Foundations of Risk Management

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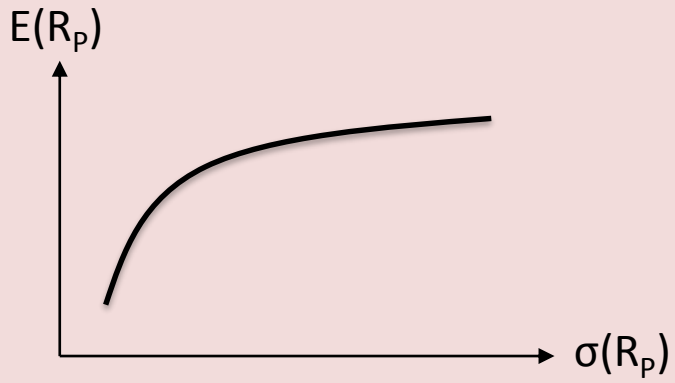
Foundations of Risk Management

1. Portfolio Management Theory
2. Enterprise Risk Management
3. Financial Disasters
4. GARP Code of Conduct

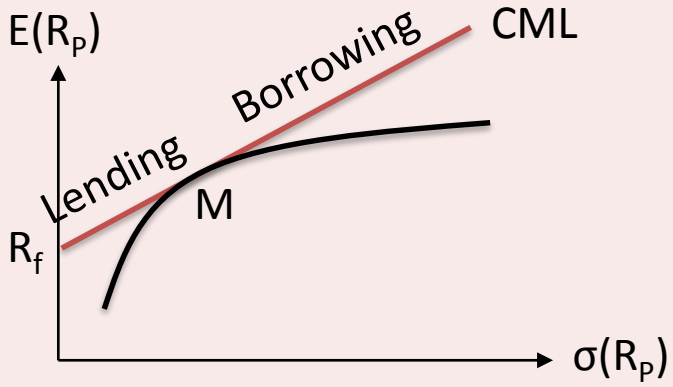
Portfolio Management Theory

Portfolio Management Theory	★★★	性质、计算
Assumption	◘ Regard E(R) as return and σ as risk	
	◘ Utility maximization	
	◘ Risk aversion	
Derivation	◘ **Minimum variance frontier** Portfolio that have the lowest standard deviation of all portfolios with a given expected return are known as minimum-variance portfolios.	
	◘ **Global minimum-variance portfolio** The portfolio on the efficient frontier that has the least 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-diversified or fully-diversified.	

Portfolio Management Theory	★★★	性质、计算
Graphics		

Basic Formulas	
Portfolio Return	$E(R_P) = \omega_1 E(R_1) + \omega_2 E(R_2)$
Portfolio Variance	$\sigma_P^2 = \omega_1^2\sigma_1^2 + \omega_2^2\sigma_2^2 + 2\omega_1\omega_2 Cov_{1,2}$ $\sigma_P^2 = \omega_1^2\sigma_1^2 + \omega_2^2\sigma_2^2 + 2\omega_1\omega_2\rho_{1,2}\sigma_1\sigma_2$

Capital Market Theory	★★	性质
Derivation	◘ **CAL** The line representing these possible combinations of risk-free assets and the optimal risky asset portfolio.	
	◘ **CAL vs. CML** CML assumption: investors share identical expectations. CML: Only One. Point of Tangency: Market Portfolio.	
	◘ **Market portfolio** Is the tangent point where the CML touches the Markowitz efficient frontier. Consists of every risky assets. 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 Theory	★★	性质
Key Conclusion	◘ **Systematic risk and Unsystematic risk** Systematic risk: cannot be diversified away. E.g., interest rate risk, currency risk, macroeconomic risk…… Unsystematic risk: diversifiable, firm-specific risk	
Graphics		

Basic Formulas

CML	$E(R_P) = R_F + \sigma_P \left[\frac{E(R_M) - R_F}{\sigma_M} \right]$

CAPM	★★★	性质、计算

Basic Formulas

- **Beta**

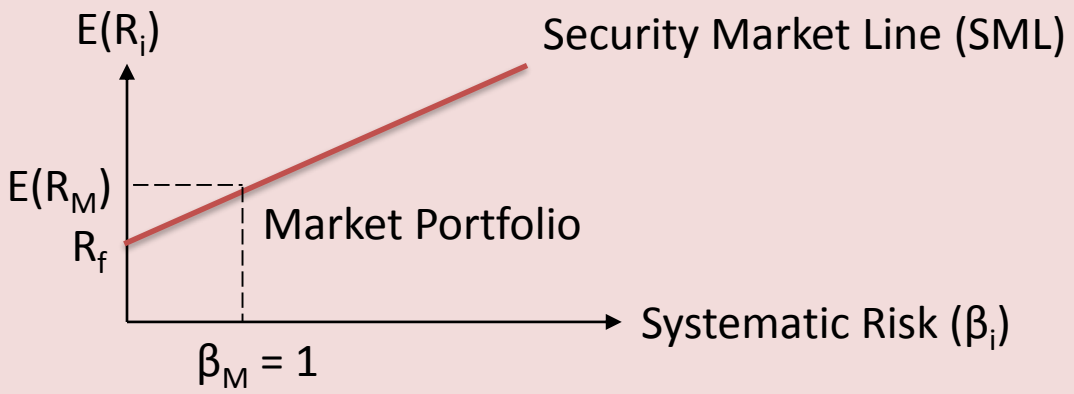
A standardized measure of systematic risk.

$$\beta_i = \frac{Cov_{i,mkt}}{\sigma^2_{mkt}} = \left(\frac{\sigma_i}{\sigma_{mkt}}\right) \times \rho_{i,mkt}$$

- **CAPM (SML)**

$$E(R_i) = R_f + \beta_i\left[E(R_m) - R_f\right], \quad (\beta_i = \frac{Cov_{i,m}}{\sigma^2_m})$$

Graphics



Differences	SML	CML
Measure of Risk	Uses systematic risk	Uses standard deviation
Application	Tool used to determine the appropriate expected returns for securities	Tool used to determine the appropriate asset allocation (percentages allocated to the risk-free asset and to the market portfolio) for the investor
Definition	Graph of the CAPM	Graph of the efficient frontier
Slope	Market risk premium	Market portfolio Sharpe Ratio

Applying the CAPM to Performance Measurement ★★★ 性质、计算

Types	Formula	Application
Sharpe Ratio	$S_P = \frac{E(R_P) - R_F}{\sigma_P}$	Applied to all portfolios and is a better method for measuring historical performance.
Treynor Ratio	$TR = \frac{E(R_P) - R_F}{\beta_P}$	For well-diversified portfolios.
Sortino Ratio	$SOR = \frac{E(R_P) - R_{min}}{\sqrt{MSD_{min}}}$	Return distribution is skewed to the left (for example hedge fund), but Sortino ratio is much less widely used.
Information Ratio	$IR = \frac{E(R_P) - E(R_B)}{\sigma_{e_P}}$	A measure of how well the manager has acquired and used information compared to the average manager.
Jensen Alpha	$\alpha_P = E(R_P) - \{R_F + \beta_P[E(R_M) - R_F]\}$	The Jensen measure is the asset' s excess return over the return predicted by the CAPM.

Multifactor Models	★★★	性质、计算
Inputs	◘ Expected return for the stock. ◘ Factor betas, also known as factor sensitivities or factor loadings. ◘ Deviation of macroeconomic factors from their expected values. ◘ Firm-specific return.	
Equation	$\mathbf{R_i = E(R_i) + \beta_{i1}F_1 + \beta_{i2}F_2 + \ldots + \beta_{ik}F_k + e_i}$ Where: R_i = return on stock i $E(R_i)$ = expected return for stock i B_{ij} = j^{th} factor beta for stock i F_j = deviation of macroeconomic factor j from its expected value e_i = firm-specific return for stock i	

Arbitrage Pricing Theory	★★★	性质、计算

Equation	$E(R_i) = R_F + \beta_{i1}RP_1 + \beta_{i2}RP_2 + \ldots + \beta_{ik}RP_k$ $= R_F + \beta_{i1}[E(R_1) - R_F] + \beta_{i2}[E(R_2) - R_F] + \ldots + \beta_{ik}[E(R_k) - R_F]$
Special Cases	▫ The CAPM is a special case of the APT where there is only one priced risk factor (market risk). ▫ The Fama-French three-factor model describes returns as a linear function of the market index return, firm size, and book-to-market factors. The firm size factor, SMB, equals the difference in returns between portfolios of small and big firms. The book-to-market factor, HML, equals the difference in returns between portfolios of high and low book-to-market firms.

Enterprise Risk Management

Key Classes of Risk	★★★	性质
Market Risk	◘ Considers how changes in market prices and rates will result in investment losses.	
Credit Risk	◘ Refers to a loss suffered by a party whereby the counterparty fails to meet its financial obligations to the party under the contract.	
Liquidity Risk	◘ Is subdivided into two parts: (1) funding liquidity risk; (2) trading liquidity risks.	
Operational Risk	◘ Considers a wide range of non-financial problems such as inadequate computer systems, insufficient internal controls, incompetent management, fraud, human error, and natural disasters.	

Key Classes of Risk	★★	性质
Legal Risk	◘ Could arise when one party sues the other party in an attempt to nullify or terminate the transaction.	
Business Risk	◘ Revolves around uncertainty regarding the entity' s income statement.	
Strategic Risk	◘ Can be thought of in the context of large new business investments, which carry a high degree of uncertainty as to ultimate success and profitability. Alternatively, it could be thought of from the perspective of an entity changing its business strategy compared to its competitors.	
Reputation Risk	◘ Consists of two parts (1) the general perceived trustworthiness of an entity and (2) the general perception that the entity engages in fair dealing and conducts business in an ethical manner.	

Risk Management Process	★★	性质
Steps	◘ Identify the risks. ◘ Quantify and estimate the risk exposures or determine appropriate methods to transfer the risks. ◘ Determine the collective effects of the risk exposures or perform a cost-benefit analysis on risk transfer methods. ◘ Develop a risk mitigation strategy (i.e., avoid, transfer, mitigate, or assume risk). ◘ Assess performance and amend risk mitigation strategy as needed.	

Key Measures	★★	性质
Scenario Analysis	◘ Takes into account potential risk factors with uncertainties that are often non-quantifiable.	
Stress Testing	◘ A form of scenario analysis that examines a financial outcome based on a given "stress" on the entity.	

Key Measures	★★★	性质
Expected Loss	◘ Considers how much an entity expects to lose in the normal course of business. It can often be computed in advance (and provided for) with relative ease because of the certainty involved.	
Unexpected Loss	◘ Considers how much an entity could lose usually outside of the normal course of business. Compared to expected loss, it is generally more difficult to predict, compute, and provide for in advance because of the uncertainty involved.	
VaR	◘ Measures the potential loss in value of a risky asset or portfolio over a defined period for a given confidence interval.	
Economic Capital	◘ Refers to holding sufficient liquid reserves to cover a potential loss.	

Enterprise Risk Management	★★	性质
ERM	◘ Takes an integrative approach to risk management within an entire entity, dispensing of the traditional approach of independently managing risk within each department or division of an entity.	

Risk Appetite	★★★	性质
Principles	◘ A firm’s risk appetite reflects its tolerance (especially willingness) to accept risk. ◘ There must be a logical relationship between the firm’s risk appetite and its business strategy. As a result, business strategy planning meetings require input from the risk management team right from the outset to ensure the consistency between risk appetite and business strategy.	

Corporate Governance	★★★	性质

The role of the Board of Directors

Include the review and analysis of:

- The firm's risk management policies.
- The firm's periodic risk management reports.
- The firm's appetite and its impact on business strategy.
- The firm's internal controls.
- The firm's financial statements and disclosures.
- The firm's related parties and related party transactions.
- Any audit reports from internal or external audits.
- Corporate governance best practices for the industry.
- Risk management practices of competitors and the industry.

Corporate Governance	★★★	性质

The role of CRO

- Providing the overall leadership, vision, and direction for ERM;
- Establishing an integrated risk management framework for all aspects of risks across the organization;
- Developing risk management policies, including the quantification of the firm's risk appetite through specific risk limits;
- Implementing a set of risk indicators and reports, including losses and incidents, key risk exposures, and early warning indicators;
- Allocating economic capital to business activities based on risk, and optimizing the company's risk portfolio through business activities and risk transfer strategies;
- Communicating the company's risk profile to key stakeholders such as the board of directors, regulators, stock analysts, rating agencies, and business partners; and
- Developing the analytical, systems, and data management capabilities to support the risk management program.

Corporate Governance	★★★	性质

The role of Audit Committee

- Has traditionally been responsible for the reasonable accuracy of the firm's financial statements and its regulatory reporting requirements.
- In addition to the more visible verification duties, the audit committee monitors the underlying systems in place regarding financial reporting, regulatory compliance, internal controls, and risk management.
- The audit committee is largely meant to be independent of management but it should work with management and communicate frequently to ensure that any issues arising are addressed and resolved.

Risk Management Failures	★★★	性质
Key Point	◘ A large loss does not necessarily mean that risk management has failed. Losses are the result of risk taking, which is required for value creation.	
Risk Management Failures	Risk management can fail if the firm does not do the following: ◘ Measure risks correctly. ◘ Recognize some risk (taking known and unknown risk into account). ◘ Communicate risks to top management. ◘ Monitor and manage risks. ◘ Use appropriate metrics.	

Data Quality	★★★	性质
Accuracy	◘ The degree to which data correctly reflects the real world object.	
Completeness	◘ Refers to the extent to which the expected attributes of data are provided.	
Consistency	◘ Refers to reasonable comparison of values between multiple data sets.	
Reasonableness	◘ Refers to conformity with consistency expectations.	
Currency	◘ Refers to the lifespan of data.	
Uniqueness	◘ Tied into the data error involving duplicate records.	

Basel Principles for Effective Risk Data Aggregation	★★★	性质
Governance	◘ A bank' s risk data aggregation capabilities and risk reporting practices should be subject to strong governance arrangements consistent with the other principles and guidance established by the Basel Committee.	
Data Architecture and Infrastructure	◘ A bank should design, build and maintain data architecture and IT infrastructure which fully supports its risk data aggregation capabilities and risk reporting practices not only in normal times but also during times of stress or crisis, while still meeting the other Principles.	
Accuracy and Integrity	◘ A bank should be able to generate accurate and reliable risk data to meet normal and stress/crisis reporting accuracy requirements. Data should be aggregated on a largely automated basis so as to minimize the probability of errors.	

Basel Principles for Effective Risk Data Aggregation	★★★	性质
Completeness	◘ A bank should be able to capture and aggregate all material risk data across the banking group. Data should be available by business line, legal entity, asset type, industry, region and other groupings, as relevant for the risk in question, that permit identifying and reporting risk exposures, concentrations and emerging risks.	
Timeliness	◘ A bank should be able to generate aggregate and up-to-date risk data in a timely manner while also meeting the principles relating to accuracy and integrity.	
Adaptability	◘ A bank should be able to generate aggregate risk data to meet a broad range of on-demand, ad hoc risk management reporting requests, including requests during stress/crisis situations, requests due to changing internal needs and requests to meet supervisory queries.	

Basel Principles for Effective Risk Data Aggregation	★★★	性质
Accuracy	◘ Risk management reports should accurately and precisely convey aggregated risk data and reflect risk in an exact manner. Reports should be reconciled and validated.	
Comprehensive-ness	◘ Risk management reports should cover all material risk areas within the organization. The depth and scope of these reports should be consistent with the size and complexity of the bank’ s operations and risk profile, as well as the requirements of the recipients.	
Clarity and Usefulness	◘ Risk management reports should communicate information in a clear and concise manner. Reports should be easy to understand yet comprehensive enough to facilitate informed decision-making. Reports should include meaningful information tailored to the needs of the recipients.	

Basel Principles for Effective Risk Data Aggregation	★★★	性质
Frequency	◘ The board and senior management (or other recipients as appropriate) should set the frequency of risk management report production and distribution. Frequency requirements should reflect the needs of the recipients, the nature of the risks reported, and the speed at which the risks can change, as well as the importance of reports in contributing to sound risk management and effective and efficient decision-making across the bank. The frequency of reports should be increased during times of stress/crisis.	
Distribution	◘ Risk management reports should be distributed to the relevant parties while ensuring confidentiality is maintained.	

Financial Disasters

Kidder Peabody	★★	特征
Background	◘ The head of the government bond trading desk at Kidder Peabody, Joseph Jett, reported substantial artificial profits. After the false profits were detected, $350 million in previously reported gains had to be reversed.	
Key Point	◘ **Artificial profits.** ◘ **Rogue traders.**	

Allied Irish Bank	★★★	特征
Background	◘ A currency trader for Allied Irish Bank, John Rusnak, hid $691 million in losses. Rusnak bullied back-office workers into not following-up on trade confirmations for imaginary trades.	
Key Point	◘ **Imaginary trades.** ◘ **Rogue traders.** ◘ **No trade confirmations.**	

Barings	★★★	特征
Background	◘ Hidden trading losses at Barings induced Nick Leeson to abandon hedging strategies in favor of speculative strategies. A lack of operational oversight and his dual roles as trader and settlement officer allowed him to conceal his activities and losses.	
Key Point	◘ **Speculative strategies:** • **Selling straddle on the Nikkei 225.** • **Long-long futures on Nikkei 225.** ◘ **Dual roles** ◘ **Rogue traders.**	

LTCM	★★★	特征
Background	◻ Extreme leverage, a lack of diversification, and inadequate risk models put Long-Term Capital Management in a cash flow crisis when an economic shock created intolerable marked to market losses and margin calls. A forced liquidation of its huge positions drove prices down, further compounding their losses.	
Key Point	◻ **Investments strategies:** • **Relative value.** • **Credit spreads.** • **Equity volatility.** ◻ **Russia’s unexpectedly default.** ◻ **Insufficient of equity and cash flow crisis.** ◻ **Model risks.**	

Metallgesellschaft	★★★	特征
Background	◘ The financial crisis at Metallgesellschaft resulted fundamentally from cash flow timing differences associated with the positions making up its hedge. Cash flows on short forward contracts occurred over the distant future. Cash flows on long futures contracts occurred daily. In addition, the sizes of the positions were so large that it prevented the company from liquidating its positions without incurring large losses.	
Key Point	◘ **Trading strategy: short-term hedges against long-term risks (stack and roll).** ◘ **Market shifted to contango.** ◘ **German accounting methods.** ◘ **Liquidating problems.**	

Sumitomo Corporation	★★★	特征
Background	◘ The Sumitomo Corporation of Japan lost $2.6 billion in a failed attempt by Yasuo Hamanaka, a senior trader, to corner the world’ s copper market. And Yasuo was fired, prosecuted, and jailed.	
Key Point	◘ Strategy: • Establish a dominant long position in futures contracts and simultaneously purchased large quantities of physical copper. • Sold put options for premium to finance his long copper positions. ◘ Sumitomo’ s lack of supervision on Hamanaka created a high degree of operational risk,	

The Credit Crisis of 2007	★★	特征
Factors	Factors that contributed to the credit crisis: □ Irrational exuberance. □ Relaxed lending standards. □ Lack of experience by rating agencies in rating complex structured investment.	
Key Lessons	□ Risk managers should be aware of potential irrational exuberance. □ Correlations can increase during periods of stress. □ Investors should not estimate RR from normal market conditions. □ Traders' compensation arrangements should reflect prudent practices. □ The risk differential between bonds and ABS should be considered by ratings agencies. □ Analysts should conduct own risk analyses when evaluating ABS. □ Transparency is important for a well-functioning financial market □ Investments from resecuritization are excessively risky.	

GARP Code of Conduct

Code of Conduct	★★	理解、案例分析

Principles	◘ Professional integrity and ethical conduct ◘ Conflicts of interest: must fully disclose any actual or potential conflict to all affected parties ◘ confidentiality
Professional Standards	◘ Fundamental responsibilities ◘ Adherence to generally accepted practices in risk management • Execute all services with diligence and perform all work in a manner that is independent from interested parties. • Be familiar with current generally accepted risk management practices and shall clearly indicate any departure from their use. • Ensure that communications include factual data and do not contain false information. • Make a distinction between fact and opinion.