



Foundation of Risk Management

Weight : 20%

课件编写：冯伟章



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CONTENTS:

考纲对比:

- 与2017年相比, 2018年的考纲基本没有变化。

课程特点与学习建议:

- 本门课程难度不高。
- 知识面牵涉比较广，概念比较多。
- 核心章节知识点逻辑性强。
- 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。



SESSION 1

Framework of Risk Management



SESSION 1

01 Risk Management: A Helicopter View

02 Corporate Risk Management: A Primer

03 Corporate Governance and Risk Management

04 What is ERM?

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06 Principles for effective data Aggregation and Risk Reporting



Risk Management: A Helicopter View

1. Basics of Risk Management

2. Key Classes of Risk

3. Measure and Manage Risk



Basics of Risk Management

Concepts of risk

- Broadly speaking, risk is exposure to **uncertainty**.
 - ✓ **Uncertainty** means it may be **losses as well as gains** in the future, it is a mix of danger and opportunity.



Basics of Risk Management

Expected loss vs. unexpected loss

- **Expected loss:** loss or cost we can expect **in normal business or daily life.**
- ✓ These losses are not big threats because they are reasonably predictable and are already allowed for in our plans, and are priced in the products and services to the customer.
- ✓ E.g.: bad debt, spread, etc.



Basics of Risk Management

Expected loss vs. unexpected loss

- **Unexpected loss:** loss or cost that occurs **outside the normal business or daily life.**
- ✓ Generally, it is much more difficult to forecast and evaluate, and price-in in advance due to the un-expectation involved.
- ✓ E.g.: some natural disaster, unflavored events happen together, etc.



Basics of Risk Management

Concepts of risk (Cont.)

- The **real risk** is that these costs will suddenly rise in an **entirely unexpected way**, or that some other cost will appear from nowhere and steal the money we've set aside for our expected outlays.



Basics of Risk Management

Risk vs. reward

- There is a **trade-off**: if one wants to achieve a higher rate of return on average, one often has to assume more risk.
- ✓ But the transparency of the trade-off between risk and return is highly variable, especially for non-publicly traded securities because the pricing of such securities is less reliable compared to publicly traded securities.



Basics of Risk Management

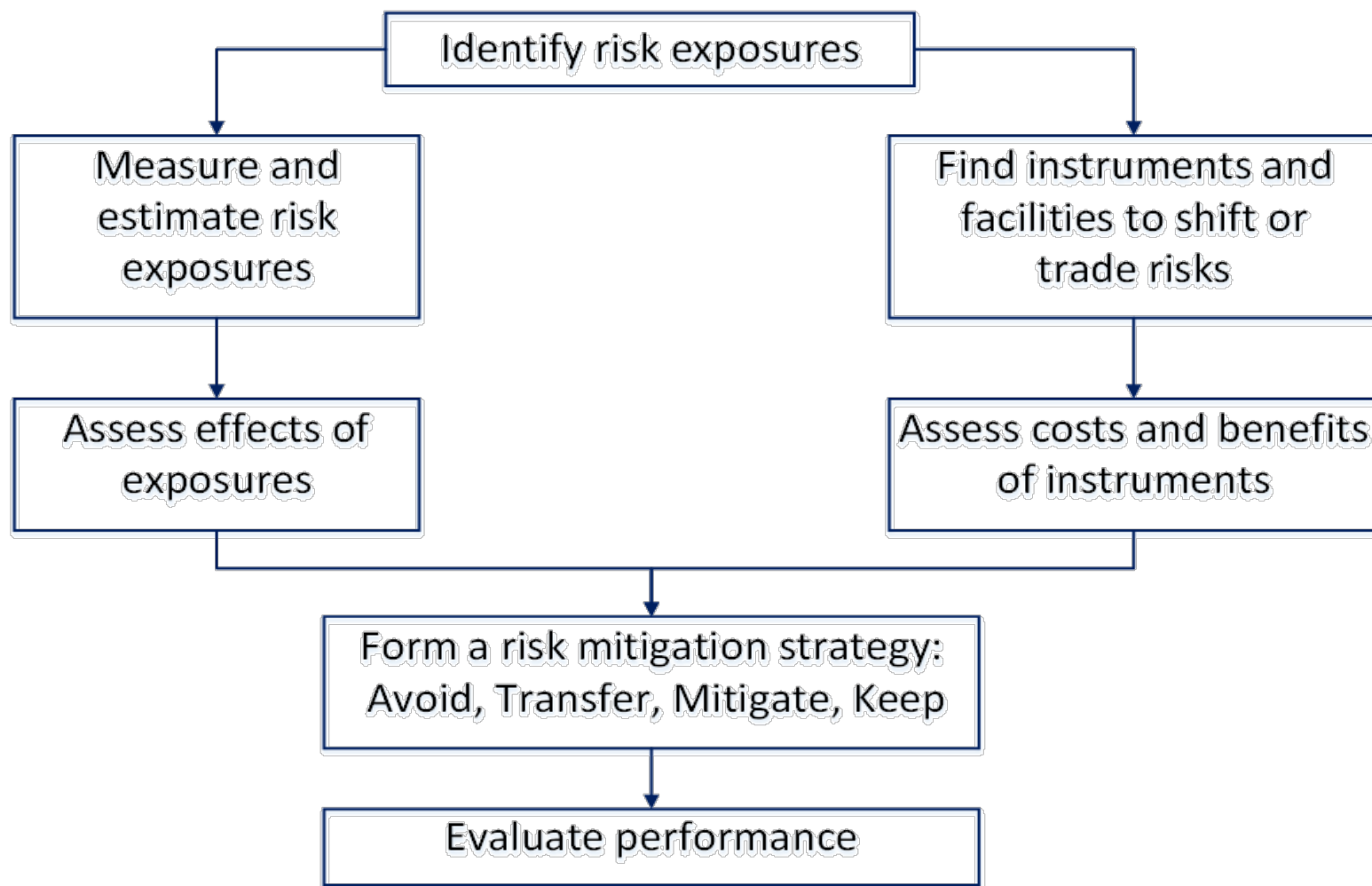
Risk management vs. risk taking

- **Risk management** is about how firms **actively select the type and level of risk that it is appropriate for them to assume.**
 - ✓ Don't think of risk management in defensive term alone.
- **Risk taking** is to **assume additional risk actively for additional gains.**
 - ✓ Risk management and risk taking aren't opposites, but two sides of the same coin.



Basics of Risk Management

Risk management process





Basics of Risk Management

Problems in risk management process

- Two key problems with the process are:
 - ✓ Identifying the correct risks.
 - ✓ Finding an efficient method of transferring the risk.



Basics of Risk Management

Challenges in risk management process

- Risks are **not sufficiently dispersed** among willing and able participants in the economy.
- Failed to consistently assist in preventing market disruptions or preventing financial accounting fraud.
- **Complex** derivative trading strategies often overstate the financial position of many entities and understate the level of risk assumed by them.
- Risk management only involves **risk transfer**, it does **not** result in overall **risk elimination**.



Basics of Risk Management

Impact of interest conflicts on risk management

- Sometimes powerful business leaders will exaggerate the potential returns while diminishing the perceived potential risks, then rewards are not properly adjusted for economic risk. Possible reasons include:
 - ✓ Compensation incentive schemes: bonuses are paid today on profits that may later turn out to be illusory.
 - E.g.: move revenues forward through a “mark-to-market” process.



Risk Management: A Helicopter View

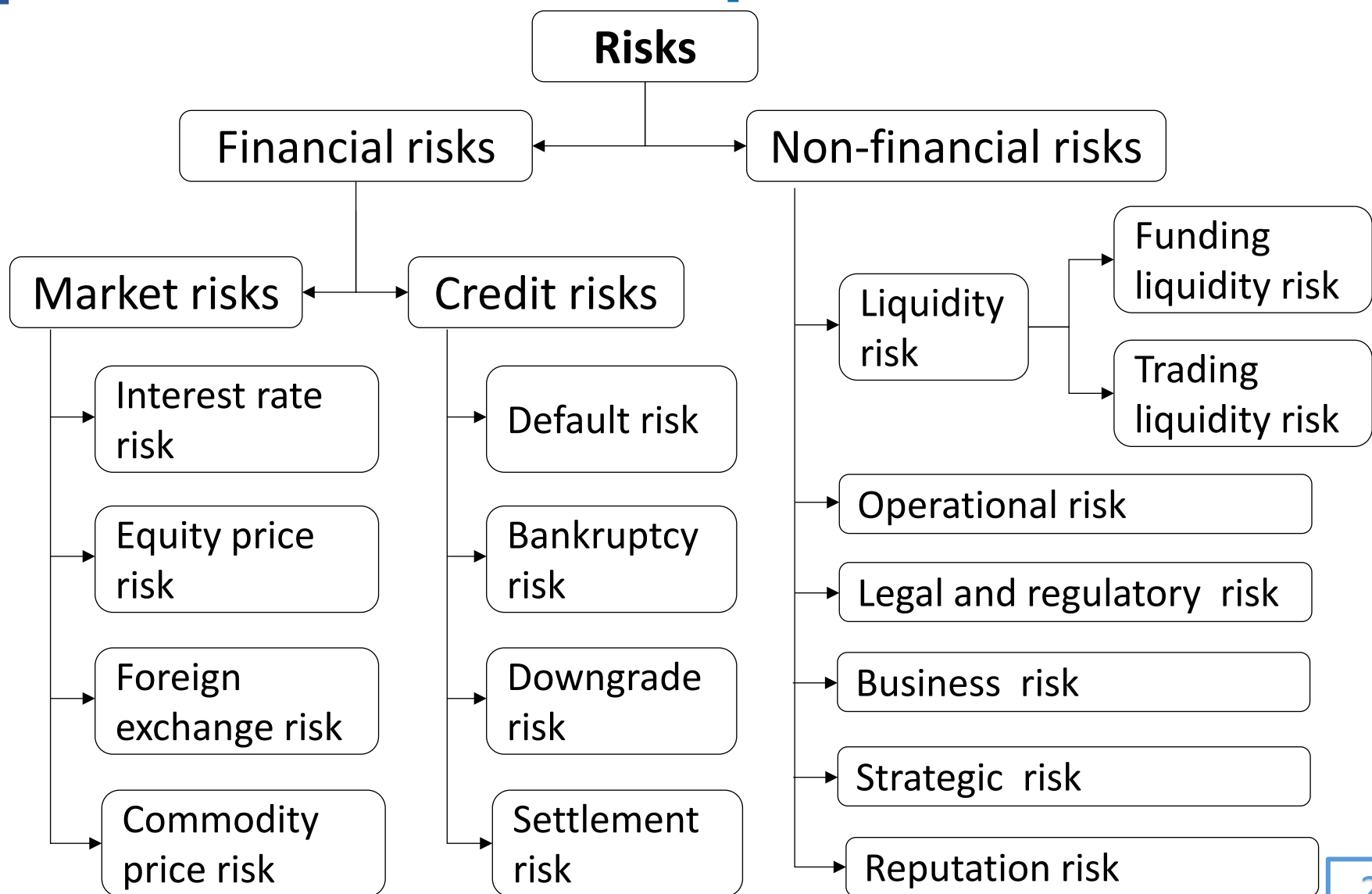
1. Basics of Risk Management

2. Key Classes of Risk

3. Measure and Manage Risk



Key Classes of Risk





Key Classes of Risk

Market risk

- The risk that changes in financial **market prices and rates** will reduce the value of a security or a portfolio.
 - ✓ Interest rate risk
 - ✓ Equity price risk
 - ✓ Foreign exchange risk
 - ✓ Commodity price risk



Key Classes of Risk

Credit risk

- The risk of an economic loss from the **failure** of a counterparty **to fulfill its contractual obligations**, or from the increased risk of default during the term of the transaction.
- ✓ **Default risk**: the debtor's incapacity or refusal to meet his/her debt obligation, whether interest or principal payments on the loan contracted.
- ✓ **Bankruptcy risk**: the risk of actually taking over the collateralized, or escrowed, assets of a defaulted borrower or counterparty.



Key Classes of Risk

Credit risk (Cont.)

- ✓ **Downgrade risk:** the risk that the **perceived creditworthiness** of the borrower or counterparty might deteriorate.
- ✓ **Settlement risk:** the risk due to the exchange of cash flows when a transaction is settled.



Key Classes of Risk

Liquidity risk

- **Funding liquidity risk:** relates to a firm's ability to **raise the necessary cash** to roll over its debt; to meet the cash, margin, and collateral requirements of counterparties; and to satisfy capital withdrawals.
- **Trading liquidity risk:** the risk that an institution will not be able to **execute a transaction at the prevailing market price** because there is, temporarily, no appetite for the deal on the other side of the market.



Key Classes of Risk

Operational risk

- **Operational risk** refers to potential losses resulting from a range of operational weaknesses including inadequate systems, management failure, faulty controls, fraud, and human errors.
- ✓ In the banking industry, operational risk is also often taken to include the risk of natural and manmade catastrophes (e.g., earthquakes, terrorism) and other nonfinancial risks.



Key Classes of Risk

Legal and regulatory risk

- **Legal risk** become apparent when a counterparty, or an investor, loses money on a transaction and decides to **sue** the provider firm to avoid meeting its obligations.
- **Regulatory risk** is the potential impact of a **change in laws and regulations** to the market entity.
 - ✓ E.g., higher tax rates, higher compliance costs.
- Under Basel II Capital Accord, legal and regulatory risks are classified as operational risks.



Key Classes of Risk

Business risk

- Business risk refers to the classic risks of the world of business.
 - ✓ Uncertainty about the demand for products.
 - ✓ The price that can be charged for those products.
 - ✓ The cost of producing and delivering products.



Key Classes of Risk

Strategic risk

- The risk of significant investments for which there is a high uncertainty about success and profitability.

Reputation risk

- Reputation risk consists of two parts:
 - ✓ An enterprise can and will fulfill its promises to counterparties and creditors.
 - ✓ An enterprise is a fair dealer and follows ethical practices.

Practice 1

Bank A has loaned funds to a private manufacturing company B. The current balance of the loan is \$ 1 million and it is secured by a piece of land and the corresponding building owned by company B. Due to an economic downturn, company B suffered a loss for the first time in its 10- year operating history and is currently experiencing some cash flow difficulties. In addition, the land and building that is held as collateral has recently been appraised at only \$800,000. Based only on the information provided, which of the following risks faced by Bank A have increased?

Practice 1

- A. Bankruptcy risk and default risk.
- B. Bankruptcy risk and settlement risk.
- C. Default risk and downgrade risk.
- D. Default risk, downgrade risk, and settlement risk.

Practice 1

Answer: A

The fact that the loan is secured by land and the building is now worth less than the amount of the loan outstanding subjects LBI to increased bankruptcy risk in the sense that the liquidation value of the collateral is insufficient to recover the loss if the loan defaults. The financial loss and the cash flow difficulties suggest that there is increased default risk for LBI as well.

Practice 1

(Cont.)

Downgrade risk does not apply here because Make It's loan is not publicly traded and is unlikely to be rated by a recognized rating agency. Settlement risk does not apply here either because there is no exchange of cash flows at the end of the transaction that would be required to incur such risk. In this case, the loan is settled when Make It fully repays the principal balance owed.



Risk Management: A Helicopter View

1. Basics of Risk Management

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Measure and Manage Risk

Quantitative measures

- Sensitivity risk measures
- Value at risk (VaR)

Qualitative measures

- Scenario analysis
 - ✓ Stress testing

Measure and Manage Risk

Sensitivity risk measures

- Examine how portfolio value responds to a **small change** in a **single** risk factor.
- ✓ Equity exposure measures: **Beta (β)**.
 - Assets with betas more (less) than 1 are considered more (less) volatile than the market as a whole.
- ✓ Fixed-income exposure measures: **duration** and **convexity**.

Measure and Manage Risk

Sensitivity risk measures (Cont.)

- Options risk measures: Delta (Δ), Gamma (Γ), Vega (Λ), etc.
 - ✓ Delta: sensitivity of option price against the underlying asset price;
 - ✓ Gamma: sensitivity of option delta against the underlying asset price;
 - ✓ Vega: sensitivity of option price against underlying asset price volatility.



Measure and Manage Risk

Value at Risk (VaR)

- The **minimum loss** that would be expected a **certain percentage** of the time over a **certain period of time** given the assumed market conditions.
- Example: the 5% VaR of a portfolio is €2.2 million over a one-day period.
- ✓ Interpretation: the minimum loss that would be expected to occur over one day 5% of the time is \$2.2 million.

Measure and Manage Risk

Scenario risk measures

- Provides an estimate of the impact on portfolio value of a set of **significant change** in **multiple** risk factors.
- ✓ **Stress tests**: examine the impact on portfolio of a scenario of **extreme** changes of risk factors.

Measure and Manage Risk

Scenario risk measures (Cont.)

- **Historical scenario approach:** use a set of changes in risk factors that have **actually** occurred in the past.
 - ✓ E.g.: change of risk factors in financial crisis.
- **Hypothetical scenario approach:** use a set of **hypothetical** change in risk factors, not just those that have happened in the past.



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Corporate Risk Management: A Primer

1. Cons and Pros of Hedging

2. Process of Risk Hedging



Cons and Pros of Hedging

Disadvantages of hedging risk

- Under MM theory, both the firm and the individual investor are able to perform the same financial transactions at the same cost, so that the value of the firm will remain constant despite any attempt to hedge risk.
- ✓ However, the underlying assumption of no transaction costs or taxes is highly unrealistic.
- Hedging is a **zero-sum game** that has no long-term increase on a firm's earnings or cash flows.



Cons and Pros of Hedging

Disadvantages of hedging risk

- Active hedging may distract management from its core business.
- Risk management requires specialized skills, knowledge, infrastructure, and data acquisition and processing effort.
- A flawed risk management strategy can drag a firm down even more quickly than the underlying risk.
- Even a well-developed risk management strategy has compliance costs, including disclosure, accounting, and management requirements.



Cons and Pros of Hedging

Advantages of hedging risk

- By reducing the volatility of earning/cash flow by hedging, a firm may **reduce the cost of capital** and enhance the ability to finance growth.
- Good risk management is often an indication to the firm's stakeholders that **management is doing a good job**, this is often reflected directly in the firm's stock price.
- Hedging may allow management better **control** over the firm's economic **performance** to better achieve the board's objectives.

Cons and Pros of Hedging

Advantages of hedging risk

- Hedging through the use of derivatives instruments such as swaps and options may be **cheaper** than purchasing an insurance policy.
- Hedging, as a risk reduction activity, may offers synergies with the operations of the firm.
- ✓ E.g., by hedging the price of a commodity that is an input to its production process, a firm can stabilize its costs and hence also its pricing policy, which can be a competitive advantage in the marketplace.



Corporate Risk Management: A Primer

1. Cons and Pros of Hedging

2. Process of Risk Hedging



Process of Risk Hedging

Process of risk hedging

- Determining the objective: risk appetite
- Mapping the risks
- Choosing instruments for risk management
- Constructing and implementing a strategy
- Performance evaluation



Process of Risk Hedging

Determining the risk appetite

- A corporation should not engage in risk management before deciding clearly on its objectives in terms of risk and return, and the **first step is to determine the risk appetite** of the firm as **the board of directors** defines it.
- ✓ **Risk appetite:** the firm's tolerance, especially its willingness, to accept risk, and can be expressed in quantitative or qualitative statements.
 - E.g., the maximum losses the organization is willing to incur at a given confidence limit during a given time period.



Process of Risk Hedging

Determining the risk appetite (Cont.)

- The board need to **communicate with the management** and set the firm's risk appetite.
- There must be a logical relationship between the firm's risk appetite and its business strategy, and ensure the **consistency between risk appetite and business strategy**.



Process of Risk Hedging

Determining the risk appetite (Cont.)

- The board in determining the firm's risk appetite must consider the **potential conflict between debtholders and shareholders**.
- ✓ Debtholders are more concerned with minimizing all risks because their upside potential is generally limited.
- ✓ Shareholders may be willing to accept a large risk in order to increase equity returns.

Process of Risk Hedging

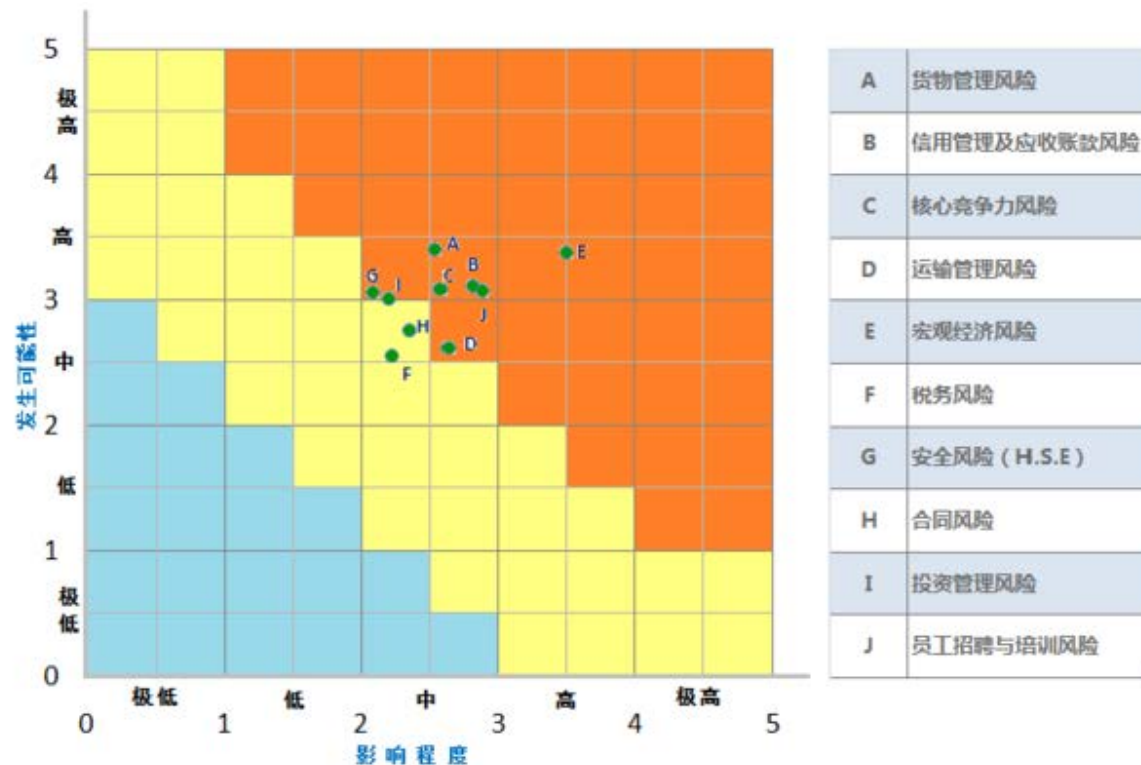
Determining the risk appetite (Cont.)

- In determining whether to hedge specific risk factor, **the role of the board of directors** includes:
 - ✓ Set out the objectives in clear and executable directives.
 - ✓ Set the criteria in advance for examining whether the objectives are attained.
 - ✓ Declare to hedge accounting profits or economic profits, and short-term profits or long-term profits.
 - ✓ Clarify the time horizon for any of the risk management objectives set for management.

Process of Risk Hedging

Mapping the risks

- It is essential to map the relevant risks and to estimate their current and future magnitudes.





Process of Risk Hedging

Choosing instruments for risk management

- Financial instruments used to hedge risks can be classified as exchange traded or over the counter (OTC):
 - ✓ Exchange traded: public trading, standardized, more liquid, no default risk, more transparent, regulated.
 - Futures, option.
 - ✓ OTC: private trading, customized, less liquid, default risk, less transparent, unregulated.
 - Forward, swap, option.



Process of Risk Hedging

Choosing instruments for risk management (Cont.)

- The company should compare **competing ways** (e.g. derivatives, insurance) to manage risks and evaluate the likely **costs and benefits**.
- ✓ **Pricing risk** can be hedged by forward or futures contract.
- ✓ **Foreign currency risk** can be hedged by currency forward or currency option contract.
- ✓ **Interest rate risk** can be hedged by forward rate agreement (FRA), interest rate futures, interest option, or interest swap.



Process of Risk Hedging

Constructing and implementing a strategy

- The company must have access to all the relevant corporate information, market data, and statistical tools and models before attempting to devise a hedging strategy.
- Considerations include:
 - ✓ Static vs. dynamic hedging strategies.
 - ✓ Hedge planning horizon.
 - ✓ Complex financial accounting implications of hedging with derivatives.

Practice 1

Which of the following statements regarding exchange-traded and over-the-counter (OTC) financial instruments is correct?

- A. There is greater liquidity with exchange-traded financial instruments.
- B. There is greater customization with exchange-traded financial instruments.
- C. There is greater price transparency with OTC financial instruments.
- D. There is credit risk by either of the counterparties inherent in exchange-traded instruments.

Answer: A



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Corporate Governance and Risk Management

1. Best Practice in Corporate
Governance and Risk Management

2. Mechanisms of Risk Governance



Best Practice in Corporate Governance

Corporate governance

- The system of internal controls and procedures by which individual companies are managed.
- ✓ It provides a framework that defines the rights, roles, and responsibilities of various groups within an organization.
- ✓ The core of corporate governance is to **minimize and manage the conflicting interests** between shareholders and other stakeholders.



Best Practice in Corporate Governance

Best practice in corporate governance

- The board keeps **independent** from the management.
 - ✓ Board consists of a majority of independent members with basic knowledge of the firm's business.
 - ✓ E.g., the CEO should not also be the chairman of the board.
- The board **looks after the interests of all stakeholders**, including shareholders and debtholders who may have interest conflicts.
- The board **develops a clear business strategy** and makes sure that risks are made transparent to stakeholders.

Best Practice in Corporate Governance

Best practice in corporate governance

- The board should be **careful of potential agency risks** that the management may take more risks to maximize personal benefits rather than the objectives of the stakeholders.
- The board should **consider the introduction of a chief risk officer (CRO)**.
- ✓ The CRO's objective would be to link the corporate governance duties to the firm's risk management objectives.



Best Practice in Corporate Governance

Best practice in risk management

- Board should **demand substance over form**.
 - ✓ E.g., focus on the firm's economic performance rather than accounting performance.
- Board **promotes a robust risk management process** within the firm.
 - ✓ E.g., upward mobility for risk management careers.
- Board sets up an ethics committee and **establish strong ethical standards**.

Best Practice in Corporate Governance

Best practice in risk management

- Board makes sure that the way staff are rewarded and compensated is based on **risk-adjusted performance** and is aligned with shareholders' interests.
- Board **approves all major transactions** after ensuring the transactions are **within the risk appetite** and consistent with the firm's overall business strategy.
- Board has a **risk committee** in place, which remain separate from the audit committee.
- ✓ But it is suggested to have at least one board member on both committees to ensure consistent corporate objectives.



Best Practice in Corporate Governance

Best practice in risk management

- Board makes sure a firm's risk management plan **aligns risk appetite with business strategy.**
- ✓ The firm should have an appropriate infrastructure in place to identify, measure, and manage all risks.
- ✓ The firm's incentive compensation should be based on risk-adjusted return and aligns with the long-term interests of stakeholders.



Corporate Governance and Risk Management

1. Best Practice in Corporate
Governance and Risk Management

2. Mechanisms of Risk Governance



Mechanisms of Risk Governance

Risk advisory director

- A risk advisory director is a board member and a risk specialist who attends risk committee and audit committee to provide advice on the firm's:
 - ✓ Risk appetite and risk management policies.
 - ✓ Internal controls, financial statements and disclosures.
 - ✓ The firm's related parties and related party transactions.
 - ✓ Periodic risk management report and any audit reports.
 - ✓ Best practices of corporate governance and risk management for the industry.

Mechanisms of Risk Governance

Risk management committee

- Risk management committee is responsible for:
 - ✓ Identify, measure, and monitor financial risks.
 - ✓ Approve credit facilities that are above certain limits or within limits but above a specific threshold.
 - ✓ Monitors the composition of the bank's lending and investment portfolios in light of the current economic environment.



Mechanisms of Risk Governance

Audit committee

- The audit committee is responsible for:
 - ✓ The accuracy of the financial and regulatory reporting.
 - ✓ Ensuring that the firm complies with minimum or best-practice standards in other key activities.
 - E.g., regulatory, legal, compliance, and risk management activities.
- The audit committee members are required to be financially literate so that they can carry out their duties.
- The audit committee needs to be independent but productive with the management.



Mechanisms of Risk Governance

Compensation committee

- Concerns involving compensation committee include:
 - ✓ Keep independent of management.
 - ✓ Incentive compensation should be aligned with the long-term interests of shareholders and other stakeholders, and with risk-adjusted return on capital.
 - Incorporating risk management considerations into performance goals and compensation decisions.
 - ✓ Stock-based compensation helps to align the interests of executives with those of shareholders, but it is not a panacea.



Mechanisms of Risk Governance

Interdependence of functional units

- In terms of risk management, the functional units within a firm are usually dependent on one another.
- All transaction data must be recorded correctly and in a appropriate manner to ensure effective risk management.
- ✓ Operations unit in a firm is often extremely important for generating and maintaining the data for risk management.



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What Is ERM?

Traditional approach to risk management

- Traditionally, companies managed risk in organizational silos.
 - ✓ Market, credit, and operational risks were treated separately and often dealt with by different individuals or functions within an institution.
- The shortcomings include:
 - ✓ Risks are highly interdependent and cannot be segmented and managed by entirely independent units.
 - One risk type can affect another.



What Is ERM?

Traditional approach to risk management (Cont.)

- ✓ Traditional approach may result in inefficient and costly over-hedging of risks at the firm level.
- ✓ The various business units may use different methods and models to measure and manage risks.
- The company's top management and the board of directors may not be easy to understand the overall risk profile.



What Is ERM?

Definition of ERM

- ERM (enterprise risk management) is a comprehensive and **integrated** framework for managing key risks in order to achieve business objectives, minimize unexpected earnings volatility, and maximize firm value.
- In fact, there is no standard definition of ERM because the practice of ERM is still relatively new. Other definitions include:
 - ✓ **By ISO:** risk is the "effect of uncertainty on objectives" and risk management refers to "coordinated activities to direct and control an organization with regard to risk."



What Is ERM?

Definition of ERM (Cont.)

- ✓ **By COSO in 2004:** ERM is a **process**, effected by an entity's board of directors, management, and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its appetite, **to provide** reasonable assurance regarding the achievement of entity objectives.



What Is ERM?

Definition of ERM (Cont.)

- ERM is all about integration, in three ways.
 - ✓ ERM requires an integrated risk organization.
 - ✓ ERM requires the integration of risk transfer strategies.
 - ✓ ERM requires the integration of risk management into the business processes of a company.



What Is ERM?

Benefits of ERM

➤ Increased organizational effectiveness

- ✓ Provide the top-down coordination necessary to make the various functions work cohesively and efficiently.

➤ Better risk reporting

- ✓ Prioritize the level and content of risk reporting that should go to senior management and the board.
- ✓ Increase risk transparency throughout an organization.

➤ Improved business performance

- ✓ Reduced losses, lower earnings volatility, increased earnings, and improved shareholder value.



What Is ERM?

Costs of ERM

- For most companies, the implementation of ERM implies a **multi-year initiative** that requires ongoing senior management sponsorship and sustained investments in **human and technological resources**.



What Is ERM?

Components of ERM

- A successful ERM program can be broken down into seven key components:
 - 1. Corporate governance:** ensure that the board of directors and management have established the appropriate organizational processes and corporate controls to measure and manage risk across the company.
 - 2. Line management:** integrate risk management into the revenue-generating activities of the company.



What Is ERM?

Components of ERM (Cont.)

- 3. Portfolio management:** aggregate risk exposures, incorporate diversification effects, and monitor risk concentrations against established risk limits.
- 4. Risk transfer:** mitigate risk exposures that are deemed too high, or are more cost-effective to transfer out to a third party than to hold in the company's risk portfolio.



What Is ERM?

Components of ERM (Cont.)

- 5. Risk analytics:** provide the risk measurement, analysis, and reporting tools to quantify the company's risk exposures as well as track external drivers.
- 6. Data and technology resources:** support the analytics and reporting processes.
- 7. Stakeholder management:** communicate and report the company's risk information to its key stakeholders.



What Is ERM?

Summary: components of ERM

1. Corporate governance

Establish top-down risk management

2. Line management

Business strategy alignment

3. Portfolio management

Think and act like a "fund manager"

4. Risk transfer

Transfer out concentrated or inefficient risk

5. Risk analytics

Develop advanced analytical tool

6. Data and technology resources

Integrate data and system capability

7. Stakeholder management

Improve risk transparency for key stakeholders



What Is ERM?

Chief risk officer (CRO)

- The CRO is a **senior executives** who will sponsor a major program to establish an ERM approach. Its role and responsibilities include:
 - ✓ Providing the overall leadership, vision, and direction for enterprise risk management.
 - ✓ 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 risk limits.

What Is ERM?

Chief risk officer (Cont.)

- ✓ Implementing risk indicators and reports, including losses and incidents, key risk exposures, 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.
- ✓ Developing the analytical, systems, and data management capabilities to support the risk management program.



What Is ERM?

Chief risk officer (Cont.)

- CRO usually reports to CEO or CFO, but this can make firms vulnerable to internal friction when serious clashes of interest occur between corporate leaders. Solutions include:
 - ✓ Establish a dotted-line reporting relationship between the CRO and the board or board risk committee.
 - ✓ Under extreme that dotted line may convert to a solid line so that the CRO can go directly to the board without fear for his or her job security or compensation.



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Optimal Level of Risk for Bank

Optimal level of risk for bank

- The relationship between bank value and risk is generally concave, so **there is an optimal amount of risk** for a bank from the perspective of its shareholders.
- ✓ An increase in risk can enable a bank to invest in assets and projects that are valuable, but can also lead to a loss in value because of an adverse impact on the bank's risk of financial distress and its ability to create value through liabilities.
- ✓ The optimal rating (probability of default) of a bank is generally not the highest rating, AAA, but some other rating.



Optimal Level of Risk for Bank

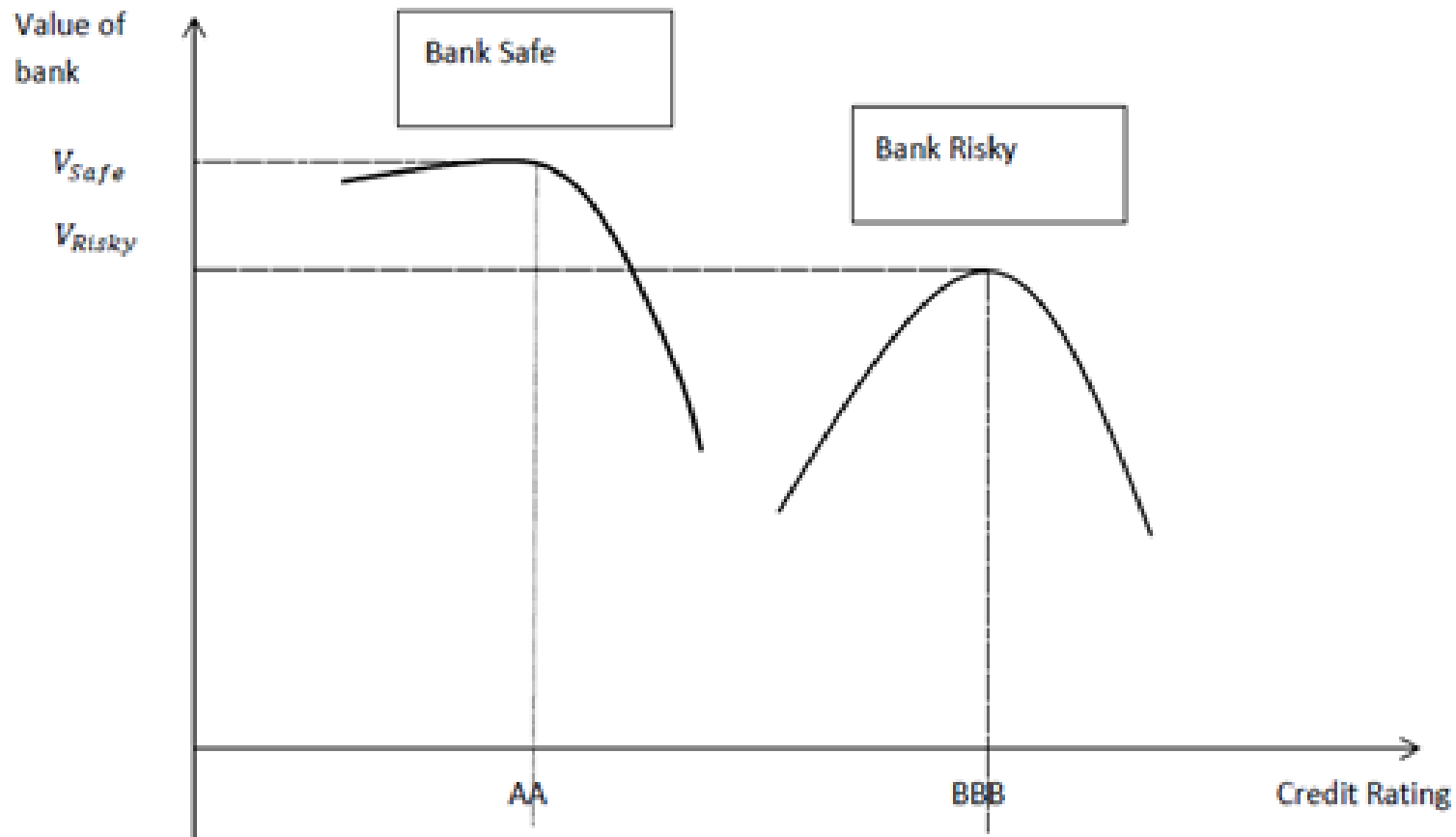
Optimal level of risk for bank (Cont.)

- The rating that maximizes bank value differs across banks due to their nature of business.
- ✓ A bank with more of deposit franchise and with more relationship lending is likely to prefer a higher rating than an institution that is engaged in more transactional activities.
- ✓ A bank that enters into long-term derivatives contracts might find a higher rating more valuable than one that does not.

Optimal Level of Risk for Bank

Optimal level of risk for bank (Cont.)

➤ A graphic illustration of optimal level of risk for banks:





Optimal Level of Risk for Bank

Risk management for bank

- Risk management can add or destroy value for a bank in the following ways:
 - ✓ Bank value will be **added** if:
 - The **incremental value** of risk management **exceeds the fixed cost**.
 - All the business units are required to manage risk from the perspective of **entire bank rather than single unit**.
 - ✓ Bank value will be destroyed if the risk management process is inflexible, and value creation activities may be rejected.



Optimal Level of Risk for Bank

Challenges and limitations

- Limitations of risk measurement technology:
 - ✓ Real-time risk measures may not exist for banks.
 - ✓ Risk measurement can be highly imprecise.
 - ✓ Risk measurement can be affected by behavioral biases.
- Limitations on hedging:
 - ✓ Some risks cannot be hedged.
 - ✓ Hedges may not work out as planned.

Optimal Level of Risk for Bank

Challenges and limitations (Cont.)

- Limitations regarding risk-taking incentives:
 - ✓ Risk-takers are often rewarded in ways that give them incentives to take risks that are more valuable to themselves than to their organizations.
 - ✓ This problem is made worse by the limitations of risk measurement tools.

Optimal Level of Risk for Bank

Challenges and limitations (Cont.)

- Banks usually use **VaR** measures in setting risk limits, but there are some challenges:
 - ✓ Firm-wide VaR is **not likely to account for all** of the bank's **risks**, especially operational risks.
 - ✓ The risk aggregation in arriving at a firm-wide VaR needs to consider the **correlation** estimates.
 - But in practice, there is usually insufficient data available to make such estimates accurately.
 - ✓ Different types of risk will lead to differing **statistical distributions**.



Optimal Level of Risk for Bank

Governance, incentive structure, and risk culture

- It may be difficult to evaluate the impact of bank's **governance** on its risk profile and its performance.
 - ✓ Data are usually limited.
 - ✓ The nature of business is different.
 - ✓ Strong bank governance doesn't necessary lead to good performance.



Optimal Level of Risk for Bank

Governance, incentive structure, and risk culture (Cont.)

- **Incentive structure** need to be set to reward managers contribution to the **entire organization**, but not the units alone, and **on a risk-adjusted basis**.
- **A strong culture** will lead to greater consistency and less variability in performance. Companies with honest and trustworthy managers are generally more profitable and are given higher valuations.



SESSION 1

01 Risk Management: A Helicopter View

02 Corporate Risk Management: A Primer

03 Corporate Governance and Risk Management

04 What is ERM?

05 Risk Management, Governance, Culture and Risk Taking in Banks

06 Principles for effective data Aggregation and Risk Reporting

Principles for effective data Aggregation and Risk Reporting

1. Risk Data Aggregation

2. Risk Reporting

Risk Data Aggregation

Definition

- **Risk data aggregation:** defining, gathering, and processing risk data according to the bank's risk reporting requirements to enable the bank to **measure its performance against its risk tolerance/appetite.**
- ✓ Risk data aggregation includes sorting, merging or breaking down sets of data.



Risk Data Aggregation

Benefit of effective risk data aggregation

- **Better anticipation of problem:**
 - ✓ If risk data is viewed as a whole rather than in isolation, it is easier to anticipate the existing and potential problems.
- **Easier to identify steps to return to financial health.**
- **Improve resolvability** in terms of bank stress or failure.
- **Increase profitability** by increase efficiency and reduce the chance of loss.

Risk Data Aggregation

Principles for risk data aggregations

➤ Overarching governance and infrastructure

- ✓ Principle 1: governance
- ✓ Principle 2: data architecture and IT infrastructure

➤ Risk data aggregation capabilities

- ✓ Principle 3: accuracy and Integrity
- ✓ Principle 4: completeness
- ✓ Principle 5: timeliness
- ✓ Principle 6: adaptability



Risk Data Aggregation

Principle 1: governance

- A bank's risk data aggregation capabilities and risk reporting practices should be **subject to strong governance** arrangements consistent with other principles and guidance established by the Basel Committee.
- ✓ Risk data aggregation should be part of the overall risk management framework.



Risk Data Aggregation

Principle 2: 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.

Risk Data Aggregation

Principle 3: 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.

Risk Data Aggregation

Principle 4: 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.

Risk Data Aggregation

Principle 5: timeliness

- A bank should be able to generate aggregate and up-to-date risk data in a **timely** manner while also meeting the other principles.
- The precise timing depend on:
 - ✓ The nature and potential **volatility** of the risk being measured.
 - ✓ The **criticality** to the overall risk profile of the bank.
 - ✓ The bank-specific frequency requirements for risk management reporting.



Risk Data Aggregation

Principle 6: 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.
 - ✓ Requests to meet supervisory queries.

Principles for effective data Aggregation and Risk Reporting

1. Risk Data Aggregation

2. Risk Reporting

Risk Reporting

Risk reporting

- To manage risk effectively, the **right** information needs to be presented to the **right** people at the **right** time.
- ✓ They should contain the correct content and be presented to the appropriate decision-makers in a time that allows for an appropriate response.
- ✓ Risk reports based on risk data should be accurate, clear and complete.



Risk Reporting

Principles for risk reporting

- Principle 7: accuracy
- Principle 8: comprehensiveness
- Principle 9: clarity and usefulness
- Principle 10: frequency
- Principle 11: distribution

Risk Reporting

Principle 7: 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.

Risk Reporting

Principle 8: comprehensive

- 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.

Risk Reporting

Principle 9: 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.

Risk Reporting

Principle 10: frequency

- The board and senior management should set the frequency of risk management report production and distribution.
- ✓ Frequency requirements should reflect:
 - The needs of the recipients.
 - The nature of the risk reported.
 - The speed at which the risk can change.
 - The importance of reports.
- ✓ The frequency of reports should be increased during times of stress/crisis.

Risk Reporting

Principle 11: distribution

- Risk management reports should be distributed to the relevant parties while ensuring confidentiality is maintained.

Summary

Summary of principles

Risk data aggregation	Risk reporting
• Principle 1: governance	
• Principle 2: data architecture and infrastructure	
• Principle 3: accuracy and integrity (Reliable)	• Principle 7: accuracy • Principle 9: clarity and usefulness
• Principle 4: completeness	• Principle 8: comprehensive
• Principle 5: timeliness	• Principle 10: frequency
• Principle 6: adaptability	
	• Principle 11: distribution



SESSION 2

Portfolio Management



Portfolio Management

Portfolio management

- **Portfolio:** a group of financial assets such as stocks, bonds and cash equivalents, as well as their mutual, exchange-traded etc.
- **Portfolio approach to investing:** evaluating individual securities in relation to their contribution to the risk and return of the whole portfolio.

SESSION 2

01 The Standard Capital Asset Pricing Model

02 Applying the CAPM to Performance Measurement

03 Arbitrage Pricing Theory and Multifactor Models of Risk and Return



The Standard Capital Asset Pricing Model

1. Modern Portfolio Theory

2. Capital Asset Pricing Model

Modern Portfolio Theory

Harry Markowitz (马克维茨)

- 美国经济学家，出生于1927年。
- 1990年获得 Nobel Memorial Prize (诺贝尔奖) in Economic Sciences.
- He is best known for his pioneering work in **Modern Portfolio Theory (MPT)**.





Modern Portfolio Theory

Portfolio Selection (1952), *Journal of Finance*.

- The HM model is also called Mean-Variance Model due to the fact that it is based on expected returns (mean) and the standard deviation (variance) of the various portfolios.
- 最早用算术均值代表风险资产的期望收益率，用方差（或标准差）代表风险来研究资产组合的选择问题。
- 马克维茨在均值-方差分析框架下，推导出证券资产的上凸的有效前沿，也就是决策所需的机会集。然后结合效用分析中下凸的无差异曲线，即决策所需的偏好函数，最优组合就被确定在两条曲线的切点处。

Modern Portfolio Theory

Measurements of return

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

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



Modern Portfolio Theory

Measurements of risk

➤ Population variance & standard deviation

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

➤ Sample variance & standard deviation

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

Modern Portfolio Theory

Risk aversion

- Investors prefer less risk given certain expected return, and prefer higher expected return given certain risk.



Modern Portfolio Theory

Portfolio return and risk

➤ Covariance

Covariance for population:

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

Covariance for sample:

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

➤ Correlation coefficient

Correlation for population:

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

Correlation for sample:

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

Modern Portfolio Theory

Portfolio return and risk

- Return of portfolio with **two risky assets**:

$$R_p = w_1 R_1 + w_2 R_2$$

- Risk (σ) of portfolio with **two risky assets**:

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

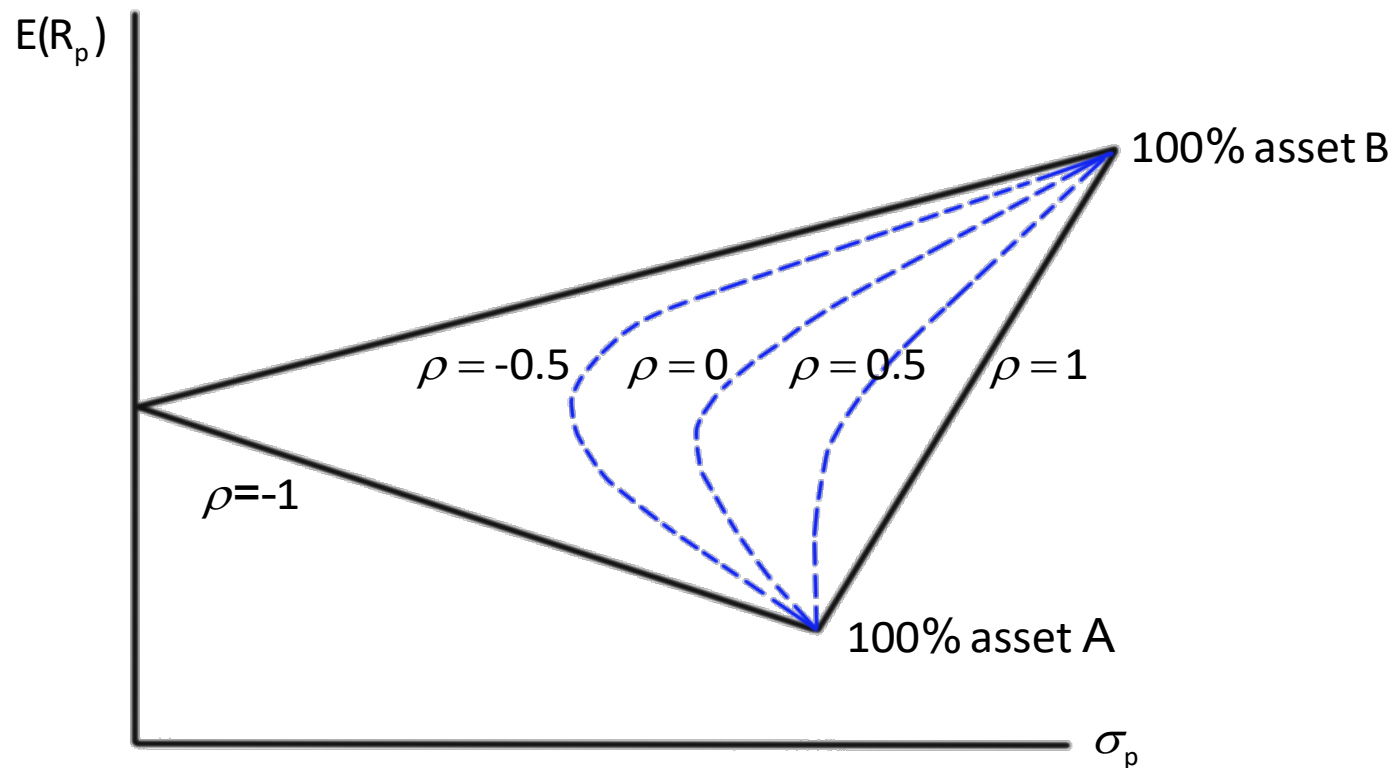
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$$\sigma_p = \sqrt{w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 \rho_{1,2} \sigma_1 \sigma_2}$$

Modern Portfolio Theory

Portfolio return and risk

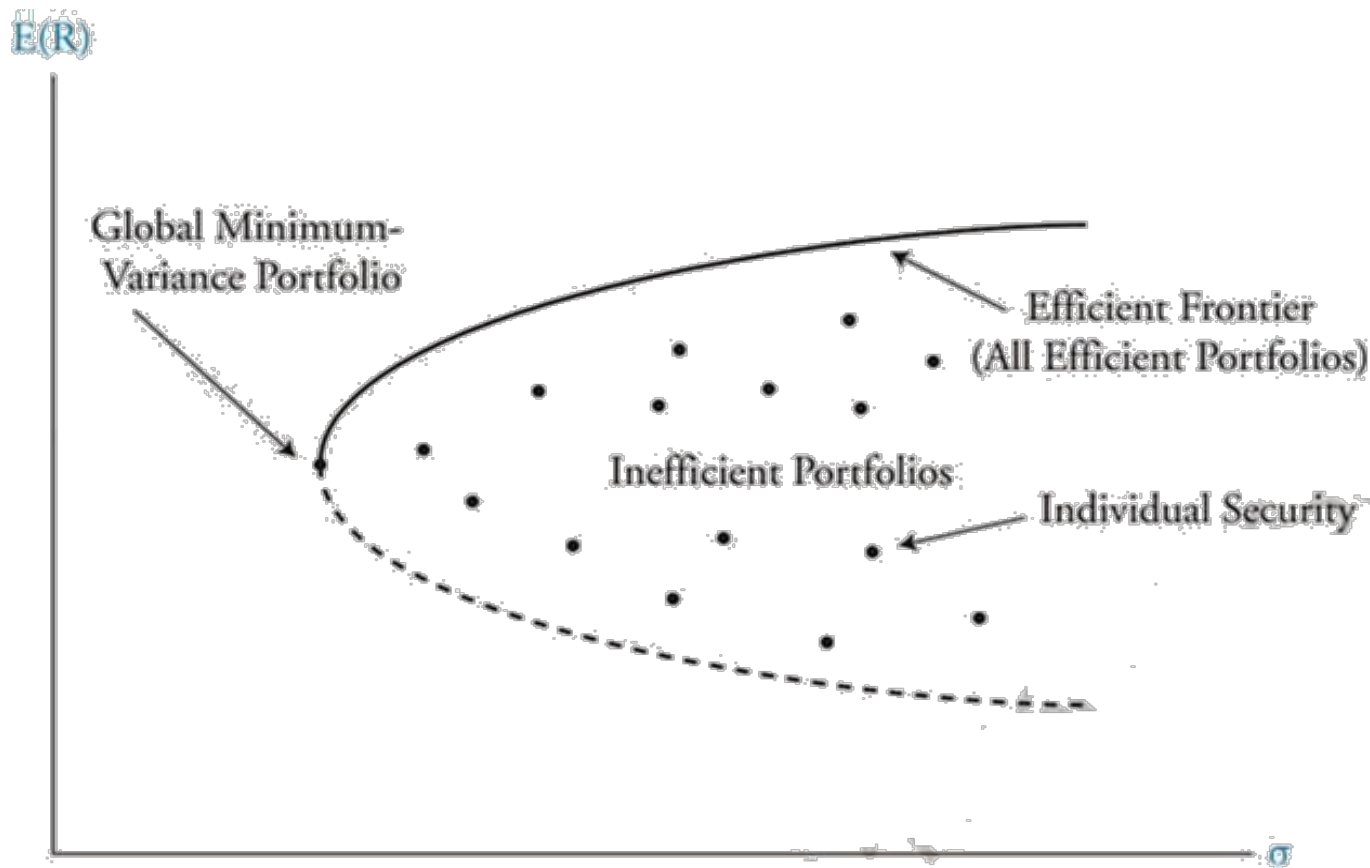
- The risk of portfolio with two risky assets decreases as the assets within the portfolio are becoming less correlated.



Modern Portfolio Theory

Portfolio return and risk

➤ All attainable portfolios with **all risky assets**:



Modern Portfolio Theory

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.

Modern Portfolio Theory

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.

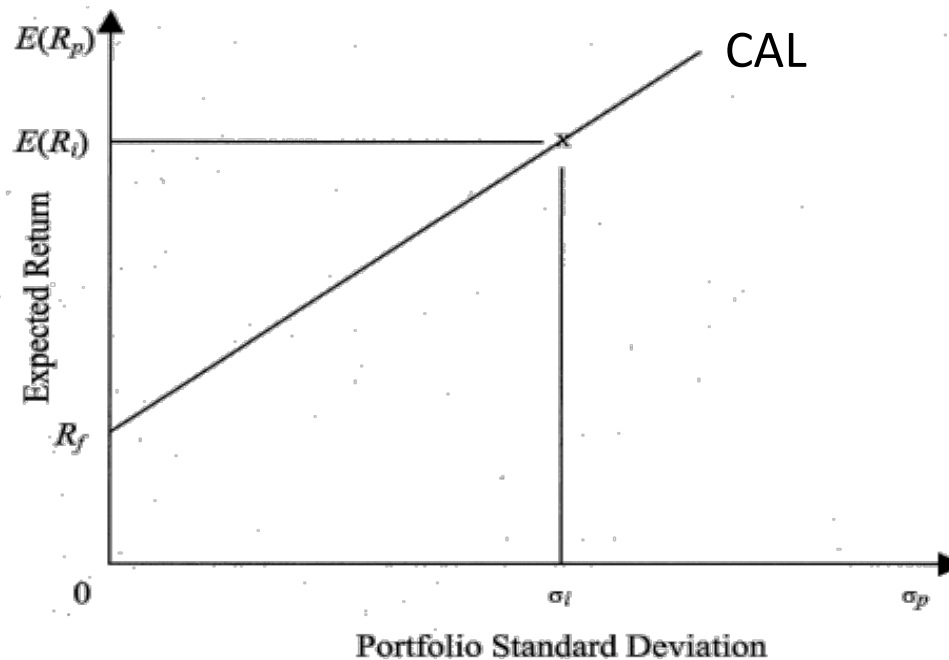
Modern Portfolio Theory

Capital allocation line (CAL)

➤ The portfolios available to an investor through **combining the risk-free asset with one risky asset**.

✓ $R_p = w_{\text{risky}} R_{\text{risky}} + w_{\text{risk-free}} R_{\text{risk-free}}$

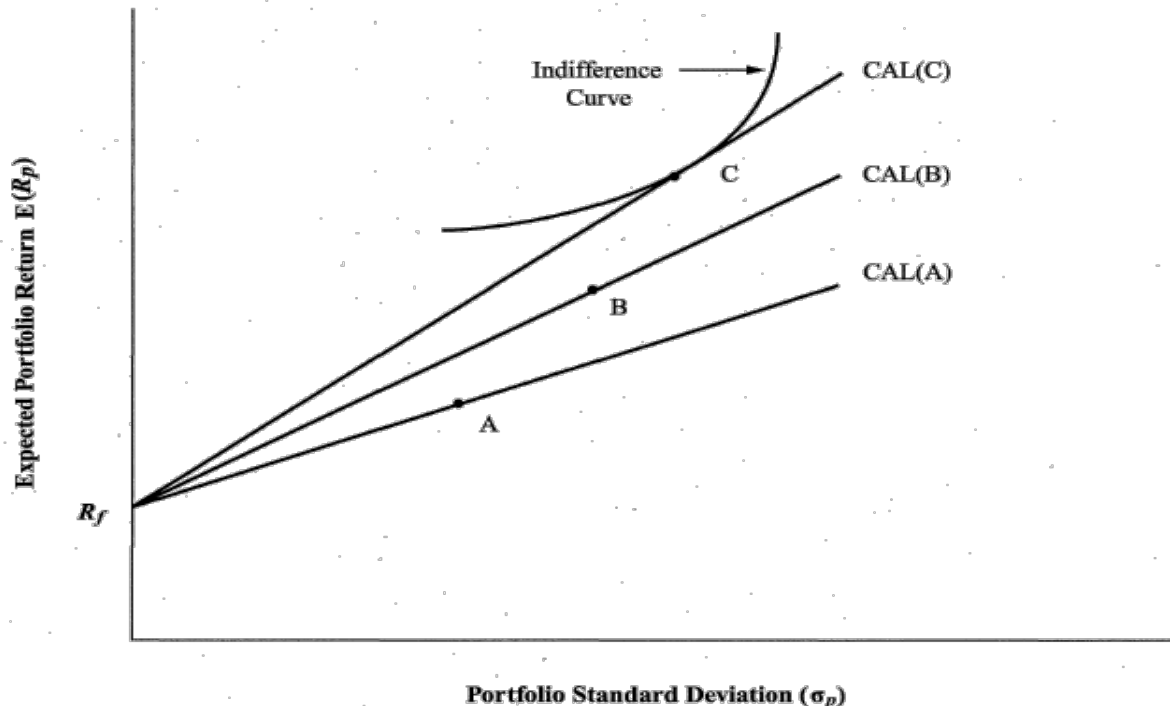
✓ $\sigma_p = w_{\text{risky}} \sigma_{\text{risky}}$



Modern Portfolio Theory

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.

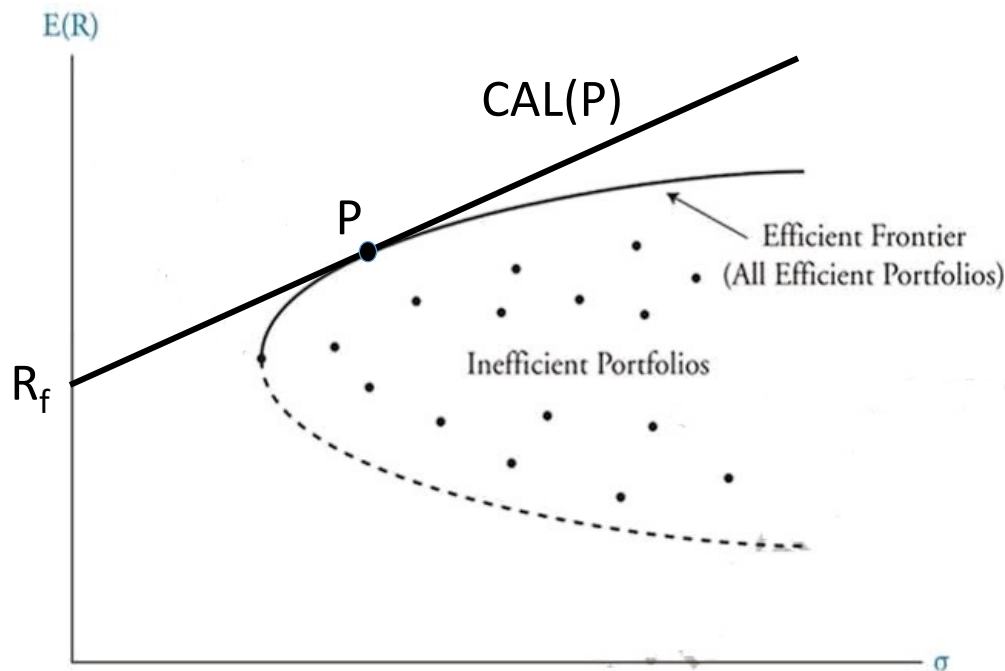




Modern Portfolio Theory

Selection among CALs

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





The Standard Capital Asset Pricing Model

1. Modern Portfolio Theory

2. Capital Asset Pricing Model



Capital Asset Pricing Model

William Sharpe (威廉·夏普)

- 美国经济学家，出生于1934年。
- 1990年获得 Nobel Memorial Prize (诺贝尔奖) in Economic Sciences.
- 主要贡献是在有价证券理论方面对不确定条件下金融决策的规范分析，以及资本市场理论方面关于以不确定性为特征的金融市场的实证性均衡理论。





Capital Asset Pricing Model

Capital market line (CML)

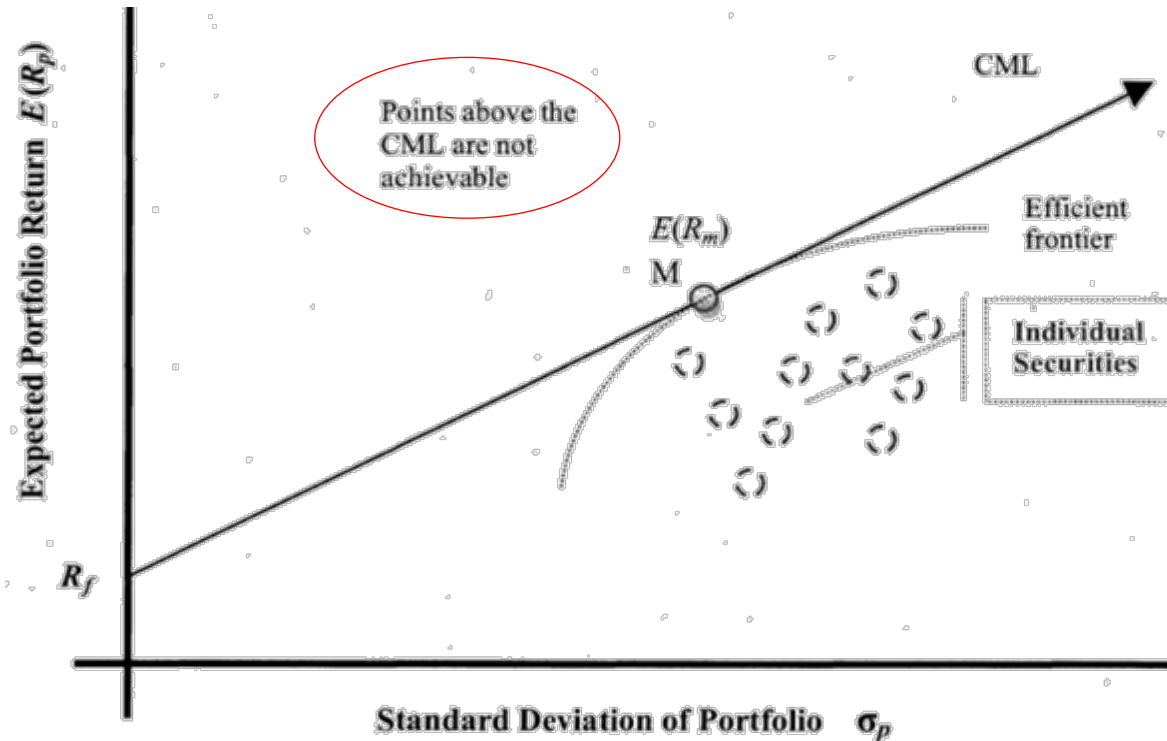
- Assuming all investors have a **homogeneous expectation**:
 - ✓ All investors have **identical efficient frontier** of risky portfolio and identical optimal risky portfolio, which is the market portfolio.
- Capital market line (CML) is a special CAL that includes all possible combinations of risk-free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



Capital Asset Pricing Model

Capital market line (CML)

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





Capital Asset Pricing Model

Capital market line (CML)

➤ The equation of the CML is:

$$E(R_p) = R_f + \frac{E(R_M) - R_f}{\sigma_M} \sigma_p$$

✓ The intercept is risk-free rate.

✓ The slope is **Sharpe ratio** of market portfolio.

$$SR_{\text{Market portfolio}} = \frac{E(R_M) - R_f}{\sigma_M}$$

✓ CML is essentially the efficient frontier for **all assets** under the assumption that all investors have a **homogeneous expectation**.



Capital Asset Pricing Model

Systematic risk & unsystematic risk

- **Systematic risk:** 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, GDP growth, supply shocks.
 - ✓ Also named non-diversifiable risk or market risk.
- **Investor would be only rewarded for bearing systematic risk.**

Capital Asset Pricing Model

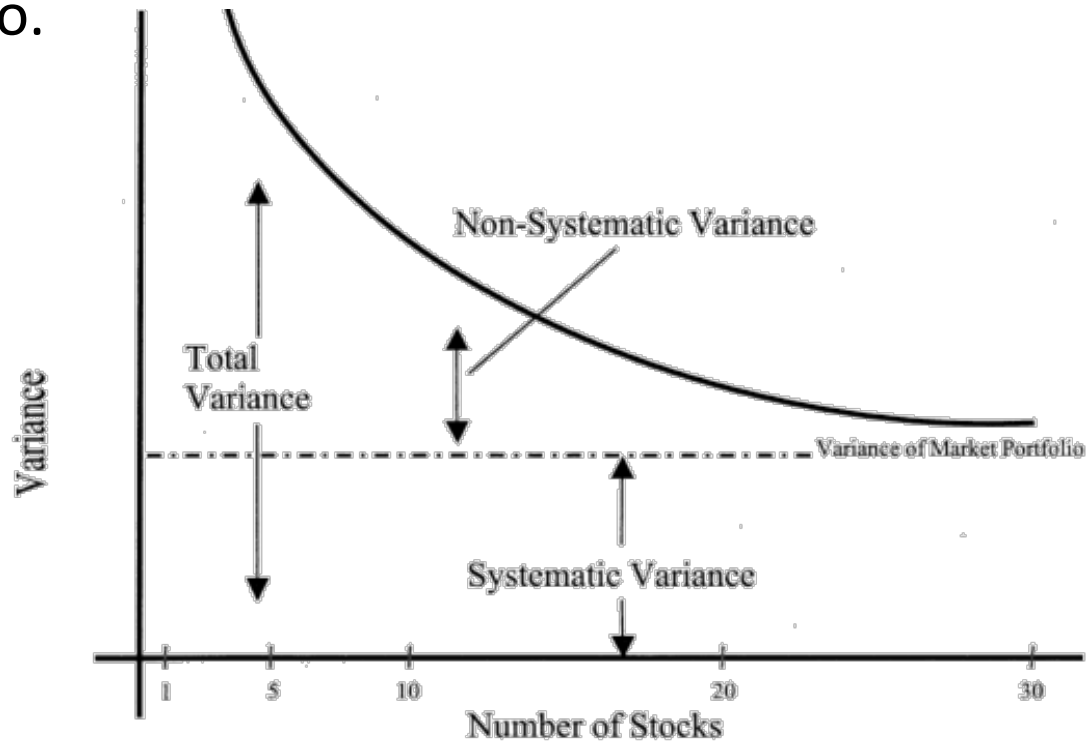
Systematic risk & unsystematic risk

- **Unsystematic risk:** the risk that can be reduced or eliminated by holding well-diversified portfolios.
 - ✓ Also named firm-specific risk.
- Investor would not be rewarded for bearing unsystematic risk as it could be eliminated through diversification.

Capital Asset Pricing Model

Systematic risk & Unsystematic risk

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





Capital Asset Pricing Model

Beta (β)

- Systematic risk can be measured by Beta (β) of the asset, which represents how sensitive an asset's return is to the market as a whole.

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

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



Capital Asset Pricing Model

Assumptions of CAPM

- There are no transaction costs.
- Assets are infinitely divisible.
- There is no personal income tax.
- An individual cannot affect the asset price by buying or selling action (price taker).
- Investors are expected to make decisions solely in terms of expected values and standard deviations of the returns on their portfolios.



Capital Asset Pricing Model

Assumptions of CAPM

- Unlimited short sales are allowed.
- Unlimited lending and borrowing at the riskless rate.
- Investor plan for the same single holding period.
- Investor have homogeneous expectations or beliefs.
- All assets are marketable, including human capital.



Capital Asset Pricing Model

Components of CAPM

➤ $E[R_i] = R_f + \beta_i [E(R_M) - R_f]$

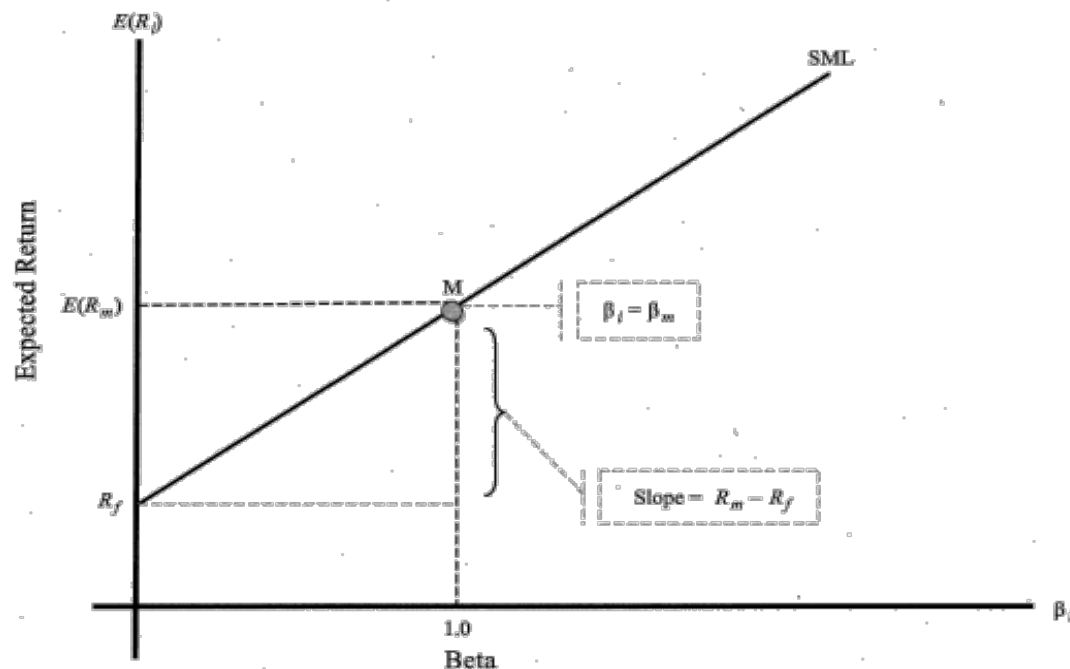
- ✓ $E(R_i)$: expected return on risky asset i.
- ✓ $E(R_M) - R_f$: market portfolio risk premium.
- ✓ β_i : systematic risk of asset i.
- ✓ $\beta_i [E(R_M) - R_f]$: beta-adjusted risk premium on risky asset i.



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 ($R_m - R_f$).

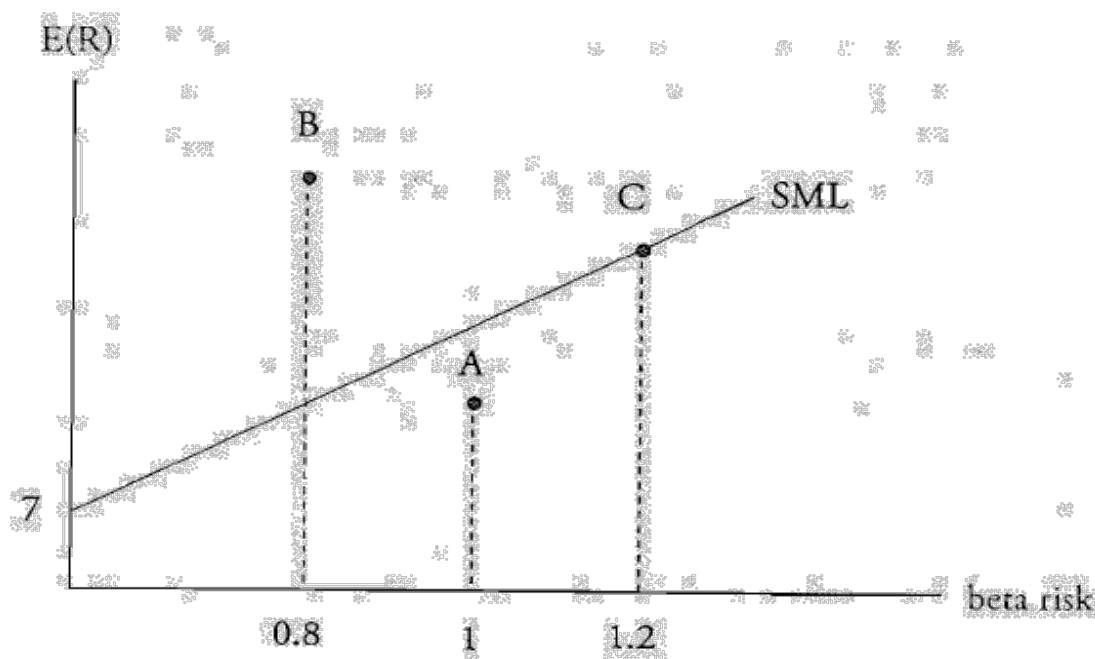




Capital Asset Pricing Model

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 15%.

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	$(17-15+0.50)/15=16.6\%$	$0.07+1.2(0.15-0.07)=16.6\%$

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



SESSION 2

01 The Standard Capital Asset Pricing Model

02 Applying the CAPM to Performance Measurement

03 Arbitrage Pricing Theory and Multifactor Models of Risk and Return

Performance Measurement

Performance measurement

- Sharpe ratio
- Treynor ratio
- Jensen's alpha
- Sortino ratio
- Tracking error
- Information ratio



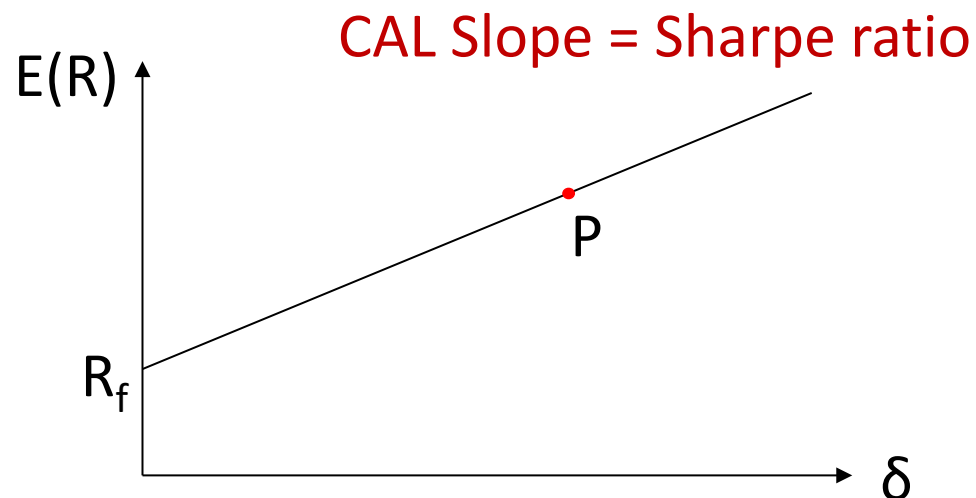
Performance Measurement

Sharpe ratio

- The ratio of the mean excess return on portfolio P to the standard deviation of the returns of portfolio P.

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

- ✓ A measure of excess return per unit of risk (total risk), the higher is better.



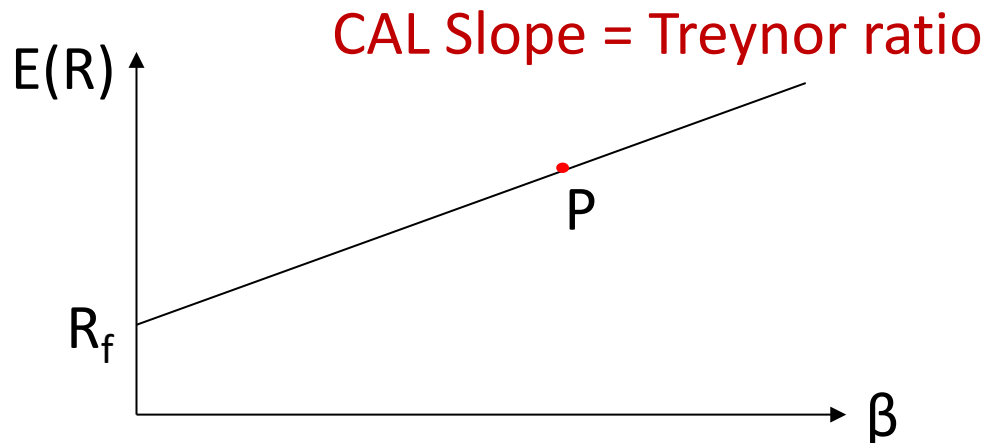
Performance Measurement

Treynor ratio

- The ratio of the mean excess return on portfolio P to the Beta (β) of portfolio P.

$$\text{Treynor ratio} = \frac{E(R_p) - R_f}{\beta_p}$$

- ✓ A measure of excess return per unit of risk (systematic risk), the higher is better.

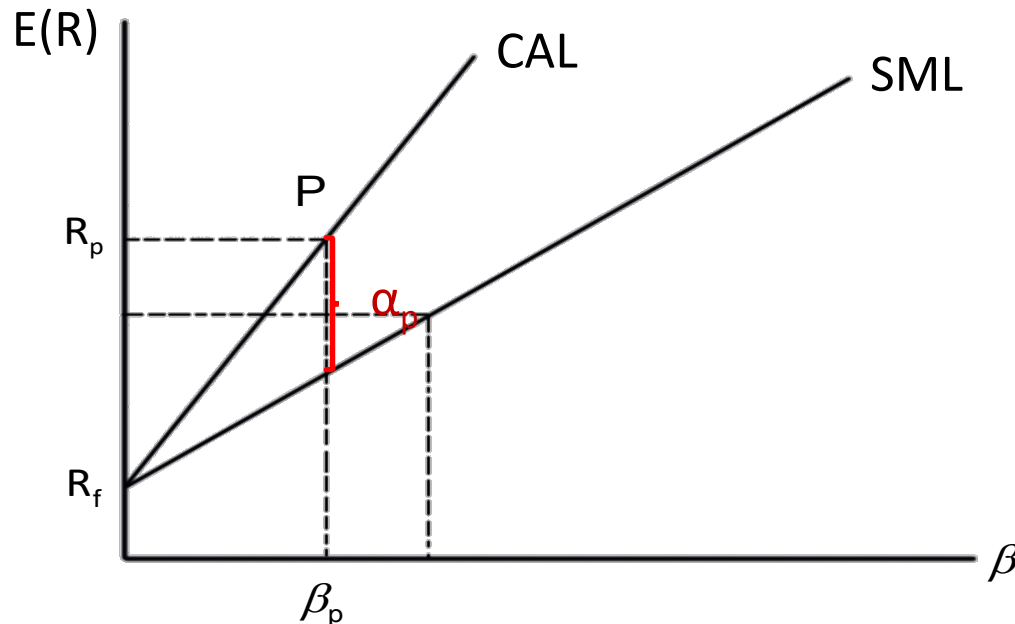


Performance Measurement

Jensen's alpha (α)

- The difference between actual return and return required to compensate for systematic risk (CAPM).

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



Performance Measurement

Sharpe ratio vs. Treynor ratio vs. Jensen's alpha

Name	Risk Used	Source	Usage
Sharpe ratio	Total risk (δ)	Portfolio theory	<ol style="list-style-type: none"> 1. Ranking portfolios with different levels of risk. 2. Not very well-diversified portfolio. 3. Portfolios that constitute an individual's total personal wealth.
Treynor ratio	Systematic risk (β)	CAPM	<ol style="list-style-type: none"> 1. Ranking portfolios with different levels of risk. 2. Well-diversified portfolios. 3. Portfolios that constitute part of an individual's personal wealth.
Jensen's alpha	Systematic risk (β)	CAPM	Ranking portfolios with the same beta.



Performance Measurement

Sortino ratio

- The ratio of portfolio return in excess of minimum acceptable return to the semi-standard deviation.
- ✓ A semi-standard deviation measures the variability of only those returns that fall below the minimum acceptable return.

$$\text{Sortino ratio (SOR)} = \frac{R_p - R_{\min}}{\sqrt{\text{MSD}_{\min}}}, \text{MSD}_{\min} = \frac{\sum_{R_p < R_{\min}} (R_p - R_{\min})^2}{N}$$

- ✓ Sortino ratio is more appropriate for a case where returns are not symmetric.

Performance Measurement

Tracking error

- The standard deviation of the difference between portfolio return and the benchmark return.

$$TE = \sigma_{(R_p - R_b)}$$

Information ratio

- The residual return of the managed portfolio relative to its benchmark divided by the tracking error.

$$\text{Information Ratio} = \frac{E(R_P) - E(R_B)}{\sigma_{(R_P - R_B)}}$$



SESSION 2

01 The Standard Capital Asset Pricing Model

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03 Arbitrage Pricing Theory and Multifactor Models of Risk and Return



Arbitrage Pricing Theory and Multifactor Models of Risk and Return

1. Arbitrage Pricing Theory

2. Multifactor Models



Arbitrage Pricing Theory

CAPM vs. APT

- The CAPM asserts that the expected return on any asset is determined by its exposure to **only one systematic risk factor (market risk)**.
 - ✓ The risk exposure in the CAPM is known as beta.
- The APT asserts that expected returns are determined by its exposures to **one or more systematic risk factors**.
 - ✓ The risk exposures in the APT are known as factor betas.
 - ✓ CAPM can be regarded as a special case of APT.



Arbitrage Pricing Theory

Arbitrage pricing model

- A linear model with multiple systematic risk factors (GDP, inflation, business cycle, interest rate, etc.).

$$E(R_P) = R_F + \beta_{P,1}(\lambda_1) + \beta_{P,2}(\lambda_2) + \dots + \beta_{P,k}(\lambda_k)$$

- ✓ $\beta_{p,j}$ = the sensitivity of the portfolio to factor j.
- ✓ λ_j = the factor risk premium for factor j; or the risk premium for a **pure factor portfolio** for factor j.
- Pure factor portfolio: a portfolio with sensitivity of 1 to factor j and sensitivity of 0 to all other factors.



Arbitrage Pricing Theory

Arbitrage pricing model

➤ Proposition under APT:

- ✓ Security returns can be described by a factor model.
- ✓ There are sufficient securities to **diversify away** idiosyncratic risk (unsystematic risk).
- ✓ Well-functioning security markets do not allow for the persistence of **arbitrage opportunities**.

Arbitrage Pricing Theory

Arbitrage pricing model

- As the number of securities in a portfolio increases (well-diversified), the unsystematic risk (residual risk) approaches to zero.
- If a risky asset is added to a well-diversified portfolio, only its systematic risk will have impact on the portfolio's risk.
- ✓ So only the systematic risk of the asset will be rewarded.



Arbitrage Pricing Theory

Arbitrage pricing model

- **The law of one price:** if two assets are equivalent in all economically relevant respects, then they should have the same market price.
- **Arbitrage opportunity** arises when an investor can earn riskless profits without making a net investment.
- ✓ If the law of one price doesn't hold, there will be an arbitrage opportunity.
- ✓ The arbitrageur will buy low and sell high, which makes the arbitrage opportunity disappear.



Arbitrage Pricing Theory

Example:

- Calculate the expected return for a portfolio with following information using the APT model. The risk free rate is 5%.

	Risk factor 1	Risk factor 2
Factor betas	1.8	0.9
Factor risk premiums	1.5%	2%

Answer:

- $E(R) = 5\% + 1.8 \times 1.5\% + 0.9 \times 2\% = 9\%$.

Fama-French three factor model

- The APT model generally doesn't identify or offer guidance to identify the risk factors.
- The Fama-French three-factor model incorporates the systematic factors of market index, firm size (market capitalization) and book-to-market ratio:

$$R_i - R_F = \alpha_i + \beta_{i,M}(R_M - R_F) + \beta_{i,SMB}SMB + \beta_{i,HML}HML + e_i$$



Arbitrage Pricing Theory

Fama-French three factor model

- ✓ SMB: Small Minus Big, i.e., the return of a portfolio of small stocks in excess of the return on a portfolio of large stocks.
- ✓ HML: High Minus L, i.e., the return of a portfolio of stocks with a high book-to-market ratio in excess of the return on a portfolio of stocks with a low book-to-market ratio.
- ✓ α_i : the residual return of asset i after controlling for the three factors.
 - If the three factors capture all systematic risk and the market is equilibrium, α_i equals to zero.



Arbitrage Pricing Theory and Multifactor Models of Risk and Return

1. Arbitrage Pricing Theory

2. Multifactor Models



Multi-factor Models

Multi-factor model

- Multi-factor models can be used to measure asset return and manage exposure to economy-wide risk factors (systematic risk) such as GDP, inflation, etc.

$$R_i = E(R_i) + \beta_{i,1}F_1 + \beta_{i,2}F_2 + \dots + \beta_{i,k}F_k + e_i$$

- ✓ R_i : return on asset i .
- ✓ $E(R_i)$: expected return on asset i .
- ✓ $\beta_{i,j}$: beta for factor j on asset i .
- ✓ F_j : deviation of factor j from its expected value (surprise).
- ✓ e_i : firm-specific return for asset i .

Multi-factor Models

Single-factor model

- A single-factor model is a special multi-factor model that has only one risk factor.

$$R_i = E(R_i) + \beta_i F + e_i$$

- ✓ R_i : return on asset i.
- ✓ $E(R_i)$: expected return on asset i.
- ✓ β_i : beta for the only risk factor on asset i.
- ✓ F : deviation of the factor from its expected value (surprise).
- ✓ e_i : firm-specific return for asset i.



Multi-factor Models

Example:

- Last year the return on Harry Company stock was 5 percent.

The portion of the return on the stock not explained by a two-factor macroeconomic factor model was 3 percent.

Using the data given below, what is Harry Company stock's expected return.

Variable	Actual Value (%)	Expected Value (%)	Stock's Factor Sensitivity
Change in interest rate	2.0	0.0	-1.5
Growth in GDP	1.0	4.0	2.0



Multi-factor Models

Answer:

$$5\% = \text{Expected return} - 1.5 * (\text{Interest rate surprise}) + 2 * (\text{GDP surprise}) + \text{Error term}$$

$$= \text{Expected return} - 1.5 * (2\%) + 2 * (-3\%) + 3\%$$

$$\text{So, the expected return} = 5\% + 3\% + 6\% - 3\% = 11\%.$$



Multi-factor Models

Hedging exposures to multiple factors

- Factor portfolios (pure factor portfolio) can be used to hedge exposures to multiple factors.

Example:

- An investor has a portfolio with a Beta of 0.8 for GDP and a Beta of 0.5 for inflation. Now, the investor wants to hedge the exposure to GDP risk factor.



Multi-factor Models

Solution:

- The investor can short sell 80% position of GDP factor portfolio. Combined with the origin portfolio, the Beta for GDP will be zero.



SESSION 3

Risk Management Failures



SESSION 3

01 Financial Disasters

02 Deciphering the Liquidity and Credit Crunch 2007-2008

03 Getting Up to Speed on the Financial Crisis: A One-Weekend-Reader's Guide

04 Risk Management Failures



Financial Disasters

1. Disasters Due To Misleading Reporting

2. Disasters Due To Large Market Moves

3. Disasters Due To The Conduct Of Customer Business

Financial Disasters

Disasters due to misleading reporting

- Chase Manhattan & Drysdale Securities
- Kidder Peabody
- **Barings**
- **Allied Irish Bank**
- Union Bank of Switzerland (UBS)
- Société Générale



Chase Manhattan & Drysdale Securities

Case briefing

- In three month of 1976, Drysdale obtained **unsecured borrowing** of \$300 million (only had \$20 million in capital) by exploiting a flaw in the market practices for computing the value of U.S. government bond collateral.
- Drysdale used the borrowed money to take outright positions in bond markets but lost money on the positions, then they lacked cash to pay back their borrowings. Drysdale went bankrupt.



Chase Manhattan & Drysdale Securities

Case briefing

- Chase Manhattan absorbed almost all of the losses because it had brokered most of Drysdale's securities borrowings.
- Although Chase employees believed they were only acting as agents on these transactions and were not taking any direct risk on behalf of Chase, the legal documentation of the securities borrowings did not support their claim.
- The losses were large enough to severely damage Chase's reputation and stock valuation for several years.

Chase Manhattan & Drysdale Securities

Failure factors

- Drysdale obtained the unsecured borrowing by misleading reporting.
- Chase Manhattan allowed such a sizable position to be built up largely because the relatively inexperienced managers were convinced they were simply acting as intermediaries, but the wording in the borrowing agreements would most likely be found by a court to indicate that Chase was taking full responsibility.

Chase Manhattan & Drysdale Securities

Lessons learned

- The securities industry needed to make its methods for computing collateral value on bond borrowings more precise.
- Firms need a process that forced areas contemplating new product offerings to receive prior approval from risk control functions within the firm.



Kidder Peabody

Case briefing

- Between 1992 and 1994, Joseph Jett , head of the government bond trading desk, misreported a series of trades, which allowed him to report **substantial artificial profits of \$350 million.**
- The events did not result in actual losses since the profits were fake, but the trades triggered a loss of confidence in the management of Kidder Peabody, which was owned by General Electric (GE).



Kidder Peabody

Failure factors

- A flaw in accounting for forward transactions in the computer system for government bond trading **failed to take into account the present valuing of the forward**. This enabled a trader purchasing a cash bond and delivering it at a forward price to book an instant profit.
- Over the period between booking and delivery, the profit would inevitably dissipate, since the cash position had a financing cost.

Kidder Peabody

Lessons learned

- Always investigate a stream of **large unexpected profits** thoroughly and make sure you completely understand the source.
- Periodically review models and systems to see if changes in the way they are being used require changes in simplifying assumptions.



Barings

Case briefing

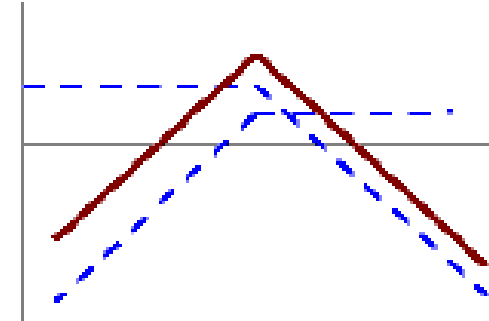
- Nick Leeson, a British Barings junior trader in Singapore, took speculative derivative positions in an effort to recoup prior trading losses that he was able to hide fraudulently. The loss of roughly \$1.25 billion went undetected due to inadequate control systems.
- The size of the losses relative to Barings Bank's capital along with potential additional losses on outstanding trades forced Barings into bankruptcy in February 1995.

Barings

Case briefing

➤ Nick Leeson's strategy:

- ✓ Short Straddles on the Nikkei 225:
 - Short call + short put
- ✓ Arbitraging price differences on Nikkei 225 futures contracts that were trading on different exchanges.
 - Long futures on one exchange where the price is relatively low and hedging with an offsetting short on another exchange where the price is relatively higher.





Barings

Case briefing

- ✓ Leeson had previously incurred huge trading losses that would have cost him his job if they were revealed.
- ✓ To recover the losses, Leeson abandoned the long-short futures price arbitrage strategy and initiated a long-long futures positions on both exchanges in hope of profiting from an increase in the Nikkei225.
- ✓ The Nikkei 225 plunged because the earthquake in Japan, then the huge losses were created on both the short straddle and the double-long futures position.



Barings

Failure factors

- Allowing Leeson to function as a head of trading and the back office at an isolated branch.
- ✓ Lesson was able to decide his trade strategy.
- ✓ Lesson used back office influence to hide the losses, and book the profitable trade to the standard trading accounts, while booking the unprofitable trade to the old error account (Account 88888) to escape reporting to senior management.



Barings

Failure factors

- The management failed to inquire how a low-risk trading strategy was generating such a **large profit**.
- ✓ The failure can be attributed to the very poor structuring of management information so that different risk control areas could be looking at reports that did not tie together. This oversight was so poor that London office transferred \$354 million to meet margin calls without questioning Leeson.
- ✓ Political power struggles and senior management's lack of understanding about Leeson's role eroded oversight and allowed trading losses to be hidden.



Barings

Lessons learned

- Absolute necessity of independent trading back office.
- Need to make thorough inquiries about unexpected sourced of profits or loss.
- The need to make thorough inquiries about any large unanticipated movement of cash.



Allied Irish Bank

Case briefing

- John Rusnak, a currency option trader in charge of a very small trading book in AIB's subsidiary, entered into massive unauthorized trades during the period 1997 through 2002.
- This ultimately resulting in \$691 million in losses, and a major blow to AIB's reputation and stock price.



Allied Irish Bank

Case briefing

- Rusnak was supposed to be running a small **arbitrage**, but he was actually running **large naked positions** and disguising them from management.
- Rusnak created imaginary trades to offset his real trades, entered false positions into the firm's system for calculating VaR, misled managers about the size of his positions.
- Rusnak persuaded back-office personnel not to check these bogus trades.

Allied Irish Bank

Failure factors

- The back office failed to confirm all trades because Rusnak succeeded in convincing back office personnel that not all of these trades needed to be confirmed.
- **Suspicious trades and trading profits** were ignored as Rusnak continually manipulated firm's operations staff.
- AIB's management was so inexperienced that failed to figure out Rusnak's trading activities.



Allied Irish Bank

Lessons learned

- This incident does not provide many new lessons beyond the lessons that should already have been learned from Barings.
- Avoid engaging in small ventures in which the firm lacks any depth of expertise.
- ✓ There is simply too much reliance on the knowledge and probity of a single individual.



Union Bank of Switzerland (UBS)

Case briefing

- This incident involves losses of between \$400 million and \$700 million in equity derivatives during 1997, which appear to have been exacerbated by lack of internal controls. A loss of \$700 million during 1998 was due to a large position in Long-Term Capital Management (LTCM).
- The 1997 losses forced UBS into a merger on unfavorable terms with Swiss Bank Corporation (SBC) at the end of 1997. The 1998 losses came after that merger.

Union Bank of Switzerland (UBS)

Failure factors

- The person with senior risk management authority for the equity derivative department doubled as head of quantitative analytics, **violated** the fundamental principles of **independent risk oversight**.

Lessons learned

- The need for independent risk oversight.



Société Générale

Case briefing

- In January 2008, Société Générale reported trading losses of \$7.1 billion that the firm attributed to unauthorized activity by a junior trader, Jérôme Kerviel.
- The large loss severely damaged bank's reputation and required it to raise a large amount of new capital.



Case briefing

- Kerviel established large, unauthorized positions in futures contracts and equity securities, and created fake offsetting forward transactions to hide the size and riskiness of these unauthorized positions.
- Knowing the conformation timing, Kerviel canceled these fake trades right before any confirmations took place.
- Given the need to continuously replace fake trades with new ones, Kerviel ultimately created close to 1,000 fictitious trades before the fraud was finally discovered.

Société Générale

Failure factors

- There was no procedure in place to confirm information entered for a trade that was then canceled, and red-flag an unusual level of trade cancellations.
- The bank's trading system was only set up to evaluate net positions, instead of both net and gross positions. Unusually high amount of brokerage commissions could also have provided a warning sign.
- The weak reporting system for collateral accounts.



Société Générale

Failure factors

- The violation of the bank's vacation policy.
 - ✓ The normal precaution of forcing a trader to take two consecutive weeks of vacation in a year, during which time his positions would be managed by another trader.
- The lack of proper supervision.
- The inaction of Kerviel's trading assistant to report fraudulent activity.
- The lack of investigation into unexpected reported gains.



Financial Disasters

1. Disasters Due To Misleading Reporting

2. Disasters Due To Large Market Moves

3. Disasters Due To The Conduct Of Customer Business

Financial Disasters

Disasters due to large market moves

- Long Term Capital Management (LTCM)
- Metallgesellschaft



Long Term Capital Management

Case briefing

- LTCM, a hedge fund founded in 1994, generated stellar returns in its first few years of operation.
- The partners made clear that they were highly secretive about the particulars of their investment portfolio, and every investment decision was made by all partners acting together, which eliminates the possibility of a rogue trader.
- The investors were locked into investments for long periods of time in order to prevent liquidation issues since the fund was focused on long-term investment strategies which favored sharing information openly.



Long Term Capital Management

Case briefing

- LTCM's investment strategies:
 - ✓ Relative value strategies: arbitraging price differences among similar securities and profiting when the prices converged.
 - ✓ Credit spread strategies: credit spread tended to revert to average historical levels, although it varied over time,
 - ✓ Equity volatility strategy: assumed that the volatility on equity options tended to revert to long-term average levels. When implied volatility of equity options was abnormally high, LTCM sold volatility.



Long Term Capital Management

Case briefing

- In August of 1998, Russia unexpectedly defaulted on its debt. This economic shock caused the yields on developing nations' debt to increase and a flight to the quality of government bonds in industrialized countries. The flight to quality increased, rather than decreased, credit spreads, causing huge losses for LTCM.
- Shortly thereafter, Brazil also devalued its currency, thereby further increasing interest rates and risk premiums. The general increase in volatility also generated losses in LTCM's equity volatility strategies.



Long Term Capital Management

Failure factors

- The large increase in yield spread and option volatility caused huge losses (LTCM lost 44% of its capital in just one month) and severe cash flow problems caused by realizing marked to market losses and meeting margin calls (funding liquidity risk).
- LTCM's high leverage (28 times) enabled it to assume extremely large positions. Falling prices resulting from LTCM's forced liquidation created more losses and margin calls (trading liquidity risk).

Long Term Capital Management

Failure factors

- **Model risk:** the valuation or trading models are flawed.
 - ✓ Assumed that historical relationships were useful predictors of future relationships.
 - ✓ Assumed that low-frequency/high-severity events were uncorrelated over time.
 - ✓ The traditional VaR models underestimated risk in the tails of the distribution.



Long Term Capital Management

Failure factors

- LTCM was diversified across the globe, different asset classes, and different trading strategies. However, all of strategies were based on the assumption that credit spread and market volatility would decline. The lack of diversification made LTCM subject to the market risk.



Long Term Capital Management

Failure factors

- As a hedge fund, LTCM's reporting obligation to regulators was limited. These reports were incomplete and lacked disclosure of derivative positions and trading strategies. Ultimately, the Federal Reserve Bank of New York provided a bailout in which 14 leading banks and investment houses invested \$3.65 billion for a 90% stake in LTCM.



Metallgesellschaft

Case briefing

- Metallgesellschaft offered customers contracts to buy fixed amounts of heating oil and gasoline at a fixed price over a 5-year or 10-year period. This contracts gave the firm a **short position in long-term** forward contracts.
- Metallgesellschaft had to use **short-term long position futures** to hedge long-term contracts (Stack and roll strategy, this hedge exposes to basis risk) because long-term futures contracts were highly illiquid.

Metallgesellschaft

Case briefing

- **Problem:** gain and loss on forward are realized at the agreement's expiration, whereas futures are marked to market such that gain and loss are realized on a daily basis.



Failure factors

- The market shifted from backwardation (Spot price > futures price) to contango (Futures price > spot price) that exploited the basis risk.
 - ✓ Creating losses on roll return and greatly increased the cost of the stack and roll hedge.
- Declining oil price resulted in losses of \$900 million on long futures, which were realized immediately. But the offsetting gains would be realized for years.
 - ✓ Creating potential short-term cash outflows, and resulted in funding liquidity risk.



Metallgesellschaft

Failure factors

- German accounting methods required the firm to show futures realized losses but not recognized unrealized gains from the forward. The magnitude of the losses caused its credit rating to drop, increasing its perceived credit risk. The losses also created a crisis of confidence with its counterparties, which began to suspect the firm was speculating rather than hedging and, therefore, demanded collateral to secure contract performance.

Metallgesellschaft

Failure factors

- The size of position was so huge that the company lacked the liquidity to unwind its positions, and was therefore subject to trading liquidity risk.



Financial Disasters

1. Disasters Due To Misleading Reporting

2. Disasters Due To Large Market Moves

3. Disasters Due To The Conduct Of Customer Business

Financial Disasters

Disasters due to the conduct of customer business

- Banker's Trust
- JPMorgan, Citigroup, and Enron

Banker's Trust

Case briefing

- P&G and Gibson Greetings sought the assistance of Banker's Trust to help them reduce funding costs. Banker's Trust used derivative trades, which promised them a high-probability, small reduction in funding costs in exchange for a low-probability, large loss.

Banker's Trust

Case briefing

- The derivative structures developed by Banker's Trust were complex and prevented P&G and Gibson from fully understanding the trade values and risks that were involved. In addition, the structures were not comparable to other derivative trades making it impossible to get a competitive quote. P&G and Gibson were misled into thinking that the structures were tailored to meet their individual needs.

Banker's Trust

Case briefing

- In 1994, P&G and Gibson suffered huge losses. As a result, the two companies sued Banker's Trust.
- In the phone conversations taped by Banker's Trust, Banker's Trust 's staff bragged about how badly they fooled clients with complex structures and showed how price quotes given to P&G and Gibson were manipulated.
- The Bankers Trust scandal severely damaged its reputation and forced its CEO to resign. Banker's Trust was eventually acquired by Deutsche Bank and ultimately dismantled.

JP Morgan, Citigroup, and Enron

Case briefing

- Citigroup and JP Morgan reached an agreement in July 2003 with the SEC to pay a combined \$286 million in fines in connection with their involvement in the fraud of Enron. The SEC charged that two banks aided defunct energy trading Enron in disguising loans as cash in order to defraud investors.



SESSION 3

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Deciphering the Liquidity and Credit Crunch 2007-2008

1. The Housing Bubble

2. The Liquidity and Credit Crunch



The Housing Bubble

Key factors leading to the housing bubble

- The U.S economy was experiencing a **low interest rate** environment because:
 - ✓ Large capital inflows from abroad, especially from Asian countries. Asian countries bought U.S. securities to:
 - Peg the exchange rates at an export-friendly level.
 - Hedge against a depreciation of their own currencies against the dollar, a lesson learned from the Southeast Asian crisis of the late 1990s.



The Housing Bubble

Key factors leading to the housing bubble (Cont.)

- ✓ The Federal Reserve had adopted a lax interest rate policy.
 - The Federal Reserve Bank feared a deflationary period after the bursting of the internet bubble and thus did not counteract the buildup of the housing bubble.



The Housing Bubble

Key factors leading to the housing bubble (Cont.)

- The **banking** system underwent an important **transformation**.
 - ✓ The traditional banking model, in which the issuing banks hold loans until they are repaid, was replaced by the "**originate and distribute**" banking model, in which loans are pooled, tranced, and then resold via **securitization**.
 - ✓ The creation of new securities facilitated the large capital inflows from abroad.

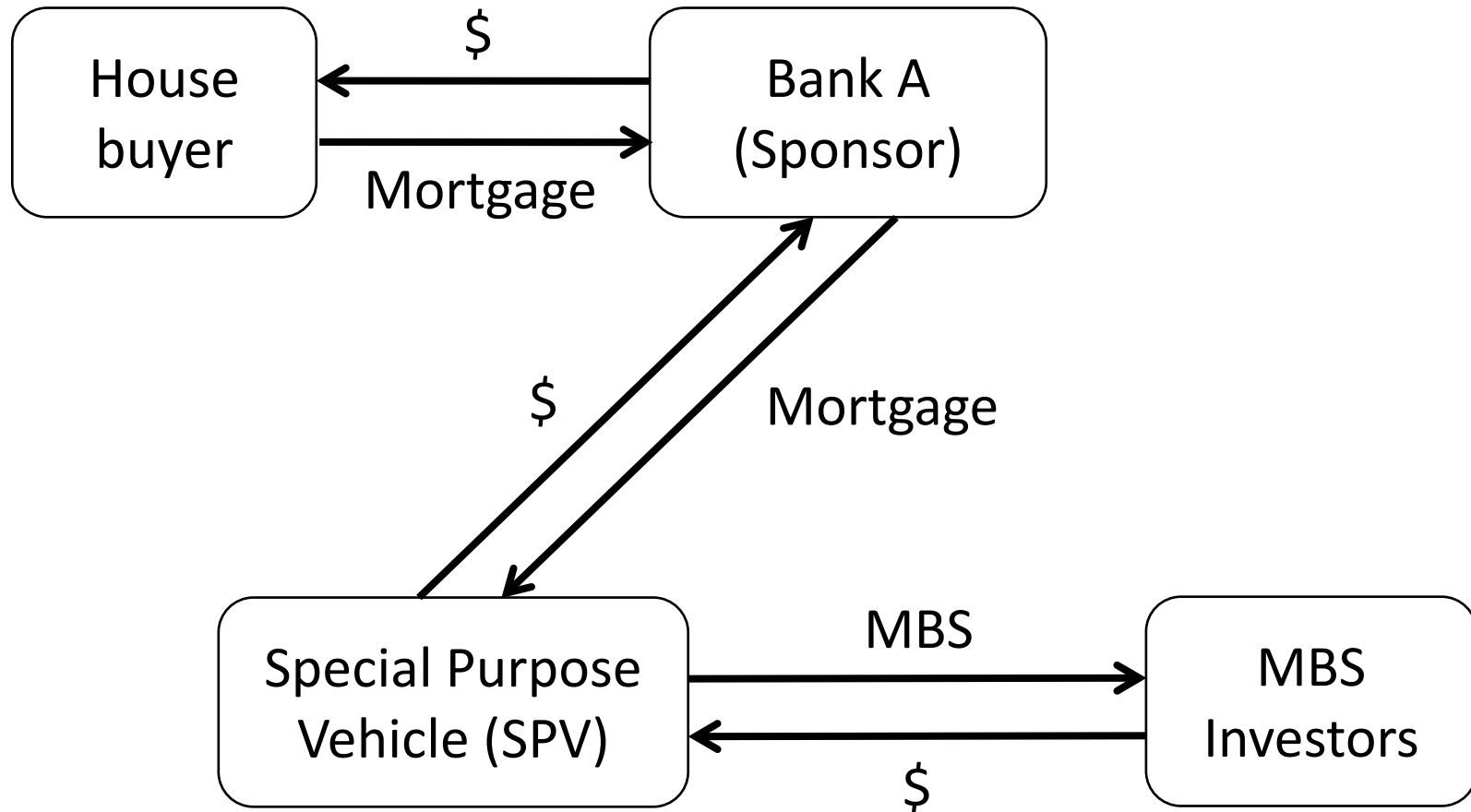
The Housing Bubble

Securitization process

- The process of pooling mortgages into a large pool, dividing the pool into smaller units, and selling the units as financial investments to investors.
- ✓ By selling mortgages to investors, lending institutions (originator) could repackage their mortgages and **transfer their risk to the markets.**

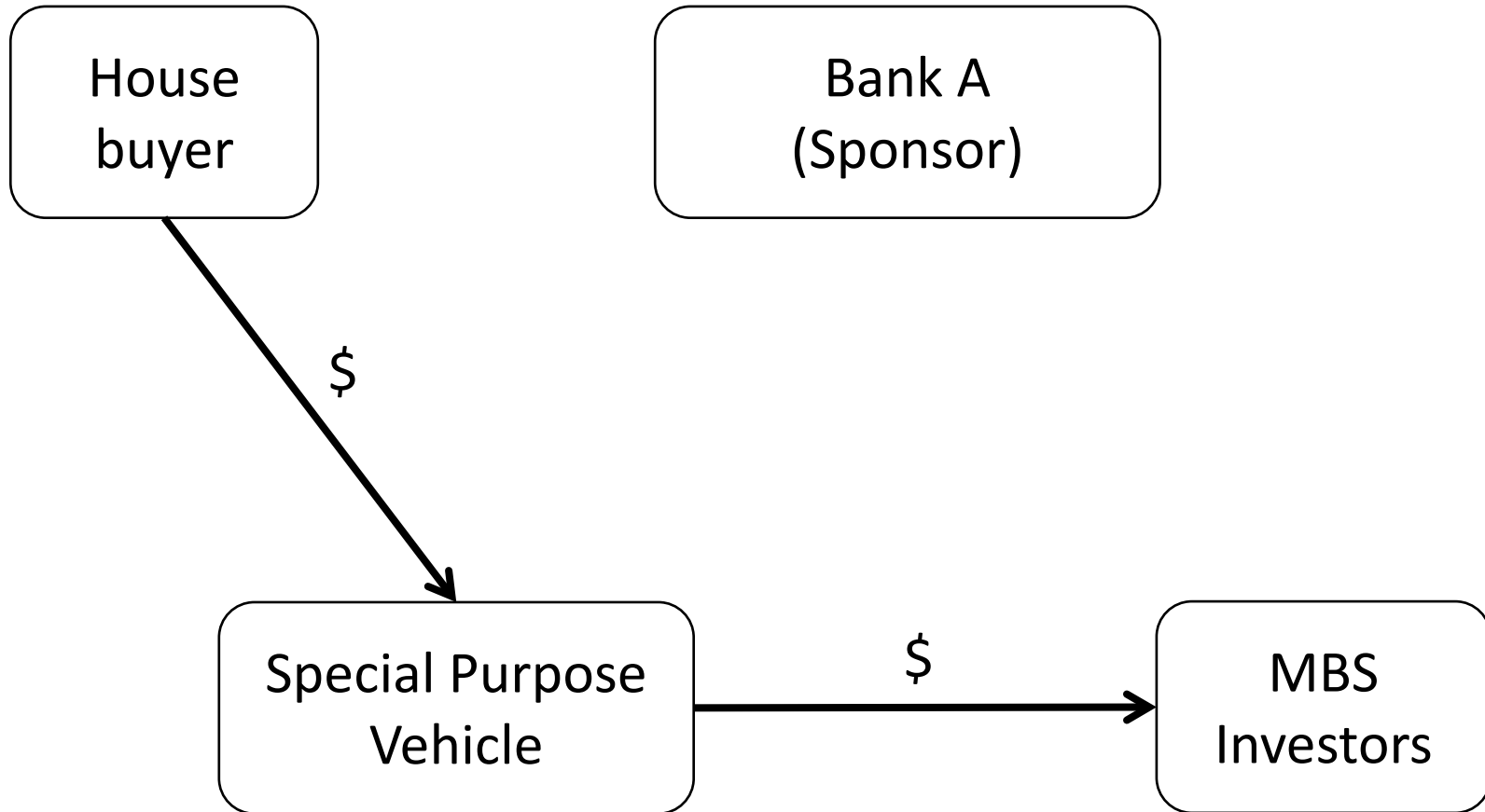
The Housing Bubble

Securitization process



The Housing Bubble

After securitization



The Housing Bubble

Structuring

- Redistribute the risk of mortgage-related products to different bond classes or tranches.
- ✓ **Credit tranching:** redistribute the credit risk.
 - Also called subordination or senior/subordinated structure.
- “Structuring” can not eliminate risk but **redistribute** risk.

The Housing Bubble

Collateralized debt obligation (CDO)

- Banks typically create structured products, which is often referred to as collateralized debt obligations (CDOs) to offload risk.
- ✓ **The first step:** form a diversified portfolios of mortgages and other types of loans, corporate bonds, and other assets like credit card receivables.
- ✓ **The next step:** slice these portfolios into different tranches.
 - These tranches are then sold to investor groups with different risk appetites.

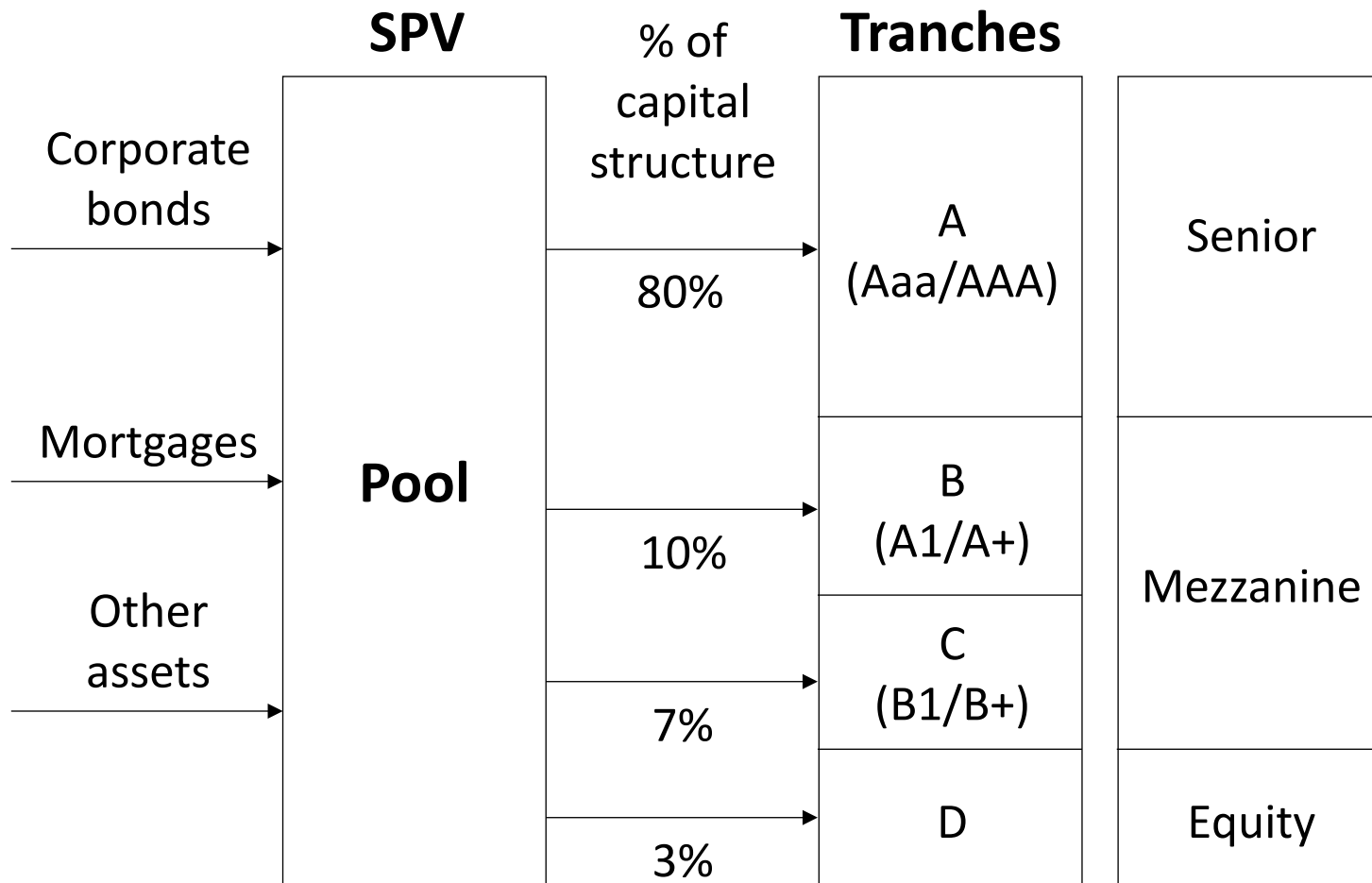
The Housing Bubble

Collateralized debt obligation (Cont.)

- **Senior tranche:** have the highest priority to receive principal and interest.
- **Equity tranche:** have the lowest priority and will absorb the first losses up to a pre-specified level.
- ✓ These securities typically do not carry a fixed coupon but receive the residual cash flows only after the other security claims are satisfied.
- **Mezzanine tranche:** absorb losses only after the equity tranche is completely.

The Housing Bubble

Collateralized debt obligation (Cont.)



The Housing Bubble

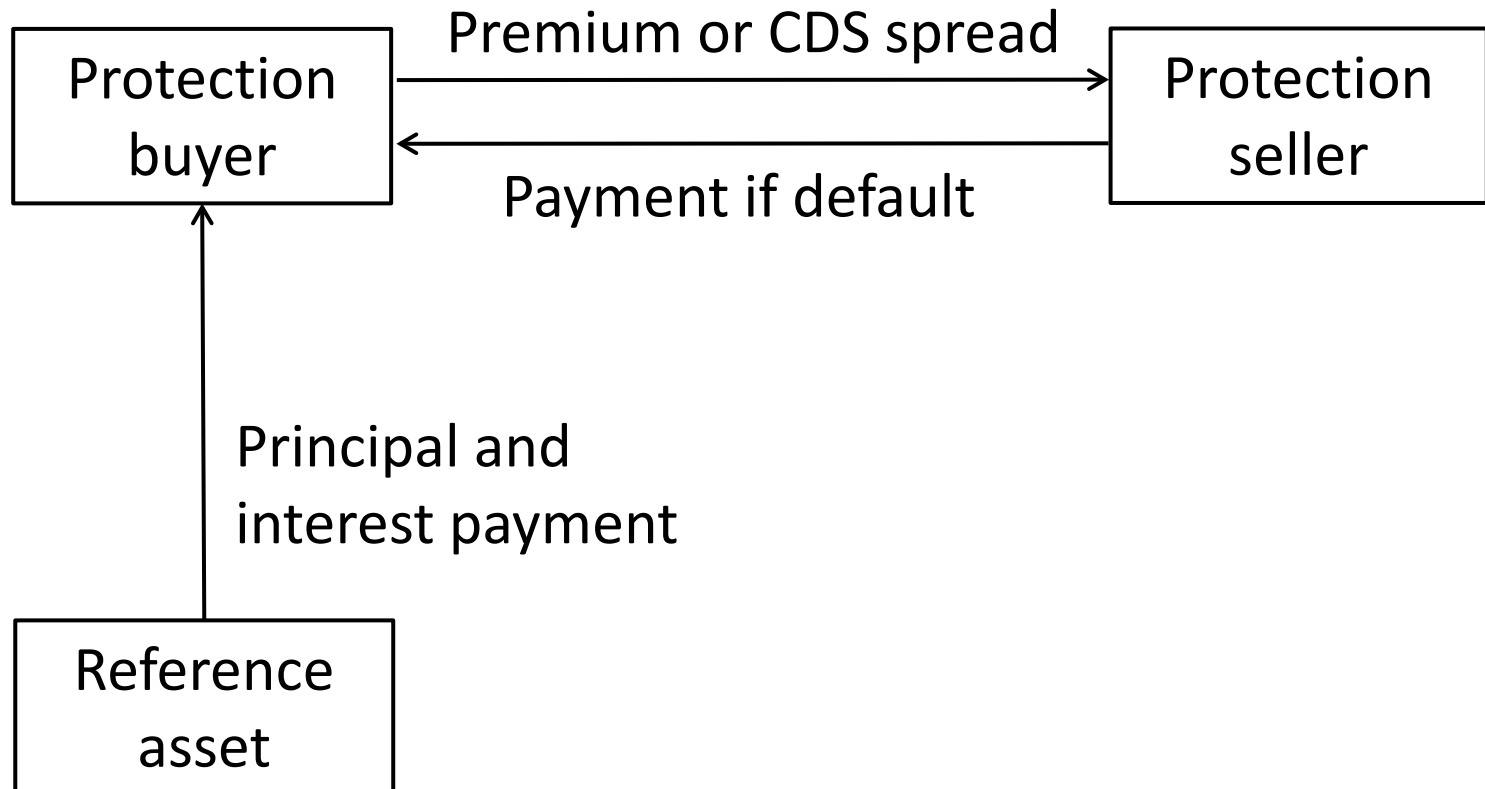
Credit default swap (CDS)

- **Credit default swap** is derivative contract between two parties, a credit protection buyer and a credit protection seller, in which **the buyer makes a series of cash payments** to the seller and **the seller provides protection** to the buyer **against a specific credit loss** resulting from the default of a third party.
- ✓ CDS is essentially an insurance contract against default.
- ✓ Long risky bond + Buy CDS = Long risk-free bond

The Housing Bubble

Credit default swap (Cont.)

➤ **Example:** using an CDS to hedge the credit risk of a loan:





The Housing Bubble

Consequences

- The popularity of securitized products ultimately led to a flood of **cheap credit** and **lending standards fell**, then resulted in the housing frenzy that laid the foundations for the crisis.
- ✓ Because a substantial part of the risk will be borne by other financial institutions, banks essentially faced only the "**pipeline risk**" of holding a loan for some months until the risks were passed on, so they had little incentive to take particular care in approving loan applications and monitoring loans.

Deciphering the Liquidity and Credit Crunch 2007-2008

1. The Housing Bubble

2. The Liquidity and Credit Crunch

The Liquidity and Credit Crunch

Funding liquidity risk vs. market liquidity risk

- **Funding liquidity risk:** the current or prospective risk arising from an institution's inability to meet its liabilities and obligations as they come due without incurring unacceptable losses.
- **Market liquidity risk:** the risk that the act of buying or selling an asset will result in an adverse price move.



The Liquidity and Credit Crunch

Two liquidity spirals

- **Loss spiral:** a loss spiral arises for leveraged investors because a decline in the value of assets erodes the investors' net worth much faster than their gross worth and the amount that they can borrow falls.
- ✓ The investor is forced to sell assets and reduce the overall position.
- ✓ These sales depress the price further, inducing more selling and so on.



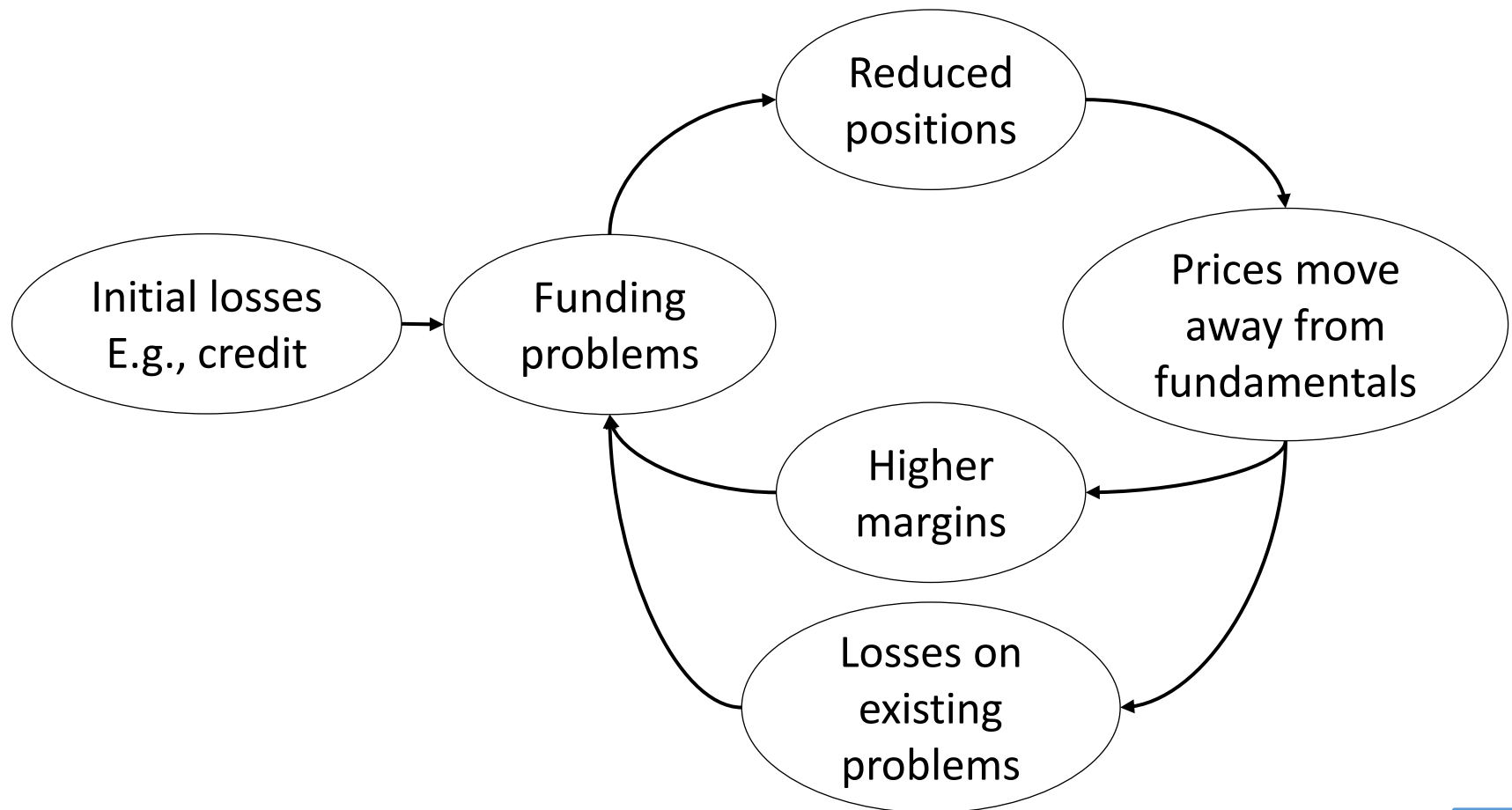
The Liquidity and Credit Crunch

Two liquidity spirals (Cont.)

- **Margin spiral/haircut spiral:** margins/haircuts spike in times of large price drops, and the investor has to sell even more because the investor needs to reduce its leverage ratio, which increase margins further and force more sales.
- ✓ Note: the leverage ratio was held constant in the loss spiral.

The Liquidity and Credit Crunch

Two liquidity spirals (Cont.)



The Liquidity and Credit Crunch

Asset-liability maturity mismatch

- There were trends in banking industry that banks increasingly financed their asset holdings with shorter maturity instruments.
- ✓ This change left banks particularly exposed to a dry-up in funding liquidity.

The Liquidity and Credit Crunch

Network effects

- Modern financial architecture consists of an interwoven network of financial obligations.
- ✓ In reality, most financial institutions are lenders and borrowers at the same time.
- ✓ An increase in counterparty credit risk can create additional funding needs and potential systemic risk.



The Liquidity and Credit Crunch

Consequences

- As mortgage defaults began to climb during the credit crisis, principal and interest on ABS began to decline, leading to losses for investors.
- ✓ As the quality of mortgages declined, rating agencies downgraded ABS, and the market for tranches of these investments became illiquid.



The Liquidity and Credit Crunch

Consequences (Cont.)

- As investors became reluctant to invest in higher-risk investments, the market experienced a flight to quality to safe haven.
- ✓ As the price of Treasuries increased and the price of structured investments decreased, credit spreads widened.
- It was difficult for non-financial companies to obtain loans from banks.
- ✓ Indeed, banks became reluctant to lend to each other at all and interbank lending rates increased sharply.



The Liquidity and Credit Crunch

Consequences (Cont.)

- Losses were also incurred by mortgage originators (Citigroup, UBS, and Merrill Lynch) because they had provided guarantee.
- ✓ There were many government bailouts of financial institutions.
- ✓ Lehman Brothers was allowed to fail.
- The world experienced the worst recession since the 1930s.
- ✓ Even people in remote parts of the world that had no connection with U.S. financial institutions were affected.

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Getting Up to Speed on the Financial Crisis: A One-Weekend-Reader's Guide

1. The Crisis Build-up

2. The Panics and Policy Responses



The Crisis Build-up

Historical background

- Banking crises play an important accelerator role in broader debt crises.
- ✓ Both external debt and domestic government debt increase sharply in advance of banking crises.
- ✓ Banking crises tend to lead sovereign-debt crises.
- Changes in credit supply (bank loans) are a strong predictor of financial crises, particularly when these changes are accelerating.

The Crisis Build-up

Vulnerabilities for the crisis

- **Shadow banks:** financial entities other than regulated depository institutions (commercial banks, thrifts, and credit unions) that serve as intermediaries to channel savings into investment.
- **Shadow banking** was the source of key vulnerabilities that led to the financial crisis.
- ✓ The **key vulnerability** was short-term debt, mostly repurchase agreements (**repo**) and asset-backed commercial paper (**ABCP**).

The Crisis Build-up

Vulnerabilities for the crisis (Cont.)

- **Repurchase agreement (Repo):** a repo transaction is a collateralized deposit in a “bank”.
 - ✓ The depositor (lender) puts money in the bank for a short term (usually overnight), and the bank promises to pay the **repo rate** on the deposited money.
 - ✓ To ensure the safety of the deposit , the bank provides collateral that the depositor takes possession of.
 - ✓ **Haircut:** the difference between the market value of the collateral and the deposited money.

The Crisis Build-up

Vulnerabilities for the crisis (Cont.)

- **Asset-backed commercial paper (ABCP):** **financial intermediaries** issue ABCP to finance **long-term** financial assets by bundling **mortgages**, credit-card receivables, and other loans into off-balance-sheet vehicles.
- ✓ Traditionally, commercial paper has been an important **short-term** security for the financing of **industrial firms**.
- ✓ When the ABCP mature, it is rolled over to refinance the assets.

The Crisis Build-up

Vulnerabilities for the crisis (Cont.)

- With the majority of ABCP held by money market mutual funds (**MMFs**), the ABCP market was deeply connected with the other parts of the financial system.

The Crisis Build-up

Vulnerabilities for the crisis (Cont.)

- There were large and persistent **capital inflows from foreign investors** seeking U.S. assets as a **store of value** in the years before the financial crisis.
- ✓ The amount of money seeking safe assets far exceeded the amount that could be insured in demand deposit accounts.
- ✓ Foreign investors hold large amounts of U.S. Treasuries rather than land and property, but the problem was that there were not enough U.S. Treasuries.



The Crisis Build-up

Vulnerabilities for the crisis (Cont.)

- The cash pools found two forms of substitutes:
 - ✓ Short-term bank debt-like products, such as repo and ABCP.
 - ✓ Money market mutual funds (MMFs).

The Crisis Build-up

Trigger for the crisis

- **Losses on subprime mortgages**, or more accurately, the prospect of such losses, after house prices started to decline, were a trigger for the crisis.

Getting Up to Speed on the Financial Crisis: A One-Weekend-Reader's Guide

1. The Crisis Build-up

2. The Panics and Policy Responses



The Panics and Policy Responses

The panics

- There are two main panic periods of the financial crisis:
 - ✓ Period 1: August 2007 (ABCP panics)
 - ✓ Period 2: Sep.-Oct. 2008 (Lehman bankruptcy)



The Panics and Policy Responses

The panics: period 1

- Due to the losses in mortgage, ABCP program suffer a “run”.
 - ✓ A “run” means the lenders (depositors) are unwilling to refinance CP when it comes due.
 - ✓ If a program is unable to issue new paper, then it must either rely on backup support from the program sponsor (typically banks), or it is forced to sell assets.
 - Most programs relied on backup support from their sponsors to cover this shortfall, with a significant impact on the balance sheets of those sponsors.



The Panics and Policy Responses

The panics: period 1 (Cont.)

- As the main holders of ABCP, many MMFs required “bail-out” from their sponsors (banks or fund families) to avoid “breaking the buck”.
- ✓ Firstly, the MMFs’ stakes decline when the outstanding ABCP yields rose.
- ✓ Furthermore, shrinking ABCP programs were forced to sell their underlying assets, placing further downward pressure on asset classes held by many MMFs.



The Panics and Policy Responses

The panics: period 1 (Cont.)

- The sponsor-based rescue of MMFs prevented “runs” by investors, but also solidified the expectation that MMFs would always be bailed out by their sponsors.
- ✓ Such expectations add to the belief that MMFs are super-safe money-like instruments that require no due diligence by investors.
- ✓ In that environment, investors can chase the highest-yielding funds without any perceived risk.



The Panics and Policy Responses

The panics: period 2

- On Sep. 15th 2008, Lehman Brothers filed for bankruptcy and was a major shock to MMFs.
- ✓ Reserve Primary Fund, a large prime MMF and a holder of Lehman ABCP, was unable to maintain its value.
- ✓ This dynamic led to a “run” on similar funds and caused significant disruption and liquidity shortage in private credit market.
- Prime MMFs are a crucial supplier of funds to corporations and to financial intermediaries.



The Panics and Policy Responses

The panics: period 2 (Cont.)

- The repo markets also played a key role in the crisis.
 - ✓ The “haircut index” on repo collaterals kept rising and led to withdrawal of liquidity from the financial system.
 - At the beginning of 2007, the index were near zero.
 - After ABCP panic, the index rose steadily to about 25% at the eve of Lehman failure.
 - After the Lehman failure, the index rose to about 45%.

The Panics and Policy Responses

The panics: period 2 (Cont.)

- It is important to note that haircuts rose and prices fell for many assets that had no direct connection to subprime securities.
- ✓ This is the key step that can allow contagion from one asset class to the broader market that includes many other types of (seemingly unrelated) short term debt.



The Panics and Policy Responses

Policy responses and their efficacy

- Central bank: monetary policy
 - ✓ Interest rate change
 - Reduction of interest rate
 - **No evidence of effect** on economic stress and limited evidence of positive effects on financial stress.

The Panics and Policy Responses

Policy responses and their efficacy (Cont.)

- ✓ Liquidity support
 - Lower reserve requirements, longer funding terms, more auctions and/or higher credit lines.
 - Significant positive effects on financial stress during the first period (pre-Lehman), but not reliable effects in later period.



The Panics and Policy Responses

Policy responses and their efficacy (Cont.)

- Government: financial sector stabilization measures
 - ✓ Recapitalization
 - Capital injection (common stock/preferred equity, subordinated debt)
 - Particularly effective in later period.
 - ✓ Liability guarantees
 - Enhancement of depositor protection, debt guarantee, government lending
 - Show weak result.



The Panics and Policy Responses

Policy responses and their efficacy (Cont.)

- Government: financial sector stabilization measures
 - ✓ Asset purchases
 - Asset purchases, provision of liquidity for bad asset purchases/removal, “ring-fencing” with toxic assets, asset guarantees
 - Show weak result.



The Panics and Policy Responses

Real effects of the financial crisis

- Banks cut back on credit supply, and the reduction had significant impacts on credit-constrained firms.
- ✓ Credit-constrained firms are those that their operations are very affected or somewhat affected.
- ✓ In a very noticeable and statistically significant way, the credit-constrained firms:
 - Cut back on expenditure and dividend payments.
 - Saw their cash holdings and number of employees decline.
 - Drew down on their credit lines to have cash in the future.
 - Bypassed attractive investment.

SESSION 3

01 Financial Disasters

02 Deciphering the Liquidity and Credit Crunch 2007-2008

03 Getting Up to Speed on the Financial Crisis: A One-Weekend-Reader's Guide

04 Risk Management Failures



Risk Management Failures

Risk management failures

- A large loss is not evidence of a risk management failure because a large loss can happen even if risk management is flawless.
- ✓ Risk management does not prevent losses. With good risk management, large losses can occur when those making the risk-taking decisions conclude that taking large, well-understood risks creates value for their organization.



Risk Management Failures

Risk management failures

- There are six types of risk management failures:
 - ✓ Failure to take risks into account (identification of risk).
 - ✓ Mismeasurement of known risks.
 - ✓ Failure in communicating the risks to top management.
 - ✓ Failure in monitoring risks.
 - ✓ Failure in managing risks.
 - ✓ Failure to use appropriate risk metrics.



Risk Management Failures

Failure to take risks into account (Ignoring risks)

- Ignoring a risk that is known.
 - ✓ The firm fails to realize how various position risks can lead to a potential disaster.
 - E.g., LTCM failed to recognize that high-yielding Russian debt had not only default risk, but also currency risk, sovereign risk, and counterparty risk.



Risk Management Failures

Failure to take risks into account (Cont.)

- Knowing about a risk, but failing to properly incorporate it into risk models.
 - ✓ Not collecting and entering data into the appropriate risk models is potential source of disaster.
- Failing to discover all risks.
 - ✓ Some risks may go completely undetected by risk managers.



Risk Management Failures

Mismeasurement of known risks

- The risk managers may not understand:
 - ✓ The **distribution of returns** of a single risky position.
 - ✓ The **relationships of the distributions** among different positions.



Risk Management Failures

Mismeasurement of known risks (Cont.)

- One of the key issues is the occurrence of **extreme events** (low frequency, high severity).
- ✓ Estimate of extreme events require a degree of **subjectivity**, which clearly has the potential for mistreatment.
- ✓ The **firm politics** can play a role in reducing the accuracy of risk estimates since some departments may wish to understate risks by using subjective measures.



Risk Management Failures

Failure in communicating the risks to top management

- It is very important to communicate the results of the risk management process effectively without any distortion by intermediaries.
- ✓ The purpose of risk management is to allow senior managers to make the optimal strategic decisions to maximize firm value.

Risk Management Failures

Failure in communicating the risks to top management

- ✓ The risk management efforts are wasted unless the results can be effectively communicated to the appropriate decision makers.
- ✓ The risk management process may be harmful if there is miscommunication, and the senior managers get a false sense of security from the information that is provided.



Risk Management Failures

Failure in monitoring and managing risks

- Risk managers must recognize how portfolio risk profiles can change even during the absence of trading.
- ✓ The properties of some securities can change for several factors.
 - E.g., interest rates, exchange rate, embedded derivatives.
- It is also important to understand that the act of monitoring and managing risk can change the nature of risk.
- ✓ The increasing the certainty for one variable may introduce uncertainty for another variable.



Risk Management Failures

Failure in monitoring and managing risks (Cont.)

- The organizations face trade-offs.
 - ✓ Monitoring and managing risk too carefully may stifle a trading department's innovation.
 - A firm's management may rightly decide not to monitor and manage some risks on an ongoing basis.
 - ✓ Employees should have some degree of flexibility.



Risk Management Failures

Failure in monitoring and managing risks (Cont.)

- Firms fail to monitor and manage risk on an ongoing basis by not having an adequate incentive structure and/or culture that promotes effective risk management.
- ✓ If risk is everyone's concern, then unobserved risks are less likely.
- ✓ If compensation is a function of risk, then employees will likely take more interest in lowering firm risk.



Risk Management Failures

Failure to use appropriate risk metrics

- Risk metrics aid the management process by providing managers a target to achieve.
- ✓ Monitoring these risk metrics allows managers to appropriately manage risk.
- ✓ However, risk metrics may be too narrow, which can make it more difficult to achieve the overall objective of managing risk.

Risk Management Failures

Failure to use appropriate risk metrics

- VaR is a widely used risk metric that is narrow in scope:
 - ✓ VaR does not capture the implications of extremely large losses that have a very low probability of occurring.
 - ✓ Choosing inappropriate time period (daily or weekly) of VaR does not correspond to the liquidity of the assets.

Risk Management Failures

Failure to use appropriate risk metrics (Cont.)

- ✓ VaR assumes distributions of losses are not correlated over time.
- The fact is that a crisis can change the nature of a return distribution for a given period.
- In the recent crisis, huge losses on one day led to drastic falls in liquidity, which led to large losses on the following day.



SESSION 4

GARP Code of Conduct

GARP Code of Conduct

GARP code of conduct

- The principles of GARP code of conduct promote the highest levels of ethical conduct and disclosure and provide direction and support for both the individual practitioner and the risk management profession.
- Violation(s) of this code may result in, among other things, the temporary suspension or permanent removal of the GARP Member from GARP's **Membership** roles, and may also include temporarily or permanently removing from the violator the right to use or refer to having earned the **FRM designation** or any other GARP granted designation.



GARP Code of Conduct

1. Principles

2. Rules of Conduct

3. General Accepted Practices

Principles

Professional integrity and ethical conduct

- GARP Members shall act with **honesty, integrity, and competence** to fulfill the risk professional's responsibilities and to uphold the reputation of the risk management profession.
- GARP Members must avoid disguised contrivances in assessments, measurements and processes that are intended to provide business advantage at the expense of honesty.



Principles

Conflicts of interest

- GARP Members have a responsibility to promote the interests of all relevant constituencies and **will not knowingly** perform risk management services directly or indirectly involving an actual or potential conflict of interest **unless full disclosure has been provided** to all affected parties of any actual or apparent conflict of interest.
- Where conflicts are unavoidable, GARP Members commit to their full disclosure and management.

Principles

Confidentiality

- GARP Members will take all reasonable precautionary measures to prevent intentional and unintentional disclosure of confidential information.



GARP Code of Conduct

1. Principles

2. Rules of Conduct

3. General Accepted Practices



Rules of Conduct

Professional integrity and ethical conduct

- GARP members shall act professionally, ethically and with **integrity** in all dealings with employers, existing or potential clients, the public, and others in the financial services industry.



Rules of Conduct

Professional integrity and ethical conduct (Cont.)

- GARP members shall exercise reasonable judgment in the provision of risk services while maintaining **independence** of thought and direction.
- ✓ GARP Members must not offer, solicit, or accept any gift, benefit or compensation that could be reasonably expected to compromise their own or another's **independence and objectivity**.



Rules of Conduct

Professional integrity and ethical conduct (Cont.)

- GARP members must take **reasonable precautions** to ensure that the Member's services are not used for improper, fraudulent or illegal purposes.
- GARP members shall not **misrepresent** details relating to analysis, actions, recommendations or other professional activities.

Rules of Conduct

Professional integrity and ethical conduct (Cont.)

- GARP members shall not engage in any professional conduct that reflects negatively on their honesty, **integrity**, character, trustworthiness, or professional ability or on the risk management profession.
- GARP members shall not engage in any conduct that compromises the **integrity** of the GARP, FRM designation or the **integrity** or validity of examinations leading to the award of the right to use the FRM designation that may be offered by GARP.

Rules of Conduct

Professional integrity and ethical conduct (Cont.)

- GARP members shall be **mindful of cultural differences** regarding ethical behavior and customs, and to avoid any actions that may have the appearance of being unethical according to local customs. If there appears to be a conflict or overlap of standards, the GARP member should always seek to apply the **higher standard**.

Rules of Conduct

Conflict of interest

- GARP members shall act **fairly** in all situations and must fully disclose any actual or potential conflict to all affected parties.
- GARP members shall make **full and fair disclosure** of all matters that could reasonably be expected to impair their **independence and objectivity** or interfere with their respective duties to their employer, clients, and prospective clients.

Rules of Conduct

Confidentiality

- GARP members shall not make use of confidential information of work, employer or client for inappropriate purposes and unless having received prior consent.
- GARP members must not use confidential information to benefit personally.



GARP Code of Conduct

1. Principles

2. Rules of Conduct

3. General Accepted Practices



General Accepted Practices

General accepted practices

- GARP members shall execute all services with **diligence** and perform all work in a manner that is **independent** from interested parties. Collect, analyze and distribute risk information with the highest level of professional **objectivity**.
- GARP members shall be familiar with current generally accepted risk management practices and shall clearly indicate any departure from their use.



General Accepted Practices

General accepted practices

- GARP members shall ensure that communications include **factual data** and do not contain false information.
- GARP members shall make a distinction between **fact and opinion** in the presentation of analysis and recommendations.



You are a champion

Thank you !

Thanks for staying with us. You have finished this chapter.