Portfolio Management

-- 2017

Instructor: Feng

Brief Introduction

Topic weight:

SS1	Ethics & Professional Standards	15%
SS2 - SS3	Quantitative Methods	12%
SS4 - SS5	Economics	10%
SS6 - SS9	Financial Reporting and Analysis	20%
SS10 - SS11	Corporate Finance	7%
SS12	Portfolio Management	7%
SS13 - SS14	Equity Investment	10%
SS15 - SS16	Fixed Income	10%
SS17	Derivatives	5%
SS18	Alternative Investments	4%
	Weights:	100%

Brief Introduction

Content:

- **Study session 12**
  - Reading 40: Portfolio Management: An Overview
  - Reading 41. Risk Management: An Introduction
  - Reading 42: Portfolio Risk and Return: Part I
  - Reading 43: Portfolio Risk and Return: Part II
  - Reading 44: Basics of Portfolio Planning and Construction

Brief Introduction

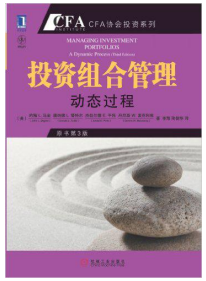
考纲对比:

- 与2016年相比，2017年的考纲没有变化。

Brief Introduction

推荐阅读:

- 投资组合管理
  - John L. Maginn, Donald L. Tuttle, Jerald E. Pinto, Dennis W. Mcleavey
  - ISBN: 978-7-111-38719-0
  - 机械工业出版社



Brief Introduction

学习建议:

- 本门课程难度不高，要争取多拿分；
- 听课与做题相结合，但并不建议“刷题”；
- 最重要的，认真、仔细的听课。

持续的动力，来自内心对卓越的追求，
而不是对金钱的追逐，或他人的目光！

Types of Investors

Tasks:

- Describe the portfolio approach to investing;
- Describe types of investors and distinctive characteristics and needs of each.

Portfolio Approach

Portfolio approach to investing

- Evaluating individual securities in relation to their contribution to the risk and return of the whole portfolio.
  - Portfolio diversification helps investors avoid disastrous investment outcomes;
  - Portfolio diversification also generally offer equivalent expected returns with lower overall volatility of returns, which means the risk is reduced.

Types of Investors

Type of investors

- **Individual investors**
  - Individuals
  - Defined contribution (DC) pension plan
- **Institutional investors**
  - Defined benefit (DB) pension plan
  - Endowments and foundations
  - Banks
  - Insurance companies

Types of Investors

Defined contribution pension plan

- Individuals makes specified contributions to pension plan;
- The benefits are not guaranteed, and individuals accept the investment risk and rewards.

Types of Investors

Defined benefit pension plan

- Employers obligate to pay specified amount to their employees after their retirements;
- The benefits are defined, and employers accept the investment risk;
- **Characteristics and needs**:
  - Investment time horizon: typically long;
  - Liquidity needs: typically low;
  - Risk tolerance: typically high.

Types of Investors

Endowments & foundations

- To maintain the real (inflation-adjusted) capital value of the fund while generating income to fund the objectives of the institution;
- **Characteristics and needs**:
  - Investment time horizon: long (typically perpetual);
  - Liquidity needs: low;
  - Risk tolerance: high.

Types of Investors

Banks

- Accept deposits and extend loans, and earn a return on its reserves that exceeds the rate of interest it pays on its deposits;
- **Characteristics and needs**:
  - Investment time horizon: short;
  - Liquidity needs: high;
  - Risk tolerance: low.

Types of Investors

Life insurance companies

- Investing the premiums in a manner to pay the claims;
- **Characteristics and needs**:
  - Investment time horizon: long;
  - Liquidity needs: high;
  - Risk tolerance: low.

Types of Investors

Property & Casualty (P&C) insurance companies

- Investing the premiums in a manner to pay the claims;
- **Characteristics and needs**:
  - Investment time horizon: short;
  - Liquidity needs: high;
  - Risk tolerance: low.

Types of Investors

Summary of characteristics and needs

	Time horizon	Liquidity needs	Risk tolerance
DB pension plan	Long	Low	High
Endowments & Foundations	Long	Low	High
Banks	Short	High	Low
Insurance companies	Long for life; Short for P&C	High	Low

Summary

- **Importance:** ☆☆☆
- **Content:**
  - Portfolio approach to investing;
  - Types of investors: DC, DB, endowment & foundation, bank, insurance company.
- **Exam tips:**
  - 常考点：四类机构投资者的 time horizon, liquidity, risk tolerance特征。

Portfolio Management Process & Pooled Investment

Tasks:

- Described the steps in the portfolio management process;
- Describe pooled investment products.

Portfolio Management Process

Steps in portfolio management process

- **Planning**
  - Understanding the clients' objectives and constraints;
  - Developing the investment policy statement (IPS);
  - The benchmark should be specified in IPS for evaluation;
  - IPS should be reviewed regularly.

Portfolio Management Process

Steps in portfolio management process (Cont.)

- **Execution**
  - Deciding the target asset allocation for the clients;
  - Security analysis;
  - Portfolio construction and trade executions.
- **Feedback**
  - Portfolio monitoring and rebalancing;
  - Performance evaluation and reporting.

Pooled Investments

Pooled investment

- Mutual funds
  - Open-end funds
  - Closed-end funds
- Exchanged traded funds (ETF)
- Separately managed accounts
- Hedged funds
- Buyout funds
- Venture capital funds

Pooled Investments

Open-end mutual funds

- Investors can buy and redeem the mutual fund shares at net asset value (NAV).
  - Number of shares issued would increase as new investments are made, or decrease when withdrawn occur;
  - Not fully invested as some cash kept for redemption;
  - Fee charged: management fees, upfront fees, redemption fees.

Pooled Investments

Closed-end mutual funds

- No new investments are accepted.
  - Number of shares issued does not change;
  - Investors can only liquidate the shares by selling them to other investors;
  - Traded at a premium or discount to net asset value;
  - Could be fully invested;
  - Fee charged: management fees, upfront fees.

Pooled Investments

Types of mutual funds

- Money market funds
- Bond funds
- Stock funds
- Hybrid/balanced funds

Pooled Investments

Exchange traded funds

- Traded like closed-end fund;
- Price tracking net asset value;
- Transaction costs are lower compared to mutual funds;
- Dividends are paid out to shareholders;
- Minimum required investment is smaller than that of index funds;
- Tax advantages over index funds.

Summary

- **Importance:** ☆☆
- **Content:**
  - 3 steps of portfolio management process;
  - Pooled investment products: mutual fund, ETF.
- **Exam tips:**
  - 常考点：考概念，辨别各种投资行为是属于portfolio management process的那个步骤。

Basics of Risk Management

Tasks:

- Define risk management, describe features of a risk management framework;
- Define risk governance, describe risk budgeting and its role in risk governance.

Risk Management

Definition

- **Risk**
  - Broadly speaking, exposure to uncertainty;
- **Risk exposure**
  - The extent to which the underlying environmental or market risks result in actual risk borne by a business or investor who has assets or liabilities that are sensitive to those risks.

Risk Management

Definition (Cont.)

- **Risk management**
  - The process by which an organization or individual defines the level of risk to be taken, measures the level of risk being taken, and adjusts the latter toward the former, with the goal of maximizing the company's or portfolio's value or the individual's overall satisfaction, or utility.

Risk Management

Risk management framework

- The infrastructure, process, and analytics needed to support effective risk management in an organization.
  - **Risk infrastructure**: the people and systems required to track risk exposures and perform most of the quantitative risk analysis to allow an assessment of the organization's risk profile.

Risk Management

Risk management framework (Cont.)

- Features (key factors) of risk management framework:
  - **Risk governance**
  - **Risk identification and measurement**
  - Risk infrastructure
  - Defined policies and processes
  - Risk monitoring, mitigation, and management
  - Communications
  - Strategic analysis or integration

Risk Management

Risk governance

- The top-down process and guidance that directs risk management activities to align with and support the overall enterprise.
  - **Governance**: the top-level system of structures, rights, and obligations by which organizations are directed and controlled.

Risk Management

Elements of effective risk governance

- **Enterprise risk management**
  - Provides an enterprise-view of risk management;
  - Focus risk activities on the objectives, health, and value of the entire organization.
- **Risk tolerance (risk appetite)**
  - Identifies the extent to which the entity is willing to experience losses or opportunity costs and to fail in meeting its objectives;
  - Focus on what is and is not acceptable.

Risk Management

Elements of effective risk governance (Cont.)

- **Risk budgeting**
  - Quantifies and allocates the tolerable risk by specific metrics;
  - Focus on where and how risk is taken.

Risk Management

Effects of risk tolerance on risk management

- Serve as the high-level guidance for management in its strategic selection of risks.
  - Delineates which risks are acceptable, which are unacceptable, and how much risk the overall organization can be exposed to;
  - Target where it should actively pursue risk and where it should mitigate or modify risk.

Risk Management

Role of risk budgeting in risk governance

- Guides implementation of the risk tolerance decision at strategic level.
  - A means of bridging from the high-level governance risk decision to the many management decisions, large and small, that result in the actual risk exposures.

Summary

- **Importance:** ☆
- **Content:**
  - Definition and framework of risk management;
  - Risk governance, risk tolerance, and risk budgeting.
- **Exam tips:**
  - 不是考试重点。

Identification and Measurement of Risk

Tasks:

- Identify financial and non-financial sources of risk;
- Describe methods for measuring and modifying risk exposures.

Identification of Risk

Financial risk

- The risks that arise from events occurring in the financial markets.
  - E.g., changes in prices or interest rates.

Non-financial risk

- The risks that emanate from outside the financial markets, such as actions within an entity, or from external origins.
  - E.g., environment, the community, regulators, politicians, suppliers, and customers.

Identification of Risk

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 an amount owed on an obligation (e.g., bond, loan, derivative) to another party.

Identification of Risk

Financial risk (Cont.)

- **Liquidity risk**
  - Risk of a significant downward valuation adjustment when selling a financial asset.

Identification of Risk

Non-financial risk

- **Settlement risk**
  - Closely related to default risk but deals more with the settling of payments that occur just before a default.
- **Legal risk**
  - The risk of being sued over a transaction or for that matter, anything an entity does or fails to do.
- **Model risk**
  - The risk of a valuation error from improperly using a model.

Identification of Risk

Non-financial risk (Cont.)

- **Tail risk**
  - More events in the tail of the distribution than would be expected by probability models.
- **Operational risk**
  - Risk that arises from the people and processes that combine to produce the output of an organization.

Identification of Risk

Non-financial risk (Cont.)

- **Solvency risk**
  - Risk that the entity does not survive or succeed because it runs out of cash, even though it might otherwise be solvent.

Identification of Risk

Non-financial risk (Cont.)

- **Compliance risk**
  - Risks that deal with the matter of conforming to policies, laws, rules, and regulations.
    - ✓ Regulatory risk;
    - ✓ Accounting risk;
    - ✓ Tax risk.

Identification of Risk

Interactions of risks

- Risks do not usually arise independently, but generally interact with one another, a problem that is even more critical in stressed market conditions.

Measurement of Risk

Measurement of market risk

- Probability
- Standard deviation
- Beta
- Sensitivity (Delta, Gamma, Vega, Rho, Duration)
- Value at Risk (VaR) and Conditional VaR (CVaR)
- Extreme value theory (EVT)
- Scenario analysis and stress testing

Measurement of Risk

Measurement of credit risk

- Credit rating (Moody's, Fitch, S&P);
- Solvency ratios (e.g., current ratio);
- Profitability ratios (e.g., ROA, ROE);
- Leverage measures (e.g., debt-to-asset ratio);
- Credit VaR, probability of default, expected loss given default, and the probability of a credit rating change;
- Ex ante risk cost (e.g., CDS, put options, exotic options, insurance contracts).

Modification of Risk

Methods of risk modification

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

Factor considered in choosing the methods

- Tradeoff between costs and benefits.

Summary

- **Importance:** ☆☆
- **Content:**
  - Types of financial risk and non-financial risk;
  - Measurement of market risk and credit risk;
  - Modification of risk.
- **Exam tips:**
  - 常考点：风险种类的辨识，特别是financial risk的种类。

Utility Theory

Tasks:

- Calculate and interpret major return and risk measures;
- Describe characteristics of the major asset classes;
- Explain risk aversion and its implications for portfolio selection.

Measurements of Return & Risk

Measurements of return

- **Holding period return**
  - Return earned from holding an asset for a single specified period of time.

$$R = \frac{P_T + D_T}{P_0} - 1$$

- **Average return (Arithmetic return)**
  - It is used to estimate the expected return of next single period.

$R = (R_1 + R_2 + \ldots\ldots + R_n)/n$

Measurements of Return & Risk

Measurements of return (Cont.)

- **Geometric mean return (Time-weighted return)**
  - Used to calculate the compounding growth rate.

$$\text{Periodic return}_{\text{compound}} = \sqrt[n]{(1+R_1)(1+R_2)\ldots\ldots(1+R_n)} - 1$$

- **Money-weighted return (IRR)**
  - Similar to calculation of IRR.

$$CF_0 + \frac{CF_1}{1+MWR} + \ldots + \frac{CF_N}{(1+MWR)^N} = 0$$

Measurements of Return & Risk

Measurements of return (Cont.)

- **Gross return:** return before deducting management and administrative fees.
- **Net return:** return after deducting management and administrative fees.
- **After-tax return:** return after deducting tax liability.
- **Real return:** return after adjusting for inflation.

Measurements of Return & Risk

Measurements of risk

- **Population variance & Standard deviation**

$$\sigma^2 = \frac{\sum_{i=1}^{N}(X_i - \mu)^2}{N} \qquad \sigma = \sqrt{\frac{\sum_{i=1}^{N}(X_i - \mu)^2}{N}}$$

- **Sample variance & Standard deviation**

$$s^2 = \frac{\sum_{i=1}^{n}(X_i - \bar{X})^2}{n-1} \qquad s = \sqrt{\frac{\sum_{i=1}^{n}(X_i - \bar{X})^2}{n-1}}$$

Major Asset Class

Characteristics of major asset classes

- There is a positive relationship between expected return and risk.

Asset classes	Annual returns	Standard deviations
Small cap	11.7%	33.0%
Large cap	9.6%	20.9%
Corporate bond	5.9%	8.4%
Long-term T-Bond	5.7%	9.4%
T-Bills	3.7%	3.1%

Source: 2009 Ibbotson SBBI Classic Yearbook (Tables 2-1, 6-1, C-I to C-7).

Utility Theory

Risk aversion

- **Risk averse**
  - Investors prefer less risk given certain expected return, and prefer higher expected return given certain risk.
- **Risk neutral**
  - Investors are indifferent with the risk given certain expected return.
- **Risk seeking**
  - Investors prefer higher risk given certain expected return.

Utility Theory

Utility theory

- A measure of relative satisfaction that an investor drives from different investment portfolios.

  $U = E(R) - \frac{1}{2}A\sigma^2$ where: A = a measure of risk aversion.
  - A>0, when investor is risk-averse;
  - A=0, when investor is risk-neutral;
  - A<0, when investor is risk-seeking.
- Utility theory helps us quantify the rankings of the investment choices using risk and return.

Utility Theory

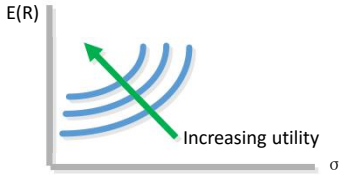
Indifference curve

- Plots the combinations of risk-return pairs that an investor would accept to maintain a given level of utility;
- Defined by trade-off between expected return and risk.

Utility Theory

Indifference curve for risk-averse investors

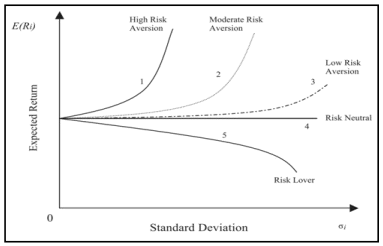
- The curves slope upwardly and getting steeper;
- Higher utility corresponding to a more left or upward indifference curve.



Utility Theory

Indifference curve for various types of investors

- The more risk-averse the investor, the steeper the curve.



Summary

- **Importance:** ☆☆
- **Content:**
  - Measurement of return and risk;
  - Characteristics of major asset classes;
  - Risk averse, risk neutral and risk seeking, and indifference curve.
- **Exam tips:**
  - 常考点：不同风险类别投资者的辨识，及其indifference curve的特征。

Modern Portfolio Theory

Tasks:

- Calculate and interpret portfolio standard deviation;
- Describe and interpret the minimum-variance and efficient frontiers;
- Discuss the selection of an optimal portfolio, given an investor's risk aversion and the capital allocation line.

Return & Risk of Portfolio

Return of portfolio with two risky assets

- $R_p = w_1 R_1 + (1 - w_1) R_2$

Risk (σ) of portfolio with two risky assets

- $\sigma_p = \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2Cov(R_1, R_2)}$

$$\Updownarrow$$

- $\sigma_p = \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\rho_{1,2}\sigma_1\sigma_2}$

Return & Risk of Portfolio

Risk (σ) of portfolio with two risky assets (Cont.)

- **Covariance**

Covariance for population:

$$Cov(x,y) = \frac{\sum_{i=1}^{N}(X_i - \bar{X})(Y_i - \bar{Y})}{N}$$

Covariance for sample:

$$Cov(x,y) = \frac{\sum_{i=1}^{n}(X_i - \bar{X})(Y_i - \bar{Y})}{n-1}$$

- **Correlation coefficient**

Correlation for population:

$$\rho_{xy} = \frac{Cov(x,y)}{\sigma_x\sigma_y}$$

Correlation for sample:

$$r_{xy} = \frac{Cov(x,y)}{s_x s_y}$$

Return & Risk of Portfolio

Risk (σ) of portfolio with two risky assets (Cont.)

- If ρ=1 (perfectly correlated), then:

$\sigma_p = \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\sigma_1\sigma_2} = \sqrt{(w_1\sigma_1 + w_2\sigma_2)^2}$

$= w_1\sigma_1 + w_2\sigma_2$

- If ρ<1 (less perfectly correlated), then:

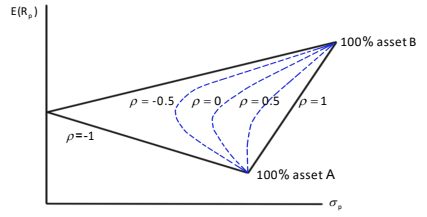
$\sigma_p = \sqrt{w_1^2\sigma_1^2 + w_2^2\sigma_2^2 + 2w_1w_2\rho_{1,2}\sigma_1\sigma_2} < w_1\sigma_1 + w_2\sigma_2$

- The portfolio risk of investing in assets that are less perfectly correlated is lower than the one with assets are perfectly correlated.

Return & Risk of Portfolio

Risk of portfolio with two risky assets (Cont.)

- Portfolio risk decreases as the assets within the portfolio are becoming less correlated.



Efficient Frontier

Minimum-variance frontier of risky assets

- The investment portfolios of risky assets that provide minimum variance (the lowest risk) given a certain level of return.
- **Global minimum-variance portfolio**
  - The investment portfolio that has the lowest variance on minimum-variance frontier of risky assets.

Efficient Frontier

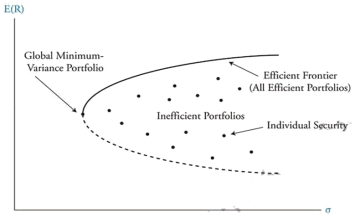
Efficient frontier of risky assets

- The investment portfolios that not only provide the lowest risk given a certain level of return (Minimum-variance frontier), but also offer the highest return given certain level of risk.
  - The investment portfolios on minimum-variance frontier that are above the global minimum-variance portfolio;
  - Also called Markowitz efficient frontier.

Efficient Frontier

Efficient frontier of risky assets

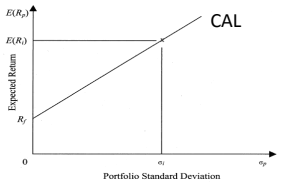
- Portfolios above efficient frontier is not achievable, and portfolios below efficient frontier is un-efficient.



Capital Allocation Line

Capital allocation line (CAL)

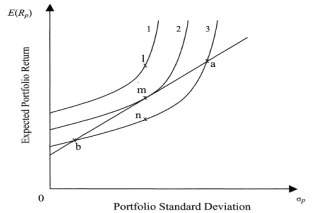
- The portfolios available to an investor through combining the risk-free asset with one risky asset.
  - $R_p = w_{risky}R_{risky} + w_{risk\text{-}free}R_{risk\text{-}free}$
  - $\sigma_p = w_{risky}\sigma_{risky}$



Optimal Portfolio Selection

Optimal portfolio along CAL

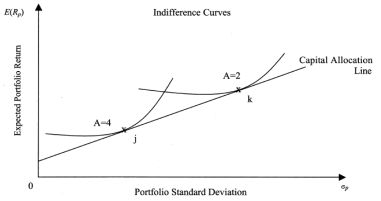
- Investor should choose portfolio "**m**" to invest as it supplies the most satisfaction (utility).



Optimal Portfolio Selection

Optimal portfolio along CAL (Cont.)

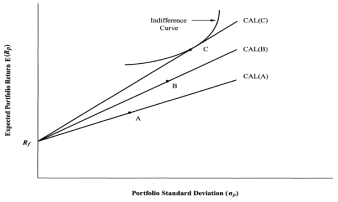
- More risk-averse investor (A=4) will select portfolio "**j**" (less in risky asset), and less risk-averse investor (A=2) will select portfolio "**k**" (more in risky asset).



Optimal Portfolio Selection

Selection among CALs

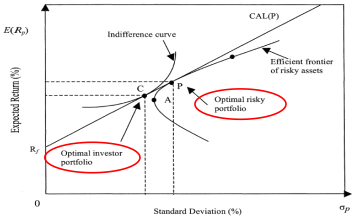
- CAL(C) should be selected because it provides the highest utility among these three CALs.
  - The Sharpe ratio of CAL(C) is the highest.



Optimal Portfolio Selection

Optimal risky portfolio & Optimal investor portfolio

- CAL(P) is the optimal CAL, which is tangent to efficient frontier of risky assets.



Summary

- **Importance:** ☆☆☆
- **Content:**
  - Risk of portfolio with two risky assets;
  - Minimum-variance frontier & efficient frontier;
  - CAL, optimal risky portfolio, optimal investor portfolio.
- **Exam tips:**
  - 常考点1：计算题，两个风险资产组合的risk计算；
  - 常考点2：概念题，efficient frontier的含义。

Capital Market Line & Return Generating Model

Tasks:

- Explain the capital market line;
- Explain systematic and nonsystematic risk;
- Calculate and interpret beta;
- Explain return generating models and their uses.

Capital Market Line

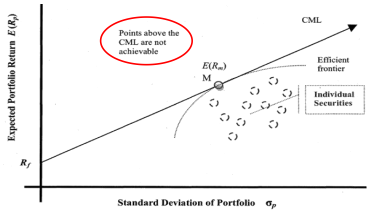
Capital market line (CML)

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

Capital Market Line

Capital market line (Cont.)

- CML is tangent to the efficient frontier at a point representing market portfolio.



Systematic Risk & Unsystematic Risk

Systematic risk (Non-diversifiable risk/market risk)

- Risk affects the entire market or economy, which cannot be avoided and is inherent in the overall market;
  - Caused by macro factors: interest rates, GDP growth, supply shocks;
  - Measured by covariance of asset return and return on the market portfolio, or Beta (β) of the asset.
- Investor would be only rewarded for bearing systematic risk.

Systematic Risk & Unsystematic Risk

Beta (β)

- A measure of systematic risk of an asset, representing how sensitive an asset's return is to the market as a whole.

$$\beta_i = \frac{cov(R_i, R_m)}{\sigma^2_{mkt}} = \frac{\rho_{i,m}\sigma_i\sigma_m}{\sigma^2_m} = \rho_{i,m}\frac{\sigma_i}{\sigma_m}$$

$$\beta_{mkt} = \frac{cov(R_m, R_m)}{\sigma^2_{mkt}} = \frac{\sigma^2_{mkt}}{\sigma^2_{mkt}} = 1$$

$$\beta_{portfolio} = \sum_{i=1}^{n} w_i\beta_i$$

Systematic Risk & Unsystematic Risk

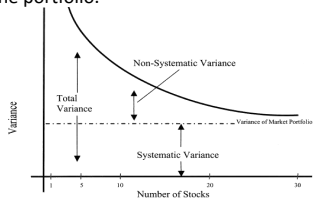
Unsystematic risk (firm-specific risk)

- Risk that can be reduced or eliminated by holding well-diversified portfolios;
- Investor would not be rewarded for bearing unsystematic risk as it could be eliminated through diversification.

Systematic Risk & Unsystematic Risk

Systematic risk & Unsystematic risk

- Systematic risk would not change while unsystematic risk would decrease as more diversification is made within the portfolio.



Return Generating Model

Multi-factor Model

- $E[R_i] - R_f = \beta_{i,1}E[\text{Factor 1}] + \beta_{i,2}E[\text{Factor 2}] + \ldots + \beta_{i,k}E[\text{Factor k}]$

where: $\beta_{i,k}$: 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.

Return Generating Model

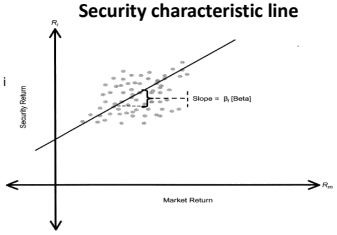
Single-index model

- $E[R_i] - R_f = \beta_i[E(R_m - R_f)]$

Market Model

- $R_i = \alpha_i + \beta_i R_m + e_i$

Security characteristic line



Summary

- **Importance:** ☆☆☆
- **Content:**
  - Capital market line;
  - Systematic risk vs. unsystematic risk, and beta;
  - Return generating model: multi-factor model, single-factor model, and market model.
- **Exam tips:**
  - 常考点1：概念题，CML线的含义和两种风险的辨识；
  - 常考点2：计算题，beta的计算。

Capital Asset Pricing Model

Tasks:

- Explain the capital asset pricing model (CAPM), including its assumptions, the security market line (SML), and its application;
- Calculate and interpret the expected return of an asset using the CAPM.

Capital Asset Pricing Model

Capital asset pricing model (CAPM)

- $E[R_i]=R_f+\beta_i[E(R_m-R_f)]$
  - The expected returns (required return) of assets vary only by their systematic risk as measured by beta (β);
  - Expected return (required return) obtained from the CAPM is used for assets valuation by investors and capital budgeting to determine economic feasibility of projects .

Capital Asset Pricing Model

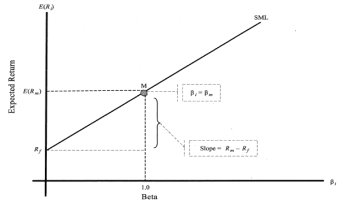
Assumptions of CAPM

- Investors are risk averse, utility-maximizing, rational individuals;
- Markets are frictionless, including no cost and no taxes;
- Investor plan for the same single holding period;
- Investor have homogeneous expectations or beliefs;
- All investments are infinitely divisible;
- Investors are price takers.

Capital Asset Pricing Model

Security market line (SML)

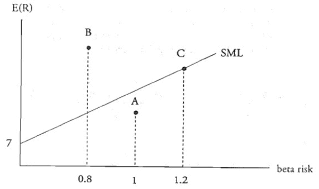
- A graphical representation of the CAPM with beta on the x-axis and expected return on the y-axis.
  - Intercept is R_f, slope is the market risk premium (R_m-R_f).



Capital Asset Pricing Model

Security market line (SML)

- 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 Asset Pricing Model

Example

- An analyst has forecast the following for three stocks when R_f is 7% and $E(R_m)$ is 5%.

Stock	Price today	E(Price) in 1 year	E(Dividend) in 1 year	Beta
A	25	27	1	1
B	40	45	2	0.8
C	15	17	0.5	1.2

Are these stocks overpriced, underpriced, or at their equilibrium prices? Show where they plot on the SML graph?

Capital Asset Pricing Model

Answer:

Stock	Forecasted return	Required return(CAPM)
A	(27-25+1)/25=12.0%	0.07+1.0(0.15-0.07)=15.0%
B	(45-40+2)/40=17.5%	0.07+0.8(0.15-0.07)=13.4%
C	(17-15+0.50)/15=16.6%	0.07+1.2(0.15-0.07)=16.6%

Capital Asset Pricing Model

Answer:

Stock A: Forecasted return < Required return,

thus it is overvalued (sell it or sell it short).

Stock B: Forecasted return > Required return,

thus it is undervalued (buy it);

Stock C: Forecasted return = Required return,

thus it is properly valued.

Capital Asset Pricing Model

CML vs. SML

	CML	SML
Definition	All efficient portfolios	All properly priced assets or portfolios
X-axis	Total risk (σ)	Systematic risk (β)
Slope	Market portfolio's Sharpe ratio	Market risk premium
Application	Used for asset allocation	Used for security selection

Capital Asset Pricing Model

Application of CAPM

- Portfolio performance evaluation
  - Sharpe ratio
  - M-Squared (M^2)
  - Treynor ratio
  - Jensen's Alpha (α)

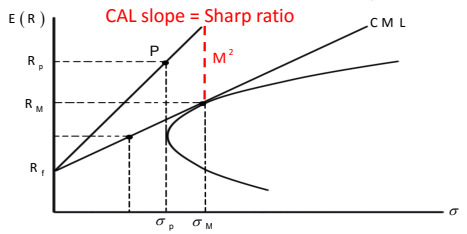
Capital Asset Pricing Model

Sharpe ratio

$$\text{Sharpe ratio}=\frac{R_p-R_f}{\sigma_p}$$

M-Squared

$$M^2=(R_p-R_f)\frac{\sigma_m}{\sigma_p}-(R_m-R_f)$$



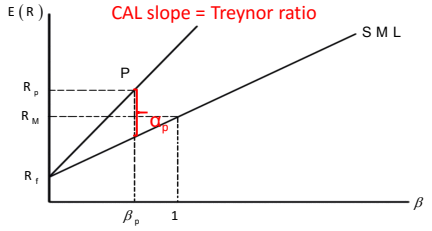
Capital Asset Pricing Model

Treynor ratio

$$\text{Treynor Ratio}=\frac{R_p-R_f}{\beta_p}$$

Jensen's Alpha

$$\alpha_p=R_p-[R_f+\beta_p(R_m-R_f)]$$



Summary

- **Importance:** ☆☆☆
- **Content:**
  - CAPM and its assumption;
  - SML and its application, CML vs. SML;
  - Sharpe ratio, M-Squared, Treynor ratio, and Jensen's Alpha.
- **Exam tips:**
  - 常考点1：概念题，CAPM的假设；
  - 常考点2：计算题，利用CAPM计算要求的回报，并进一步判断一个资产价格是否合理。

Portfolio Planning and Construction

Tasks:

- Describe reasons for a written investment policy statement and its major components;
- Explain the specification of asset classes in relation to asset allocation.

Investment Policy Statement (IPS)

Major component of IPS

- Introduction
  - Describes the client.
- Statement of purpose
  - State the purpose of IPS.
- Statement of duties and responsibilities
  - Details the duties and responsibilities of the clients, the custodian and investment managers.

Investment Policy Statement (IPS)

Major component of IPS (Cont.)

- Procedures
  - Steps to update IPS and procedures to respond to contingencies.
- **Investment objectives**
  - Client's objectives in investing (return & risk).
- **Investment constraints**
  - The factors constrain the client in the investing.

Investment Policy Statement (IPS)

Major component of IPS (Cont.)

- Investment guidelines
  - Execution policy (e.g., use of leverage and derivatives) and assets that are allowed to invest.
- Evaluation and review
  - Feedback on investment results.
- Appendices
  - Strategic asset allocation (SAA), rebalancing policy.

Investment Policy Statement (IPS)

Reasons for writing an IPS

- Identifies client objectives and constraints;
- Clear statement of client risk tolerance and return requirements;
- Imposes investment discipline on both client and manager;
- Serves as a guideline to assess the suitability of a particular investment;
- Identifies a benchmark portfolio consistent with client preferences.

Investment Policy Statement (IPS)

Return objectives

- Specify what return is required by the client.
  - Absolute return objectives;
  - Relative return objectives.

Investment Policy Statement (IPS)

Risk objectives (Cont.)

- The **risk tolerance** of the client is specified.
  - Absolute risk objectives;
  - Relative risk objectives.
- Factors dependent upon:
  - Psychological factors;
  - Personal factors: age, family situation, existing wealth, insurance coverage, cash reserves, income.

Investment Policy Statement (IPS)

Risk tolerance

- **Ability to bear risk:** depends on investment horizon, insurance, income, wealth, financial responsibilities;
- **Willingness to bear risk:** depends on attitudes and beliefs about investment risk.
  - If willingness > ability: advisor should go with ability;
  - If ability > willingness: educate the investor about investment risk, but do not attempt to change personality/psychological characteristics.

Investment Policy Statement (IPS)

Investment constraints (TTLLU)

- **Liquidity**
  - The potential need for cash.
- **Legal and regulatory**
  - Applies more to institutional investors, but this constraint also affects individual investors (e.g., IRA accounts).
- **Time horizon**
  - The time until the proceeds of the investment will be required.

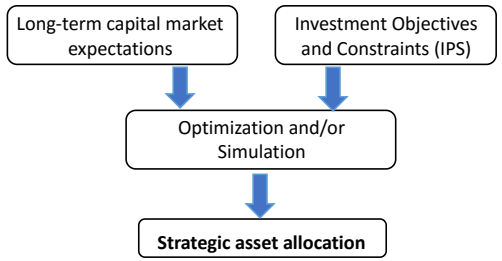
Investment Policy Statement (IPS)

Investment constraints (Cont.)

- **Tax concerns**
  - Is the account taxable, tax-deferred, or tax-exempt.
- **Unique needs and preferences**
  - Anything that does not fit into the above categories.

Asset Allocation

Strategic asset allocation



Asset Allocation

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.

Portfolio Construction

Steps of portfolio construction

- Use risk, return, and correlations among asset classes to construct an efficient frontier;
- Strategic asset allocation: use objectives and constraints from IPS to select an optimal portfolio;
- **Tactical asset allocation** (deviations from SAA), and security selection as permitted and appropriate;
- Risk budgeting: allocates permitted risk to strategic allocation, tactical allocation, and security selection.

Summary

- **Importance:** ☆☆
- **Content:**
  - IPS components: RRTTLLU;
  - Risk tolerance: willingness vs. ability;
  - Strategic asset allocation, and specifications of asset classes.
- **Exam tips:**
  - 常考点1：概念题，RRTTLLU的辨识；
  - 常考点2：asset classes的划分方法。