Foundations of Risk Management

FRM一级培训项目-强化班

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Framework

- Risk management: a helicopter view
- Corporate risk management: a primer
- Corporate governance and risk management
- What is ERM?
- Risk management and risk taking in banks

Risk Management: a Helicopter View

A. Is Risk Management Useful?

- Risk management and risk taking aren't opposites, but two sides of the same coin.
  - Together they drive all our modern economies.
  - It's all about making forward-looking choices about risk in relation to reward.
- Blames for Risk Management
  - Fail to prevent market disruptions or accounting scandals.
  - Derivative markets make it easier to take on large amount of risk.
  - Sophisticated financial engineering lead to the violent implosion of firms.
  - Only transfer risks to other firms.
  - Work to the short-term benefit.

C. The Conflict of Risk and Reward

- A Tradeoff between Risks and Rewards
  - Poor risk management: powerful business leaders exaggerate returns while diminishing risks.
  - Management might leave gaps in risk measurement.
  - Risk management failure can be exacerbated by the compensation incentive schemes.
  - Trading institutions may manipulate revenues.
  - Poor risk measurement techniques: distorted risk.
  - Industry regulators can be drawn into the deception.

G. Typology of Risk Exposures

- **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

G. Typology of Risk Exposures

- **Credit Risk:** the risk of an economic loss from the failure of a counterparty to fulfil its contractual obligations, or from the increased risk of default during the term of the transaction.
  - Default risk
  - Bankruptcy risk(the risk of actually taking over the collateralized, or escrowed, assets of a defaulted borrower or counterparty)
  - Downgrade risk
  - Settlement risk

G. Typology of Risk Exposures

- **Liquidity Risk**
  - **Funding Liquidity Risk:** a firm's ability to raise the necessary cash to roll over its debt; to meet the cash, margin, and collateral requirements; and to satisfy capital withdrawals.
  - **Trading Liquidity Risk:** 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.

Corporate Risk Management: A Primer

A. Why Not to Manage Risk in Theory

- Franco Modigliani and Merton Miller (M&M):
  - The value of a firm cannot be changed merely by means of financial transactions (or risk mgmt).
  - Firms should therefore not engage in any risk reduction activity.
  - Individual investors can execute on their own.
- MM's assumption: the capital markets are perfect.
  - Highly competitive; participants are not subject to transaction costs, commissions, or taxes.

A. Why Not to Manage Risk in Theory

- CAPM: in a world with perfect capital markets, firms only base their investment decisions on systematic risks.
- Using hedging tools cannot increase the value of the firm.
- Active hedging may distract management from its core business.
- A careless risk management strategy can drag a firm down.
- Risk management strategy has compliance costs.

B. Reasons for Managing Risk in Practice

- The "perfect market" assumption does not hold.
- The high fixed costs associated with financial distress and bankruptcy.
- Managers have an interest in reducing risks ⇒ to achieve the board's objectives.
- Hedging reduces the cost of capital and increases the debt capacity of companies.
- A firm can stabilise its costs through hedging.
- Purchasing insurance is expensive.

Corporate Governance and Risk Management

B. Corporate Governance and Risk Management

- The Board Should (basic functions)
  - Look after the interests of shareholders.
  - Be sensitive to the concerns of other stakeholders.
  - Alert for any conflict between the interests of management and stakeholders.
  - Separate the role of the CEO and the chairman of the board.

B. Corporate Governance and Risk Management

- CRO (dual positions)
  - Act as a senior member of the management committee and attend board meetings regularly.
  - Have a direct reporting line to the board or its risk committees in addition to reporting to the executive team.

C. True Risk Governance

- Risk Appetite
  - The board characterises the risk appetite.
  - Be connected to a firm's overall business strategy and capital plan.
  - Clear communication of the firm's risk appetite and risk position.

C. True Risk Governance

- Four Basic Choices in Risk Management
  1. Avoid risk.
  2. Transfer risk to third parties.
  3. Mitigate risk.
  4. Accept risk.

C. True Risk Governance

- The Board Should ensure (advanced functions)
  - Economic rather than accounting performance.
  - "Soft" risks.
  - Staff are rewarded based on risk-adjusted performance.
  - Major transactions are consistent with the risk authorised.
  - Keeping healthy skepticism.

D. Committees and Risk Limits

1. Risk Management Committee

- Translate the overall risk appetite into a set of limits.
- Independently review credit, market, and liquidity risks.
- Report back to the board on a variety of items, such as all loans and credits over a specified dollar limit.

D. Committees and Risk Limits

2. Audit Committee of The Board

- Check for infringements, oversee the quality of the processes.
- But only confines to verification function.
- Audit committee members are required to be financially literate.

D. Committees and Risk Limits

3. Risk Advisory Director: is a member of the board who specialises in risk matters.

4. Compensation Committee

- Determine the compensation of top executives.
- Be aligned with the long-term interests of stakeholders, and with risk-adjusted return on capital.
- Removal of guaranteed bonuses.
- Stock-based compensation can encourage risk-taking.

H. What Is the Role of the Audit Function?

- A Key Role of the Audit Function
  - Provide an independent assessment of the bank's risk management.
  - Examine the integrity of the management information system.
  - Verify the accuracy of models through back-testing.
  - Examine the documentation relating to compliance.

What is ERM?

B. The Benefits of ERM

ERM Is All About Integration

- ERM requires an integrated risk organisation.
  - The CRO reports to the CEO and the Board in support of their risk oversight responsibilities.
- ERM requires the integration of risk transfer strategies.
  - Take a portfolio view of all types of risk within a company.
- ERM requires the integration of risk management into the business processes of a company.

B. The Benefits of ERM

Three Benefits To ERM

1. Organisational Effectiveness
   - Various functions work cohesively and efficiently.
2. Risk Reporting
   - Timely and relevant risk reporting
3. Business Performance
   - Market value improvement.
   - Lower earnings volatility …

C. The Chief Risk Officer

- A CRO Is Responsible For
  - Providing the overall leadership for enterprise risk management.
  - Establishing an integrated risk management framework for all aspects of risks.
  - Allocating economic capital to business activities.
  - Communicating the company's risk profile to key stakeholders.

C. The Chief Risk Officer

- Reporting
  - The heads of individual risk department report to the CRO.
  - The CRO reports to the CFO or CEO.
  - A dotted-line reporting relationship between the CRO and the board.

D. Components of ERM

Risk Management and Risk Taking in Banks

A. How Does Risk Management Add Value?

- The Goal of Risk Management for Banks
  - To determine the optimal level of risk the level that maximises bank value;
  - But subject to the constraints imposed by regulators, laws, and regulations.
- A Tradeoff between Return and Risk
  - Cost of taking on a single new risk < gain.
  - But risk-taking decisions must be assessed in terms of their impact on the overall risk.
  - Major challenge: the tradeoff can not be made in real time.

A. How Does Risk Management Add Value?

- Two Ways that Risk Management can Destroy Value
  - Fail to ensure that the bank has the right amount of risk.
  - Fail to exercise the right amount of flexibility.
    - ✓Too restrictive: policemen.
    - ✓Too flexible.
    - ✓It is critical to strike the balance.

B. Determining a Bank's Risk Appetite

- Banks Cannot Operate with too much Risk
  - Constrained by laws and regulations.
  - Limiting a bank's ability to attract deposits.
  - Derivatives counterparties will be reluctant to deal with the bank.
  - Difficult to hire potential employees.
- Banks have to Take Some Risks
  - To create wealth for their shareholders.

B. Determining a Bank's Risk Appetite

- A Bank's Optimal Credit Rating Approaches
  - Banks targets a certain credit rating.
    - ✓ the optimal rating of a bank is generally not the highest rating
    - ✓ Banks with very different strategies, or liability and asset structures, could well end up having very different credit ratings, and different attitudes toward risk.
    - ✓ A bank with more of a deposit franchise and with more relationship lending is likely to prefer a higher rating than an institution that is engaged in more transactional activities.
  - Banks targets a certain PD depending on the bank's business model.

B. Determining a Bank's Risk Appetite

- Taking Social Costs into Account
  - To maximise value for banks' shareholders ⇒ generate systemic risk to society.
  - Regulators therefore impose restrictions (capital).
  - Banks have to choose their level of risk subject to external constraints.

C. Governance and Risk Taking

- A Good Governance
  - Make value-maximising trade-offs between risk and reward.
  - Operate within the constraints imposed by regulation.
  - Consistent with the firm's risk appetite.
- Better Risk Governance=Better Risk Mgt. Proceed ≠ Less Risk
  - Effective risk governance = taking risks rewarding for shareholders ≠ eliminating or even reducing risk-taking.
  - Optimal amount of risk for a bank ≠ optimal amount for society.

D. The Organisation of Risk Management

The Right Degree of Independence for Risk Managers

- Risk management is not an audit.
  - Auditors only have a verification function.
- If risk managers are viewed as a police ⇒ face obstacles in gathering information.
- The reporting lines of risk managers should be completely separate from the businesses.
  - Business lines have a strong commitment to managing risk ⇒ business lines collaborate with risk managers.

G. Incentives, Culture, and Risk Management

- Risk Management is not Auditing
  - Risk managers must understand the bank's businesses.
  - Risk managers also have to determine when risk appetite has to be changed.
  - Risk managers: having a dialogue with business units.

G. Incentives, Culture, and Risk Management

- Corporate Culture of Risk
  - No incentive plan can precisely tell what actions to take in every situation.
  - Not all risks can be quantified ⇒ incentive for employees to take risks that are not quantified.
  - The ability of a firm to manage risk properly depends on its corporate culture.
  - Companies where managers are viewed by their employees as trustworthy are more profitable.
  - But good governance changes.

Framework

- Financial disasters
- Deciphering the liquidity and credit crunch 2007-2008
- Getting up to speed on the financial crisis
- Risk management failures

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Financial Disasters

1. Chase Manhattan Bank/Drysdale Securities

- Incident
  - Drysdale obtained unsecured borrowing of $300 million by exploiting a flaw in computing the value of U.S. government bond collateral.
  - Drysdale lost the borrowed money in bond markets.
  - Chase Manhattan absorbed these losses because it had brokered most of Drysdale's securities borrowings.

1. Chase Manhattan Bank/Drysdale Securities

- Result
  - Severely damaged Chase's reputation.
  - Managers in Chase were convinced they were simply acting as intermediaries.
- Lessons
  - Make the methods for computing collateral value on bond borrowings more precise.
  - New product offerings must receive prior approval from the risk control functions.

2. Kidder Peabody

- Incident
  - Kidder Peabody entered into a series of trades that were artificially inflating the firm's reported profits.
  - It had not resulted in any actual loss of cash.
  - But triggered a substantial loss of confidence in the competence of the firm's management.
- Lessons
  - Always investigate a stream of large unexpected profits.
  - Periodically review any potential violations of assumptions in models and systems.

3. Barings Bank

- Incident
  - A loss of $1.25 billion due to the unauthorised trading of a trader Nick Leeson.
  - Forced Barings into bankruptcy.
- Arose
  - Leeson disguised his speculative position and manufactured substantial reported profits for his own accounts.

3. Barings Bank

- Why not detected?
  - Allowing Leeson to function as head of trading and the back office => depriving the firm of an independent check on his activities.
- Lessons
  - The absolute necessity of an independent trading back office.

4. Allied Irish Bank

- Incident
  - John Rusnak entered into massive unauthorised trades, resulting in $691 million in losses.
- Arose
  - Rusnak invented **imaginary trades** that offset his real trades, making his trading positions appear small.
  - He persuaded back-office personnel not to check these bogus trades.
  - He booked imaginary trades with counterparties in the Asian time zone.
  - He was extremely modest in the amount of false profit he claimed.
  - He relied on arguments that costs should be cut be weakening or eliminating key controls.

4. Allied Irish Bank

- Lessons
  - This case is similar to Barings. But Rusnak had no dual role.
  - Avoid engaging in small ventures in which the firm lacks any depth of expertise.
  - Relationship between parent and overseas units needs to be clarified.
  - Strong and enforceable back-office controls are essential.

5. Union Bank of Switzerland

- Incident
  - Losses of $400 million ~ $700 million in equity derivatives during 1997.
  - Another loss of $700 million during 1998 due to a large position in LTCM.
- Result
  - The 1997 losses forced UBS into a merger with Swiss Bank Corporation.
- Arose
  - The person with senior risk management authority for the department doubled as head of quantitative analytics. His compensation tied to trading results.
- Lessons
  - Less is known about this disaster than the others.
  - The need for independent risk oversight.

6. Societe Generale

- Incident
  - In January 2008, Societe Generale reported trading losses of $7.1 billion caused by unauthorised activity of a trader, Jerome Kerviel.
- Arose
  - Kerviel took very large unauthorised positions from 2005 to 2008.
  - He concealed these unauthorised positions by entering fictitious transactions that offset the risk and P&L of his true trades.
  - He constantly replaced canceled fictitious transactions with new ones, totalling 947 transactions.

6. Societe Generale

- Why not detected?
  - No red-flagging for an unusual level of trade cancellations.
  - Kerviel's trading assistant may have been operating in collusion with Kerviel.
    - ✓ In any case, the trading assistant appears to have accepted Kerviel's directions without questioning.
  - No mandatory vacation.
  - No limits of Kerviel's gross positions, only his net positions.
  - Kerviel's unusually high amount of brokerage commissions, related to his high level of gross positions
  - Kerviel was reporting trading gains in excess of levels his authorized position taking could have accounted for, but an investigation into unexpected reported trading gains was lacked.

6. Societe Generale

- Lessons
  - Flag any trader who is using an unusually high number of cancellations.
  - Don’t trust the independence of the trading assistant too much.
  - Rules for mandatory vacation should be enforced.
  - Unusually high ratios of gross to net positions are a warning sign of unauthorised activities.

7. Long-Term Capital Management

- The Crisis
  - The triggers: Russian debt default in 1998.
  - The LTCM fund's equity began to decline, and it was reluctant to cut positions in a turbulent market.
  - As competitors learned more about the actual positions, their pressure on market prices in the direction unfavorables to LTCM intensified.

7. Long-Term Capital Management

- The Fall of LTCM
  - 14 of the largest creditors contributed a fresh $3.65 billion in equity investment into the LTCM fund to allow for a substantial time period in which to close out positions.
  - By 2000, LTCM had been wound down.
- Lessons
  - LTCM failed to supplement VaR measures with a full set of stress test scenarios.
  - LTCM failed to account for the illiquidity of its largest positions.

8. Metallgesellschaft

- Background
  - MGRM: long-term contracts to supply customers with gas and oil products at fixed costs and to hedge these contracts with short-term gas and oil futures.
- The Crisis
  - In 1993, a large decrease in gas and oil prices had resulted in funding needs of around $900 million.
  - MG negotiated unwinds of these contracts at unfavourable terms.
- Lessons
  - When using shorter-term hedges against longer-term contracts, this can be successfully carried out only if proper risk controls are applied.

9. Bankers Trust

- Incident
  - Both P&G and Gibson claimed that they had suffered large losses in derivatives trades they had entered into with BT due to being misled by BT as to the nature of the positions.
- Result
  - BT was forced into an acquisition by Deutsche Bank.
- Arose
  - BT offered P&G and Gibson a probable but small reduction in funding expenses in exchange for a potentially large loss under some less probable circumstances.

9. Bankers Trust

- How detected?
  - The internal BT recordings showed that price quotes to P&G and Gibson were being manipulated to mislead them.
- Lessons
  - Banks should match the degree of complexity of trades to the degree of financial sophistication of customers.
  - Be cautious about how to use any form of communication.

10. JPMorgan, Citigroup, and Enron

- Incident
  - Enron had been engaging in dubious accounting practices to hide the size of its borrowings.
  - JPMorgan and Citigroup agreed to pay a combined fine of $286 million for "helping to commit a fraud".
- Arose
  - Enron sold oil for future delivery, getting cash, and then agreed to buy back the oil that it delivered for a fixed price. So, in effect, no oil was ever delivered. **This was in fact a loan.**
  - Enron did not have to report this as a loan.

Deciphering the Liquidity and Credit Crunch 2007-2008

A. Banking Industry Trends

- **Trend 1: Securitisation.** "Originate and distribute" model: banks repackaged loans and passed them on to various other financial investors.
  - Collateralised Debt Obligations (CDOs).
  - Tranches: senior, equity, mezzanine tranches.
  - Credit Default Swaps (CDS): buyers of these tranches can protect themselves by purchasing CDS contracts insuring against the default.

A. Banking Industry Trends

- **Trend 2: Shortening the Maturity Structure and Resulting the Maturity Mismatch**
  - Most investors prefer assets with short maturities.
    - ✓To withdraw funds at short notice.
  - But most investment mortgages have long maturities.
  - As a result, banks increasingly financed their asset holdings with shorter maturity instruments.

A. Banking Industry Trends

- Shadow Banks
  - Raise funds by lending short-term asset-backed commercial paper.
  - The short-term assets are backed by a pool of mortgages.
  - In the case of default, owners of the asset-backed commercial paper have the power to sell the underlying collateral assets.
  - But exposes the banks to funding liquidity risk (borrow short and invest in long).

A. Banking Industry Trends

- Short-term Repurchase Agreements (repos)
  - Repo: A firm borrows funds by selling a collateral asset today and promising to repurchase it at a later date.
  - Overnight repos: banks have to roll over their funding on a daily basis.
- Conclusion
  - Leading up to the crisis, any reduction in funding liquidity could thus lead to significant stress for the financial system.

A. Banking Industry Trends

- **Why the Popularity of Structured Products rises?**
  - Lowering funding interest rates because risk is transferred.
  - Regulatory and ratings arbitrage: banks were able to reduce their capital charges.
  - Optimistic forecasts about structured finance products: low default, low correlation.
  - More favourable ratings: higher rating fees, high return.
  - Rating agencies collected **higher fees** for structured products than corporate bond.

C. Amplifying Mechanisms and Recurring Themes

Loss Spiral And Margin Spiral

- Loss Spiral
  - Decline in the value of assets ⇒ eroding the investors' net worth ⇒ selling for money ⇒ these sales depressing the price further ⇒ inducing more selling.
- Margin/haircut Spiral
  - As margins or haircuts rise ⇒ the investor has to sell more assets ⇒ a lower price ⇒ increasing margins further and forcing more sales.

C. Amplifying Mechanisms and Recurring Themes

Lending Channel

- Moral Hazard
  - Most lending is intermediated by banks.
  - The net worth of the intermediaries' stake falls ⇒ intermediaries may then reduce their monitoring effort.
- Precautionary Hoarding
  - Lenders are afraid that they might suffer from interim shocks ⇒ precautionary hoarding arises ⇒ sharp spikes in LIBOR.

C. Amplifying Mechanisms and Recurring Themes

- Runs On Financial Institutions
  - Everybody had an incentive to be the first to withdraw funds from a possibly troubled bank.
- Network Effects
  - Most financial institutions are lenders and borrowers at the same time.
  - Gridlock Risk: multilateral netting agreements can stabilise the system.

Getting up to Speed on the Financial Crisis

C. The Crisis Build-Up

- Why were Shadow Banks Growing?
  - The traditional banking model became less profitable.
  - Institutional cash pools have a demand for insured deposit alternatives.
  - And the shadow banking system rose to fill this gap.

C. The Crisis Build-Up

- Credit Boom (Foreign Factors)
  - In the US: national saving < U.S. capital investment.
  - Large and persistent capital inflows from foreigners seeking U.S. assets.
  - Institutional cash pools had to find substitutes such as repo.
- Credit Boom (Domestic Factors)
  - The increase in the production of asset-backed securities appears to be a credit boom.
  - House prices were rising.

D. The Panics

1. Asset-backed Commercial Paper

- What is ABCP?
- Why ABCP Becoming Prevalent?
  - More transparent ⇒ lowering funding costs.
  - Save on regulatory capital.
- ABCP Run
  - Lenders are unwilling to refinance CP when it comes due.
  - Programs were more likely to experience a run if they had high credit risk or high liquidity risk.

D. The Panics

2. Money Market Mutual Funds

- A Chain Effect
  - MMFs saw the values of their stakes decline when ABCP yields rose ⇒ were forced to sell their underlying assets ⇒ further downward pressure on asset classes held by many MMFs.
- The Lehman bankruptcy was a major shock to MMFs.
  - It led to run on many MMFs.
  - Investors moved to government-only MMFs.

D. The Panics

3. Repo

- Repo is the shadow-banking equivalent of a deposit market.
- Haircuts continued a steady rise throughout 2007-2008.
- Following the Lehman failure, the haircut rose by an additional 20% to 100%.

➢ Subprime crisis turned into the collapse of global financial institutions.

E. Policy Responses

- Liquidity support was effective during the pre-Lehman period.
- After the fall of Lehman, **capital injections** were the most effective policy.

F. Real Effects of the Financial Crisis

- The widespread loss of confidence reached the real sector of the economy.
- Intermediaries began to hoard cash and stop lending.
- Significant impacts on the real economy.

Risk Management Failures

A. A Typology of 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.

1. Mis-measurement of Known Risks

- Risk Managers could Make a Mistake in
  - Assessing the probability of a loss.
  - Using the wrong distribution.
  - Correlations may be mis-measured.
  - A known risk may not manifest itself in the past.

A. A Typology of Risk Management Failures

2. Mis-measurement Due To Ignored Risks

- Ignored known risks
- Mistakes in information collection
  - Risk is known but did not enter the relevant risk models.
  - Losses from risks that were not accounted for (such as business risk).
- Unknown risks
  - Do not create risk management problems.

A. A Typology of Risk Management Failures

3. Communication Failures

- Risk management has to provide timely information to the board and top management.
- Right information, at the right time, to the right people.
- Hierarchical structures sometimes are filters when information was sent up.

A. A Typology of Risk Management Failures

4. Failures In Monitoring And Managing Risks

- Risks can change sharply because of derivatives positions.
- Hedges adjusted daily could create large losses.
- When liquidity dries up in the markets, many risk-mitigating options can no longer be used.
- Individuals may take risks that remain hidden for a while.
- The effectiveness of risk monitoring and control depends crucially on an institution's culture and incentives.

A. A Typology of Risk Management Failures

5. Risk Measures and Risk Management Failures

- VaR does not capture small-probability losses.
- To assess risk, firms have to look at longer horizons and have to take a comprehensive view of their risks. But VaR seems work well with shorter horizons.
- When we consider years, crises are not extremely rare events.
- During crisis periods, firms will make multiple losses.
- Crises involve complicated interactions across risks and across institutions. There is little hope for statistical risk models relying on historical data to capture such complicated situations.

Framework

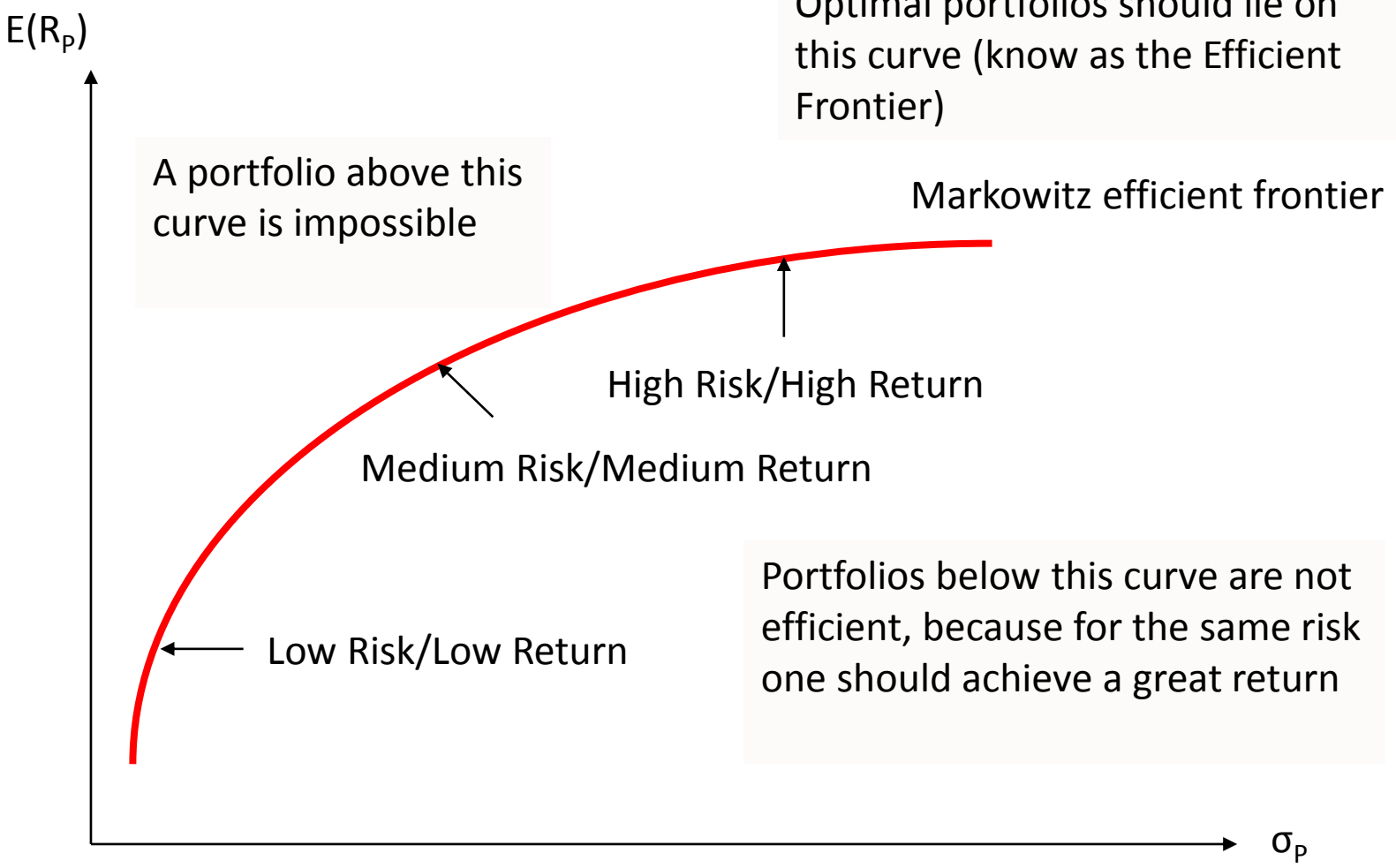
- The standard capital asset pricing model
- Applying the CAPM to performance measurement
- Arbitrage pricing theory
- Effective data aggregation and risk reporting
- GARP code of conduct

The Standard Capital Asset Pricing Model

Markowitz portfolio theory

- Assumptions about a Markowitz investor
  - No transaction costs
  - Assets are infinitely divisible
  - The absence of personal income tax
  - An individual cannot affect the price of a stock by his trading
  - Investors make decisions solely in terms of returns and standard deviation of the returns
  - Unlimited short sales are allowed
  - Unlimited lending and borrowing at the riskless rate
  - All investors have identical expectations: μ σ ρ
  - All assets are marketable

Markowitz efficient frontier

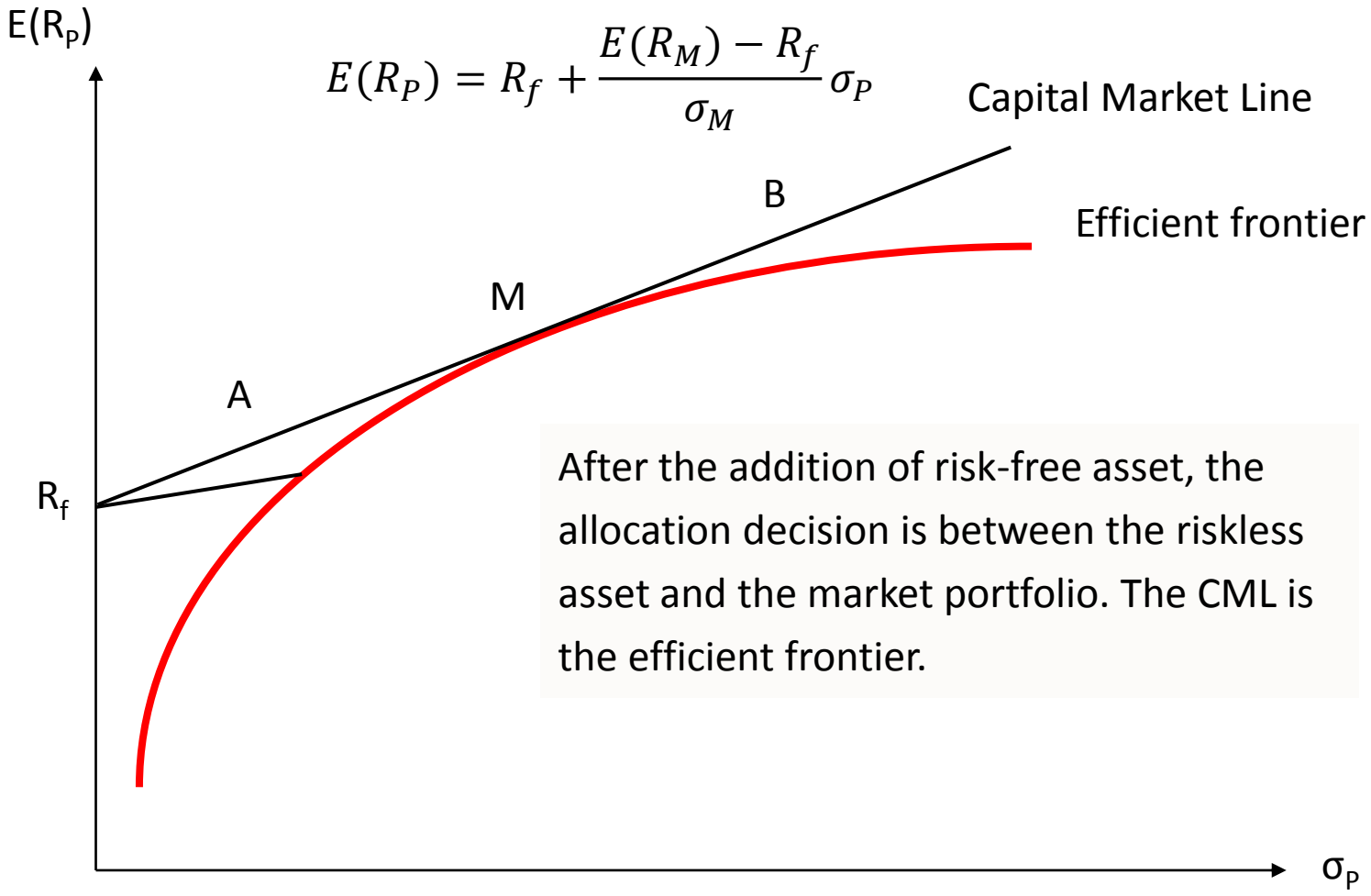


Minimum variance portfolio

- Definition: the portfolio with the smallest variance among all possible portfolios on a portfolio possibilities curve.
- The shape of the portfolio possibilities curve is best described in two pieces:
  - The portion of the portfolio possibility curve that lies above the minimum variance portfolio is concave.
  - The portion of the portfolio possibility curve that lies below the minimum variance portfolio is convex.

Capital Market Line (CML)

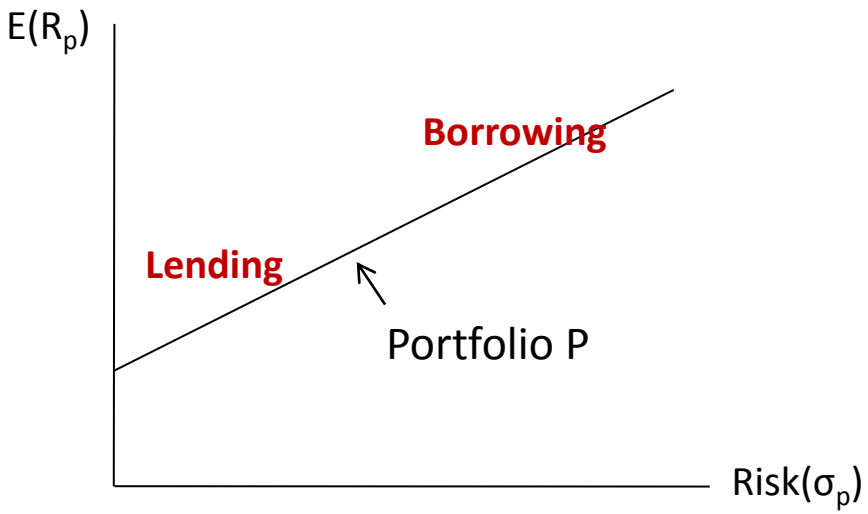
$$E(R_P) = R_f + \frac{E(R_M) - R_f}{\sigma_M}\sigma_P$$



After the addition of risk-free asset, the allocation decision is between the riskless asset and the market portfolio. The CML is the efficient frontier.

Capital Market Line (CML)

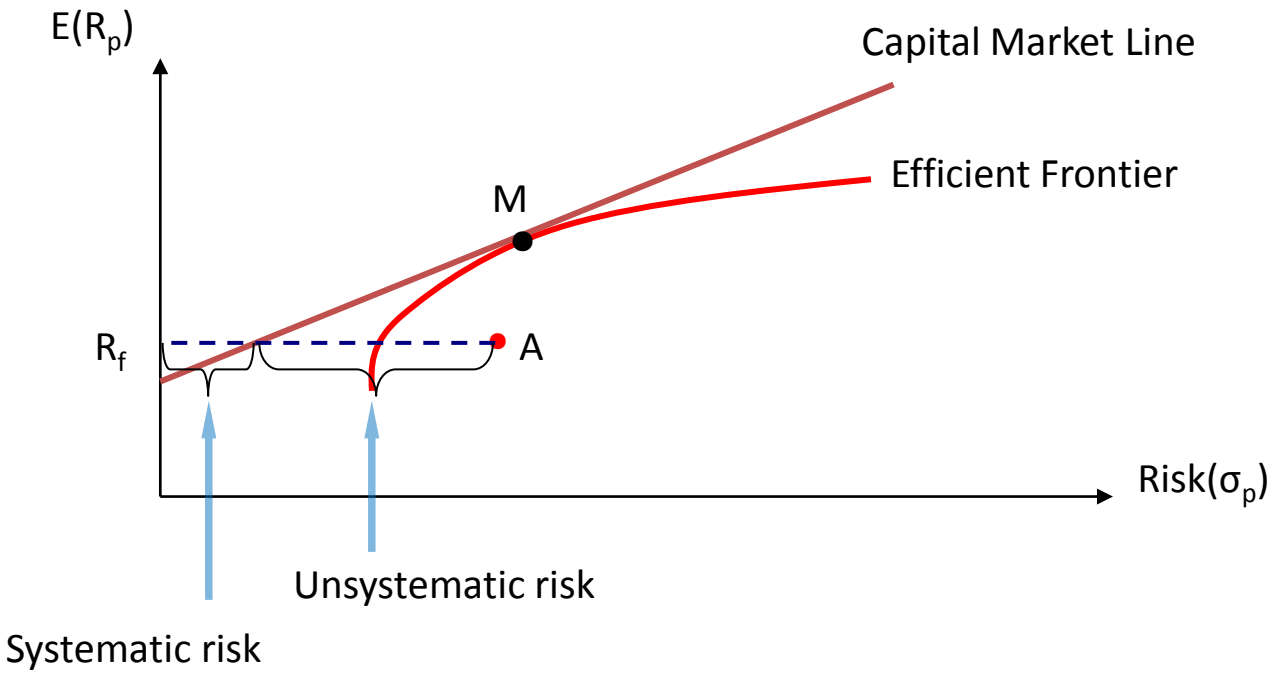
- The point of tangency – Portfolio P, is known as the market portfolio. When one can lent or borrow money use riskless rate, investor will hold a combination of the market portfolio and the risk-free asset.
- Risk-averse investors will create lower risk portfolios by lending (i.e., investing in the risk-free asset). More risk-tolerant investors will increase portfolio return by borrowing at the risk-free rate.



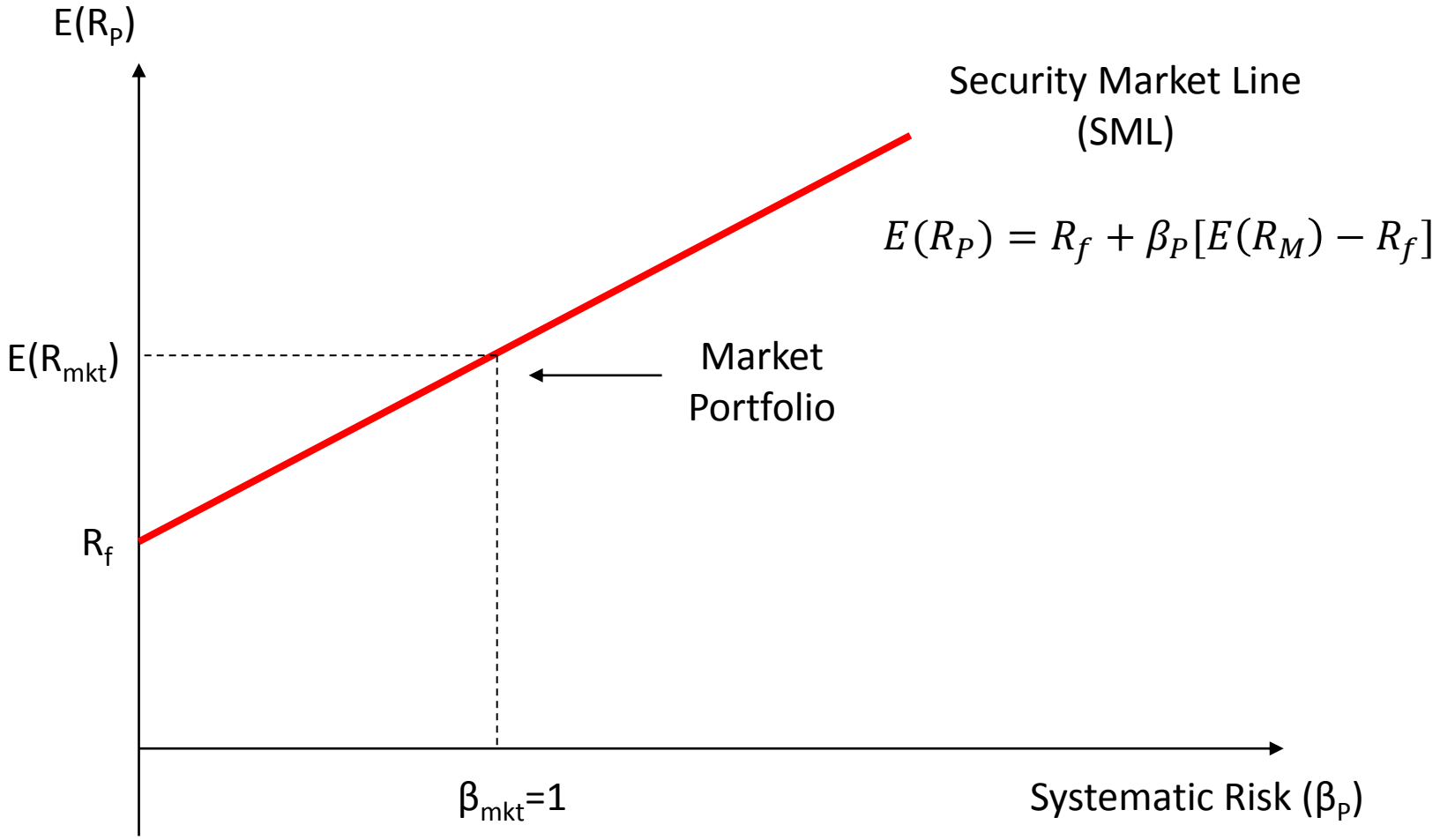
Systematic and Unsystematic Risk

Total risk= systematic risk+ unsystematic risk

Systematic risk is the only important ingredient in determining expected returns and that nonsystematic risk plays no role



Security Market Line (SML)



$$E(R_P) = R_f + \beta_P[E(R_M) - R_f]$$

Capital Asset Pricing Model (CAPM)

- $E(R_P) = R_f + \beta_P[E(R_M) - R_f]$
- $\beta_P = \frac{Cov(P,M)}{\sigma_M^2} = \rho_{P,M}\frac{\sigma_P}{\sigma_M}$
  - $E(R_P)$: expected return on risky asset
  - R_f : risk-free rate
  - $E(R_M) - R_f$: market portfolio risk premium
  - β_P : systematical risk of asset P
  - $\beta_P \times [E(R_M) - R_f]$: beta-adjusted market risk premium

Applying the CAPM to Performance Measurement

Sharpe ratio

- Measures the ratio of the average rate of return $E(R_P)$, in excess of the risk-free rate R_F, to the absolute risk $\sigma(R_P)$.

$$SR = \frac{E(R_P) - R_F}{\sigma(R_P)}$$

  - Widely used for measuring portfolio performance that are not very diversified.
  - A better method for measuring historical performance.
  - Suitable for evaluating the performance of a portfolio that represents an individual's total investment.

Treynor ratio

- Treynor ratio is equal to the risk premium divided by beta (systematic risk)

$$TR = \frac{E(R_P) - R_F}{\beta_P}$$

  - More appropriate for comparing well-diversified portfolios and a more forward-looking measure.

Sortino ratio

- MAR (minimum acceptable return) is the return below which the investor does not wish to drop.
- Sortino ratio measures the ratio of the average rate of return $E(R_P)$, in excess of the risk-free rate R_F, to the semi-standard deviation, which considers only data points that represent a loss.

$$Sortino\ Ratio = \frac{E(R_P) - MAR}{\sqrt{\frac{1}{N-1}\sum_{t=1}^{N}(R_{Pt} - MAR)^2}} \qquad (R_{Pt} < MAR)$$

  - Where T is the number of observed losses.
  - The Sortino ratio is more relevant than the Sharpe ratio when the return distribution is skewed to the left.

Jensen's alpha

- Jensen's alpha is the asset's excess return over the return predicted by the CAPM.

$$E(R_P) - R_F = \alpha_P + \beta_P[E(R_M) - R_F]$$

  - Most appropriate for comparing portfolios that have the same beta and can be used to rank portfolios within peer groups.

Information ratio

- Tracking error: the standard deviation of the difference in return between the portfolio and the benchmark.

$$TE = \sigma(R_P - R_B)$$

- The information ratio measures the ratio of the residual return of the portfolio compared with its residual risk (tracking error).

$$IR = \frac{E(R_P) - E(R_B)}{\sigma(R_P - R_B)} = \frac{\alpha_P}{\sigma(\alpha_P)}$$

  - To check that the risk taken by the manager, in deviating from the benchmark, is sufficiently rewarded.

Arbitrage Pricing Theory

Single-Factor Model

- In a single-factor model, uncertainty in asset returns has two sources: a common or macroeconomic factor, and firm-specific events.
- $R_i = E(R_i) + \beta_i F + e_i$
  - F is the deviation of the common factor from its expected value;
  - β_i is the sensitivity of firm i to that factor;
  - e_i is the firm-specific disturbance;
  - $E(R_i)$ is the expected excess return on stock i;
  - The nonsystematic components of returns (e_i), are assumed to be uncorrelated among themselves and uncorrelated with the factor F.
    - ✓ The expected value of e_i for any well-diversified portfolio is zero

Multifactor models

- Multifactor Model
  - Models that allow for several factors can provide better descriptions of security returns.
  - Multifactor models of security returns can be used to measure and manage exposure to each of **many economy-wide factors such as business-cycle risk, interest or inflation rate risk, energy price risk**, and so on.
  - Factor models are tools that allow us to **describe and quantify the different factors that affect the rate of return** on a security during any time period.

Multifactor models

- The equation for multifactor model for stock i
- $R_i = E(R_i) + \beta_{i,GDP} GDP + \beta_{i,IR} IR + e_i$
  - R_i = return on stock i
  - $E(R_i)$ = expected excess rate of return for stock i
  - $\beta_{i,GDP}$ = GDP factor beta for stock i
  - $\beta_{i,IR}$ = interest rate factor beta for stock i
  - GDP = deviation of GDP factor from its expected value
  - IR = deviation of interest rate factor from its expected value
  - e_i = firm-specific return for stock i

Arbitrage Pricing Theory

- Arbitrage pricing theory (APT) is a general theory of asset pricing that holds that the expected return of a financial asset can be modeled as a linear function of various macro-economic factors or theoretical market indices, where sensitivity to changes in each factor is represented by a factor-specific beta coefficient.
- $E(R_P) = R_f + \sum \beta_i F_i$

Arbitrage Opportunities

- Arbitrage Opportunities
  - The APT assumes there are no market imperfections preventing investors from exploiting arbitrage opportunities
  - Extreme long and short positions are permitted and mispricing will disappear immediately
  - All arbitrage opportunities would be exploited and eliminated immediately

Fama-French Three-Factor Model

- The Fama-French three-factor model incorporates the following systematic factors:
- $R_{it} = \alpha_i + \beta_{iM} R_{Mt} + \beta_{i,SMB} SMB_t + \beta_{i,HML} HML_t + e_{it}$
  - SMB = Small minus big (the return of a portfolio of small stocks – return on a portfolio of large stocks)
  - HML = High minus low (the return of a portfolio of stocks with a high book-to-market ratio – return on a portfolio of stocks with a low book-to-market ratio)
- F&F have observed: firms with high ratios of book-to-market value are more likely to be in financial distress and that small stocks may be more sensitive to changes in business conditions. Thus, these variables may capture sensitivity to risk factors in the macro economy.

Effective Data Aggregation and Risk Reporting

I. Data Architecture and IT Infrastructure

- 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.
- Principle 2
  - Data architecture and IT 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.

II. Risk data aggregation capabilities

- 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.
- 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.

II. Risk data aggregation capabilities

- Principle 5
  - Timeliness – A bank should be able to generate aggregate and up-to-date risk data **in a timely manner**. The precise timing will also depend on the bank-specific frequency requirements for risk management reporting, under both normal and stress/crisis situations.
- 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 and requests to meet supervisory queries.

III. Risk reporting practices

- 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**.
- Principle 8
  - Comprehensiveness - 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.

III. Risk reporting practices

- 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.**
- Principle 10
  - **Frequency** – The board and senior management (or other recipients as appropriate) should set the frequency of risk management report production and distribution. The frequency of reports should be increased during times of stress/crisis.

III. Risk reporting practices

- Principle 11
  - Distribution - Risk management reports should be distributed to the relevant parties while ensuring **confidentiality** is maintained.

GARP Code of Conduct

Sample questions

- Junaid Manzoor has been hired as head of risk management by KDB Asset Management, a small investment firm in Pakistan. Manzoor implements a risk measurement framework to gauge portfolio risk for the firm. Unfortunately, the methodology he implements for risk measurement has changed considerably in recent years and is no longer used internationally. Neither Manzoor nor anyone else at the firm is aware of the changes to risk measurement approaches. As a GARP member, has Junaid violated the GARP Code of Conduct?

  A. No, this is not a violation of the GARP Code of Conduct because neither Manzoor nor the firm is aware of the changes to risk measurement approaches.

  B. No, this is not a violation as the methodology worked when Manzoor took his FRM exams.

  C. This is only a violation of the GARP Code of Conduct if investment decisions are made based on Manzoor's risk reports.

  D. Yes, this is a violation of the GARP Code of Conduct.

- Correct Answer ：D

Sample questions

- Which of the following is a potential consequence of violating the GARP Code of Conduct once a formal determination is made that such a violation has occurred?

  A. Formal notification to the GARP Member's employer of such a violation.

  B. Suspension of the GARP Member's right to work in the risk management profession.

  C. Removal of the GARP Member's right to use the FRM designation.

  D. Required participation in ethical training.

- Correct Answer：C

Sample questions

- GARP Members agree to uphold and implement Rules of Conduct, which includes each of the following EXCEPT for:
  - A. Shall exercise reasonable judgment in the provision of risk services while maintaining independence of thought and direction.
  - B. Shall be knowledgeable about probable future regulations in order to ensure their recommendations can endure future developments.
  - C. Shall be diligent about not overstating the accuracy or certainty of results or conclusions and shall clearly disclose the relevant limits of their specific knowledge and expertise concerning risk assessment, industry practices and applicable laws and regulations.
  - D. Shall endeavor to be mindful of cultural differences regarding ethical behavior and customs, and to avoid any actions that are, or may have the appearance of being unethical according to local customs.

- Correct Answer：B

It's not the end but just beginning.

By training your thoughts to concentrate on the bright side of things, you are more likely to have the incentive to follow through on your goals. You are less likely to be held back by negative ideas that might limit your performance.

试着训练自己的思想朝好的一面看，这样你就会汲取实现目标的动力，而不会因为消极沉沦停滞不前。