

FRM - Foundations of Risk Management

Chapter 1 The Need for Risk Management

Chapter 2 Risk Management Failures

Chapter 3 Case Studies of Risk Management

Chapter 4 Investors and Risk Management

Chapter 5 Creating Value with Risk Management

Chapter 6 Overview of Enterprise Risk Management (ERM)

Chapter 7 Code of Conduct

Chapter 1 The Need for Risk Management

1. Concepts of risk

Define risk and describe some of the major sources of risk

- Definition of risk:
 - Risk is the volatility of unexpected outcomes.
 - Risk is the deviation from expected earnings (earnings volatility).
- Sources of risk:
 - Human-created: business cycle, inflation, changes in government policies, wars.
 - Unforeseen natural phenomena: weather and earthquakes.
 - Long-term economic growth: IT innovations can render existing technology obsolete and create dislocations in employments.

Differentiate between business and financial risks and give examples of each

- Types of risk:
 - Business risk:
 - (i) Business decision: includes strategic risk, product development choices, capital expenditure decisions, marketing strategies.
 - (ii) Business environment: competition and macroeconomic risk.
Corporations assume such risk willingly in order to create a competitive advantage and add to value for shareholders
 - Financial risk: Possible loss due to financial market activities.

Describe the functions and purposes of financial institutions as they relate to financial risk management

- For corporations, they should concentrate on managing “business risks” (what they do best) and optimize the exposure to financial risks.
- For financial institutions, the primary function is to manage “financial risks” actively, as the purpose of financial institutions is to assume, intermediate, or advise on financial risks. Financial institutions have to:
 - “Understand” financial risks, consciously plans for the consequences of adverse outcomes.
 - “Measure” financial risks precisely in order to “control” and “price” them properly.

Define and describe the four major types of financial risks: market, liquidity, credit, and operational

Within market risk:

Describe and differentiate between absolute and relative market risk

Describe and differentiate between directional and non-directional market risk

Describe basis risk and its sources

Describe volatility risk and its sources

- **Market risk:** the risks of losses owing to movements in the level or volatility of market prices.

Absolute risk	<ul style="list-style-type: none"> • Measure price movement in dollar terms. • Focus on the “volatility” of total return.
Relative risk	<ul style="list-style-type: none"> • Measure return change relative to benchmark index. • Focus on “tracking error” or deviation from the index.

Directional risk	Exposure to the direction of movement in financial variables or market prices.
Nondirectional risk	Remaining risks: <ol style="list-style-type: none"> Nonlinear risk Basis risk: Exposure to hedged position. It is created from unanticipated movements in the relative prices of assets in a hedged position. Volatility risk: Exposure to actual or implied volatility

- Mitigation: Market risk is controlled by limits on notionals, exposures, VaR.

Within liquidity risk:

Describe and differentiate between asset and funding liquidity risk

- **Liquidity risk:**

Asset liquidity risk (Market liquidity risk, Product liquidity risk)	<ul style="list-style-type: none"> • Definition: A transaction can't be conducted at prevailing market price due to the size of the position relative to normal trading lots. • This risk varies across asset categories, time, and size of the position. • Mitigation: Such risk can be managed by setting limits and by means of diversification.
Funding liquidity risk (Cash-flow risk)	<ul style="list-style-type: none"> • Definition: Inability to meet payments obligations, which may force early liquidation and thus transform papers losses into realized losses. • The risk is especially a problem for portfolios that are leveraged and subject to margin calls from lenders. • Mitigation: Such risk can be controlled by proper planning of cash-flow, by means of diversification and by the consideration of ways to raise new funds.

- Death spiral: Funding liquidity risk interacts with asset liquidity risk. If cash reserves are insufficient for payment (Funding liquidity risk), we may suffer an involuntary liquidation of the portfolio at depressed prices (Asset liquidity risk).

Within credit risk:

Describe and differentiate between exposure and recovery rate

Describe credit event and how it may relate to market risk

Describe sovereign risk and its sources

Describe settlement risk and its sources

• **Credit risk:**

Company-specific	<ul style="list-style-type: none"> • Definition: The risk of losses that counterparty may be unwilling or unable to fulfill their contractual obligations. Credit risk is measured by the cost of replacing cash flows if counterparty defaults. • Credit loss encompasses the exposure (amount at risk) and the recovery rate (the proportion paid back to the lender). • Credit event vs. market risk: Credit risk can occur “before” the actual default. It is defined as potential loss in mark-to-market value due to the occurrence of a credit event (e.g. change in counterparty’s ability to perform its obligation, change in credit rating, change in market’s perception of default). • Mitigation: Credit risk can be controlled by credit limits on nationals, current and potential exposures, credit enhancement (collateral or marked-to-market).
Country-specific	<ul style="list-style-type: none"> • Sovereign risk • Sources: <ul style="list-style-type: none"> - A government may be unwilling or unable to fulfill its contractual obligations. - A country imposes FX controls that makes it impossible for counterparty to honor its obligation.
Settlement risk	<ul style="list-style-type: none"> • A particular form of credit risk. • Sources: In the process of exchanging payments with the counterparty, the risk arises when the counterparty may default after the institution already made its payment.

Within operational risk:

Describe the potential relationships between operational, market and credit risk

Describe people risk

Describe model risk and its sources

Describe legal risk and its sources

- **Operational risk:**

- Definition: The risk of loss from failures or inadequacy in a company's systems, people or processes or from external events.

People risk	<ul style="list-style-type: none">• Sources: Internal fraud.• People risk is sometimes related to market risk. For example, rogue traders typically falsify their positions after incurring large market losses.
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- Operational risk can lead to market and credit risks. For example, an operational problem in a business transaction or a settlement fail can create market risk because the cost may depend on movements in market prices.

- Operational risk also includes model risk and legal risk.

Model risk	<ul style="list-style-type: none">• Sources: A part of inadequate internal process. Model risk emerges if we use flawed valuation model or misspecify model.• Mitigation: Model must be subjected to independent evaluation.
Legal risk	<ul style="list-style-type: none">• Sources: Exposures to fines, penalties or punitive damages resulting from supervisory actions and private settlements.• Legal risk is generally related to credit risk. Counterparty who loses money on a transaction may try to find legal ground for invalidating the transaction.• Mitigation: Corporation's legal counsel develops policies in consultation with risk managers and senior management. In addition, corporation should make sure that agreements with counterparties can be enforced before any deal is consummated.

2. Derivatives and risk management

Relate significant market events of the past several decades to the growth of the risk management industry

- The recent growth of the risk management industry can be traced directly to the increased volatility of financial markets since the early 1970s as below. The only constant across these events is their unpredictability.

1971	Fixed exchange rate system broke down, leading to flexible and volatile exchange rates
1973	Oil price shock accompanied by high inflation and wild swings in interest rates
1987	US stock collapsed 23%, wiping out \$1 trillion on Oct 19 (Black Monday)
1989	Japanese stock-price bubble deflated and \$2.7 trillion capital lost, leading to an unprecedented financial crisis in Japan
1994	Fed started six consecutive interest rate hikes, erasing \$1.5 trillion in global capital
1997	Asia turmoil wiped out about 75% of dollar capitalization of equities in Indonesia, Korea, Malaysia and Thailand
1998	Russian default sparked a global financial crisis and a near failure of LTCM
2001	A terrorist attack in WTC caused horrendous human cost and \$1.7 trillion loss in US stock market
2007~	US sub-prime event and resulting credit crunch and global financial crisis

Define what a derivative contract is and how it differs from a security

- Definition of derivatives: Derivatives are generally a private contract deriving its value from some underlying asset price, reference rate or index. Derivatives are instruments designed to manage financial risks efficiently. The need to hedge against “financial risks” had led to the exponential growth of derivatives market.
- **Derivatives vs. Securities**
 - Stocks and bonds are securities – issued to raise capital.
 - Derivatives are contracts or private agreements between two parties - used for risk transfer.

Describe the dual role leverage plays in derivatives and why it is relevant to a risk manager

- Although derivatives are equivalent economically to a position in cash market, the derivatives are leveraged since there is no upfront cash flow.
- Leverage is a double-edged sword:
 - It makes the derivatives an efficient instrument for hedging and speculation owing to very low transaction costs.
 - The absence of an upfront cash payment makes it more difficult to assess potential risk.

3. Risk management tools

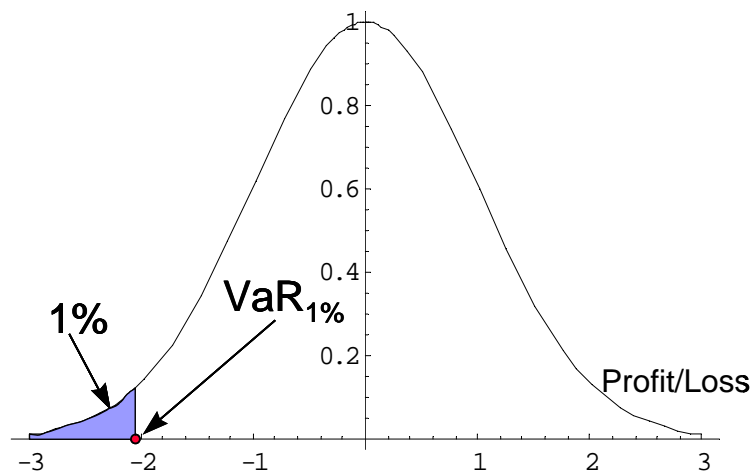
Define financial risk management

- Financial risk management refers to the design and implementation of procedures for identifying, measuring, and managing financial risks.
- Development of analytic risk management tools:

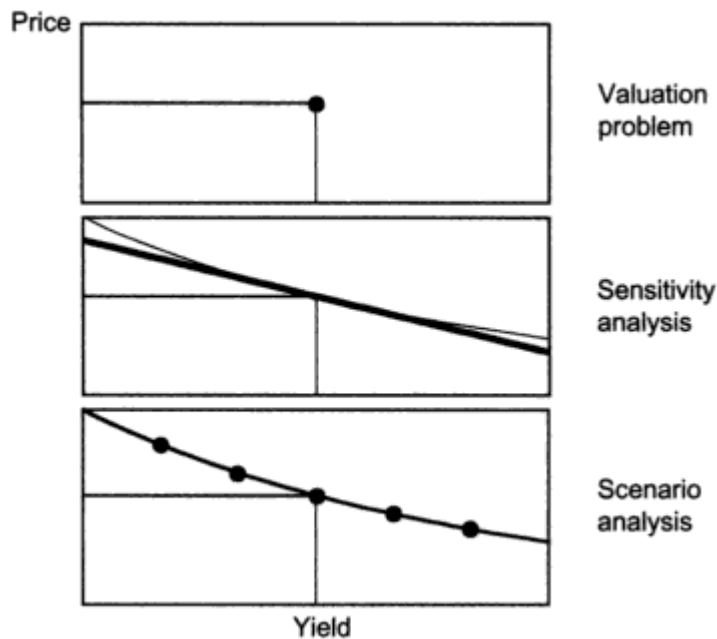
1938	Duration
1952	Markowitz mean-variance
1963	Sharpe's CAPM
1966	Multiple factor models
1973	Black-Merton-Scholes model
1983	RAROC
1986	Limits by duration buckets
1988	Risk-weighted assets (banks)
1992	Stress Testing
1993	Value-at-Risk (VaR)
1994	RiskMetrics
1997	CreditMetrics
1998~	Integration of credit and market risk management
2000~	Enterprisewide risk management (ERM)

Define value-at-risk (VaR) and describe how it is used in risk management

- Definition:
 - VaR is defined as the predicted worst-case loss at a specific confidence level (e.g. 99%) over a certain period of time under normal market conditions.
 - Definition (Jorion): VaR is the worst loss over a target horizon with a given level of confidence.



- **Conventional risk-measurement tools**

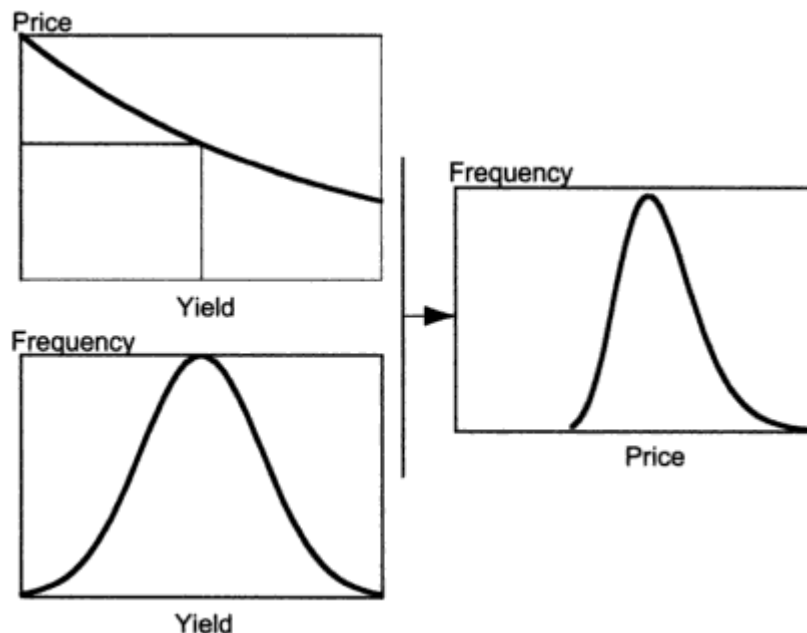


- Limits of conventional risk-measurement tools:

- (i) Sensitivity analysis does not consider the volatility of risk factors.
- (ii) Sensitivity measures are not additive and cannot be used to aggregate risks.

- **Risk-measurement tool with VaR**

- VaR is a statistical risk measure of potential losses. For fixed-income instruments, VaR combines price-yield relationship with the probability of adverse market movement.



- Limits:

- (i) VaR is a necessary, but not sufficient procedure for controlling risk.
- (ii) VaR must be supplemented by limits and controls, in addition to an independent risk-management function.

Describe the advantages and disadvantages of VaR relative to other risk management tools such as stop-loss limits, notional limits, and exposure limits

- Comparison of Risk limit

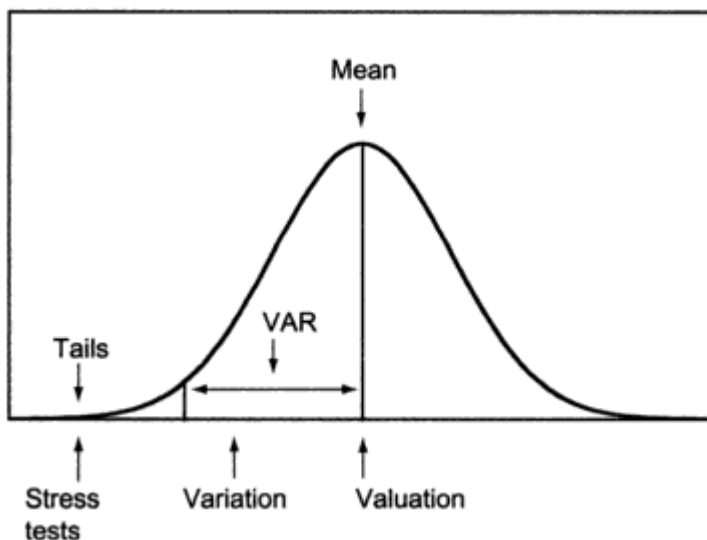
	Control mechanism type	Ease of calculation	Ease of explanation	Aggregation
Notional limit	Ex ante	Yes	Yes	No
Exposure limit	Ex ante	No	No	No
Stop-loss limit	Ex post	Yes	Yes	Yes
VaR limit	Ex ante	No	Yes	Yes

Compare and contrast valuation and risk management, using VaR as an example

- VaR extends current valuation methods for derivatives instruments. While two approaches have much methodology in common, there are some notable differences.

	Derivatives Valuation	Risk management
Principle	Expected discounted value of a distribution	Distribution of future values
Focus	Central (mean) of distribution	Tail (variation) of distribution
Horizon	Current value (after discounted)	Future values
Precision	High precision for pricing/trading purposes	Less precision needed (errors cancel out)
Distribution	Risk-neutral	Actual (physical)

- Different views of the payoff distribution:
 - Valuation: To price option, we need to make an assumption about the distribution of the driving factor. We then price the option by taking the present value of the expected option value at maturity.
 - Risk management: Use simulation to construct the distribution of the option value at the horizon.
 - (i) VaR: Simply the worst loss in the distribution at the given confidence level
 - (ii) Stress test: Analyze the behavior the tails.



Chapter 2 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. -- René Stulz --

Define the role of risk management and explain why a large financial loss is not necessarily a failure of risk management

- Role of risk management:
 - Assess/measure the risks faced by the firm.
 - Communicate these risks to the firm's leadership (those who make risk-taking decisions concerning the firm's risk and to factor the firm's risk in their decisions).
 - Manage and monitor those risks to make sure that the firm only bears the risks its management and board of directors want it to bear.

- An institution makes an extremely large loss "does not" imply that risk management failed or that the institution made a mistake.
 - Even though risk managers knew the true distribution of possible outcomes of the portfolio, the bad outcome could occur and bring a large financial loss. Thus it is not necessarily a failure of risk management, as long as the risks were properly understood.
 - To define the risk appetite of an institution and take a known risk is a decision for the board and top management, not risk managers. If top management has incentives to take too much risk, it could create value for its shareholders or bring a large financial loss.

Describe how risk management can fail

- A typology of risk management failures:

Typology	Types of mistakes
Risk measuring	- Mismeasurement of known risks - Failure to take risks into account. Some risks can be ignored, either because risks are unknown or viewed as not material.
Risk communicating	- Failure in communicating risk to top management
Risks managing and monitoring	- Failure in managing risks - Failure in monitoring risks - Failure to use appropriate risk metrics

Describe how risk can be mismeasured.

Explain how a firm can fail to take known and unknown risks into account in making strategic decisions.

Explain the importance of communication in effective risk management.

Describe how firms can fail to correctly monitor and manage risk on an ongoing basis

Explain the role of risk metrics and discuss the shortcomings of existing risk metrics.

Types of mistakes	Cases
- Mismeasurement of known risks	<ul style="list-style-type: none"> - Make a mistake in assessing the probability of a large loss or the size of large loss if it occurs. - Use the wrong distribution: the distribution is not normal or binomial. - Misestimate correlations of return distributions for different positions. Correlations can change over time. - Excessive reliance on risk models and historical data. Lack of subjective assessments.
- Failure to take risks into account	<ul style="list-style-type: none"> - Ignored known risks. - Mistakes in information collection, and risk is not captured by the risk models accordingly. Incomplete risk aggregation when a firm can not account for all the risks. - A truly unknown risk. It will be a risk management failure, if the firm's managers had known about risk and their actions would have been different accordingly.
- Failure in communicating risk to top management	<ul style="list-style-type: none"> - Risk reports did not communicate an effective message, because they were overly complex, presented outdated data or were not made available to the right audience. - Information arrives to top management too late or too distorted by intermediaries or hierarchical structures.
- Failure in managing risks on an ongoing basis	<ul style="list-style-type: none"> - Failure in identifying appropriate risk mitigating actions, such as hedging/mitigating some known risks, and rejecting some proposed trades.
- Failure in monitoring risks	<ul style="list-style-type: none"> - Risk exposures in the financial industry can change very rapidly even with no trading activities, which may cause risk managers to fail in adequately measuring and hedging risks. - Lack of contingency hedging plans.
- Failure to use appropriate risk metrics (such as VaR)	<ul style="list-style-type: none"> - Too focus on the daily market VaR (because daily VaR does not capture catastrophic losses and illiquid market). Risk measures should contemplate the distribution of large losses at longer horizons rather than over one day. - Existing risk models are generally not designed to capture risks associated with crises event, complicated interactions across risks, and risk concentrations.

Chapter 5 Creating Value With Risk Management



“‘Be careful!’ All you can tell me is ‘be careful?’”

Explain how risk management can create value by handling bankruptcy costs.

- Risk management may be considered value-increasing if we can reduce or eliminate the risks of bankruptcy and financial distress. This is because these risks can not be hedged by the shareholders in contrast to beta risk or product price risk.
- If risk management were costless, the firm would certainly eliminate any likely decrease in firm value due to bankruptcy and financial distress costs. Through the use of risk management, the value of the firm can be increased.

Describe debt overhang, and explain how risk management can increase firm value by reducing the probability of debt overhang.

- **Debt overhang** can decrease the firm value, due to two reasons:
 - Management may reject positive net present value project, as the high amount of existing debt prevents additional debt financing. Although the firm could issue new equity to finance new profitable project, the most increase in value will accrue to the debtholder. As a result, the small increase in value of the equity can be too little to offer the required return of new equity and management will forgo value-increasing opportunities.
 - Management could accept high-risk projects, which will decrease expected firm value but can increase the probability of positive equity value at the cost of debt value.

- Risk management can reduce the probability of getting into a situation of debt overhang by hedging, and then increase firm value.

Explain the relationship between risk management, managerial incentives, and the structure of management compensation.

- Since incentives program (e.g. bonus based on the firm performance) has the problem that some elements of firm performance are not under the control of management (e.g. weakened market, rising price of key inputs), risk management can decrease such non-management related risk factors in incentive compensation contracts. As a result, management incentives are improved, thus increasing the firm value.
- However, the structure of management compensation contracts with more proportion in incentive stock options can have a negative effect on firm value. Since the value of incentive stock options increases with increased volatility of outcomes, managers may choose less hedging.

Explain how risk management can reduce the problem of information asymmetry and increase firm value.

- **Information asymmetry:** Insiders/firm managers possess better information about the firm's performance and prospect than outside investors. Information asymmetry may affect the cost of raising capital:
 - If the firm seeks outside capital to fund growth opportunity, investors must rely on management estimate of the quality/profitability of the opportunity. However, the firm's negative performance due to "**poor management decision**" or "**factors outside management control**" is unclear to outsiders. Therefore, outside investors could punish the firm's cost of capital and then cause the decrease of firm value given the information asymmetry.
- Risk management can make financing based on current assets/projects possible and hedge such risks outside of management control. This can increase the outsider investors' confidence that firm results fully reflect management quality, thereafter reducing funding cost and increase firm value.

Describe those circumstances when risk reduction benefiting a large shareholder may increase or decrease firm value.

- Large shareholder may have "expertise" in the firm's business and the firm's industry, and can provide advice that will help the firm's managers increase the firm's value.
- Large shareholder may have greater "incentive" to monitor management and influence management decision by decreasing agency cost, which will also increase the firm's value.

Explain how risk management can create value moving income across time and reducing taxes.

- When higher firm income is taxed at higher rate than lower firm income, risk management is likely to reduce total taxes by smoothing taxable income.
 - Tax carry-backs: Losses in any period can be used to recover tax paid in prior periods.
 - Tax carry-forwards: Losses in any period can be used to reduce tax liability in future periods.
- Reducing the variability of taxable income (moving taxable income from a high tax year to low tax year) through risk management does reduce the present value of taxes paid, therefore increasing the value of the firms.

Chapter 7 Code of Conduct

On February 26, 2007, GARP's Board of Trustees unanimously adopted a Code of Conduct for all GARP FRM-holders and candidates, other GARP certification and diploma holders and candidates, members of GARP's Board of Trustees, GARP Regional Directors, GARP Committee members and GARP staff.

I. Introductory Statement

The GARP Code of Conduct ("Code") sets forth principles of professional conduct for Global Association of Risk Professional ("GARP") Financial Risk Management program (FRM®) certification and other GARP certification and diploma holders and candidates, GARP's Board of Trustees, its Regional Directors, GARP Committee Members and GARP's staff (hereinafter collectively referred to as "GARP Members") in support of the advancement of the financial risk management profession. These principles promote the highest levels of ethical conduct and disclosure and provide direction and support for both the individual practitioner and the risk management profession.

The pursuit of high ethical standards goes beyond following the letter of applicable rules and regulations and behaving in accordance with the intentions of those laws and regulations, it is about pursuing a universal ethical culture.

All individuals, firms and associations have an ethical character. Some of the biggest risks faced by firms today do not involve legal or compliance violations but rest on decisions involving ethical considerations and the application of appropriate standards of conduct to business decision making.

There is no single prescriptive ethical standard that can be globally applied. We can only expect that GARP Members will continuously consider ethical issues and adjust their conduct accordingly as they engage in their daily activities.

This document makes references to professional standards and generally accepted risk management practices. Risk practitioners should understand these as concepts that reflect an evolving shared body of professional standards and practices. In considering the issues this raises ethical behavior must weigh the circumstances and the culture of the applicable global community in which the practitioner resides.

II. Code of Conduct

The Code is comprised of the following Principles, Professional Standards and Rules of Conduct which GARP Members agree to uphold and implement.

Describe the responsibility of each GARP member with respect to professional integrity, ethical conduct, conflicts of interest, confidentiality of information and adherence to generally accepted practices in risk management.

1. Principles

1.1 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 and truthfulness.

1.2 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.

1.3 Confidentiality.

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

2. Professional standards

2.1 Fundamental Responsibilities

GARP Members must endeavor, and encourage others, to operate at the highest level of professional skill.

GARP Members should always continue to perfect their expertise.

GARP Members have a personal ethical responsibility and cannot out-source or delegate that responsibility to others.

2.2 Best Practices

GARP Members will promote and adhere to applicable 'best practice standards', and will ensure that risk management activities performed under his/her direct supervision or management satisfies these applicable standards.

GARP Members recognize that risk management does not exist in a vacuum.

GARP Members commit to considering the wider impact of their assessments and actions on their colleagues and the wider community and environment in which they work.

2.3 Communication and Disclosure.

GARP Members issuing any communications on behalf of their firm will ensure that the communications are clear, appropriate to the circumstances and their intended audience, and satisfy applicable standards of conduct.

III. Rules of Conduct

1. Professional Integrity and Ethical Conduct

GARP Members:

- 1.1 Shall act professionally, ethically and with integrity in all dealings with employers, existing or potential clients, the public, and other practitioners in the financial services industry.
- 1.2 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, compensation, or consideration that could be reasonably expected to compromise their own or another's independence and objectivity.
- 1.3 Must take reasonable precautions to ensure that the Member's services are not used for improper, fraudulent or illegal purposes.
- 1.4 Shall not knowingly misrepresent details relating to analysis, recommendations, actions, or other professional activities.
- 1.5 Shall not engage in any professional conduct involving dishonesty or deception or engage in any act that reflects negatively on their integrity, character, trustworthiness, or professional ability or on the risk management profession.
- 1.6 Shall not engage in any conduct or commit any act that compromises the integrity of the GARP, the (Financial Risk Manager) FRM® designation or the integrity or validity of the examinations leading to the award of the right to use the FRM designation or any other credentials that may be offered by GARP.
- 1.7 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. If there appears to be a conflict or overlap of standards, the GARP member should always seek to apply the higher standard.

2. Conflict of Interest

GARP Members shall:

- 2.1 Act fairly in all situations and must fully disclose any actual or potential conflict to all affected parties.
- 2.2 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.

3. Confidentiality

GARP Members:

- 3.1 Shall not make use of confidential information for inappropriate purposes and unless having received prior consent shall maintain the confidentiality of their work, their employer or client.
- 3.2 Must not use confidential information to benefit personally.

4. Fundamental Responsibilities

GARP Members shall:

- 4.1 Comply with all applicable laws, rules, and regulations (including this Code) governing the GARP Members' professional activities and shall not knowingly participate or assist in any violation of such laws, rules, or regulations.
- 4.2 Have ethical responsibilities and cannot out-source or delegate those responsibilities to others.
- 4.3 Understand the needs and complexity of their employer or client, and should provide appropriate and suitable risk management services and advice.
- 4.4 Be diligent about not overstating the accuracy or certainty of results or conclusions.
- 4.5 Clearly disclose the relevant limits of their specific knowledge and expertise concerning risk assessment, industry practices and applicable laws and regulations.

5. General Accepted Practices

GARP Members shall:

- 5.1 Execute all services with diligence and perform all work in a manner that is independent from interested parties. GARP Members should collect, analyze and distribute risk information with the highest level of professional objectivity.
- 5.2 Shall be familiar with current generally accepted risk management practices and shall clearly indicate any departure from their use.
- 5.3 Shall ensure that communications include factual data and do not contain false information.
- 5.4 Shall make a distinction between fact and opinion in the presentation of analysis and recommendations.

IV. Applicability and Enforcement

Describe the potential consequences of violating the GARP Code of Conduct.

Every GARP Member should know and abide by this Code. Local laws and regulations may also impose obligations on GARP Members. Where local requirements conflict with the Code, such requirements will have precedence.

Violation(s) of this Code by 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, following a formal determination that such a violation has occurred.