CFA 一级知识框架图

Portfolio Management

专业来自101%的投入！

网址：WWW.GFEDU.CN
电话：400-700-9596

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Framework

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Portfolio Management: An Overview

Portfolio Perspective	
概念	Evaluate individual investments by their contribution to the risk and return of an investor's portfolio.
作用	➢ **Diversification** allows an investor to reduce portfolio risk without necessarily reducing the portfolio's expected return. ➢ During periods of financial crisis, correlations tend to increase, which reduces the benefits of diversification.

Portfolio Management Process ★		
概念	**Planning Step**	Analysis of the investor's characteristics, IPS.
	Execution Step	Asset allocation, Security analysis, Portfolio Construction.
	Feedback Step	➢ Monitor and rebalance the portfolio. ➢ Measure portfolio performance.

Types of Investors and Pooled Investment Products

	Investor	Time Horizon	Risk Tolerance	Liquidity Needs	Income Needs
特征	Individuals	Varies	Varies	Varies	Varies
	DB plan	Long	High	Quite low	High— mature funds Low— growing funds
	Banks	Short	Quite low	High	Pay interest& operational expenses
	Endowments& Foundations	Very long	High	Quite low	Meet spending commitments
	Insurance	Long— life Short— P&C	Quite low	High	Low
	Mutual funds	Varies by fund	Varies by fund	High	Varies by fund

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Portfolio Risk and Return: Part I

Return Measures, Properties of Returns

概念	**HPR**	HPR= (Ending Value+ Cash Flow Received)/ Beginning Value- 1
	Average Return	➢ Arithmetic mean return: unbiased estimator of the true mean. ➢ Geometric mean return: compound annual rate. ➢ Money-weighted rate of return: IRR.
	Other Return Measures	➢ Gross return: total return before management and administration fees. ➢ Pretax nominal return: return prior to paying taxes. ● Dividend, interest, short-term capital gains, and long-term capital gains may all be taxed at different rates. ➢ After-tax nominal return: return after deducting tax liability. ➢ Real return: nominal return adjusted for inflation. ● Real return measures the increase in an investor's purchasing power. ➢ Leveraged return: the gain or loss as a percentage of an investor's cash investment (real estate).

Return Measures, Properties of Returns

计算	**Expected Return**	$E(R)=\sum_{i=1}^{n}P_iR_i=P_1R_1+P_2R_2+\cdots+P_nR_n$
	Variance of Return	$Var=\sigma^2=\sum_{i=1}^{n}[R_i-E(R)]^2P_i$
	Covariance	$Cov_{1,2}=\sum_{i=1}^{n}P_i[R_{i,1}-E(R_1)][R_{i,2}-E(R_2)]$
	Correlation	$\rho_{1,2}=\frac{Cov_{1,2}}{\sigma_1\sigma_2}$
	The Portfolio Variance Formula (Two Assets/N-Assets)	$\sigma_p^2=\omega_1^2\sigma_1^2+\omega_1^2\sigma_1^2+2\omega_1\omega_2\sigma_1\sigma_2\rho_{1,2}$ $\sigma_p^2=\frac{\overline{\sigma}^2}{N}+\frac{N-1}{N}\overline{Cov}$

Modern Portfolio Theory ★		
假设	**Returns Distribution**	Each investment can be measured by a probability distribution of expected returns over a given horizon.
	Utility Maximization	Investor intends to maximize their expected utility over time horizon.
	Risk is Variability	Risk is measured in terms of variance (standard deviation) of expected returns.
	Risk/Return	Investors make their decision based on expected return and the risk.
	Risk Aversion	Investors prefer lower risk given the same return.

Modern Portfolio Theory ★★		
概念	**Minimum Variance Frontier**	Portfolio that have the lowest standard deviation of all portfolios with a given expected return.
	Global Minimum-Variance Portfolio	The portfolio on the efficient frontier that has the lowest risk.
	Efficient Frontier	➢ Those portfolios that have the greatest expected return for each level of risk make up the efficient frontier. ➢ All risky assets are contained. ➢ **Efficient portfolio**: well/fully-diversified.
	Risk Aversion	➢ Refers to the fact that individuals prefer less risk to more risk. ➢ 用indifference curve表示投资者的主观愿望，风险厌恶投资者的indifference curve是凸的.

Capital Allocation Line (CAL) ★★

概念	➢ **CAL** is the line representing these possible combinations of risk-free assets and the risky asset portfolio. ➢ **Two-fund separation theorem** ● Combining a risky portfolio with a risk-free asset. ● All investors' optimal portfolios will be made up of some combination of an optimal portfolio of risky assets and the risk-free asset.
应用	➢ **Optimal CAL** ● The optimal capital allocation line connects the risk-free assets and the optimal risky asset portfolio. ● **The optimal risky portfolio** is at the tangent of CAL and the efficient frontier of risky assets. ➢ **Optimal portfolio of an investor** ● The optimal portfolio for the investor is the portfolio on the optimal CAL, which is tangent to the indifference curve.

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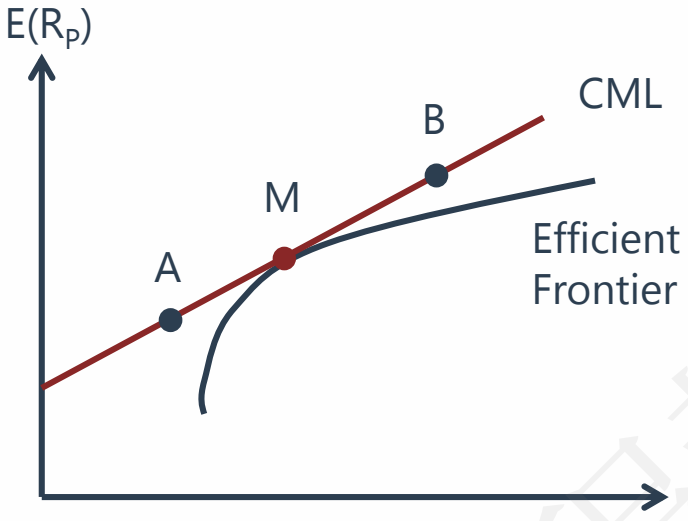
Portfolio Risk and Return: Part II

Market Portfolio ★★	
概念	The tangent point where the CML touches the Markowitz efficient frontier.
性质	➢ Consists of every risky assets, based on homogeneity of expectations. ➢ The weights on each asset are equal to the percentage of the market value of the asset to the market value of the entire market portfolio.

Capital Market Line (CML) ★★ 计算、性质	
计算	➢ $E(R_p) = R_f + \frac{E(R_m) - R_f}{\sigma_m}\sigma_p$ ● CML slope= SR_M ● Portfolio on the CML: $SR_P = SR_M$
性质	➢ CML assumption: investors share **identical expectations.** ➢ CML与efficient frontier相切，切点为Market Portfolio. ➢ The Sharpe ratio for any portfolio along the CML is the same. ➢ CML: 唯一的一条 ↔ CAL: 无数条

Capital Market Line (CML) ★

图像



- **Lending portfolio and borrowing portfolio**
  - A: lending portfolio (risk-free asset+ market portfolio).
  - B: borrowing portfolio (所有资金投market portfolio, 同时还以无风险利率借钱投market portfolio).

应用

- **Asset allocation**
  - Investment using CML follow a passive investment strategy: risk-free asset + market portfolio.

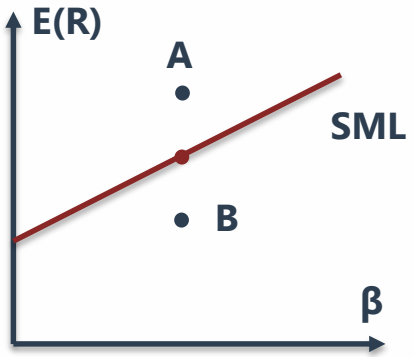
Systematic Risk (beta), Return Generating Models ★★

	Systematic Risk	Nonsystematic Risk	Beta
概念	Cannot be diversified away. (or market risk) interest rate risk, currency risk, macroeconomic risk……	Diversifiable, firm-specific risk.	A standardized measure of systematic risk.
计算	$\beta_i = \frac{Cov_{i,mkt}}{\sigma^2_{mkt}} = (\frac{\sigma_i}{\sigma_{mkt}}) \times \rho_{i,mkt}$		

Return Generating Models （了解）

	Multifactor model	Single Factor/ Market Model
概念	➢ Macroeconomic factors ➢ Fundamental factors ➢ Statistical factors	$R_i = \alpha_i + \beta_i R_m + e_i$

CAPM and SML ★★

假设	➢ Investors are risk-averse, utility-maximizing, rational individuals; ➢ Markets are frictionless, including no transaction costs and no taxes; ➢ Investors plan for the same single holding period; ➢ Investors have homogeneous expectations or beliefs; ➢ All investments are infinitely divisible; ➢ Investors are price takers.
计算	➢ $E(R_i) = R_f + \beta_i[E(R_m) - R_f]$ ● SML slope = $E(R_m) - R_f$
图像	➢ A portfolio: Undervalued → Buy ● market estimated return> E(R) from the SML ➢ B portfolio: Overvalued → Sell ● market estimated return< E(R) from the SML 
应用	Pricing（所有资产都可以被定价）

Differences between SML and CML		
	SML	**CML**
概念	Graph of the capital asset pricing model.	A special case of the CAL, where the optimal risky portfolio is the market portfolio .
性质	➢ **Measure of risk:** Use systematic risk (non-diversifiable risk). ➢ **Slope:** Market risk premium.	➢ **Measure of risk:** Use standard deviation (total risk). ➢ **Slope:** Market portfolio Sharpe ratio.
应用	To determine the appropriate expected returns for securities.	To determine the appropriate asset allocation.

Performance Evaluation Indicators ★		
	计算	**应用**
Sharpe Ratio	$\text{Sharpe ratio} = \frac{R_P - R_f}{\sigma_P}$	➢ For *not* well-diversified portfolio. ➢ 需要和其他组合的SR进行比较
M-Squared (M^2)	$M^2 = (R_P - R_f)\frac{\sigma_M}{\sigma_P} - (R_M - R_f)$	➢ For *not* well-diversified portfolio. ➢ 可直接根据大小判断投资业绩
Treynor Ratio	$\text{Treynor ratio} = \frac{R_P - R_f}{\beta_P}$	➢ For well-diversified portfolio. ➢ 需要和其他组合的TR进行比较
Jensen's Alpha	$\alpha_P = R_P - [R_f + \beta_P(R_M - R_f)]$	➢ For well-diversified portfolio. ➢ 可直接根据大小判断投资业绩

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Basics of Portfolio Planning and Construction

Components of IPS, Risk and Return Objectives

Components of IPS ★

构成	➢ Description of client. ➢ Statement of the purpose. ➢ Statement of duties and responsibilities. ➢ Procedures to update IPS and to respond to various possible situations. ➢ Investment objectives. ➢ Investment constraints. ➢ Investment guidelines. ➢ Evaluation of performance. ➢ Appendices: information on asset allocation.

Risk and Return Objectives

	Risk	Return	Objectives
概念	➢ Willingness（主观） ➢ Ability （客观）	➢ Consistent with risk objective.	➢ Absolute ➢ Relative

Investment Constraints, Asset Allocation

Investment Constraints

概念	Liquidity requirement	Time horizon	Tax concerns
	Legal and regulatory factors	Unique circumstances	

Asset Allocation

	Strategic Asset Allocation	**Tactical Asset Allocation**
概念	Combine the IPS and capital market expectations to formulate weights on acceptable asset classes.	The manager's ability to identify shot-term opportunities in specific asset classes.
性质	Long-term	Short-term
	Specify the percentage allocations to the included asset classes.	Security selection: deviation from index weights on individual securities within an asset class.
	➢ Correlation between asset classes → low ➢ Correlation within the class → high	

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Risk Management: An Introduction

Define Risk Management	
概念	➢ Best achieve organizational or personal objectives while bearing a tolerable level of risk. ➢ Not about minimizing risk.

Risk Management Framework	
概念	➢ Risk governance. ➢ Risk identification and measurement. ➢ Risk infrastructure. ➢ Defined policies and processes. ➢ Risk monitoring, mitigation, and management. ➢ Communications. ➢ Strategic analysis or integration.

Identify Financial and Non-Financial Sources of Risk

	Financial Risks	Non-Financial Risks
概念	➢ Market risk ➢ Credit risk ➢ Liquidity risk	➢ Operational risk ➢ Solvency risk

Methods for Measuring and Modifying Risk Exposures

	Common Measures of Risk	Methods of Risk Modification
概念	➢ Standard deviation or volatility ➢ Asset-specific measures, such as beta or duration ➢ Derivative measures, such as delta, gamma, vega, and rho ➢ Tail measures such as VaR, CVaR and expected loss given default	➢ Risk prevention and avoidance ➢ Risk acceptance: self-insurance and diversification ➢ Risk transfer (insurance) ➢ Risk shifting (derivatives)

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Fintech in Investment Management

What is Fintech

Basic Concept: Innovation	Stage in Development
Technological innovation in the design and delivery of financial services and products	➢ Early from ➢ Followed system

Areas of Fintech development

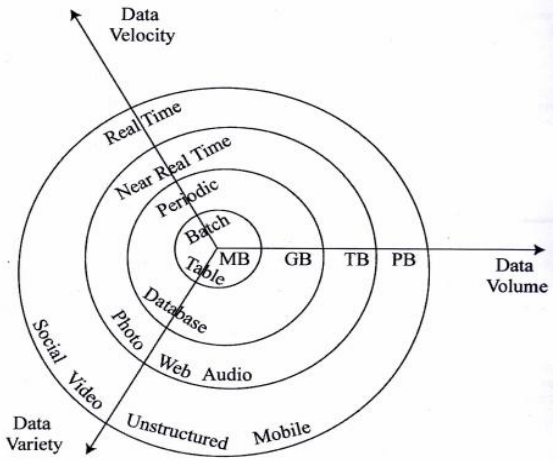
Analysis of large datasets	➢ Growing amounts of traditional data ➢ Massive amounts of alternative data generated
Analytical techniques	➢ Better suited to identify complex, non-linear relationships
Automated trading	➢ May provide a number of benefits to investors
Automated advice	➢ Wealth management services
Financial record keeping	➢ New technology, such as DLT

Big Data

各个领域产生的极大数量的传统及非传统数据

Characteristics

- Very large volume
- Velocity(real-time or near-real-time)
- Variety(structured/semi-structured/unstructured)



Big Data & Data Science

Sources of big data	Sources of alternative data		Challenges
➢ Financial markets ➢ Businesses ➢ Governments ➢ Individuals ➢ Sensors ➢ The internet of things	➢ Individuals ➢ Business process		➢ Quality ➢ Volume ➢ Appropriateness
	Sensors	➢ Satellites ➢ Geolocation ➢ Internet things ➢ Other sensors	➢ 在分析前 Must be sourced, cleaned, organized.

<table>
<tr><th colspan="3">Advanced Analytical Tools</th></tr>
<tr><td colspan="2">Artificial intelligence</td><td>Definition: Capable of performing tasks that have traditionally required human intelligence.</td></tr>
<tr><td colspan="2">Machine Learning</td><td rowspan="2">➢ Grown out of wider AI field
➢ Overfitting errors
➢ Underfitted errors</td></tr>
<tr><td>Supervised</td><td>Unsupervised</td></tr>
</table>

<table>
<tr><th colspan="2">Applications of Fintech</th></tr>
<tr><th>Text analytics</th><th>Natural language processing</th></tr>
<tr><td rowspan="2">➢ Large, unstructured text- or voice-based datasets.
➢ Used in predictive analysis to help identify indicators of future performance.</td><td>➢ A field of research at the interaction to analyze and interpret human language.</td></tr>
<tr><td>➢ Include translation, speech recognition, text mining, sentiment analysis, and topic analysis.</td></tr>
</table>

<table>
<tr><th colspan="2">Applications of Fintech</th></tr>
<tr><th colspan="2">Robo-advisor services</th></tr>
<tr><th>Characteristics</th><th>Be regulated</th></tr>
<tr><td rowspan="3">➢ Passive/fairly conservative investment approach
➢ Low fees and low account minimums
➢ Reach underserved populations</td><td>Eg. SEC(USA), FCA(UK), ASIC(AUS)</td></tr>
<tr><td>Wealth management service types</td></tr>
<tr><td>Fully automated digital wealth managers
Adviser-assisted digital wealth managers</td></tr>
</table>

<table>
<tr><th colspan="2">Risk analysis</th></tr>
<tr><th>Types</th><th>Definition</th></tr>
<tr><td>➢ Stress test
➢ Risk assessment
➢ Backtesting simulation</td><td>Analysis of vast amounts of quantitative and qualitative risk data.</td></tr>
</table>

Applications of Fintech

Algorithmic trading

Computerized	➢ 按照既定规则和引导。
执行算法	➢ Slicing orders into small pieces.
	➢ Speed, anonymity, lower transaction costs. ➢ Continuously Update & Revise.
High frequency trading	➢ Defined when, what, how to trading. ➢ 以获利为目的。

Distributed Ledger Technology

Involved technical concepts	Networks
➢ Consensus mechanism ➢ Cryptography ➢ Smart contracts	➢ Permissionless (any user) ➢ Permissioned (restricted)

Distributed Ledger Technology	
DLT applications	
➢ **Cryptocurrency**	➢ **Tokenization**
➢ Self-imposed limit on the total amount. ➢ Proven to be an attractive means for companies looking to raise capital.	➢ The process of representing ownership rights to physical assets on a blockchain or distributed ledger.
➢ **Post-trade clearing & settlement**	➢ **Compliance**
➢ Requiring multiple interactions between counterparties and financial intermediaries.	➢ May better support shared information, communications, and transparency within and between firms, exchanges, custodians, and regulators.

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