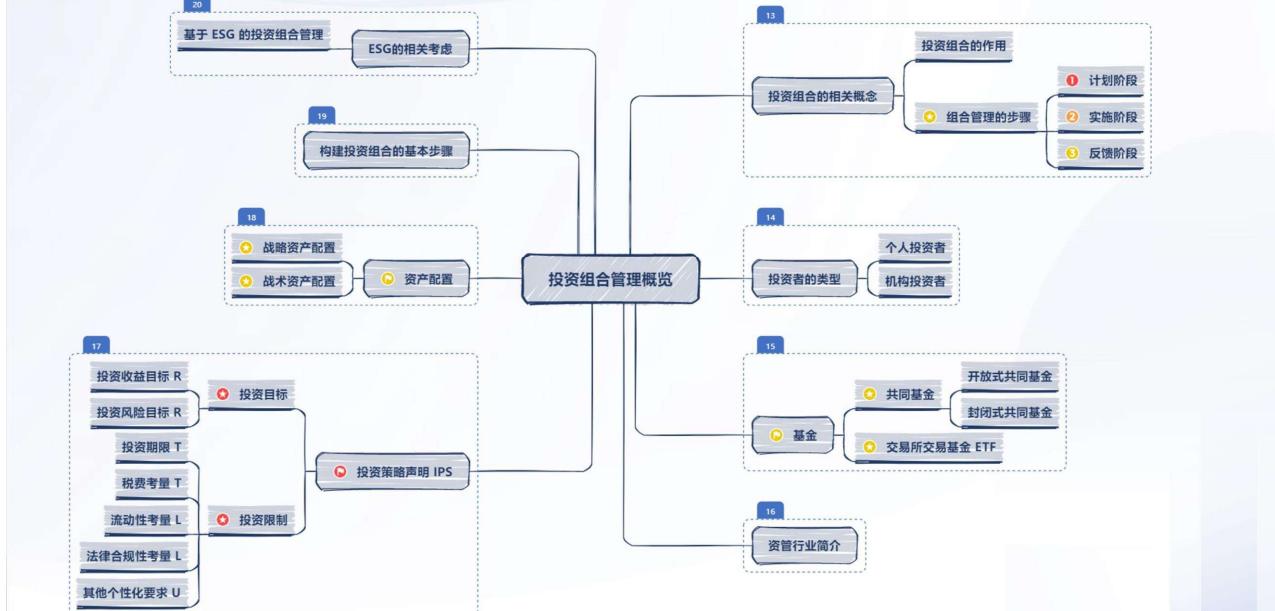
20. 1 ESG 考量

- Environmental issues**: carbon emissions, air pollution, biodiversity, etc.
- Social issues**: labor standards, human rights, community relations, etc.
- Governance issues**: board composition, bribery & corruption, executive compensation, etc.

20. 2 基于 ESG 的投资组合管理

- | | |
|---|---|
| <ul style="list-style-type: none"> <input type="checkbox"/> Negative screening (exclusionary screening): excluding companies or sectors that do not meet client standards <input type="checkbox"/> Best-in-class: identifying companies or sectors that rank most favorably with clients <input type="checkbox"/> ESG integration: integrating the ESG considerations with traditional security and industry analysis | <ul style="list-style-type: none"> <input type="checkbox"/> Positive screening <input type="checkbox"/> Active ownership <input type="checkbox"/> Impact investing <input type="checkbox"/> Thematic investing: focusing on business themes or specific goals |
|---|---|

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个人行为偏差

21. 行为偏差的分类

□ Behavioral biases come in two forms, and both forms of bias may cause decisions to deviate from what is assumed by traditional finance theory

1. Cognitive errors: faulty cognitive reasoning

① Belief perseverance biases ② Processing errors

- | | |
|----------------------------|---------------------------------|
| ■ Conservatism bias | ■ Anchoring and adjustment bias |
| ■ Confirmation bias | ■ Mental accounting bias |
| ■ Representativeness bias | ■ Framing bias |
| ■ Illusion of control bias | ■ Availability bias |
| ■ Hindsight bias | |

2. Emotional biases: based on feelings or emotions

- | | | |
|-----------------------|---------------------|------------------------|
| ■ Loss aversion bias | ■ Self-control bias | ■ Regret aversion bias |
| ■ Overconfidence bias | ■ Endowment bias | |

22.1 认知错误

- **Conservatism bias:** people maintain their prior views or forecasts by inadequately incorporating new, conflicting information
- **Confirmation bias:** tendency to notice what confirms prior beliefs and to ignore whatever contradicts them
- **Representativeness bias:** tendency to classify new information based on past experiences and classifications
 - Two types: base-rate neglect, sample-size neglect
- **Illusion of control bias:** people believe that they can control or influence outcomes
- **Hindsight bias:** people tend to believe past events as having been predictable and reasonable to expect
- **Anchoring and adjustment bias:** people tend to rely on an initial piece of information to make subsequent estimates and decisions
- **Mental accounting bias:** people tend to mentally divide money into "accounts" that influence decisions
- **Framing bias:** people tend to answer a question differently based on the way in which it is asked or framed
- **Availability bias:** people tend to estimate the probability of an outcome based on how easily information is recalled

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22.2 情感偏差

- **Loss-aversion bias:** tendency to strongly prefer avoiding losses to achieving gains
- **Overconfidence bias:** people demonstrate unwarranted faith in their own abilities
 - It will be intensified when combined with self-attribution bias, in which people take too much credit for successes and assign responsibility to others for failures
- **Self-control bias:** people fail to act in pursuit of their long-term, overarching goals because of lack of self-discipline
- **Status quo bias:** people choose to do nothing instead of making a change
- **Endowment bias:** people value an asset more when they own it than when they do not
- **Regret-aversion bias:** people tend to avoid making decisions out of fear that the decision will turnout poorly, herding behavior

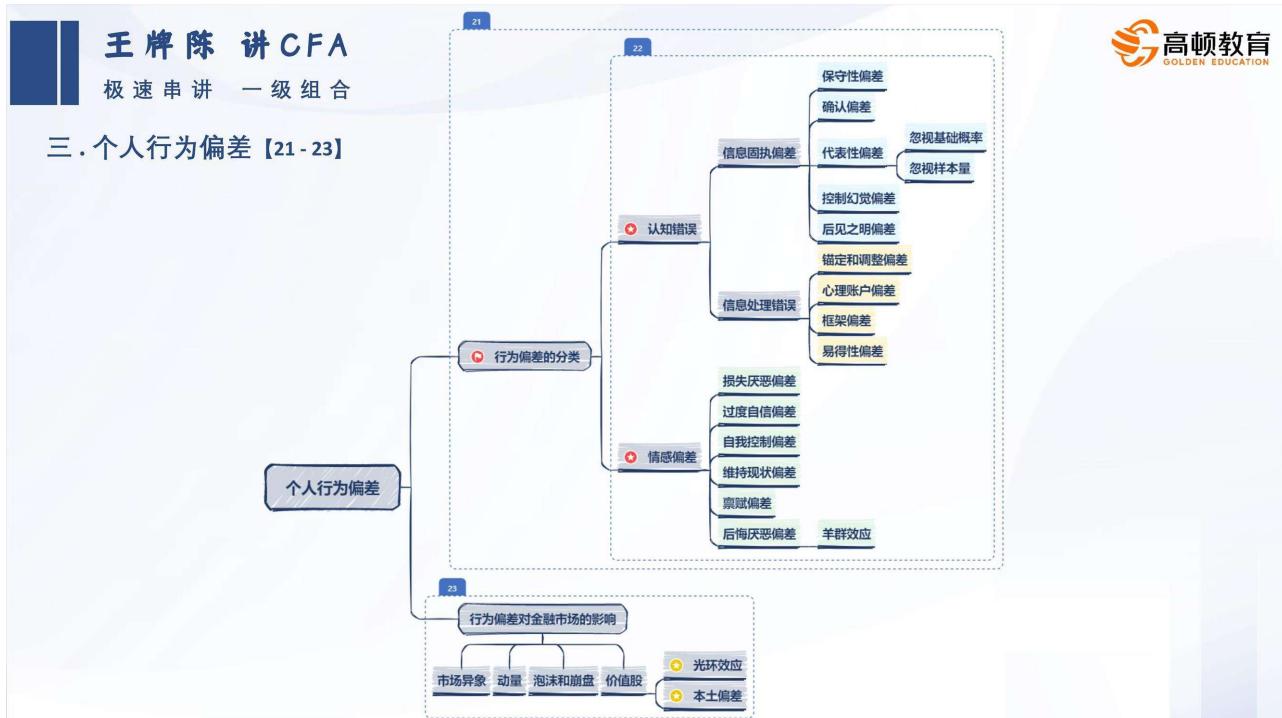
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23. 行为偏差对市场的影响

- **Anomalies** are apparent deviations from the efficient market hypothesis, identified by persistent abnormal returns that differ from zero and are predictable in direction
 - Not every deviation is anomalous, and misclassifications tend to stem from three sources:
 - Choice of asset pricing model
 - Statistical issues
 - Temporary disequilibria
- **Momentum:** future price behavior correlates positively with that of the recent past
- **Bubbles and crashes:** investors exhibit symptoms of overconfidence and over-trading
- **Value stocks** are typically with low price-to-earnings ratios, high book-to-market equity
 - The value stocks historically outperformed growth stock, which could be explained by:
 - The halo effect, a company with a good growth record might be seen as a good investment, which is a form of representativeness
 - Home bias can also be involved in predicting growth rates, leading growth stocks to be overvalued

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三. 个人行为偏差 [21 - 23]



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风险管理基础

24.1 风险管理框架

□ Risk management framework

- **Risk infrastructure:** the **people** and **systems** required to track risk exposures and perform the quantitative risk analysis to assess the organization's risk profile
- **Risk governance:** the **top-down process** and guidance that directs risk management activities to the **overall enterprise**

24.2 全面风险管理

- **Enterprise risk management:** provides an **enterprise-view** of risk management, and focus risk activities on the **entire organization**
 - **Risk tolerance (risk appetite)** serves as the high-level guidance for management in its strategic selection of risks
 - **Risk budgeting** is a means of **bridging** from the high-level governance risk decision to the many management decisions

25. 1 风险识别

Interactions of risks: risks do not usually arise independently, but generally interact with one another

□ Financial risk

- **Market risk:** risks that arise from movements in interest rates, stock prices, exchange rates, and commodity prices
- **Credit risk:** risk of loss if one party fails to pay that owed to another party
- **Liquidity risk:** risk that cannot be quickly liquidated at fair value

□ Non-financial risk

- **Model risk:** the risk of a valuation error from improperly using a model
- **Tail risk:** the probability of extreme losses is higher than predicted
- **Operational risk:** risk that arises from the people and processes
- **Solvency risk:** the entity does not survive or succeed because it runs out of cash
- Settlement risk ■ Legal risk ■ Compliance risk

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25. 2 风险计量

□ Measurement of market risk

- Probability
- Standard deviation
- Beta
- **Sensitivity** (delta, gamma, duration)
- **Value at Risk (VaR)** & Conditional VaR (CVaR)
 - VaR is a measure of the **maximum (minimum)** amount of loss expected for a given period at a given **confidence (significance) level**
- Extreme value theory (EVT)
- Scenario analysis and stress testing

□ Measurement of credit risk

- **Credit rating**
- Solvency ratios
- Profitability ratios
- Leverage measures
- Credit VaR
- Probability of default, Expected loss given default
- Ex-ante risk cost

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25. 3 风险处置

□ Methods of risk modification

- **Risk prevention and avoidance**
- **Risk acceptance:** self-insurance and diversification
- **Risk transfer**
- **Risk shifting**

□ Factor considered in choosing the methods

- **Trade-off** between costs and benefits

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人生不是为了超越别人
而是不断自我实现的过程
尽自己最大的努力
不虚度人生，不会后悔

