I R M T

# Financial Services Risk Management Professional Examination

## Student Study Pack

## 2018

## IRMT Syllabus Module I-X

www.irmtz.org

irmT
The Institute of Risk Management Tanzania

# INSTITUTE OF RISK MANAGEMENT TANZANIA (IRMT)

I
R
M
T

## This manual covers IRMT Modules:

| | |
|---|---|
| Module I | Module VI |
| Module II | Module VII |
| Module III | Module VIII |
| Module IV | Module IX |
| Module V | Module X |

**CERTIFIED FINANCIAL SERVICES RISK SPECIALIST (CFRS) COURSE**



irmT
The Institute of Risk Management Tanzania

# Candidates Details

**Surname:……..**

**Other Names: ……..**

**Candidate Registration No: ……**

**Examination Session: …….**

**Date: ……..**



I R M T

irmT The Institute of Risk Management Tanzania

# Introduction to IRMT

IRMT is a professional organization established in 2015 under the Chapter 212 of Laws of Tanzania with mandate to promote the common interest and advance theory and practice of risk management of persons carrying on risk management profession in the United Republic of Tanzania.

Ancillary to this, to conduct review classes, forums, seminars, workshops and examinations in the profession of risk management.

In executing such responsibilities, IRMT conducts risk management examinations twice in a year during the month of December and June.

# Introduction to IRMT

This training manual has been prepared to provide guidance to trainers and candidates preparing for the IRMT examinations in the Professional Examination Scheme leading to the

* Certified Risk Management Technician (CRMT)
* Certified Risk Management Professional (CRMP) or
* Certified Financial Services Risk Specialist (CFRS).

This handbook should be read in conjunction with the IRMT Examination and Training guidelines as amended from time to time for the CFRS.

# CFRS Examination Scheme

- The financial services risk specialist examination scheme intends to build and nurture necessary competence for Risk Management strategist in the banking, insurance and financial sector.
- It provides knowledge and skills in the use and application of financial risk management tools and nurture the details of financial Risk management and internal control framework.

# CFRS Examination Scheme

- It covers the knowledge and skills on utilization of Risk Management techniques for effective decision making and provides competence and proficiency necessary for identifying and solving complex financial Risk situations.

# CFRS Examination Scheme

- The examination scheme intends to cover the meaning, scope and purpose of Risk Management, Risk Management framework, risk governance, risk aware culture, risk assessment, risk response and insurance, operational risk management, risk assurance and future of risk management as generic component and narrows down to risk analytics with financial risk management as a key component

# Entry Requirement for CFRS Examination

- A person should at least meet one of the following entry requirement:
  - Certified Risk Management Technician
  - Any recognized professional qualification such as CPA, ACCA, CISA, CFE or other equivalent PROFESSIONAL QUALIFICATIONS OR
  - Any university degree but must attend and pass foundation in risk management prerequisite course conducted by IRMT authorized training center
- Any degree in risk management

# CFRS Examination Scheme

- The Certified Financial Service Risk Specialist Examination Scheme shall consist of 150 weighted multiple choice questions and two written case studies question with a total score of 500 points where the pass mark is 375 points. The Examination will usually take three hours

# Content of the Curricula

IRMT

## Module I: Foundation in Risk Management

- Meaning, scope and purpose of risk management
- Risk Management framework
- Risk Governance
- Risk Aware Culture

# Content of the Curricula

## Module II: Introduction to Financial Risk Management

- Introduction to Risk and Return
- The efficiency frontier and Capital Asset Pricing Model
- Arbitrage Pricing Theory
- Risk Management for financial institutions
- Credit Rating

# Content of the CFRS Curricula

## Module II: Risk Management in Banks

- Commercial Banking and capital Requirements
- Deposit insurance
- Investment banking and security trading
- The risks facing banks

# Content of the CFRS Curricula

**Module III: Risk Management in Insurance Companies and Pension Plans**

- Life Insurance
- Annuity Contracts
- Mortality Tables
- Longevity and Mortality Risk
- Property Casuality Insurance
- Health Insurance
- Moral Hazard and Adverse selection
- The Risk facing Insurance Companies and Pension Plans

# Content of the CFRS Curricula

IRMT

## Module IV: Trading in Financial Markets

- The markets
- Long and short positions in Assets
- Derivative Markets
- Plain Vanilla Derivatives
- Exotic Options and Structured Products
- Risk Management challenges in Financial Markets
- Mutual Funds and Hedge Funds

irmT
The Institute of Risk Management Tanzania

# Content of the CFRS Curricula

**Module V: Interest Rate Risks, Value at Risk and Volatility**

- Management of net interest income
- LIBOR and Swap Rates
- Duration and Convexity
- Interest Rate Deltas in Practice
- Definition of VaR and Calculation
- VaR and Capital
- Coherent Risk Measures
- Marginal VaR, Incremental VaR and Component VaR
- Implied volatilities
- Power Law
- Exponentially Weighted Moving Average and Volatility Modeling

# Content of the CFRS Curricula

**Module VI: Basel I, Basel II, Basel 2.5, Basel III, Solvent II and Dodd-Frank**

- Bank Regulations
- Basel II, 2.5 and III
- Credit Risk and Operational Risk
- Solvency II
- Dodd-Frank Act
- Banking Legislation in other countries

# Content of the CFRS Curricula

## Module VII: Market Risk

* Historical simulation approach
* Extreme Value theory
* Correlation and Covariance Matrices
* Linear Model and option
* Monte Carlo simulation
* Model Building vs. Historical Simulation

# Content of the CFRS Curricula

## Module VIII: Credit Risk and Estimating Default Probabilities

- Credit Ratings and Historical default probabilities
- Recovery Rates and credit default swaps
- Credit spreads
- Comparison of Default probabilities estimates
- Using equity prices to estimate default probabilities
- Credit Risk in Derivatives
- Credit Value at risk
- Lesson learned from credit crisis 2007-2012

# Content of the CFRS Curricula

IRMT

**Module IX: Operational Risk in Financial Services**

- Operational Risk and determination of regulatory capital
- Loss Severity and loss frequency
- Proactive approaches
- Insurance
- Sarbanes Oxley

irmT
The Institute of Risk Management Tanzania

# Content of the CFRS Curricula

**Module X: Liquidity Risk and model risk**

- Liquidity Trading Risk, funding risk and liquidity black holes
- Model Risk and marking to market
- Hedging and dangers of building the model
- Detecting model problems
- Managing trading room and risk limits

# Disclaimer

IRMT has designed and created CFRS Review Manual 2016 Student Pack primarily as an educational resource to assist individuals preparing to take the CFRS certification exam. It was produced independently from the CFRS exam and the CFRS Certification Committee, which has no responsibility for its content.

IRMT makes no representations or warranties whatsoever with regard to these or other IRMT Publications assuring candidates' passage of the CFRS exam.

# Reservation of Rights

* © 2016 IRMT. All right reserved. No part of this publication may be used, copied, reproduced, modified, distributed, displayed, stored in a retrieval system or transmitted in any form by any means (electronic, mechanical, photocopying, recording or otherwise) without the prior written authorization of IRMT



IRMT

irmT The Institute of Risk Management Tanzania

# Acknowledgments

Development of this manual has been a collaborative effort. This is the result of contributions from volunteers across the globe who are actively involved in risk management.

IRMT wish to record gratitude to all individuals and organs that were involved in the process of preparation and finalization of this manual, for their dedication and commitment into the whole process.

# Acknowledgments-Contd..

IRMT furthermore, recognize the invaluable assistance, encouragement from Ministry of Finance through the Internal Auditor General's office in person **Mr. Mohammed A. Mtonga** Internal Auditor General of Tanzania.

**Mr. Emmanuel Subby** Assistant Internal Auditor General Risk and Quality Assurance Unit, for their encouragement and support of the whole process of molding the manual.

# Acknowledgments-Contd..

Besides, IRMT would like to extends an handful thanks in person to **Dr. Kadida R. Mashaushi** Senior Lecturer at IFM for his contribution to the entire endeavor to the success of the manual and the Institute.

Also would like to extend the heartfelt appreciation to the following individuals and their families for their commitment and selflessness that has become the hallmark of contributors to IRMT CFRS Review Manual Student Pack.

Their participation and insights are truly appreciated and recommended for success of Risk Management Professional and IRMT in general.

# Acknowledgments-Contd..

**CRMP Subject Matter Expert Reviewers:**

***Sako Mayrick:*** *PGDLT, LLB, MBA, PGRM, CPA, CRMP, CFRS*

***Mleleu Omary:*** *CISM,CISA, CRISC, CGIT,ITIL, MBA (IT)*

***Elias Malubi:*** *MBA, PDG(MIS),ADA, CPA*

***Buyamba Buyamba:*** *MBA,BBA, CPA,CRISC,CRMP,CFRS*

# Module I

I
R
M
T

# Meaning Scope and Purpose of Risk Management



irmT
The Institute of Risk Management Tanzania

# Module Structure

- Definition of Risk
- Impact of Risks on Organization
- Practical Aspects of Risk Management
- Origins of Risk Management
- Principles, Standards and Objectives of Risk Management
- Risk Management Regulatory Framework
- Enterprise Risk Management
- Case Studies

# Definition of Risk

- All organizations face internal and external factors and influence that make it uncertain whether and when they will achieve their objectives
- Risk is the effect of the uncertainty on an organization objectives (International Organization Standardization- ISO- 31000)
  - Effect is a deviation from the expected (positive or negative)
  - Objective can be in aspects of financial , health, safety and environmental goals)
  - Objectives can apply at different levels (strategic, organization wide, project; product and process)

# Definition of Risk Cont…

* Risk is characterized by reference to potential events and consequences or combination of these including change in circumstances.

* Uncertainty is the state, even partial, of deficiency on information related to understanding or knowledge of event; its consequence; or likelihood.

# What is Risk?

- Real or perceived threat, danger or benefit.
- Risk is the threat or possibility that an action or event will adversely or beneficially affect organization's ability to achieve its. objectives.
- ‘A calculation of both probability and improbability becoming a reality’.
- Risk has no religion.
- This definition is based on three scenarios …



IRMT

irmT The Institute of Risk Management Tanzania

# What is risk?

- Something happening that may have an impact on the achievement of objectives
- It includes risk as an opportunity as well as a threat.
- By managing threats entity will be in a stronger position to deliver its business plan priorities.
- By managing opportunities the organisation will be in a better position to provide improved services and better value for money.

# Risk Scenarios

- Whatever can go wrong, will go wrong
- Whatever cannot go wrong, will go wrong
- When things go wrong, they go badly wrong



IRMT

irmT
The Institute of Risk Management Tanzania

# Probability VS 'Risk Magnitude'

**Improbable Risk**

**Probable Risks**

-10; -9; -8; -7; -6; -5; -4; -3; -2; -1; 0 1; 2; 3; 4; 5; 6; 7; 8; 9; 10

**Unlikely Risk**

**High Magnitude Risk**

**Likely Risk**

**Low Magnitude Risk**



IRMT

irmT The Institute of Risk Management Tanzania

# Review Skill Set 1

- What is risk?
- What is ISO 31000?
- Can you identify ten risk scenarios?
- Do you agree that one risks normally results into other potential risks?
- Is this a probable or improbable risks?
- What are major risks in any organization which are improbable?

# Upside and Down Side of Risks Definition

**Threats:**

- ✓ Death
- ✓ Head Injury
- ✓ Injury
- ✓ Reputation
- ✓ Financial
- ✓ Damage to the bike
- ✓ Sunburn/frost bite

**Opportunities:**

- ✓ Exercise
- ✓ Sunlight
- ✓ Reputation
- ✓ Financial
- ✓ Role model
- ✓ Environment

# Examples of Risks

- Typical examples of risk relates to:
  - Resources, Political, economic, Social, Technological, legislative/Regulatory, Environmental, competition, Customer/citizen, Managerial Professional, Financial, Legal, Partnership/Contractual, procurement, Physical, technological…

# Mention the Risk you Know in …

- Public Sector Service Delivery
- Banking Industry
- Starting a job or carrier
- Transport and travel
- Financial management
- Attending this workshop
- Risk related to your organization

# Examples of Risk: Possible Risk Areas

| Risk Category | Possible Risks Areas | | |
|---|---|---|---|
| Strategy | • Planning<br>• Business Portfolio<br>• Management Activity<br>• New Business/Growth Opportunities | • Strategy Development<br>• Business Performance Management<br>• Target Setting/Vision/Goals<br>• Investor Relations | • Joint Venture Mgt<br>• Rationalisation<br>• Communicaiton of strategic direction set by Board |
| Human Resources | • Workplace Industrial Relations<br>• Employment Practices<br>• Remuneration and Entitlements<br>• Succession Planning | • Recruitment and Retention<br>• Workers Compensation<br>• Skills availability/Training and Development<br>• Leadership<br>• Diversity | • Employee Safety and Health<br>• Performance Incentivisation<br>• Communication<br>• Contractors / 3rd parties |
| Information Technology | • Data Management<br>• Data Security<br>• Systems Development / New systems | • Systems Maintenance<br>• Availability<br>• Data Integrity<br>• Service delivery | • 'e' Commerce<br>• Outsourcing manageme<br>• Interface with 3rd partie<br>• Sharing of classified inofrmation |
| Marketing | • Competitive Positioning<br>• Market Research<br>• Image<br>• Trademarks<br>• Strategic alliance networks<br>• Pricing / Costing | • Patents<br>• Reputation<br>• Customer Service<br>• New Products<br>• Project management | • Research and Development<br>• Product portfolio<br>• Product Liability<br>• Obsolescence<br>• "e" Commerce |

# Examples of Risks: Key Risk Areas

| Risk Category | Possible Risks Areas | | |
|---|---|---|---|
| Supply Chain / Distribution<br><br>Environment | • Logistics<br>• Purchasing/procurement<br>• Regulatory Compliance<br>• Contamination | • Inventory Management<br>• Contract Management<br>• Loss of Containment<br>• Complaints Management<br>• Handling Image/ reputation | • Import Clearance<br>• Continuity management<br>• Community / Governme Relations |
| Legal | • Regulatory Compliance<br>• Commercial Relationships | • Acquisitions/Divestments<br>• Intellectual Property | • Competition Law<br>• Contractual Obligations |
| Finance | • Funding / Treasury<br>• Investments<br>• Taxation | • Debt Management<br>• Supplier Payments<br>• Capital Expenditure | • Financial Controls and Reporting<br>• Fraud<br>• Insurance |
| Physical Assets | • Security<br>• Natural Disaster | • Fire<br>• Explosion | • Impact<br>• Capital Expenditure |
| Operations<br><br><br><br>Government | • Manufacturing upscaling<br>• Technical Engineering<br><br>• Sovereignty<br>• Politics<br>• War | • Capacity Planning<br>• Costs of upscaling to Production<br><br>• Legislative Change<br>• Corruption<br>• Terrorism | • Reliability Managemen & partners<br>• Safe Operations<br>• Tax law change<br>• Change to party in pow |
| Economics | • Interest Rates | • Commodity | • Currency |

# Software Development Risks

| Risk | Affects | Description |
|---|---|---|
| Staff turnover | Project | Experienced staff will leave the project before it is finished. |
| Management change | Project | There will be a change of organisational management with different priorities. |
| Hardware unavailability | Project | Hardware that is essential for the project will not be delivered on schedule. |
| Requirements change | Project and product | There will be a larger number of changes to the requirements than anticipated. |
| Specification delays | Project and product | Specifications of essential interfaces are not available on schedule |
| Size underestimate | Project and product | The size of the system has been underestimated. |
| CASE tool under-performance | Product | CASE tools which support the project do not perform as anticipated |
| Technology change | Business | The underlying technology on which the system is built is superseded by new technology. |
| Product competition | Business | A competitive product is marketed before the system is completed. |



IRMT
irmT The Institute of Risk Management Tanzania

# Wording of Risks

- Risks should be described in terms of "if… then…" This ensures that you are considering the implications of the risk event occurring. For example 'if we do not review and manage our budget, then there is a risk that we will overspend.'

- In wording risks, care needs to be taken to avoid stating the impacts that may arise as being the risk rather then the risk itself, or to simply define the risk as the opposite of the objective

# Example

## Objective: Improve forecast accuracy

| Failure to improve forecast accuracy | This is not correct risk description because it is simply the opposite of the objective |
|---|---|
| Being late and fail to provide accurate forecast | This is a statement of impact of the risk, not risk itself |
| There is no fuel in vehicle so the driver get thirst | This does not impact on achievement of the objective |
| Inadequate forecast equipment causes inaccurate forecast | This is a risk because it can be controlled by making sure TMA finds fund to buy forecast equipment. This risk could be broken down further to identify all possible causes that may have the effect of failure to improve forecast accuracy |
| Poor government cash flow causes TMA fail to forecast effectively | This is the risk we cannot control, but against which we can plan and make contingency plan. Further assessment would cause one to look at the likelihood of the risk occurring |

# Risk Description example

| Objective – to travel by train from A to B for a meeting at a certain time | |
|---|---|
| Failure to get from A to B on time for the meeting | X this is simply the converse of the objective |
| Being late and missing the meeting | X This is a statement of the impact of the risk, not the risk itself |
| There is no buffet on the train so I get hungry | X this does not impact on achievement of the objective |
| Missing the train causes me to be late and miss the meeting | ✓ This is a risk which can be controlled by making sure I allow plenty of time to get to the station |
| Severe weather prevents the train from running and me from getting to the meeting | ✓ This is a risk which I cannot control, but against which I can make a contingency plan |

# Qualities of good risk description

- It contains three main components
  - Cause – the negative or positive conditions that currently exist relative to the risk
    - Identification of root cause(s) of the risk
    - This provides justification that a risk exists
  - Probability of Occurrence – The likelihood of the occurrence of the risk
    - Within a future time frame or future event
  - Consequences – The effect, negative impact (s) to the program (s) in case the risk occurs
    - The consequence should be related to at least cost, schedule, scope and performance
    - Consequence should also result in opportunities that may surface in correcting problem

# Qualities of good risk description

- Proper risk descriptions helps to manage right risks
  - Risks management is time and resource consuming
  - Managing non-risk is not cost effective
- Example
  - The risk many be identified as stock expiry
  - Writing this risk as "if we don't use technology forecast will not be accurate"
    - May fail to inspire interest and action
      - Risk is too vague or there Is no clear reason why this is a risk
  - In this case one needs to identify causal conditions that may cause risk. *If there is non this is not a risk*



IRMT

irmT The Institute of Risk Management Tanzania

# Qualities of good risk description

- Risks must be written in a clear, concise and unambiguous fashion
- Word and phrases that may have confusing and multiple interpretations must be avoided
  - Adequate, limited, near real time, all, periodic, rapid, fast, flexible, future, immediately, large, light, portable, several, sometimes, when required, future, clearly, appropriate,
- Key root cause should be determined early enough
  - Root Cause Analysis is an analytical technique used to determine the basic underlying reason that causes a variance or a defect or a risk.

# Best Practices

- Avoid writing mitigation in a risk description
- When risk has occurred they become issues and are managed as issues
- When risk has been mitigated or is no longer a threat it is closed



IRMT

irmT
The Institute of Risk Management Tanzania

# Group Work

- Recall the case of crossing the river where the car was drowned
  - Discuss any four major risks before crossing the river
  - Write the proper description of each of the four risks
  - Discuss any three mitigation you could recommend



IRMT

irmT The Institute of Risk Management Tanzania

# Risk Basics

- Risk (uncertainty) may affect the achievement of objectives.
- Effective mitigation strategies/controls can reduce negative risks or increase opportunities.
- Residual risk is the level of risk after evaluating the effectiveness of controls.
- Acceptance and action should be based on residual risk levels.

# A Simple Framework

IRMT

irmT The Institute of Risk Management Tanzania

I
R
M
T

# End of Session I



irmT
The Institute of Risk Management Tanzania

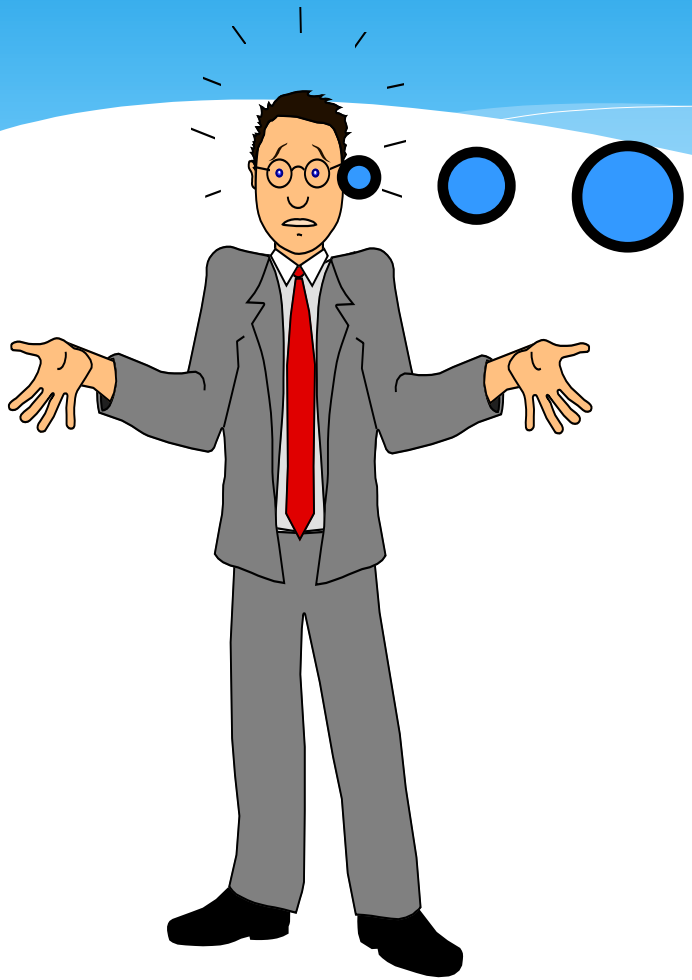
I
R
M
T

# Risk Management

*The only alternative to risk management is crisis management --- and crisis management is much more expensive, time consuming and embarrassing*

JAMES LAM, Enterprise Risk Management, Wiley Finance © 2003

I
R
M
T



# What is Risk Management?

irmT
The Institute of Risk Management Tanzania

# Origins of Risk Management

I
R
M
T

# History of Risk Management

- Study of risk management started after World War II (1945).
- It started with an ides of market insurance to protect individuals and companies from various losses associated with accidents.
- Other alternative to market insurance, surfaced in 1950s when market insurance was perceived as very costly and incomplete for protection against pure risk.
- In 1970s the use of derivatives as risk management instruments arose and expanded to 1980s as corporates intensifies financial risk management.

# History of Risk Management Cont…

International risk regulations began in 1990s, and financial firms developed internal risk management models and capital calculation formulas to hedge against unanticipated risks and reduce regulatory capital:

- Governance of risk management become essential,
- Integrated risk management was introduced
- First Corporate Risk Officer position was created
- Consideration of financial management or risk portfolio emerged
- Financial risk management become complementary to pure risk management for many companies
- Financial institutions including banks and insurance companies, intensified their market and credit risk management activities during 1980s.

# History of Risk Management Cont…

- Operational risk and liquidity risk management emerged in 1990s
- Financial institutions developed internal risk management models and capital calculations formulas to protect themselves from unanticipated risk and reduce regulatory capital.
- Integrated risk management was introduced

**Food for thought**

All these regulations ( on preceding slide), governance rules and risk management methods failed to prevent the financial crisis that began in 2007. Why?

# Origins Risk Management

- The origins of modern risk management is dated back to 1955 to 1964
- There were no books on risk management at the time
- No university offered courses in the subject
- First academic books published by Mehr and Hedges (1963)Their content covered pure risk management , that it excluded enterprise risk management:
  - Engineers developed technological risk management models
  - Operational risk partly covers technological losses, today operational risk has to be managed by financial institutions.
  - Engineers also consider the political risk of projects

# Origins Risk Management

- After World War II, larger companies with diversified portfolios of physical assets began to develop self-insurance against risks
- Self insurance covers the financial consequences of an adverse event or losses from an accident
  - It involves creating a fairly liquid reserve of funds to cover losses resulting from an accident or a negative market fluctuation

# Origins Risk Management

- Concept of risk management was revolutionized in 1970s, when financial enterprises exposed to various price fluctuations such as risk related to interest rates, stock markets returns, exchange rates, and prices of raw materials or commodities
- The risk of natural catastrophe also magnified significantly
- To increase flexibility or to reduce the cost of traditional hedging activities, derivatives were then increasingly used

# Origins of Risk Management

- Derivatives are contracts that protect the holder from certain risks
  - Their value depends on the value and volatility of the underlie, or of the asset or value indices on which the contract are based.
  - The best known derivatives are forwards, options, futures and swaps
- Derivatives were first viewed as form of insurance to protect individuals and companies from major fluctuations in risks. However, speculation quickly arose in various markets, creating other risks that are increasingly difficult to control or manage
  - Proliferation of derivatives made it difficult to assess companies' global risks
- The definition of risk management became more general.

# Key Dates in Development of Risk Management

- 1900 – Birth of financial theory –Brownian motion to analyze fluctuations in a financial assets
- 1930 – first research in prices of financial assets
- 1939 – first meeting of American Finance Association
- 1942 – Journal, American Finance appeared
  - 1946 become The Journal of Finance
  - 1964 become The Journal of Finance and Insurance followed by journal of Risk Management published by Risk and Insurance Management Society (RIMS) founded in 1950

# Key Dates in Development of Risk Management

- 1950s and 1960s researchers undertook fundamental studies of financial decisions
  - Resulted into modern theory of portfolio choice on the CAPM (Capital Asset Pricing Model)
  - In early 1970s that the main financial risk management products appeared, and that the initial theoretical models of models of modern risk coverage were published.
- Black and Scholes's model proposed explicit formula for pricing a derivative, namely OPTION.
- In 1980s, high market volatility spurred the large US investment banks to put in place risk management departments. JP Morgan developed RiskMetrics for market risks and CreditMetric for credit risks in 1994 and 1997

# Key Dates in Development of Risk Management Cont…

- The publication of RiskMetric model prompted broad dissemination of Value-at-Risk (VaR) risk measures among professionals and academic alike.
- These two new risk measurement tools are important instruments for calculating bank's regulatory capital under Basel II and Basel III.
- Risk management became a corporate affair in late 1990s
  - The major decisions in firms; management policy (and monitoring) are now made by board of directors. Most often, the audit committee monitors these decisions, although some large financial institutions have put risk management committee in place
  - Position of Corporate Risk Officer, or CRO, emerged

# Key dates in development of risk management

- Adequate capital reserves problems in 2000s due to defaults in late 1990s and the Enron bankruptcy in 2001
  - Basel II introduced rigorous rules for banks
  - In addition to modifying the credit risk management rules, the accord introduced new rules for operational risk

# History of Risk Management

- In 2002 there were major corporate scandals and bankruptcies resulting from poor risk management
- Sarbanes-Oxley regulations was introduced in US in 2002
  - It stipulated governance rules for companies
  - Stock exchange, including the NYSE in 2002, also added risk management governance rules for listed companies.
  - The regulations did not prevent financial crisis in 2007
    - not because of that the rules were inefficient but they lacked application and enforcement

| | |
|---|---|
| 1730 | First futures contracts on the price of rice in Japan |
| 1864 | First futures contracts on agricultural products at the Chicago Board of Trade |
| 1900 | Louis Bachelier's thesis "Théorie de la Spéculation"; Brownian motion |
| 1932 | First issue of the *Journal of Risk and Insurance* |
| 1946 | First issue of the *Journal of Finance* |
| 1952 | Publication of Markowitz's article "Portfolio Selection" |
| 1961-1966 | Treynor, Sharpe, Lintner and Mossin develop the CAPM |
| 1963 | Arrow introduces optimal insurance, moral hazard, and adverse selection |
| 1972 | Futures contracts on currencies at the Chicago Mercantile Exchange |
| 1973 | Option valuation formulas by Black and Scholes and Merton |
| 1974 | Merton's default risk model |
| 1977 | Interest rate models by Vasicek and Cox, Ingersoll and Ross (1985) |
| 1980-1990 | Exotic options, swaptions and stock derivatives |
| 1979-1982 | First OTC contracts in the form of swaps: currency and interest rate swaps. |
| 1985 | Creation of the Swap Dealers Association, which established the OTC exchange standards |
| 1987 | First risk management department in a bank (Merrill Lynch) |
| 1988 | Basel I |
| Late 1980s | Value at risk (VaR) and calculation of optimal capital |
| 1992 | Article by Heath, Jarrow and Morton on the forward rate curve |
| 1992 | Integrated Risk Management |
| 1992 | RiskMetrics |
| 1994-1995 | First bankruptcies associated with misuse (or speculation) of derivatives: Procter and Gamble (manufacturer, rates derivatives, 1994), Orange County (management funds, derivatives on financial securities, 1994) and Barings (futures, 1995) |
| 1997 | CreditMetrics |
| 1997-1998 | Asian and Russian crisis and LTCM collapse |
| 2001 | Enron bankruptcy |
| 2002 | New governance rules by Sarbanes-Oxley and NYSE |
| 2004 | Basel II |
| 2007 | Beginning of the financial crisis |
| 2009 | Solvency II (not yet implemented in March 2013) |
| 2010 | Basel III |

# History of Risk Management

Five categories of risks

* Pure risks (Insurable or not, and not necessarily exogenous in the presence of moral hazard)
  * It is also called absolute risk i.e. the risk that is beyond human control and has only one possible outcome: loss. Pure risk include such things as natural disaster, fire and untimely death
* Market risks (variation of price of commodities, exchange rates, asset returns)
* Default risks (probability of default, recovery rate, exposure at defaults)
* Operational risks (employee errors, fraud, IT system breakdown)
* Liquidity risk – risk of not processing sufficient funds to meet short-term financial obligations without effecting prices. May degenerate into default risk

# History of Risk Management

Four main risks for banks are:

- Credit Risks (80% of the risk of banks, including default risk)
- Market Risks (5%)
- Operational Risks (15%)
- Liquidity Risks ( not yet well quantified and generally included in yield spread between private and public bonds)

Basel agreement of 2004 addresses these risks

# Basis of Risk Management

* Risk management is a part of the wider corporate governance and internal control system of an organization
* Corporate governance is the system by which organizations are directed and controlled and ensures that the objectives and plans are established and operations adheres to transparency, probity and accountability

# Risk Management

* Organizations manage risk by identifying it, analysing it and then evaluating whether the risk should be modified by risk treatment in order to satisfy their risk criteria. Throughout this process, they communicate and consult with stakeholders and monitor and review the risk and the controls that are modifying the risk in order to ensure that no further risk treatment is required (ISO 31000).

# Risk Management

- It is not avoiding risk
- It is application of management policies and procedures and practices to the task of **identifying, analyzing, assessing, treating and monitoring** the various risks that might prevent an organization from achieving its objectives
- There is no risk free environment!

# Back at the Office

- ***Why is the organization interested in RM?*** What are they hoping will be achieved with its implementation?
- ***Who is doing what?*** Roles & responsibilities must be clearly defined. Make sure Leadership supports RM and uses RM results to make decisions. Everyone is a risk manager. Make sure that all risks have owners and the responsibilities for mitigation are assigned
- ***How will it be implemented?*** What is your framework? What is the common language? How will risks be measured and reported?

# Back at the Office Cont…

- ***Where will you start?*** Choices could be where you can most easily succeed or where it is needed the most or where interest is high.
- ***When will it be implemented?*** It is a journey not a destination; 3-5 years for complete roll-out; how often will risks be assessed; when will mitigation plans be implemented and monitored; when will risks be reported.

# Ask Questions and Develop Your Approach

- Do we understand our major risks? Do we know what is causing our risks to increase, decrease or stay the same?
- Have we assessed the likelihood and impact of our risks?
- Have we identified the sources and causes of our risks?
- How well are we managing our risks?
- Are we trying to prevent the downside risks from happening? Or are we trying to simply recover from them?
- Who is accountable for these risks?

# Ask Questions and Develop Your Approach

- How do we talk about risk? Do we have a common language across branches, across divisions, across the ministry, across the OPS, across the health care system?
- Are we taking too much risk? Or not enough risk?
- Are the right people taking the right risks at the right time?
- What's our culture? Are we risk adverse or are we risk-takers? Or are we somewhere in between?

# The Case

- Consider the 13 categories of risk
- Identify top 5 threats (downside) and top 5opportunities (upside)
- Propose mitigation strategies
- Discuss how the following risk factors would affect your assessment:
  - Economy
  - Demographics
  - Weather
  - Technology
  - Timing of events such an election
  - Others

# Defining Risk Management

- Enterprise Risk Management
  - 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 risks to be within its risk appetite,
  - to provide reasonable assurance regarding the achievement of entity objectives (COSO)
- Risk Management is a set of coordinated activities to direct and control an organization with regard to risk (ISO 31000)
- In general terms, "risk management" refers to the architecture (principles, framework and process) for managing risks effectively, while "managing risk" refers to applying that architecture to particular risks

# Video Case Study

* https://youtu.be/BLAEuVSAlVM



IRMT

irmT
The Institute of Risk Management Tanzania

- RM is a structured, consistent and continuous process across the whole organization for identifying, assessing, deciding on responses to and reporting on opportunities and threats that affect the achievements of its objectives. *IIA*
- Risk Management is the identification, assessment, and priotization of Risk (ISO 31000) and subsequent application of resources to minimize, monitor, and control the probability and/or impact of downside events or to maximize the realization of opportunities.
- It deals with the management of uncertainty, risks and opportunity towards the achievement of company goals and objectives.

# Risk Management and Corporate Governance

- **Pillars of Corporate Governance**
  - **Accountability**
    - Ensure that management is accountable to the Board
    - Ensure that the Board is accountable to the shareholders
  - **Fairness**
    - Protects shareholders rights
    - Treats all Shareholders including minorities, equitably
    - Provide effective redress for violation

# Risk Management and Corporate Governance Cont…

* **Transparency**
  * Ensure timely, accurate disclosure on all material matters including financial situation, performance, ownership and corporate governance
* **Independence**
  * Procedures and structures are in place so as to minimize, or avoid completely conflicts of interest
    Independent directors, advisers i.e. free from influence of others

Risk Management is a component of Corporate Governance to ensure achievement of its key pillars

# Objectives of Risk Management

* increase the likelihood of achieving objectives;
* encourage proactive management;
* be aware of the need to identify and treat risk throughout the organization;
* improve the identification of opportunities and threats;
* comply with relevant legal and regulatory requirements and international norms;
* improve mandatory and voluntary reporting;
* improve governance;
* improve stakeholder confidence and trust;
* establish a reliable basis for decision making and planning;

# Objectives of Risk Management

* improve controls;
* effectively allocate and use resources for risk treatment;
* improve operational effectiveness and efficiency;
* enhance health and safety performance, as well as environmental protection;
* improve loss prevention and incident management;
* minimize losses;
* improve organizational learning; and
* improve organizational resilience.

# Objectives of Risk Management

* Support strategic  and business planning
* Enhances communication between directors and departments
* Support effective use of resources
* Promote continual improvement
* Helps focus internal audit programs
* Fewer shocks and unwelcome surprises
* Reassures stakeholders
* Quick grasps of new opportunities

# Benefits of Risk Management

- Aligns risk profile and strategy
- Broadens risk awareness
- Minimizes surprise and losses
- Rationalizes capital requirements
- Improves the shareholders value
- Assures regulatory compliance

# Entity Objectives and Risk Management

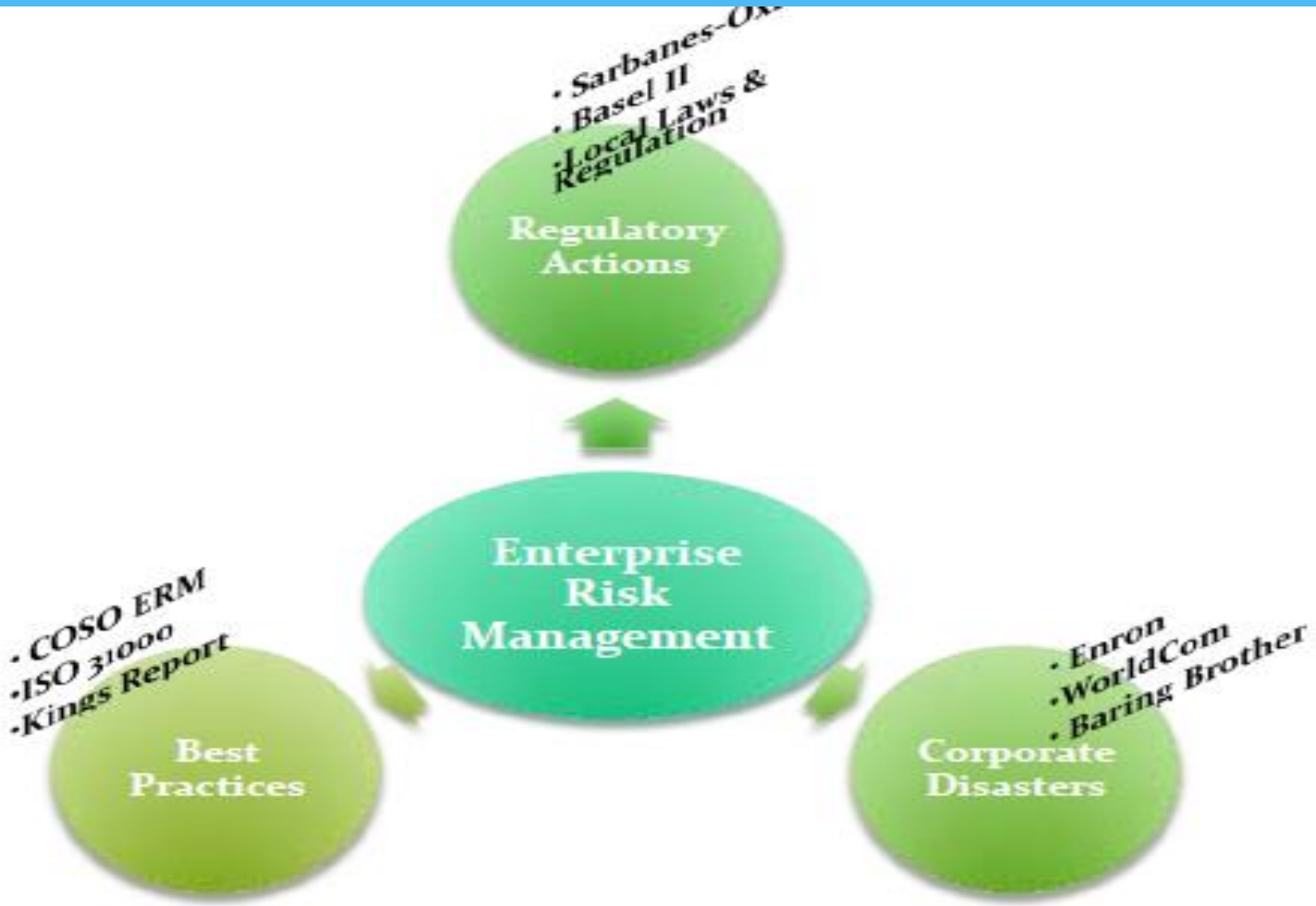
Risk can be describe as The chance of something happening that will have an impact on objectives. It is measured in terms of consequences and likelihood:

- Objective must be defined before defining risks which may affect the objectives.
- Risk management must be linked to objectives/ strategies/ project

# Hard and Soft side of Risk Management

| Hard Side | Soft Side |
|---|---|
| Measures and Reporting | Risk Awareness |
| Risk Oversight Committees | People |
| Policies and Procedures | Skills |
| Risk Assessment | Integrity |
| Risk Limits | Incentives |
| Audit Process | Culture and Values |
| Systems | Trust and Communication |

# Drivers for Risk Management



# Principles and Standards of Risk Management

I
R
M
T

## Principles of Risk Management

## &

## Risk Management Standards



irmT
The Institute of Risk Management Tanzania

# Principles of Risk Management

- Creates value (Gain should exceed pain)
- Be an integral part of organizational processes
- Be part of decision making process
- Explicitly address uncertainty and assumptions
- Be systematic and structured
- Be based on best available information
- Be customizable to entity needs
- Take human factors into account
- Be transparent and inclusive
- Be dynamic, iterative and responsible to change
- Be capable of continual improvement and enhancement
- Be continually and periodically re-assessed
- Be tailora-ble

# Common Risk Management Standards

- Risk Management Standard (IRM, ALARM and AIRMIC) of UK
- ISO 31000 Risk Management – Guidelines on principles and implementation of risk management
- ISO Guide 73 – Risk Management Vocabulary
- BS 31100 Cod of best practice for Risk Management
- AZ/ANS 4360:2004 Risk Management Standard
- COSO Enterprise Risk Management
- Canadian Government Sector Standard
- Basel I,II, 2.5 and III
- Solvency II (ICAAP)
- Kings Report

WESTINGHOUSE

COCO

MALCOLM BALDRIGE

Cadbury

Deming

COSO

Twelve Attributes

Peter Senge's

Deep Learning Framework

ISO 31000

Basel II



IRMT

irmT
The Institute of Risk Management Tanzania

# Many Models to Chose Among

- COSO
- COCO
- Cadbury Report
- Deming Award
- TQM
- 12 Attributes
- Deep Learning Framework
- Baldrige Award
- ISO 31000
- Westinghouse Award
- Northrop Award

# Who Developed Models?

- **COSO:** The major accounting and audit professional organizations issued COSO in 1992.
- **12 Criteria:** The Canadian Comprehensive Auditing Foundation published Effectiveness Reporting and Auditing in the Public Sector in 1987.
- **COCO:** In November 1995, The Canadian Institute of Chartered Accountants (CICA) published Guidance on Control.

# Who Developed Models? (Continued)

- **ISO 31000** developed by the International Organization for Standardization (ISO)

- **Deep Learning Framework:** In 1990, Peter Senge published the now classic The Fifth Discipline and then in 1995 published The Fifth Discipline Field book

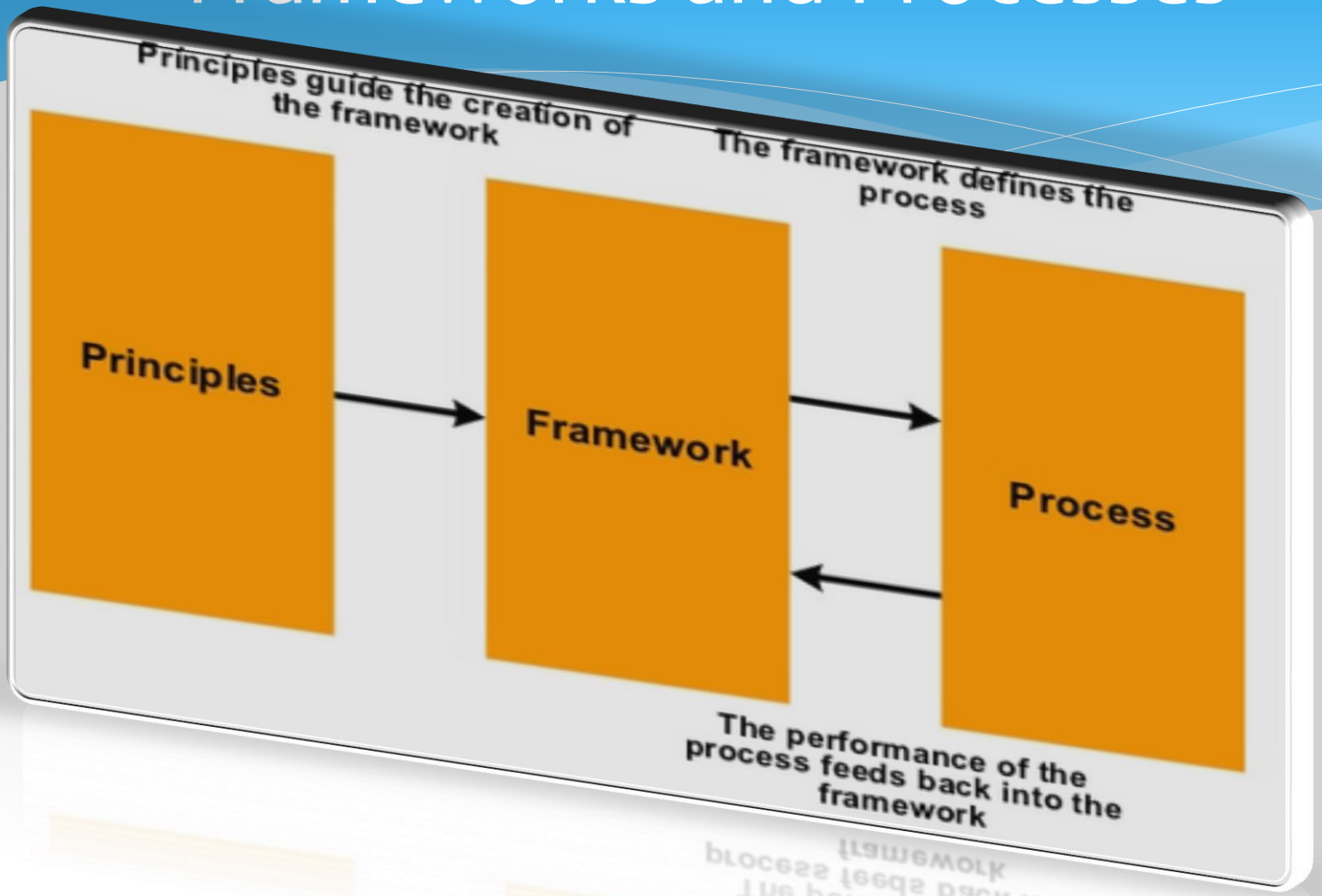
# Different Models: Same Goals

- Models provide a way of understanding our organizations.
- By having different groupings, each highlights some aspects of control more than others.
- The criteria in the frameworks provide a basis for understanding control in an organization and for making judgment about the effectiveness of control

# Different Models: Same Goals

* Models provide a systematic step by step method of evaluating and addressing the adequacy of controls in multiple dimensions of a business.
* Models provide a standard review process.
* Models provide a tool that helps management and auditors evaluate the adequacy of controls in multiple dimensions of the business. It helps give a picture of how well all of the controls in all of the dimensions are working.

# Risk Management Principles, Frameworks and Processes



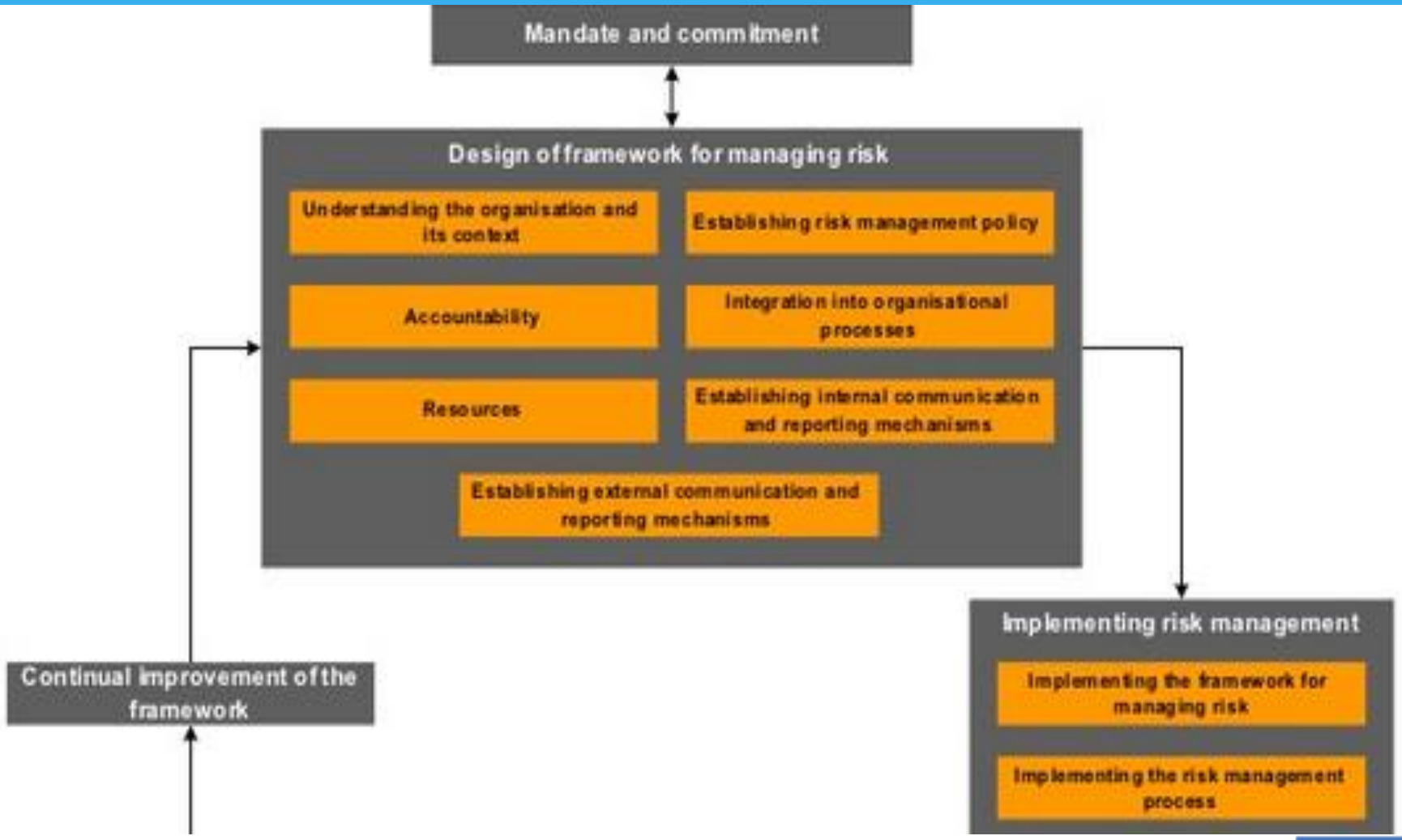



IRMT

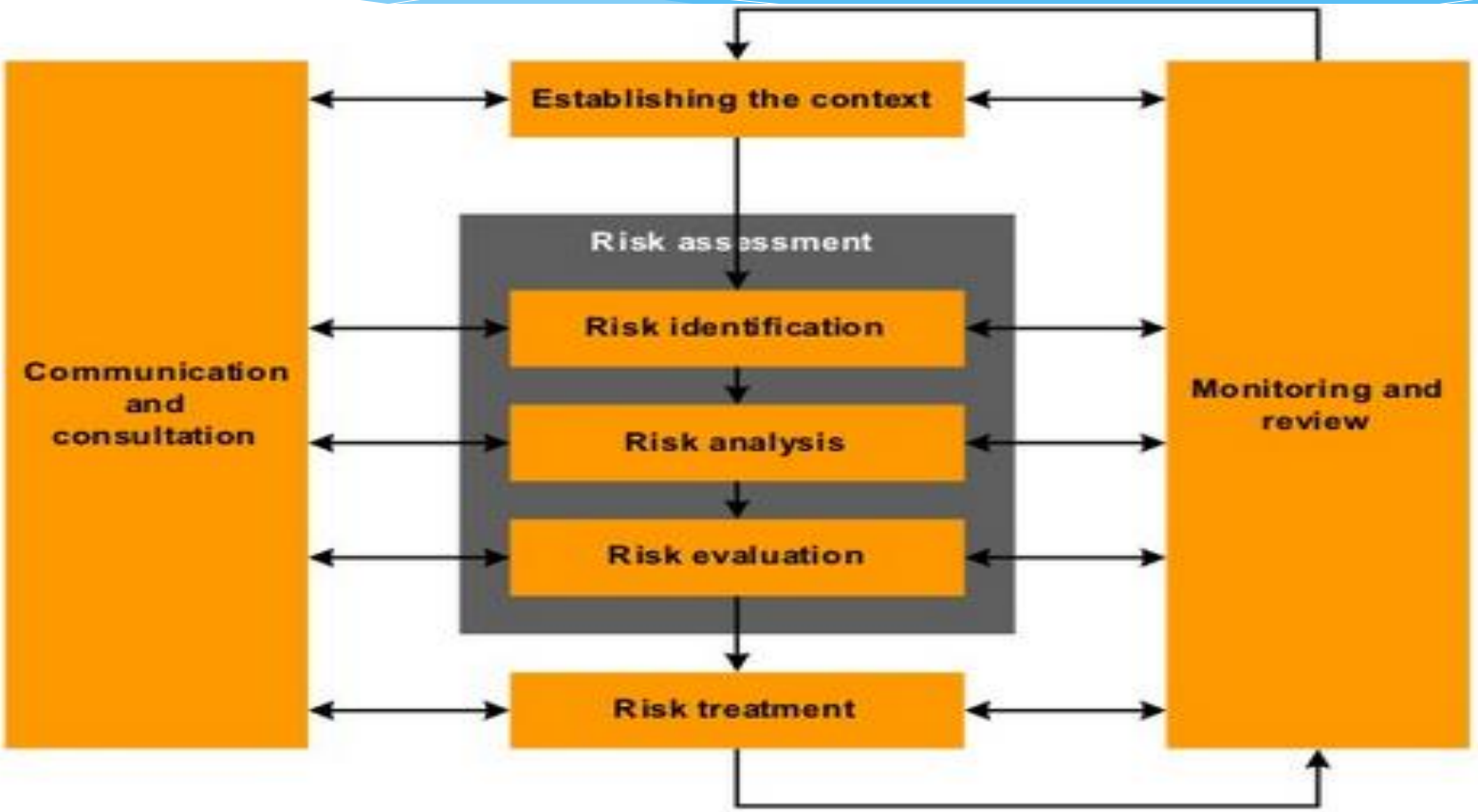
irmT The Institute of Risk Management Tanzania

# Risk Management Principles, Frameworks and Processes

# Risk Management Principles, Frameworks and Processes



# Risk Management Principles, Frameworks and Processes

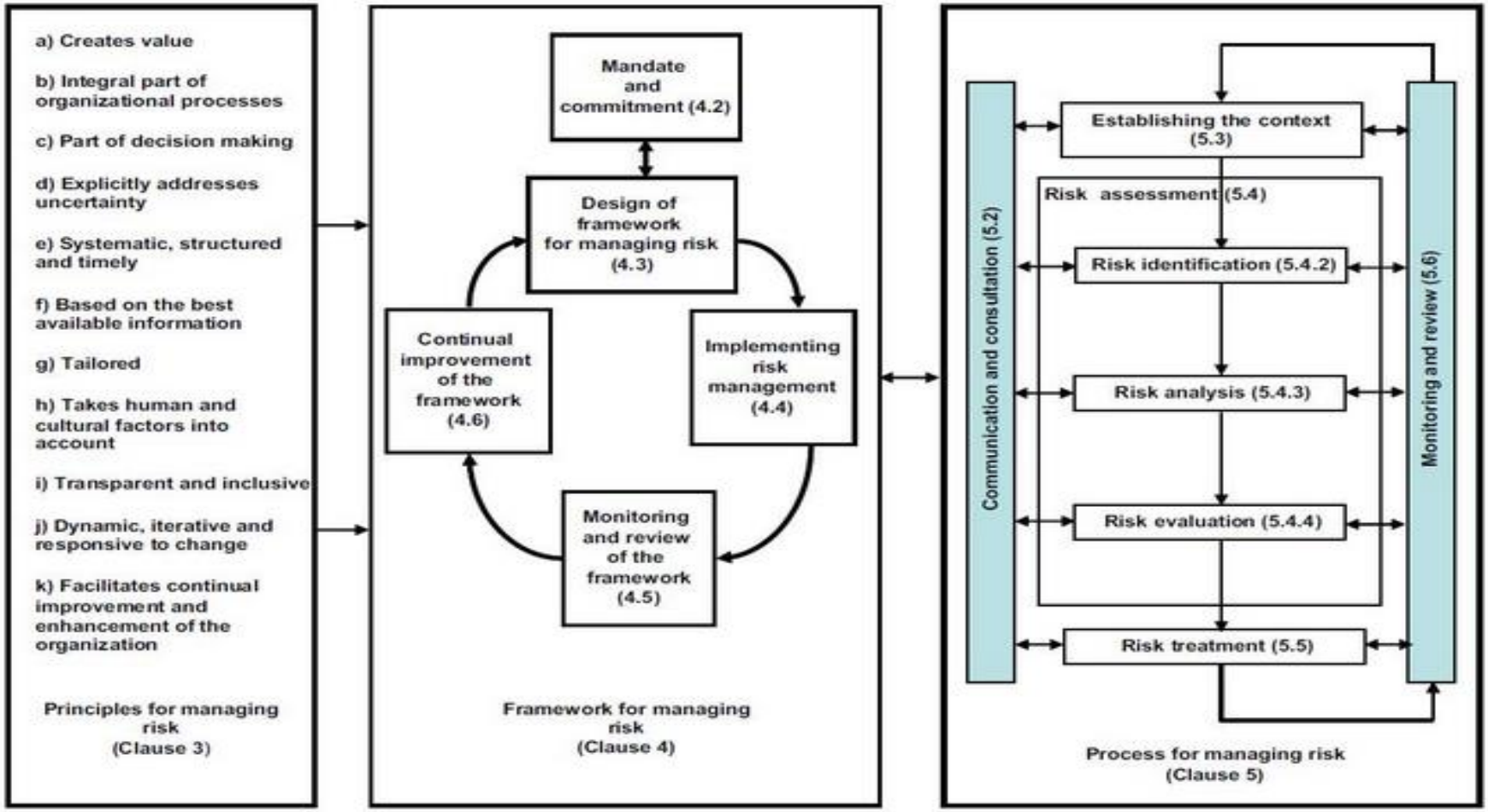




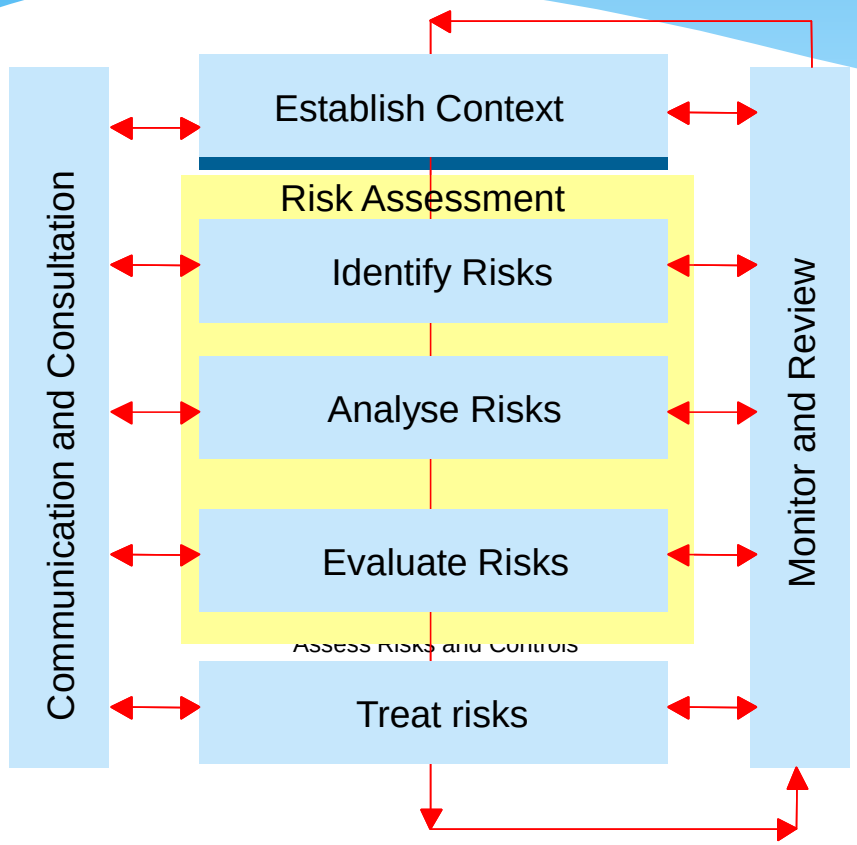

IRMT

irmT The Institute of Risk Management Tanzania

# Risk Management Principles, Frameworks and Processes



# Risk Management Process




**Context:**
Strategic, internal, external context

**Identification:**
What can go wrong? Missed opportunities?

**Analysis/Measurement:**
Assess risk likelihood and consequence, review

**Evaluate:**
Compare risks, set risk priorities

**Treatment Options:**
Reduce, avoid, transfer or retain

# Risk Management Process
# COSO Framework

- COSO stands for Committee of Sponsoring Organizations of the Treadway Commission
- It is the US Private Sector organization,
- Dedicated to providing guidance to executives, management and governance entities on critical aspects of governance, Business Ethics
- Guidance on Internal Control, ERM, Fraud, and financial reporting
- COSO has established a common internal control model against which companies and organizations may assess their control systems.

# COSO and ISO 31000

- COSO defines ERM as a process;
- Effected by an entity's board of directors, management and other personnel;
- Applied in strategy setting and across enterprise;
- Designed to identify potential events that may affect the entity;
- Manage risks within its risk appetite;
- Provides reasonable assurance regarding the achievement of entity objectives.

- IRM (New COSO) defines Risk Management as
- The process whereby the organizations methodically address the risks attaching to their activities
- With a goal of achieving sustained benefits within each activity and across the portfolio of all activities
- Generally it is a decision-making discipline that reduces uncertainty and managers potential variations from expected outcomes in achieving company goals (RIMS)

# COSO and ISO 31000 (Continue)

- ISO 31000 defines risk Management as
- Integral part of all organization processes
- It is not a stand alone activity that is separate from main activities and processes of the organization
- It is part of responsibilities of management; and
- An integral part of all organizational processes including strategic planning and all project and change management processes

- In practical insight the whole of the business is just like risk management, why?

# Warren Buffet on Risk Management- Recall

- Risk is part of business operation – It is important for corporates to take insurance
- Any business undertaking is about taking risk
- CEO is a Chief Risk Officer of any business organisation. Why?
  - Has large picture of the entire organisation
  - Every morning CEO walk up to manage risks
  - He/she asks what risk is facing my business today

# Analysis of Warren Case

- What is risk Management
- What are consequences of dedicating risk management activities to a unit in a organisation?
- Who is supposed to manage risk in an organization
- What is the status of Risk Management today?

I
R
M
T

# Module II
# Risk Management Frameworks



irmT
The Institute of Risk Management Tanzania

# Risk Management Standards

- There are number of established risk management standards and frameworks
- The first was developed in Australia in 1995, and has been followed by those being developed in Canada, Japa, the UK and the US.
- The overall approach for each standard is similar.
- The standard with a widest recognition was the Australian Standard AS 4360 ((2004) but this was withdrawn in 2009 in favor of ISO 31000
- The ERM version of the COSO standard is also widely applied in many organizations
- In June, 2011, the British BS 31100:2011 'Risk Management: Code of practice and guidance for implementation of BS ISO 31000' was published in June, 2011

# Risk Management Standards Vs Risk Management Framework

- In the later part of 2009, international standard ISO 31000 (2009), 'Risk Management: Principles and guidelines", was published.
- Some standards are better recognized than others, organizations should select the approach that is most relevant to their particular circumstances
- The difference between risk management standard and risk management framework
  - A risk management standard sets out the overall approach to the successful management of risk, including description of risk management process, together with the suggested framework that supports the process
  - Risk Management standard is a combination of a description of the risk management process, together with the recommended framework
  - ISO 31000 (issued by International Standards Organization (2009)) and Institute of Risk Management (IRM) issued by Airmic, Alarm and the IRM (2002) are main standards
  - COSO ERM and CoCo (Criteria of control) are main frameworks

# Risk Management Standards Vs Risk Management Framework

- An example of widely used risk management standards was produced by IRM in 2002 in co-operation with Airmic and Alarm
  - It is a high level approach aimed at non risk management specialist
  - The IRM standard can be downloaded from the IRM website
- The Australian Standard and the COSO standard/framework are designed for use primarily by specialist risk management practitioners
- The organizations listed on the New York stock exchange, the approach outlined in the COSO Internal Control framework (1992) is recognized by the Sarbanes-Oxley Act of 2002 (SOX)
  - It is also applicable to US listed companies around the world
  - COSO approach is internationally recognized and in many circumstances mandated.

# Risk Management Standards Vs Risk Management Framework

- There are standards developed by risk management professionals and others by accountants or auditors.
- These makes the approaches to managing risks in three distinct ways
  - Risk Management approach, followed by ISO 31000, British Standard BS 31100 and the IRM Standard
  - 'Internal Control' approach, developed by COSO Internal Control framework and by the UK Turnbull Report
  - 'risk aware culture' approach, develop by Canadian Institute of Chartered Accountants, known as the CoCo framework

# Approaches to Risk Management Framework

I
R
M
T

# Risk Architecture, Strategy and protocols

- Risk Architecture, Strategy and Protocols is represented by mnemonic RASP for an organization
- An important component of RASP is the risk management policy
- Risk Management policy sets out the overall strategy of the organization towards risk management, define risk management roles and responsibilities and se out the protocol that should be followed
- The RASP create the Risk Framework
- RASP represent the context for risk management in the organization
- The risk strategy component will normally be set out as the one page statement of what the organization want TO achieve with respect to risk management

# Risk Management Framework

**Risk architecture**

Risk architecture defines roles, responsibilities, communication and risk reporting structure

**Risk strategy**

Risk strategy, appetite, attitudes and philosophy are defined in the risk management policy

**Risk management process**

**Risk protocols**

Risk protocols are defined in the risk guidelines for the organization and include the rules and procedures, as well as the risk management methodologies, tools and techniques that should be used

# Risk Architecture, Strategy and Protocols

- RASP provides a simple way to explain the scope of the risk management framework
- RASP approach is consistent with concept of risk management framework described in ISO 31000
- The three components of risk architecture, strategy and protocol are required for successful risk management activities
- The organization must have clear understanding of the risk management process, followed by a clear definition of the framework that supports the process.
- Framework is a supportive structure and is a series of components build around and supporting risk management process

# RASP- Risk Management Framework

- A Risk Management Framework should facilitate communication and flow of risk
- Risk Management framework has two major important considerations
  - It must be supportive of the risk management process
  - It must ensure that the outputs from the process are communicated into organization and achieve anticipated benefits for the organizations
- When an organization decides to follow the structure of any risk management standard
  - It should set up a framework that includes structures, responsibilities, administration, reporting and communication components of risk management
  - All these procedures will then be recorded in a risk management manual

# Many Models To Chose Among

- COSO
- COCO
- Cadbury Report
- Deming Award
- TQM
- 12 Attributes
- Deep Learning Framework
- Baldrige Award
- ISO 9000
- Westinghouse Award
- Northrop Award

IRMT

WESTINGHOUSE

COCO

MALCOLM BALDRIGE

Cadbury

Deming

COSO

Twelve Attributes

Peter Senge's

Deep Learning Framework

ISO 9000



irmT The Institute of Risk Management Tanzania

# Who Developed Models?

- **COSO:** The major accounting and audit professional organizations issued COSO in 1992.
- **12 Criteria:** The Canadian Comprehensive Auditing Foundation published Effectiveness Reporting and Auditing in the Public Sector in 1987.
- **COCO:** In November 1995, The Canadian Institute of Chartered Accountants (CICA) published Guidance on Control.

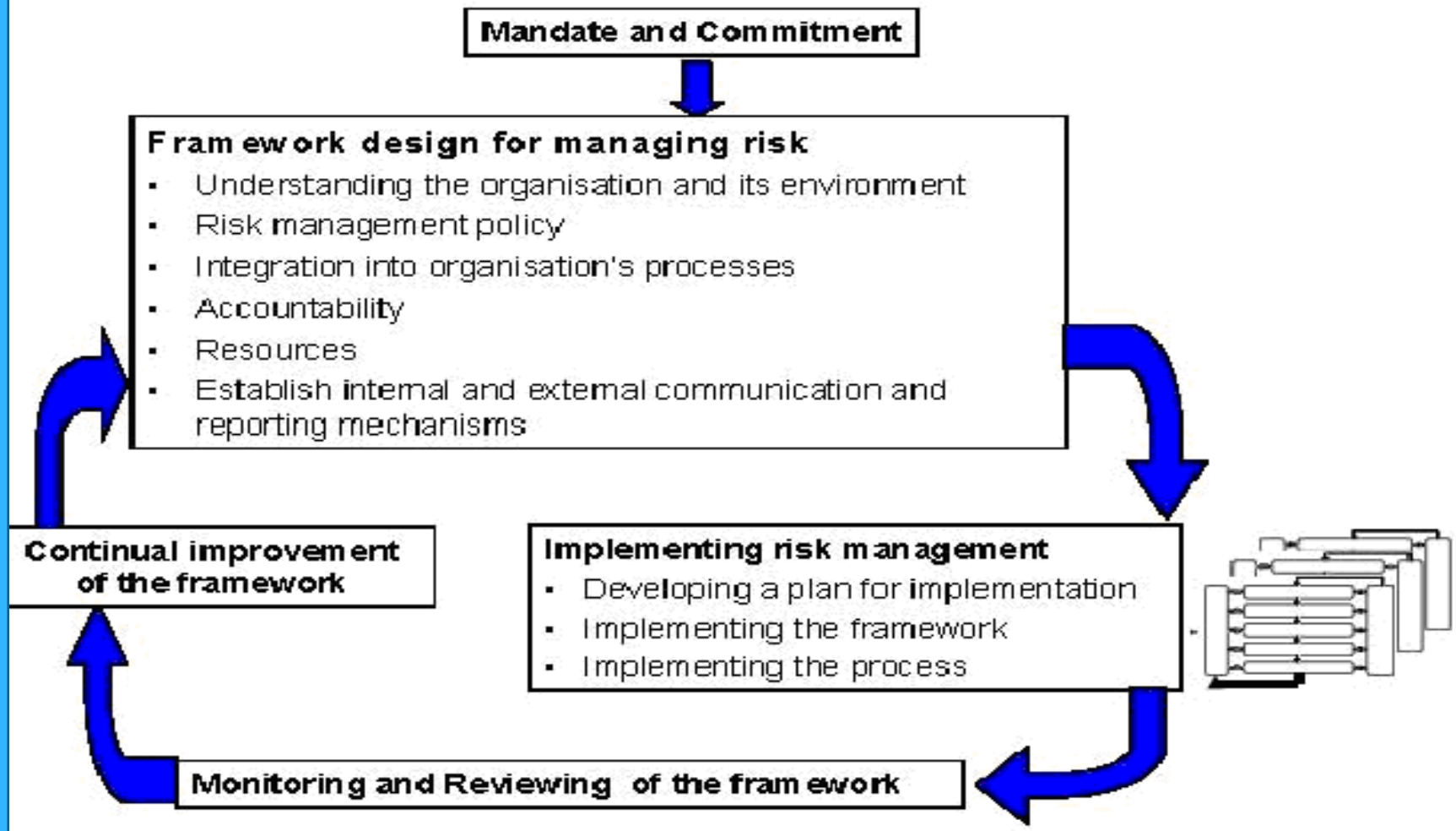
I
R
M
T

# ISO 31000



irmT
The Institute of Risk Management Tanzania

# ISO 31000 Risk Management Framework



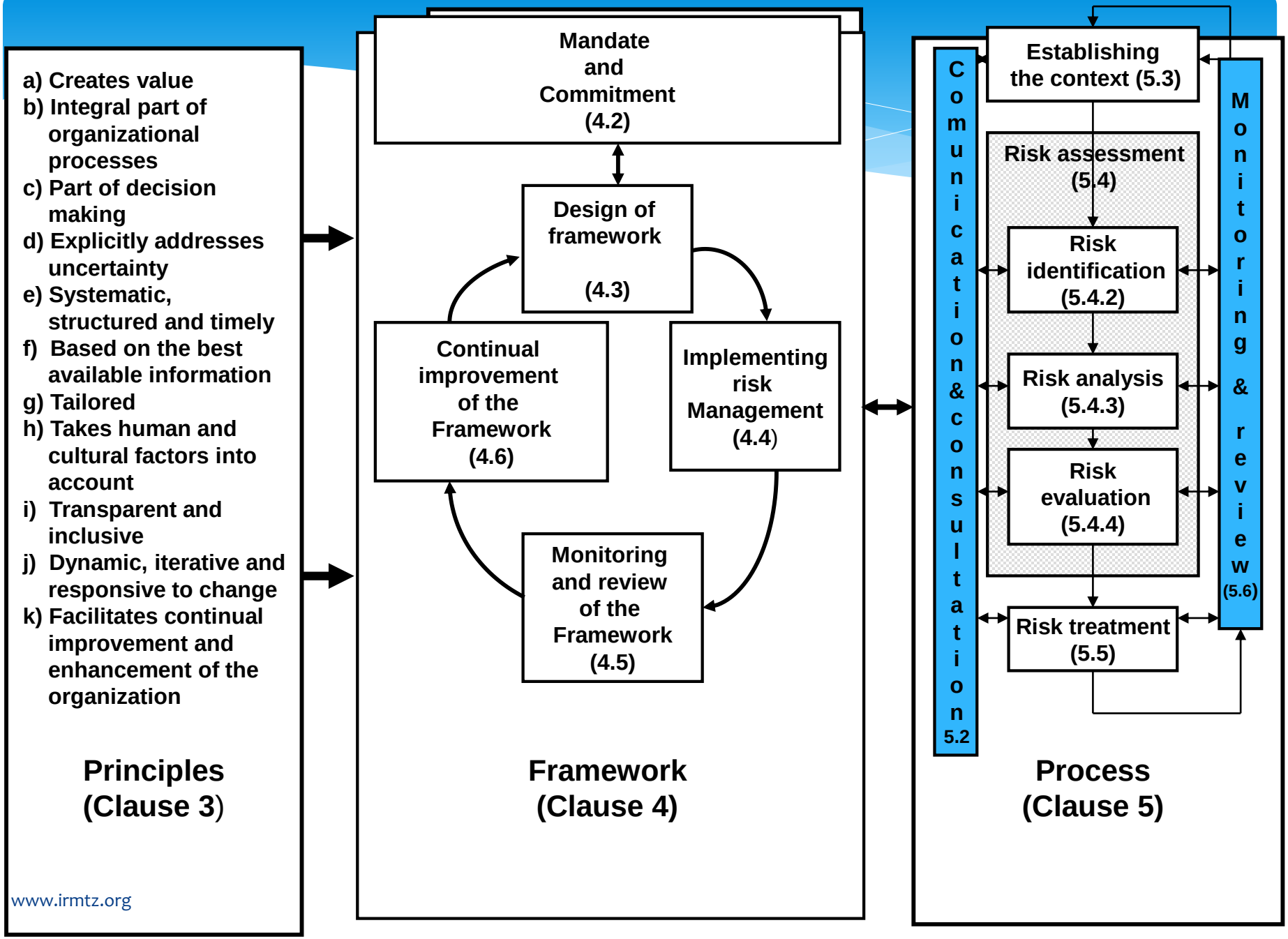
# ISO 31000:2009 - SCOPE

- To provide principles and generic guidelines on risk management
- It can be used by any public, private or community enterprise, association, group or individual
- It can be applied throughout the life of an organization, and to a wide range of activities, including strategies and decisions, operations, processes, functions, projects, products, services and assets
- It can be applied to any type of risk, whatever its nature, whether having positive or negative consequences
- It is not intended to promote uniformity of risk management across organizations
- To harmonize risk management processes in existing and future standards
- ISO 31000 is not intended for the purpose of certification

# Reasons of ISO 31000

- ISO 31000:2009 is a natural successor to AS/NZS 4360:2004
- It has influenced a revision of COSO
- It fits 'ERM' requirements, but also allows silo/project risk management
- Following ISO 31000 will provide a low cost, high chance of success approach to ERM
- ISO 31000 adds value and reduces risk in risk management
- ISO 31000 provides generic guidance on how to embed risk management, and reinforce the concept of "positive" risk
- Managing risk is about creating value out of uncertainty

# ISO 31000:2009 Relationship between the Principles, Framework and Process




www.irmtz.org

# Principles (Clause 3)

- Risk management should….

a) Create value
b) An integral part of organizational processes
c) Part of decision making
d) Explicitly address uncertainty
e) Be systematic and structured
f) Be based on the best available information
g) Be tailored
h) Take into account human factors
i) Be transparent and inclusive
j) Be dynamic, iterative and responsive to change
k) Be capable of continual improvement and enhancement

# Risk Management Principles Summary (PACED)

| Principle | Description |
|---|---|
| Proportionate | Risk management activities must be proportionate to the level of risk faced by the organization. |
| Aligned | Risk management activities need to be aligned with the other activities in the organization. |
| Comprehensive | In order to be fully effective, the risk management approach must be comprehensive. |
| Embedded | Risk management activities need to be embedded within the organization. |
| Dynamic | Risk management activities must be dynamic and responsive to emerging and changing risks. |

# Mandate and Commitment (4.2)

**ISO 31000 Relationship between the components of the framework for managing risk**

**4.3 Design of framework**

- **5.3.1 Understanding the organization and its context**
- **5.3.2 Risk management policy**
- **5.3.3 Integration into organizational processes**
- **5.3.4 Accountability**
- **5.3.5 Resources**
- **5.3.6 Establishing internal communication and reporting mechanisms**
- **5.3.7 Establishing external communication and reporting mechanisms**

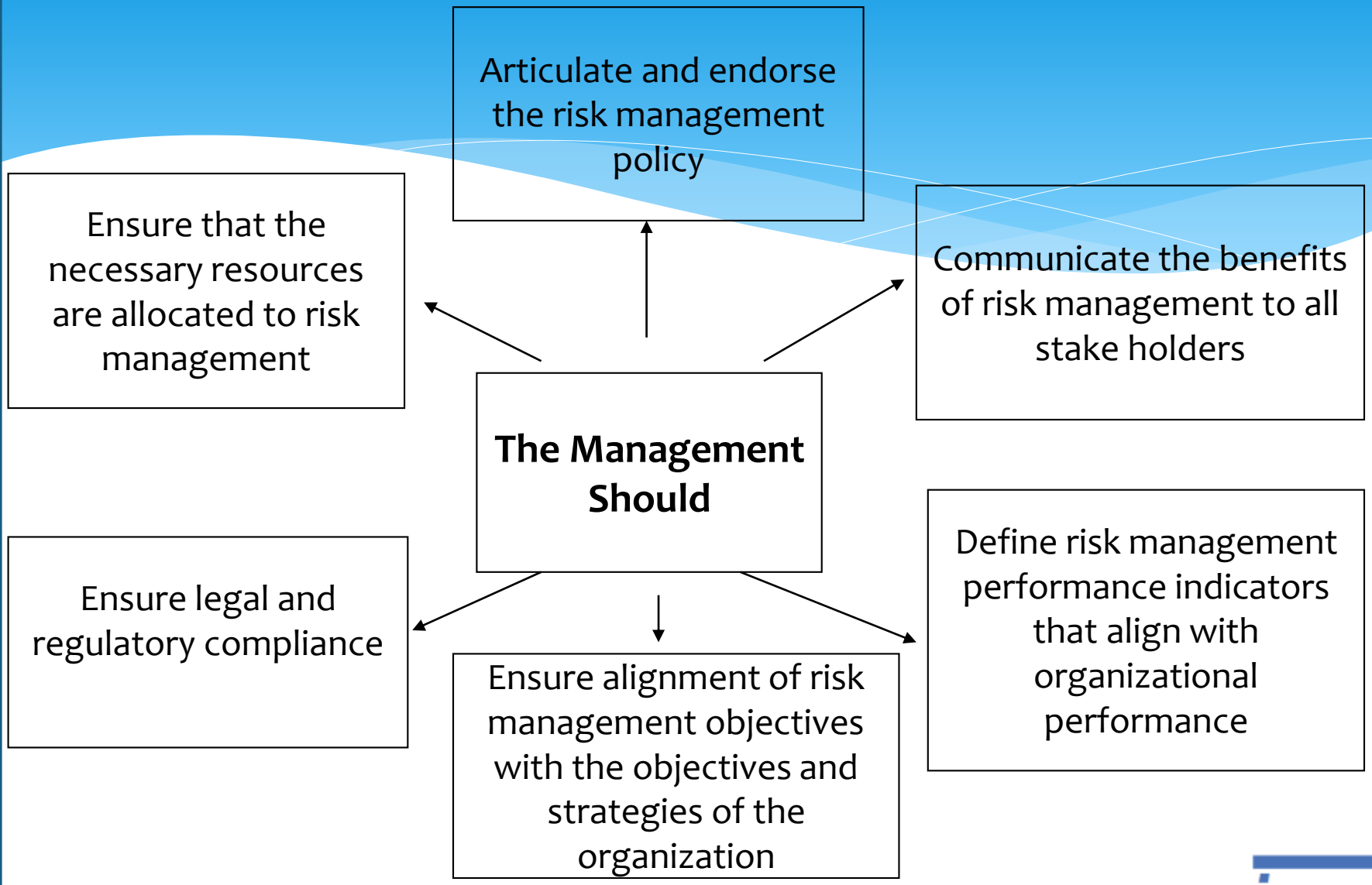
**4.4 Implementing risk management**

- **4.4.1 Implementing the framework**
- **4.4.2 Implementing the risk management process**

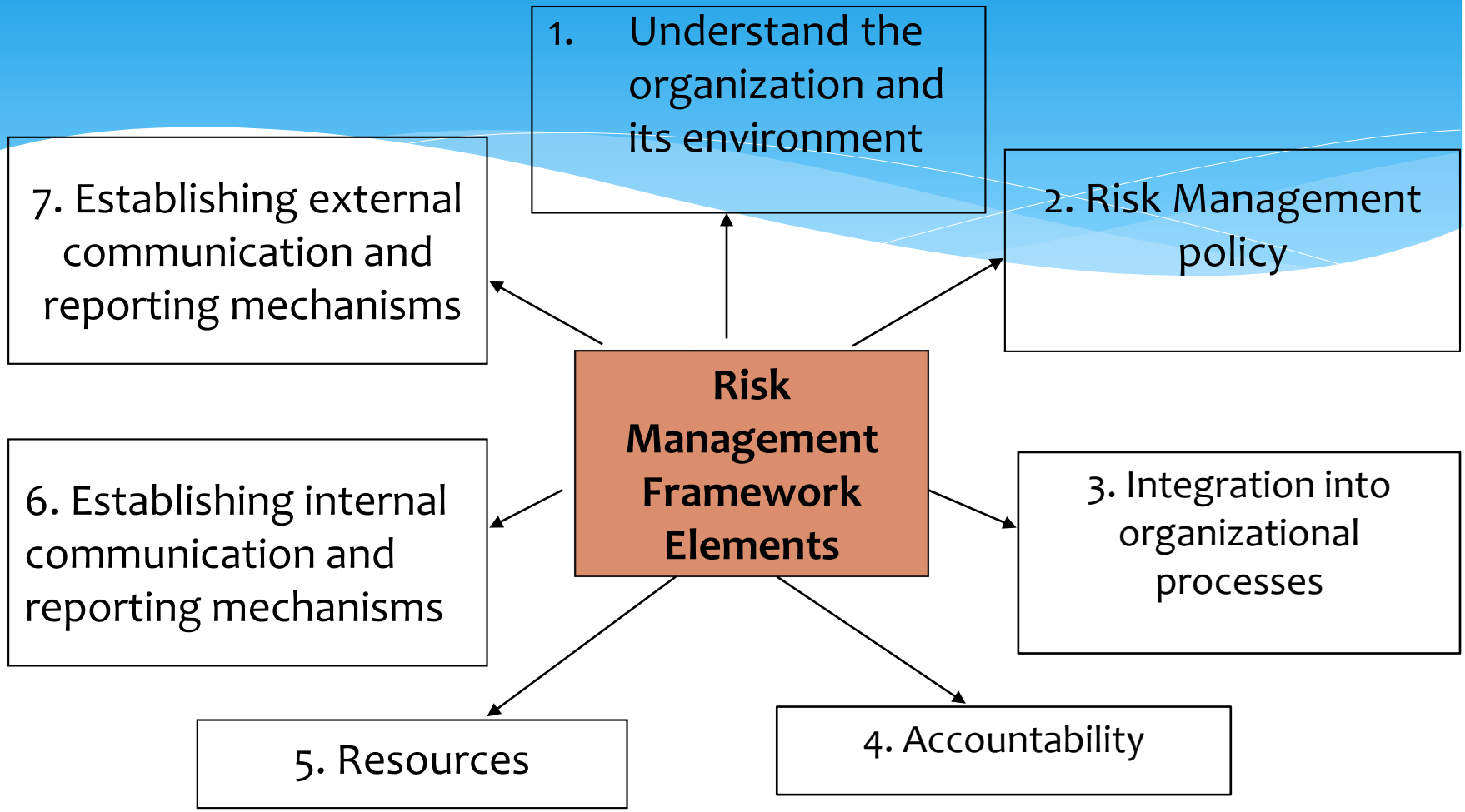
**4.5 Monitoring and review of the framework**

**4.6 Continual improvement of the framework**

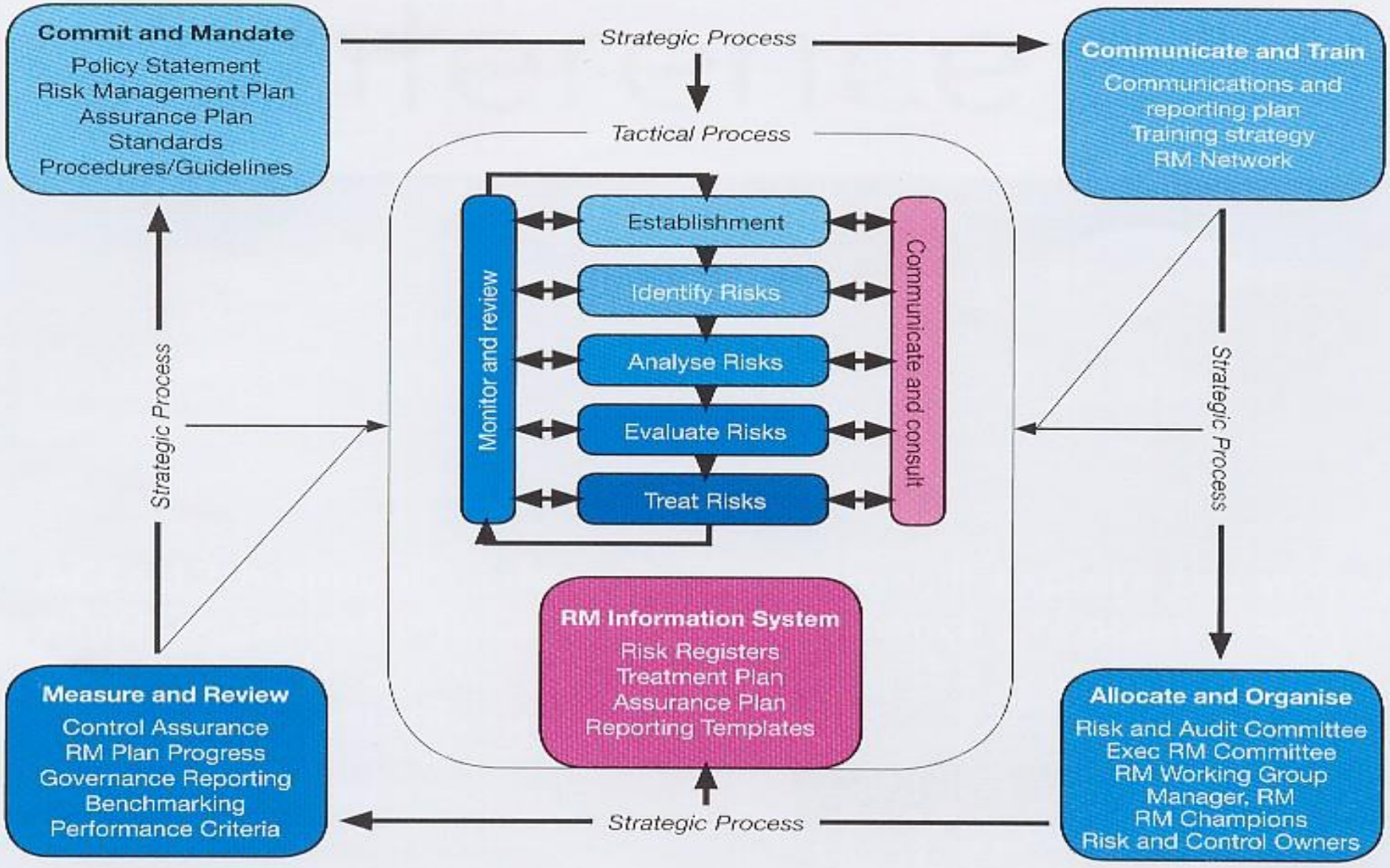
# ISO 31000: Mandate and Commitment



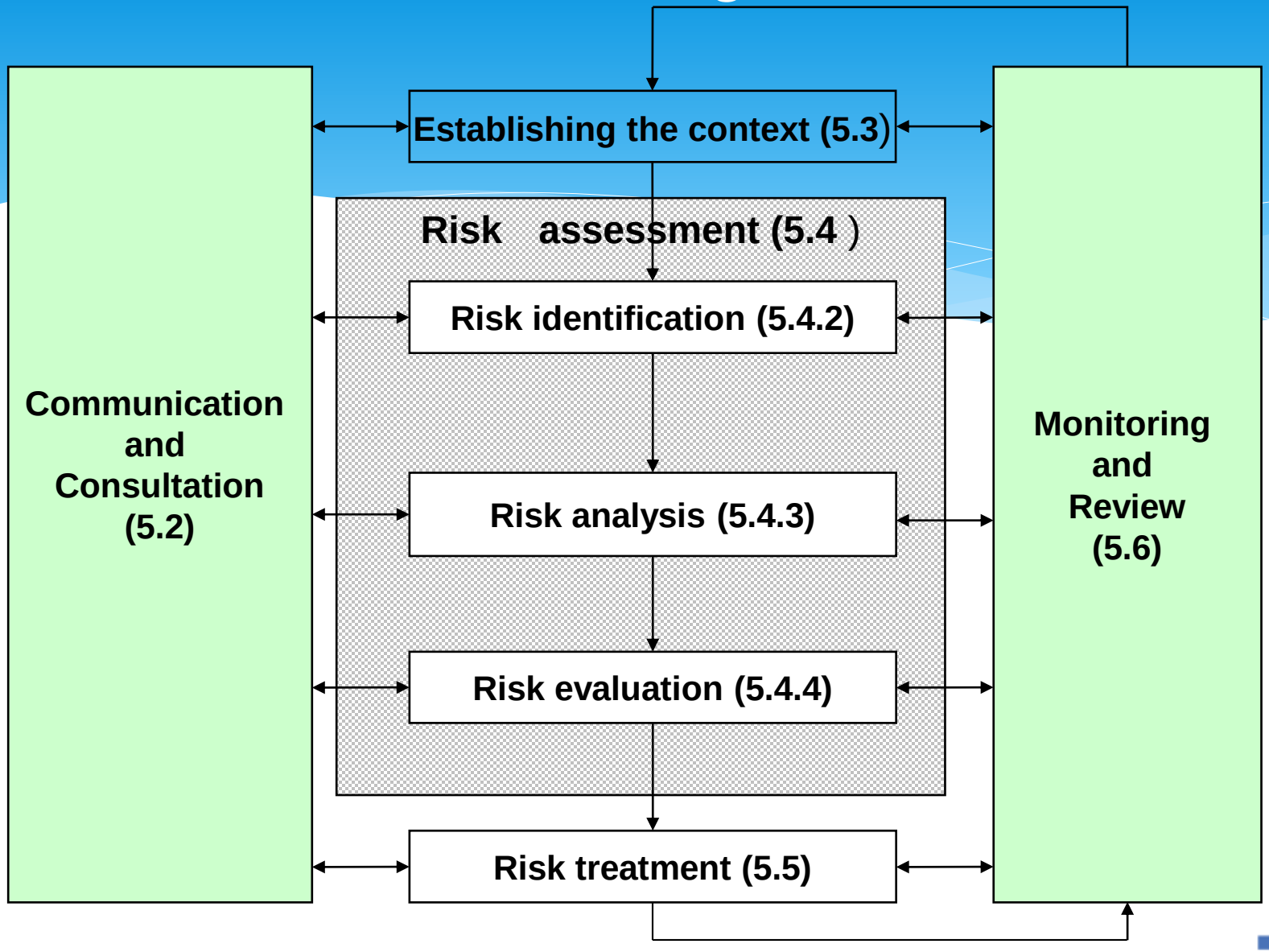
# ISO 31000: Framework Design For Managing Risk



# Risk Framework Elements



# ISO 31000 Risk Management Process







IRMT

irmT The Institute of Risk Management Tanzania

# Risk Management Process (Clause 5)

- Should be an integral part of management, be embedded in culture and practices and tailored to the business processes of the organization.

- Includes five activities: communication and consultation; establishing the context; risk assessment; risk treatment; and monitoring and review.

# Reporting

- Reporting is incidental to good Risk Management, not the sole focus of it!
- If you only focus on reporting, you will not motivate the required culture change
- Advanced Governance Codes (e.g. ASX, LSX) require two sets of reports:
  - The maturity and performance of the RM framework
  - The risk profile and how/why it has changed

# IEC 31010 Risk Assessment Techniques

1. Brainstorming
2. Structured or Semi-structured Interviews
3. Delphi Technique
4. Check-lists
5. Preliminary Hazard Analysis
6. HAZOP
7. HACCP
8. Toxicological Risk Assessment
9. Structured What If (SWIFT)
10. Scenario Analysis
11. Business Impact Analysis BIA
12. Root Cause Analysis (RCA)
13. Failure Modes and Effects Analysis (FMEA)
14. Fault Tree Analysis (FTA)
15. Event Tree Analysis (ETA)
16. Cause-consequence Analysis
17. Cause-and-effect Analysis
18. Layers of Protection Analysis
19. Decision Tree Analysis
20. Human Reliability Assessment (HRA)
21. Bow Tie Analysis
22. Reliability Centred Maintenance
23. Sneak Analysis
24. Markov Analysis
25. Monte Carlo Simulation
26. Bayesian Statistics and Bayes Nets
27. FN Curves
28. Risk Indices
29. Consequence /Likelihood Matrix
30. Cost Benefit Analysis
31. Multi-Criteria Decision Analysis

# ISO 31000:2009 Versus ERM(COSO II)

## The Leading Edge

### ISO 31000:2009

- ISO 31000 fully complying with COSO ERM .
- ISO 31000 is more practical
- Easy to apply (less than 30 pages)
- Applicable to organisations in all industries, large or small
- More clearly written and terms are explicitly defined
- Wider acceptance as reference for risk management in existing and future standards
- No need to redesign existing management system to apply
- Apply to all levels of organization for any type of risk, both positive and negative consequences

### ERM (COSO II)

- COSO ERM does not comply with ISO 31000
- COSO is very theoretical
- Very complicate (over 200 pages)
- Better suited for large financial organisations
- COSO is not easy to understand
- Limited acceptance, mainly in the US within financial industry
- Major system modification is required to comply with COSO
- Focus on negative risk at corporate level, often very confusing when apply at operational level

I
R
M
T

# RISK MANAGEMENT COMPACT

# ISO 31000:2009 defines risk as:

**"The effect of uncertainty on objectives"**

A deviation from the expected – positive and/or negative

**What can go wrong?**

Deficiency of information relating to an event, its consequence, or likelihood

**How likely is it?** **What are the consequences?**

- Can have different aspects e.g. finance, safety, environment goal
- Can apply at different levels e.g. strategic, department, project



IRMT

irmT The Institute of Risk Management Tanzania

# What is Risk?

I
R
M
T

# Describing Risk – Poor Example

Poor example " *there is a risk that a fraud occurs*"

It leaves too many questions:

- How might it occur?
- What parts of the organisation might be affected?
- Who in the organisation might be affected?
- What are the consequences?
- What clues are there for developing treatments?

# Describing Risk – Good Example

## A better description

*" there is a risk that a researcher falsifies research findings resulting in cancelation of the program, loss of grant funds and reputational harm to the university"*

* Allows better consideration of causal factors
* Allows us to better frame consequence and likelihood
* Allows us to consider what controls are in place and how effective they are. For example:
  - Staff codes and professional conduct
  - Peer review and quality assurance mechanisms
  - Relationship management
  - Reputational management

I
R
M
T

# Introduction to COSO Framework

# Today's organizations are concerned about:

* Risk Management
* Governance
* Control
* Assurance and (Consulting)



IRMT

irmT The Institute of Risk Management Tanzania

# ERM Defined:

- *"… 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 risks to be within its risk appetite,*
- *to provide reasonable assurance regarding the achievement of entity objectives."*

*Source: COSO Enterprise Risk Management – Integrated Framework. 2004. COSO.*

# Why ERM Is Important

- Underlying principles
  - Every entity, whether for-profit or not, exists to **realize value** for its stakeholders.
  - Value is **created, preserved, or eroded** by management decisions in all activities, from setting strategy to operating the enterprise day-to-day.

# Why ERM Is Important

ERM supports **value creation** by enabling management to:

* Deal effectively with potential future events that create uncertainty.
* Respond in a manner that reduces the likelihood of downside outcomes and increases the upside

# Enterprise Risk Management — Integrated Framework

COSO ERM framework defines essential components, suggests a common language, and provides clear direction and guidance for enterprise risk management.



IRMT

irmT The Institute of Risk Management Tanzania

# Enterprise vs Integrated Risk Management

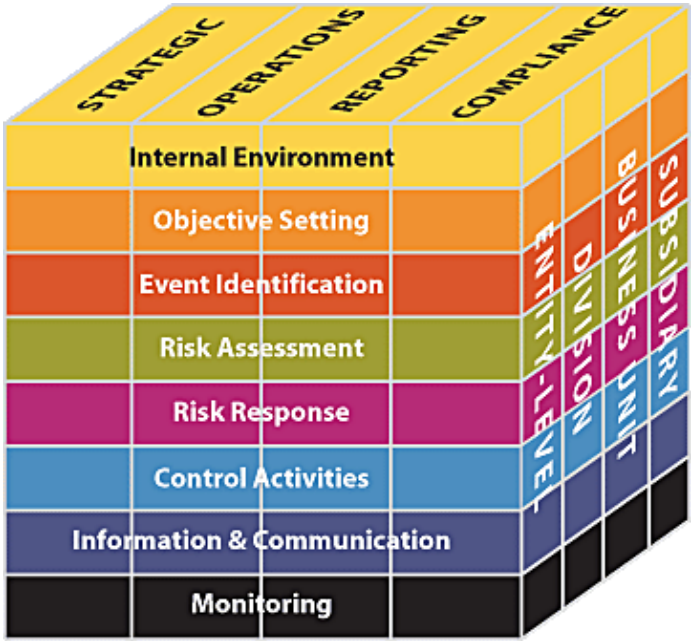
* **Similarities:**
  - ✓ Formal process
  - ✓ Consistent and systematic
  - ✓ Includes projects, programs, operations
  - ✓ Is embedded in key processes such as strategic planning, budgeting, project planning, evaluation, etc
  - ✓ Must be driven and supported by Leadership
  - ✓ Adds value to decision-making

* **Differences:**
  - ✓ **Enterprise-wide:**
  - ✓ Is organizational-centric
  - ✓ Success is defined as implementation over the entire organization
  - ✓ **Integrated:**
  - ✓ Take a systems-focus
  - ✓ May actually create risks for individual organizations

# The ERM Framework

Entity objectives can be viewed in the context of four categories:

- Strategic
- Operations
- Reporting
- Compliance





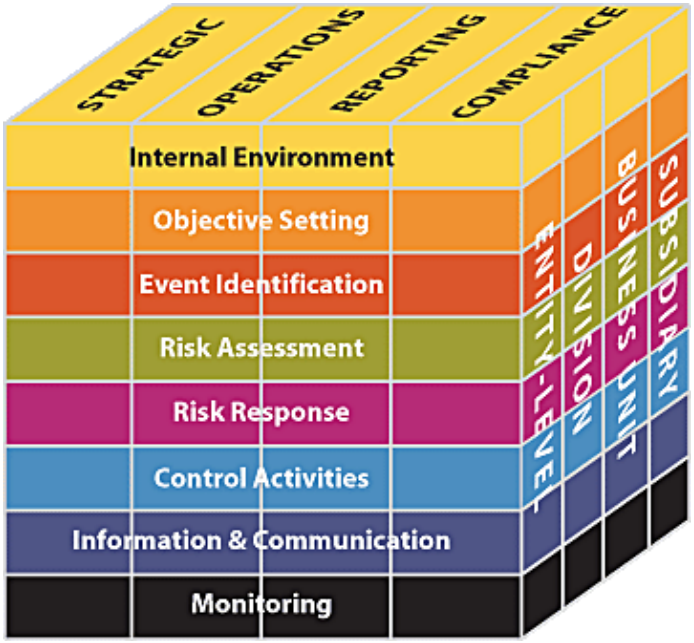

IRMT

irmT The Institute of Risk Management Tanzania

# The ERM Framework

ERM considers activities at all levels of the organization:

- Enterprise-level
- Division or subsidiary
- Business unit processes






IRMT

irmT The Institute of Risk Management Tanzania

# The ERM Framework

Enterprise Risk Management requires an entity to take a ***portfolio*** *view* of risk.



IRMT

irmT The Institute of Risk Management Tanzania

# The ERM Framework

* Management considers how individual risks interrelate.
* Management develops a portfolio view from two perspectives:

  - Business unit level

  - Entity level

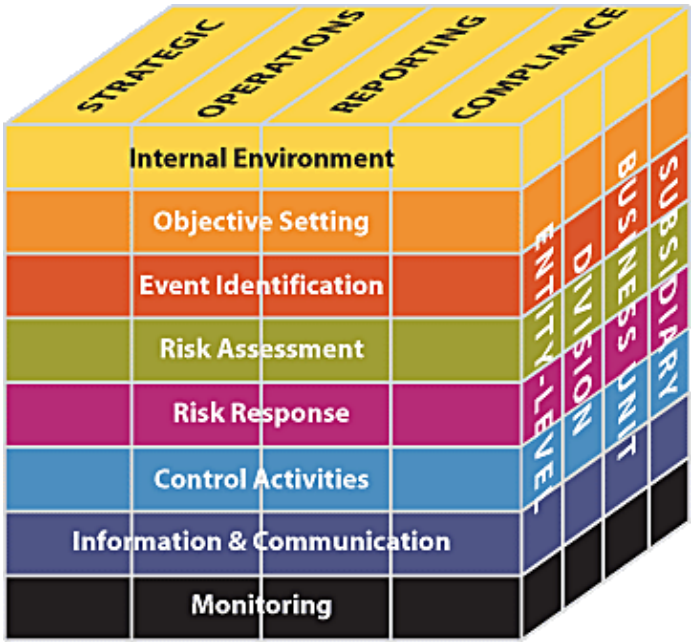


IRMT

irmT The Institute of Risk Management Tanzania

# The ERM Framework

The eight components of the framework are interrelated …






irmT The Institute of Risk Management Tanzania

# Internal Environment

- Establishes a philosophy regarding risk management. It recognizes that unexpected as well as expected events may occur.
- Establishes the entity's risk culture.
- Considers all other aspects of how the organization's actions may affect its risk culture.

# Objective Setting

- Is applied when management considers risks strategy in the setting of objectives.
- Forms the risk appetite of the entity — a high-level view of how much risk management and the board are willing to accept.
- Risk tolerance, the acceptable level of variation around objectives, is aligned with risk appetite.

# Event Identification

- Differentiates risks and opportunities.
- Events that may have a negative impact represent risks.
- Events that may have a positive impact represent natural offsets (opportunities), which management channels back to strategy setting.

# Event Identification

- Involves identifying those incidents, occurring internally or externally, that could affect strategy and achievement of objectives.
- Addresses how internal and external factors combine and interact to influence the risk profile.

# Risk Assessment

- Allows an entity to understand the extent to which potential events might impact objectives.

- Assesses risks from two perspectives:
  - Likelihood
  - Impact

- Is used to assess risks and is normally also used to measure the related objectives.

# Risk Assessment

- Employs a combination of both qualitative and quantitative risk assessment methodologies.
- Relates time horizons to objective horizons.
- Assesses risk on both an inherent and a residual basis.

# Risk Response

- Identifies and evaluates possible responses to risk.
- Evaluates options in relation to entity's risk appetite, cost vs. benefit of potential risk responses, and degree to which a response will reduce impact and/or likelihood.
- Selects and executes response based on evaluation of the portfolio of risks and responses.

# Control Activities

- Policies and procedures that help ensure that the risk responses, as well as other entity directives, are carried out.
- Occur throughout the organization, at all levels and in all functions.
- Include application and general information technology controls.



IRMT

irmT The Institute of Risk Management Tanzania

# Information & Communication

- Management **identifies, captures, and communicates pertinent information** in a form and timeframe that enables people to carry out their responsibilities.

- Communication occurs in a broader sense, flowing down, across, and up the organization.

# Monitoring

Effectiveness of the other ERM components is monitored through:

- Ongoing monitoring activities.
- Separate evaluations.
- A combination of the two.



IRMT

irmT The Institute of Risk Management Tanzania

# Internal Control

A strong system of internal control is essential to effective enterprise risk management.

# Relationship to *Internal Control — Integrated Framework*

- Expands and elaborates on elements of internal control as set out in COSO's "control framework."
- Includes objective setting as a separate component. Objectives are a "prerequisite" for internal control.
- Expands the control framework's "Financial Reporting" and "Risk Assessment."

# ERM Roles & Responsibilities

- Management
- the Board of Directors
- Risk officers
- Internal auditors



IRMT

irmT The Institute of Risk Management Tanzania

# Internal Auditors

* Play an important role in monitoring ERM, but do NOT have primary responsibility for its implementation
or maintenance.
* Assist management and the board or audit committee in the process by:

  - Monitoring - Evaluating

  - Examining - Reporting

  - Recommending improvements



IRMT

irmT The Institute of Risk Management Tanzania

# Internal Auditors

Visit the guidance section of the IIA's Web site for The IIA's position paper, "Role of Internal Auditing's in Enterprise Risk Management."



IRMT

irmT The Institute of Risk Management Tanzania

# MODULE II

# Introduction to Financial Risk Management



IRMT

irmT
The Institute of Risk Management Tanzania

I
R
M
T



irmT
The Institute of Risk
Management Tanzania

# Module II: Introduction to Financial Risk Management

IRMT

**Areas of understanding**

1. Introduction to Risk and Return
2. The efficiency frontier and Capital Asset Pricing Model
3. Arbitrage Pricing Theory
4. Risk Management for financial institutions
5. Credit Rating

# Why Should We Study Financial Risk Management?

- To better understand the nature and volatility of financial markets
- To understand the development of new financial products -- e.g., derivatives and hybrid securities
- To understand how these products can be used to change a firm's risk profile and protect its financial condition

I
R
M
T

# Risk and Return

# At the End of These Presentation You Will Understand

- Introduction
- What is risk?
- An overview of market performance
- Measuring performance
  - Return and risk measures
- Summary and Conclusions



IRMT

irmT The Institute of Risk Management Tanzania

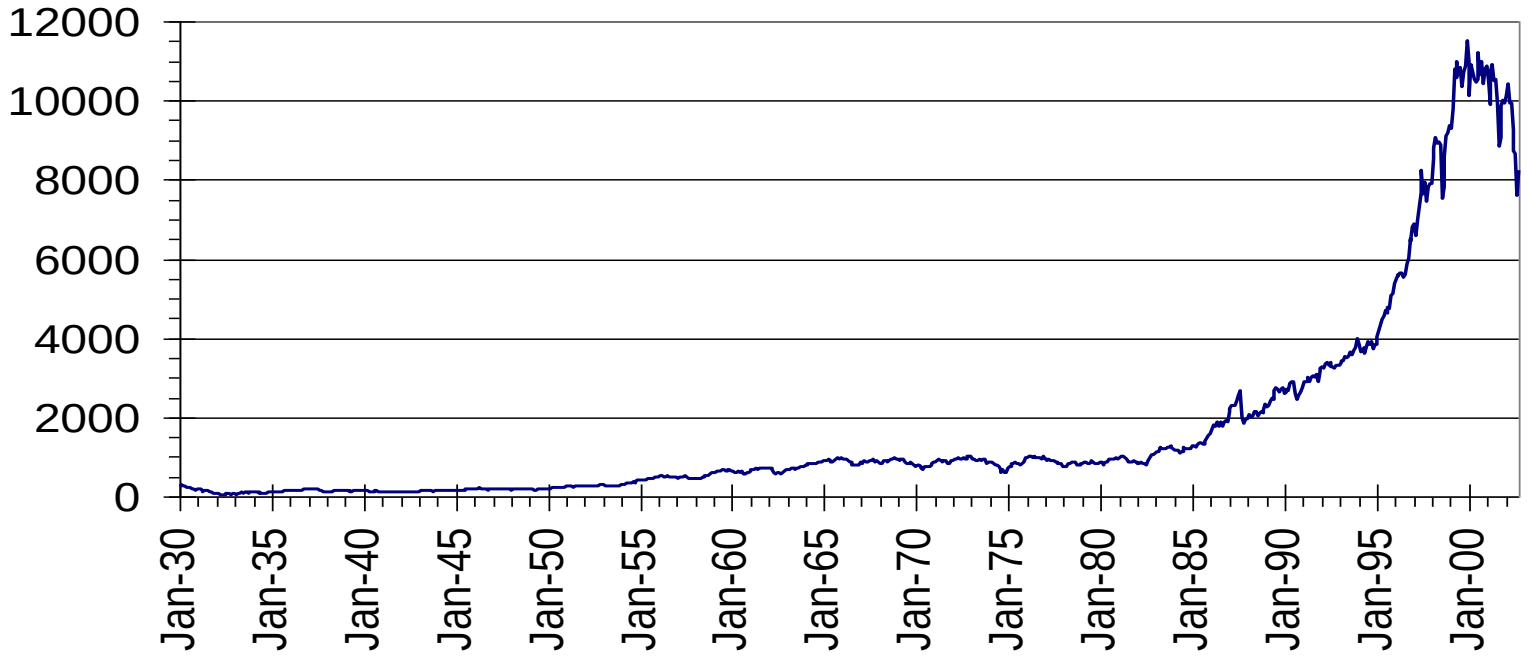
# Introduction

- It is important to understand the relation between risk and return so we can determine appropriate risk-adjusted discount rates for our NPV analysis.
- At least as important, the relation between risk and return is useful for investors (who buy securities), corporations (that sell securities to finance themselves), and for financial intermediaries (that invest, borrow, lend, and price securities on behalf of their clients).

# What is Risk? Can You Recall?

- Definition: risk is the potential for divergence between the actual outcome and what is expected.
- In finance, risk is usually related to whether expected cash flows will materialize, whether security prices will fluctuate unexpectedly, or whether returns will be as expected.

# An Overview of Market Performance – Is There Risk?

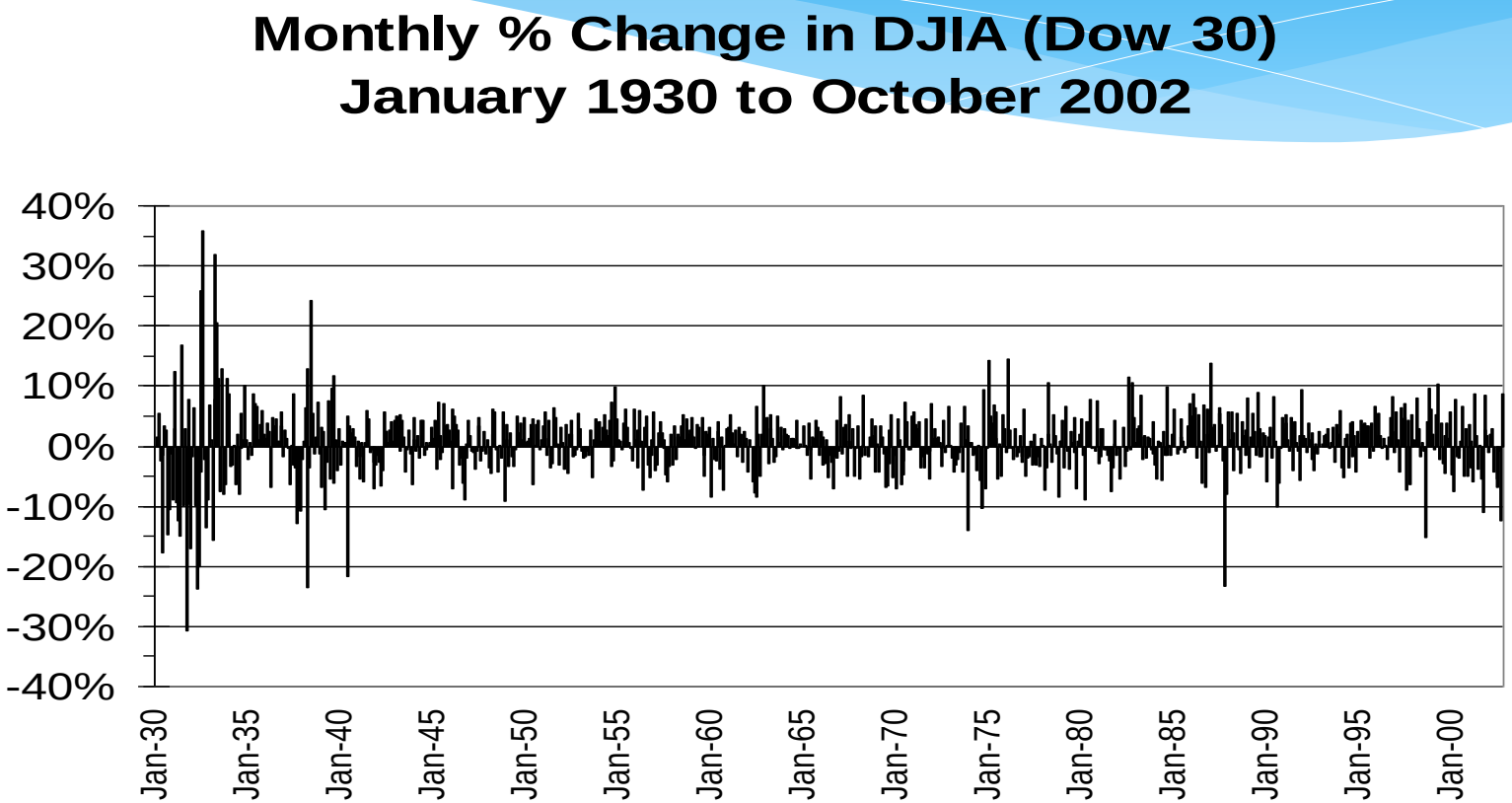





IRMT

irmT The Institute of Risk Management Tanzania

# An Overview of Market Performance – Is There Risk?



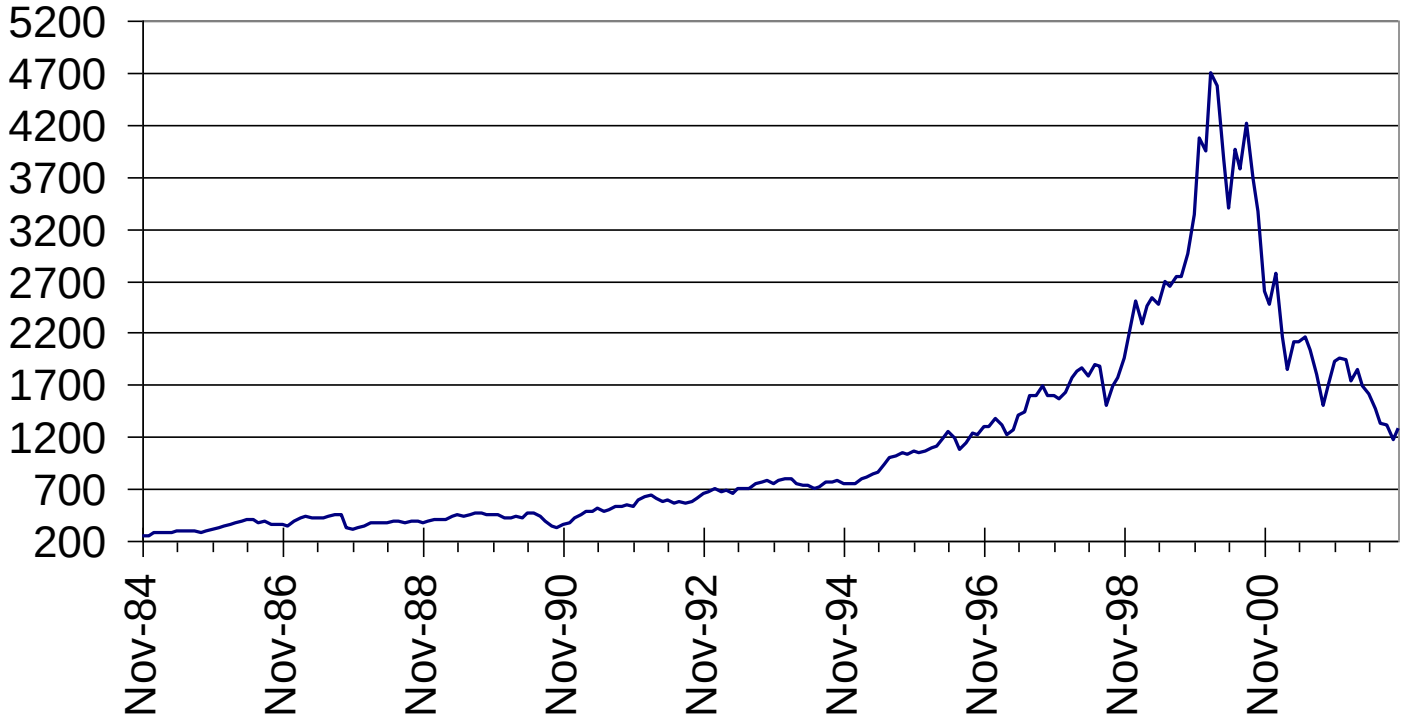



IRMT

irmT
The Institute of Risk Management Tanzania

# An Overview of Market Performance – Is There Risk?

**NASDAQ Composite Index**
**November 1984-October 2002**



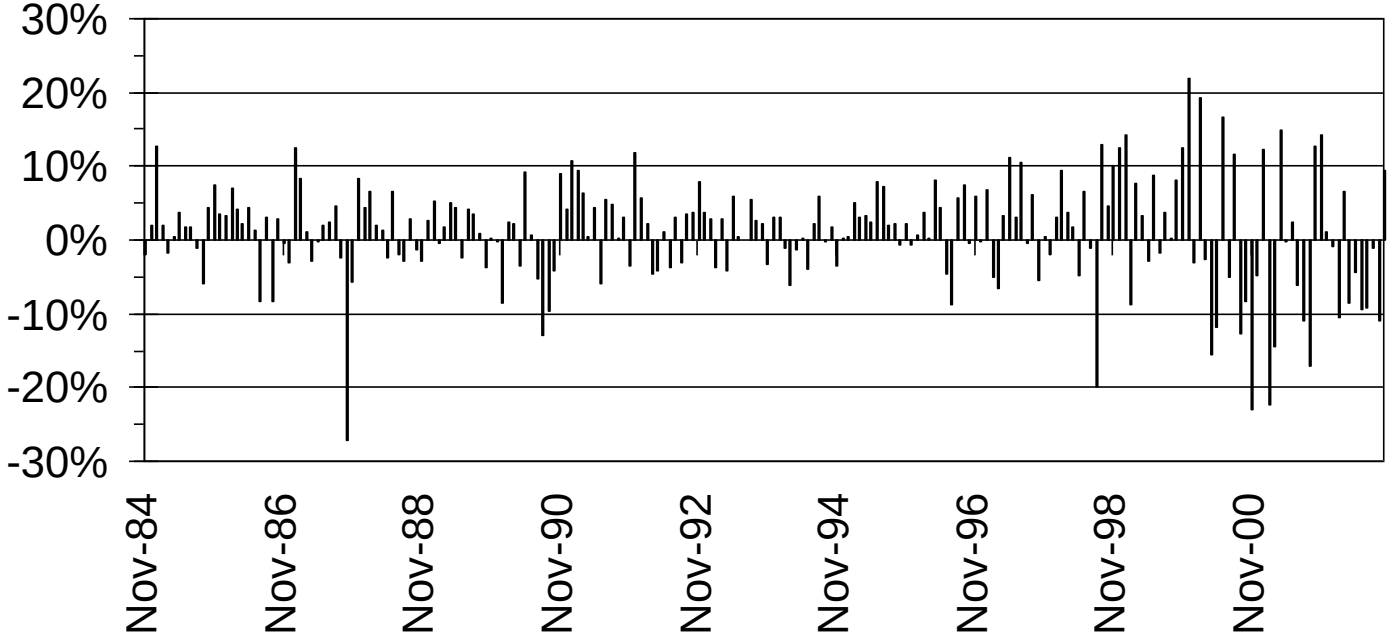



IRMT

irmT
The Institute of Risk Management Tanzania

# An Overview of Market Performance – Is There Risk?

**Monthly % Change in**
**NASDAQ Composite Index**
**October 1984 to October 2002**



# An Overview of Market Performance – Is There Risk?

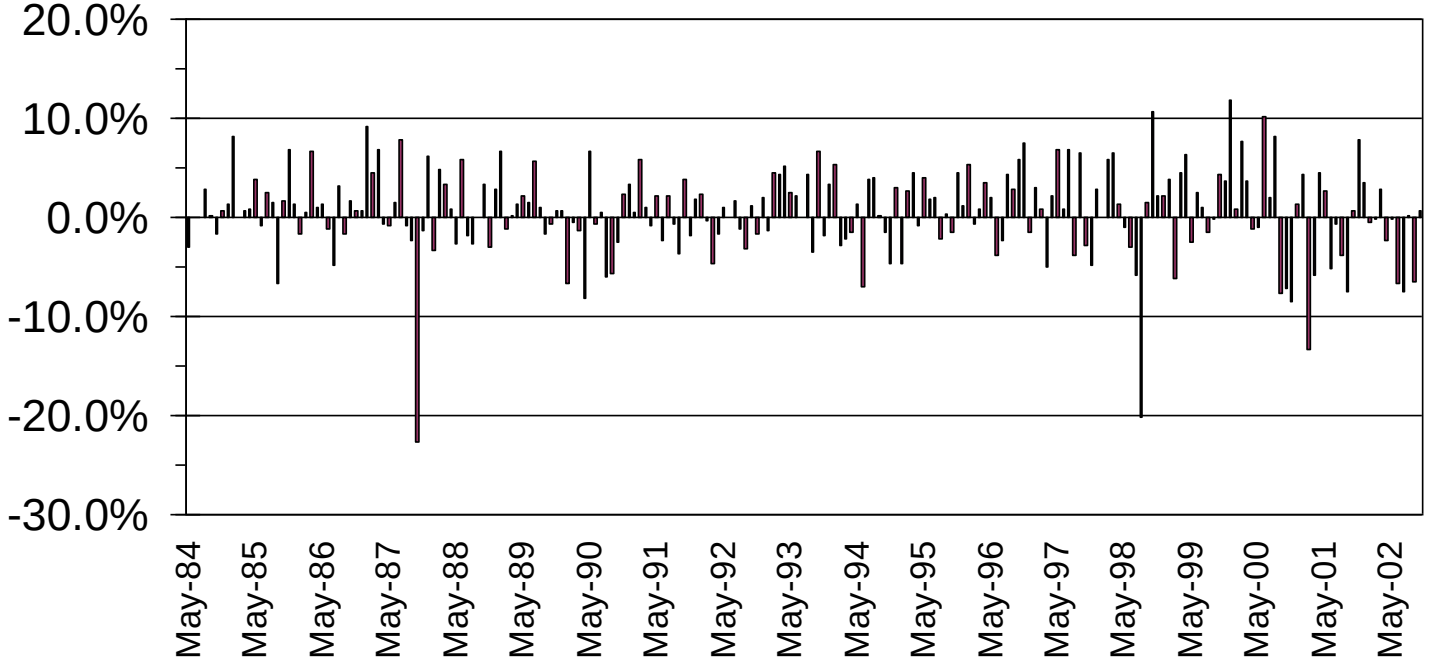
**S&P/TSX Composite Index**
**April 1984 - October 2002**

IRMT

irmT
The Institute of Risk Management Tanzania

# An Overview of Market Performance – Is There Risk?

**Monthly % Changes of**
**S&P/TSX Composite Index**
**April 1984-October 2002**






IRMT

irmT
The Institute of Risk Management Tanzania

# Measuring Performance: Returns

- Dollar return (over one period):

  = Dividends + End of Period Price – Beginning of Period Price

- Percentage return (over one period):

  =Dollar return/Beginning of Period Price

  =(Dividends + End of Period Price)/Beginning of Period Price -1

- Examples: calculate both $ and % returns

1. $P_0$=\$50, $Div_1$=\$2, $P_1$=\$55.50
2. $P_0$=\$20, $Div_1$=\$0.25, $P_1$=\$12.75
3. $P_0$ = \$30, $Div_1$=\$1, Capital Gain=\$5
4. $P_0$ = \$130, $Div_1$=\$0, Capital Loss=\$128

# Holding Period Returns

- Let $R_t$ be the observed return earned in year t, then the holding period return over a T-period time frame is as follows:

$$1+HPR_{1toT}=\prod_{t=1}^{T}(1+R_t)$$

- The average compound rate of return or geometric average rate of return (GAR) just converts the HPR to an equivalent effective annual rate:

$$(1+GAR_{1toT})=(1+HPR_{1toT})^{\frac{1}{T}}=\left(\prod_{t=1}^{T}(1+R_t)\right)^{\frac{1}{T}}$$



IRMT

irmT The Institute of Risk Management Tanzania

# Mean Returns

- The mean return is the arithmetic average rate of return and is calculated as follows:

$$\text{Mean return} = \overline{R} = \frac{\sum_{t=1}^{T} R_t}{T}$$



IRMT

irmT The Institute of Risk Management Tanzania

# The Risk Premium

- Definition: the *risk premium* is the return on a risky security minus the return on a risk-free security (often T-bills are used as the risk-free security)
  - Another name for a security's risk premium is the *excess return* of the risky security.
- The market risk premium is the return on the market (as a whole) minus the risk-free rate of return.
- We may talk about the past observed risk premium, the average risk premium, or the expected risk premium.

# Risk Measures

- Studies of stock returns indicate they are approximately normally distributed. Two statistics describe a normal distribution, the mean and the standard deviation (which is the square root of the variance). The standard deviation shows how spread out is the distribution.
- For stock returns, a more spread out distribution means there is a higher probability of returns being farther away from the mean (or expected return).
- For our estimate of the expected return, we can use the mean of returns from a sample of stock returns.
- For our estimate of the risk, we can use the standard deviation or variance calculated from a sample of stock returns.

# Sample Standard Deviation and Variance

- Sample variance is a measure of the squared deviations from the mean and is calculated as follows:

$$s^2 = Var = \frac{1}{T-1}\sum_{t=1}^{T}\left(R_t - \overline{R}\right)^2$$

*and*

- Sample standard deviation is just the square root of the sample variance:

$$s = SD = \sqrt{Var}$$



IRMT

irmT The Institute of Risk Management Tanzania

# How to Interpret the Standard Deviation as a Measure of Risk

- Given a normal distribution of stock returns …
  - there is about a 68.26% probability that the actual return will be within 1 standard deviation of the mean.
  - there is about a 95.44% probability that the actual return will be within 2 standard deviations of the mean.
  - There is about a 99.74% probability that the actual return will be within 3 standard deviations of the mean.

# Summary and Conclusions

- We can easily calculate $, %, holding period, geometric average, and mean returns from a sample of returns data.
- We can also do the same for a security's risk premium.
- The mean and standard deviation calculated from sample returns data are often used as estimates of expected returns and the risk measure for a security or for the market as a whole.

# Unpredictability

- Interest rates
  - Inflation, cash flows (investing / lending), asset and liability values
  - Late 1970s -- Volcker / FED policy change
- Commodity prices
  - Costs, substitute products
  - Price shocks -- OPEC, Kuwait
- FX rates
  - International cash flows, relative competitiveness
  - Early 1970s -- Breakdown of Bretton Woods

# Financial Risks -- Examples

- Interest rates
  - Savings & Loans
  - Inversion of yield curve around 1980
- Commodity prices
  - Airlines
  - Price of fuel after Iraq invaded Kuwait
- Foreign exchange
  - Airlines
  - Strengthening of US$ relative to pound in 1981

# Financial Risk Management: A Broad Framework

- FRM can take several (familiar and unfamiliar) forms
  - Asset hedges
  - Liability hedges
  - Asset-liability management
  - Contingent financing
  - Post-loss financing and recapitalization

# Why Do Corporations Use Financial Derivatives?

- Transaction hedges
  - FX; debt
  - Currency and interest rate risk
- Strategic (economic) hedges
  - Protect cash flows or company value from movements in financial prices
- Reduce funding costs
  - FX; synthetic debt
- Trading derivatives for profit

# Why Don't Corporations Use More Derivatives?

- Credit risk
- No suitable instrument
- Lack of knowledge
- Accounting / legal issues
- Transaction costs
- Resistance by Board / upper management

# Vocabulary

- ***Financial derivative***: a financial instrument whose value is a function of another ("underlying") financial instrument
- ***Financial engineering***: the creation and use of financial derivatives to aid in the management of risk
- ***Risk profile***: describes the effect of changes in a financial price on the value of a firm

# Forwards

# And

# Futures

# Forward Contracts

- Obligation / agreement to buy/sell in the future
- Contract price is the "exercise price"; no payment until maturity
- Physical delivery or cash-settled
- Buyer (holder) is "long"; seller (writer) is "short
- OTC -- can be tailored
- Two-sided risk

# Futures Contracts

- Obligation; agree to a future transaction
- Traded on organized exchanges
- Standardized
- Daily settlement (marking to market)
  - Reduces default risk: essentially, a series of one-day contracts
- Margins (performance bonds)
  - Initial margin
  - Maintenance margin
  - Margin call
- Exchange clearinghouse

# Exchanges Vs. Otc

**Exchanges**

- Advantages
  - Clearinghouse
  - Liquidity
  - Standardization
- Disadvantages
  - Lack of flexibility
  - Regulation
  - Trading costs
  - Public

**OTC Markets**

- Disadvantages
  - Credit risk
  - Low liquidity
  - Non-standardization
- Advantages
  - Flexible
  - Less regulation
  - Lower regulatory costs
  - Private

# Types of Contracts

- Agricultural commodities
  - Wheat, corn, soybeans
  - Farmer (supplier) can lock in sales price before harvest (short futures)
  - Consumer (user) can lock in purchase price (long futures)
- Other commodities
  - Metals, petroleum
- Financial assets
  - FX, stock market indices, interest rates

# Example

- An agrees to buy from Bill one barrel of oil, five months from now, for $20
  - Ann is in the "long" position
  - Bill is in the "short" position
- If the price of oil is $25 five months from now, who pays to whom, and how much?
- If the price of oil is $12 five months from now, who pays to whom, and how much?

# Options

# Options

- Option to buy or sell the underlying asset
- Right, not obligation
- ***Call*** option: right to ***buy*** the U/L asset
- ***Put*** option: right to ***sell*** the U/L asset
- Buyer = holder = long position (option to exercise)
- Seller = writer = short position

# Parameters of Options

- ***Exercise price*** = ***strike price*** = price at which the holder of the option can exercise the option (and thus buy or sell the underlying asset)
- ***Expiration date***
- ***Premium*** = amount paid for the option
- ***American*** option: can exercise any time up to and including expiration date
- ***European*** option: can exercise only on expiration date

# Examples of Options -- They're *Everywhere*

- Traded options
  - On stocks, indices, FX, interest rates, futures, swaps, options,...
- Convertible bonds
- Call provisions on bonds
- On projects
  - To expand, abandon, postpone
- Insurance

# Example

- Amy sells Bob a January European call option on one share of Compaq stock
- Suppose Compaq stock is trading at 32.5
- Exercise price = 35
- Premium = 3
- In January, suppose: $S_T=30$ $S_T=40$

Total payoff [profit/loss]

| | | |
|---|---|---|
| Amy: | 0 [3] | -5 [-2] |
| Bob: | 0 [-3] | 5 [2] |



IRMT

irmT The Institute of Risk Management Tanzania

# Option Values (Cont.)

- Prior to expiration:

| | Call | Put |
|---|---|---|
| * In-the-money | $S_t > X$ | $S_t < X$ |
| * At-the-money | $S_t = X$ | $S_t = X$ |
| * Out-of-the-money | $S_t < X$ | $S_t > X$ |

- Intrinsic value - profit that could be made if the option was immediately exercised
  * Call: stock price - exercise price
  * Put: exercise price - stock price
- Time value - the difference between the option price and the intrinsic value

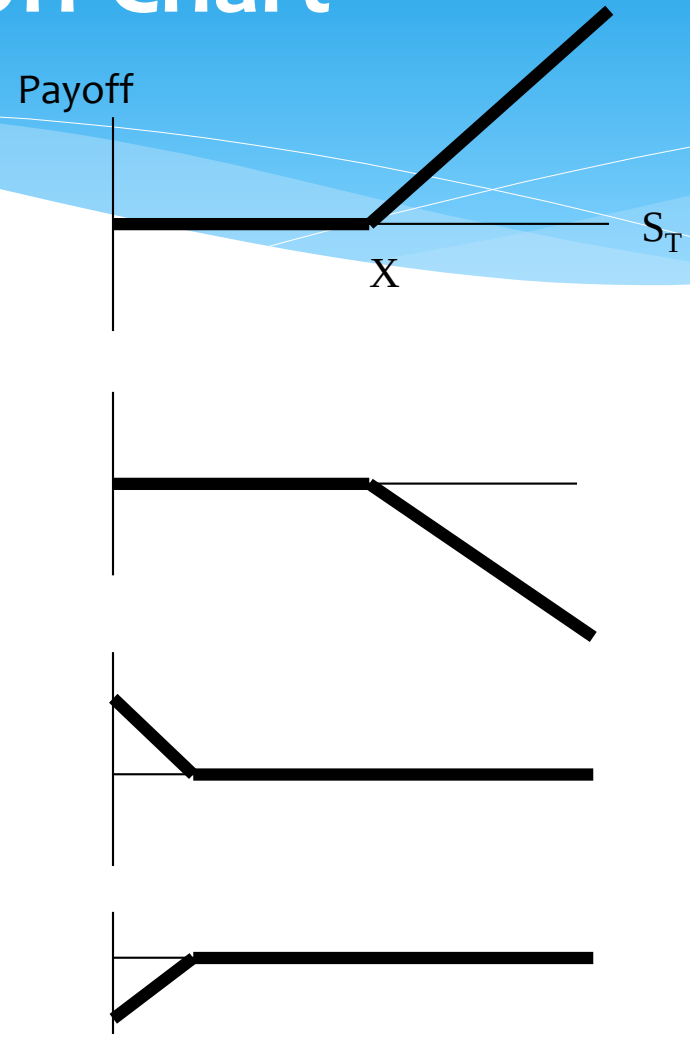


IRMT

irmT The Institute of Risk Management Tanzania

# Option Values: Payoff Chart

* Call -- long position
* Call -- short position
* Put -- long position
* Put -- short position






IRMT
irmT The Institute of Risk Management Tanzania

# Put-call Parity

- Arbitrage implies a certain relationship between put, call, and underlying asset prices
- Two portfolios have, at payoff, identical values:
  - One European call option + cash of PV(X)
  - One European put option + one share of stock
- C + PV(X) = P + S



IRMT

irmT The Institute of Risk Management Tanzania

# Black-scholes Formula

$$V_C = S\,N(d_1) - X\,e^{-rt}\,N(d_2)$$

$$d_1 = [\ln(S/X)+(r+0.5s^2)t] \,/\, st^{0.5}$$

$$d_2 = d_1 - st^{0.5}$$



IRMT

irmT The Institute of Risk Management Tanzania

# Purposes of Derivatives

- Speculative
  - Highly risky
  - Highly leveraged
  - Very volatile
- Hedging
  - Combine with other securities
  - Hedge (minimize) risk from other securities

# Hedging

- "Hedge": Take a position that offsets a risk
- Risk: Uncertainty regarding the value of the underlying asset
- By hedging, one changes the risk inherent in owning the underlying asset
- The return distribution of the underlying asset is *not* changed

# Using Options to Hedge

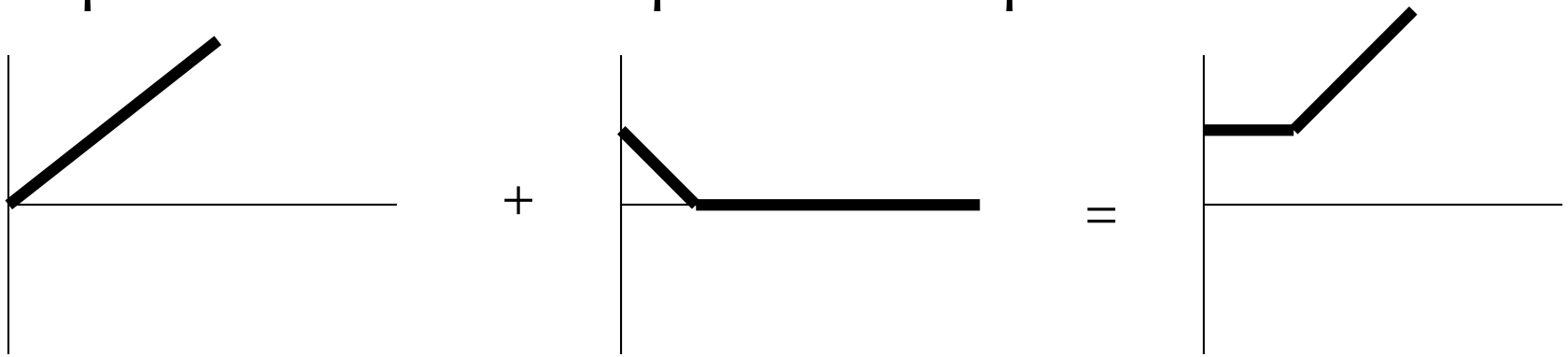
- Combine the underlying asset with an option or options
- Can reduce or eliminate downside risk while retaining upside potential
- Can protect against falls in held asset values, or against increases in input prices

# Option Strategies

- Protective put
  - Own stock (long position)
  - Own put (long position)
- Covered call
  - Own stock (long position)
  - Sell call (short position)
- Straddle
- Spread

# Protective Put

- Investor owns asset
- Investor also buys (holds) a put on the asset
- Guarantees investment portfolio proceeds at least equal to the exercise price of the put






IRMT

irmT The Institute of Risk Management Tanzania

# Protective Put Example

- Suppose you own a share of stock, and you purchase a put option with an exercise price of 22.5 on that stock, for a premium of $ 0.75

| | | | | |
|---|---|---|---|---|
| $S_T$ : | 30 | 25 | 20 | 15 |
| Premium: | -0.75 | -0.75 | -0.75 | -0.75 |
| Put Payoff: | 0 | 0 | 2.50 | 7.50 |
| | === | === | === | === |
| Overall: | 29.25 | 24.25 | 21.75 | 21.75 |

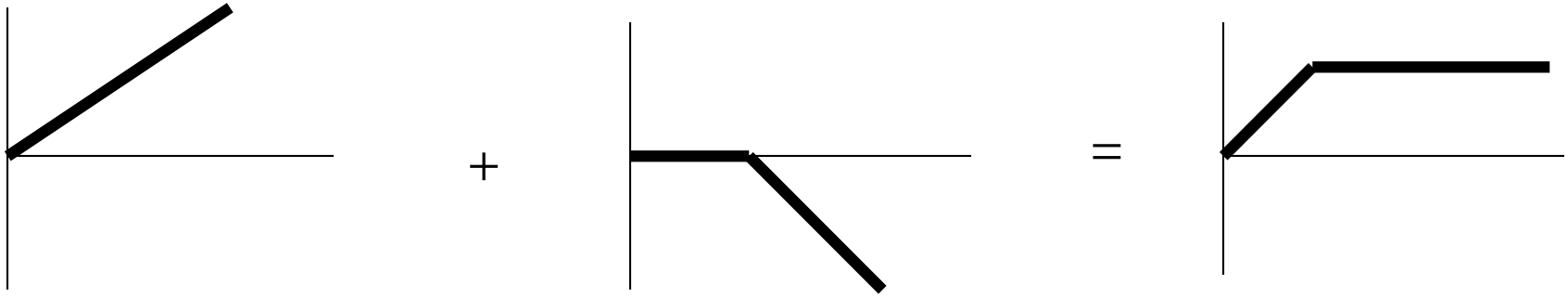


IRMT

irmT The Institute of Risk Management Tanzania

# Covered Call

- Investor purchases stock
- Investor also sells (writes) a call option on the stock
- Option position is "covered" by owning the underlying stock itself
- (vs. "naked option")
- Provides additional (premium) income






IRMT

irmT
The Institute of Risk Management Tanzania

# Covered Call Example

- Suppose you own a share of stock, and you write a call option with an exercise price of 35 on that stock, for a premium of $ 2.00

| | | | | |
|---|---|---|---|---|
| $S_T$ : | 30 | 35 | 40 | 45 |
| Premium: | 2 | 2 | 2 | 2 |
| Call Payoff: | 0 | 0 | -5 | -10 |
| | === | === | === | === |
| Overall: | 32 | 37 | 37 | 37 |

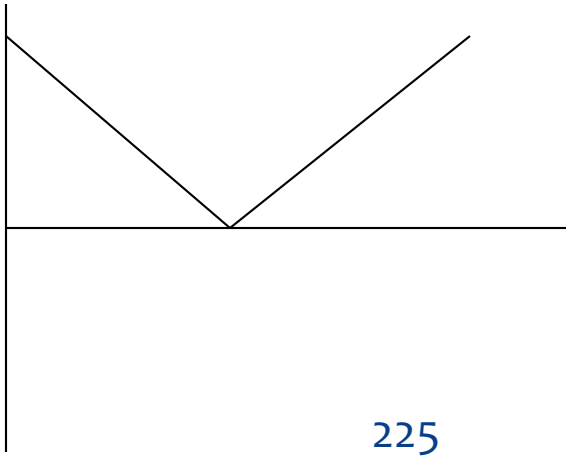


IRMT

irmT The Institute of Risk Management Tanzania

# Straddle

- (Long) Straddle: buy both a call and a put on a stock
- Each option has the same exercise price and expiration date
- Believe stock will be relatively volatile
- Worst-case: no movement in stock price



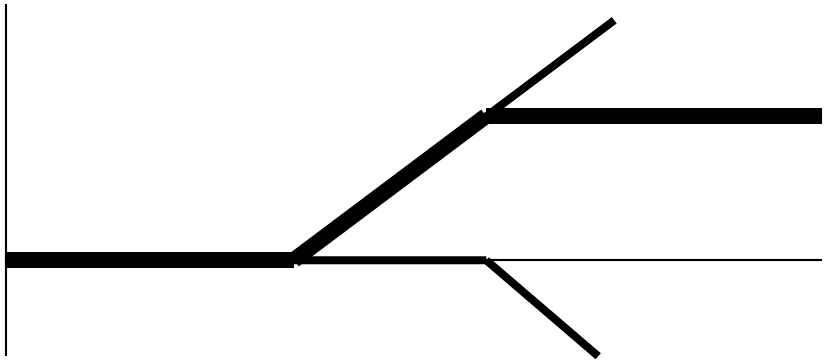


IRMT

irmT The Institute of Risk Management Tanzania

# Spread

- Combination of options
  - Two or more calls, or
  - Two or more puts
- Vertical spread: simultaneous sale and purchase of options with different exercise prices
- Horizontal spread: sale and purchase of options with different expiration dates





IRMT

irmT The Institute of Risk Management Tanzania

# Interest Rate Options

- ***Cap***: a call option on an interest rate
- ***Floor***: a put option on an interest rate
- ***Collar***: simultaneously buying a cap and selling a floor

- These options can be used to hedge rate-sensitive debt and assets

# Interest Rate Options: Terminology

- ***Underlying index***: interest rate being hedged or speculated upon; e.g., LIBOR, prime rate
- ***Strike rate***: determines cash flows (similar to exercise price)
- ***Settlement frequency***: how often the strike rate and underlying index are compared
- ***Notional amount***: principal to which the interest rate is applied
- ***Up-front premium***: paid by purchaser to seller for the option

# Interest Rate Caps

- At each settlement date, check whether index rate is greater than strike rate
- If not, cap purchaser does not receive cash flows
- If so, purchaser receives from seller:

[ (index rate - strike rate) x
(days in settlement period / 360) x
notional amount ]



IRMT

irmT The Institute of Risk Management Tanzania

# Interest Rate Caps: Example

- $20,000,000 two-year quarterly interest rate cap on 3-month LIBOR with a strike rate of 8%
- Cost: 150 basis points

- Up-front premium = 0.015 x $20M = $300,000
- If 3-month LIBOR = 9%, seller pays

$$(.09-.08) \times 90/360 \times \$20M$$

$$= \$50,000 \text{ (for that quarter)}$$

# Interest Rate Floors

- At each settlement date, check whether index rate is greater than strike rate
- If so, floor purchaser does not receive cash flows
- If not, purchaser receives from seller:

[ (strike rate - index rate) x
(days in settlement period / 360) x
notional amount ]

# Interest Rate Collars

- Purchase a cap to hedge floating-rate liabilities
- Sell a floor at a lower strike rate
- Sale of floor helps finance purchase of cap

- Net result: Interest expense will be limited on both ends -- will float between the cap and floor strike rates
- Can achieve zero-premium collar

# SWAPS

# SWAPS

- Agreement between two parties
  - "Counterparties"
  - Exchange sets of future cash flows
- Two major types
  - Interest rate swaps
  - Currency swaps
- Relatively new FRM tool

# Swaps Vs. Futures

- Futures
  - Standardized
  - Exchange-traded
  - Short horizons
- Swaps
  - Custom tailored between counterparties
  - Little regulation; potential for privacy
  - Term flexibility

# Interest Rate Swaps

- One party pays a fixed interest rate and receives a floating rate
- The other party pays a floating rate and receives a fixed rate
- Floating rates involve greater exposure to interest rate risk
- "Notional principal" is amount on which the interest payments are determined

# Interest Rate Swaps (Cont.)

- Principal is not actually exchanged -- only interest payments
- Generally, only net interest payments are transacted
  - Avoids unnecessary transactions
  - Helps credit risk
- At each "settlement date," a net payment is made, based on the difference between the two interest rates (applied to the notional principal)

# Currency Swaps

- One party holds one currency, and desires a different currency
- Three sets of cash flows:
  - Exchange principal at inception of swap
  - Periodic interest payments
  - Exchange principal at termination of swap
- Interest rates fixed ==> only change in value is from FX change
- Generally, only make net payments

# Limitations of Swaps

- Counterparties must find each other
  - Meet specific needs
  - Cost, time; facilitators
- Lack of "liquidity"; difficult to unwrap/trade / change without consent of other party
- Credit risk of counterparty

# Development of Swap Market

- Originally:
  - Unique contracts
  - Had to search for counterparty
  - Investment banks were dominant intermediaries
- More recently:
  - More standardized and liquid
  - Intermediaries accept contract, then lay off risk
  - More highly capitalized firms -- e.g., commercial banks

I
R
M
T



irmT
The Institute of Risk
Management Tanzania

# Capital Asset Pricing and Arbitrage Pricing Theory



IRMT

irmT
The Institute of Risk Management Tanzania

# The Capital Asset Pricing Model

- Capital Asset Pricing Model (CAPM)
  - Security's required rate of return relates to systematic risk measured by beta

$$E(r_M) - r_f = \overline{A}o_M^2$$

- Market Portfolio (M)
  - Each security held in proportion to market value



IRMT

irmT The Institute of Risk Management Tanzania

# The Capital Asset Pricing Model

Assumptions

Markets are competitive, equally profitable

- No investor is wealthy enough to individually affect prices
- All information publicly available; all securities public
- No taxes on returns, no transaction costs
- Unlimited borrowing/lending at risk-free rate

Investors are alike except for initial wealth, risk aversion

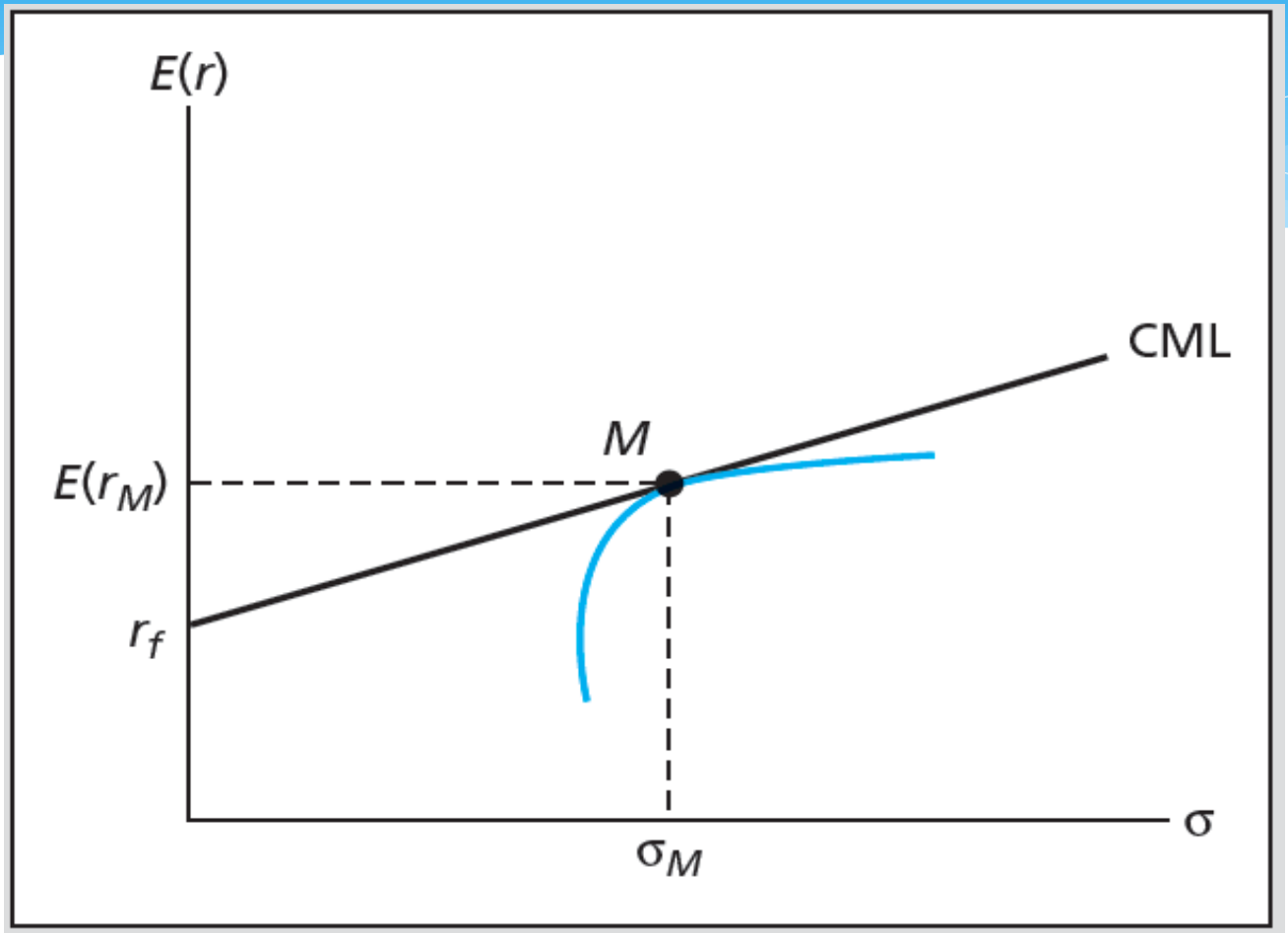
- Investors plan for single-period horizon; they are rational, mean-variance optimizers
  - Use same inputs, consider identical portfolio opportunity sets

# The Capital Asset Pricing Model

- Hypothetical Equilibrium
  * All investors choose to hold market portfolio
  * Market portfolio is on efficient frontier, optimal risky portfolio

- Hypothetical Equilibrium
  * Risk premium on market portfolio is proportional to variance of market portfolio and investor's risk aversion
  * Risk premium on individual assets
    - Proportional to risk premium on market portfolio
    - Proportional to beta coefficient of security on market portfolio

# Efficient Frontier and Capital Market Line






IRMT

irmT
The Institute of Risk Management Tanzania

# The Capital Asset Pricing Model

## Passive Strategy is Efficient

- Mutual fund theorem: All investors desire same portfolio of risky assets, can be satisfied by single mutual fund composed of that portfolio
- If passive strategy is costless and efficient, why follow active strategy?
  - If no one does security analysis, what brings about efficiency of market portfolio?

# The Capital Asset Pricing Model

- Risk Premium of Market Portfolio
  - Demand drives prices, lowers expected rate of return/risk premiums
  - When premiums fall, investors move funds into risk-free asset
  - Equilibrium risk premium of market portfolio proportional to
    - Risk of market
    - Risk aversion of average investor

# The Capital Asset Pricing Model

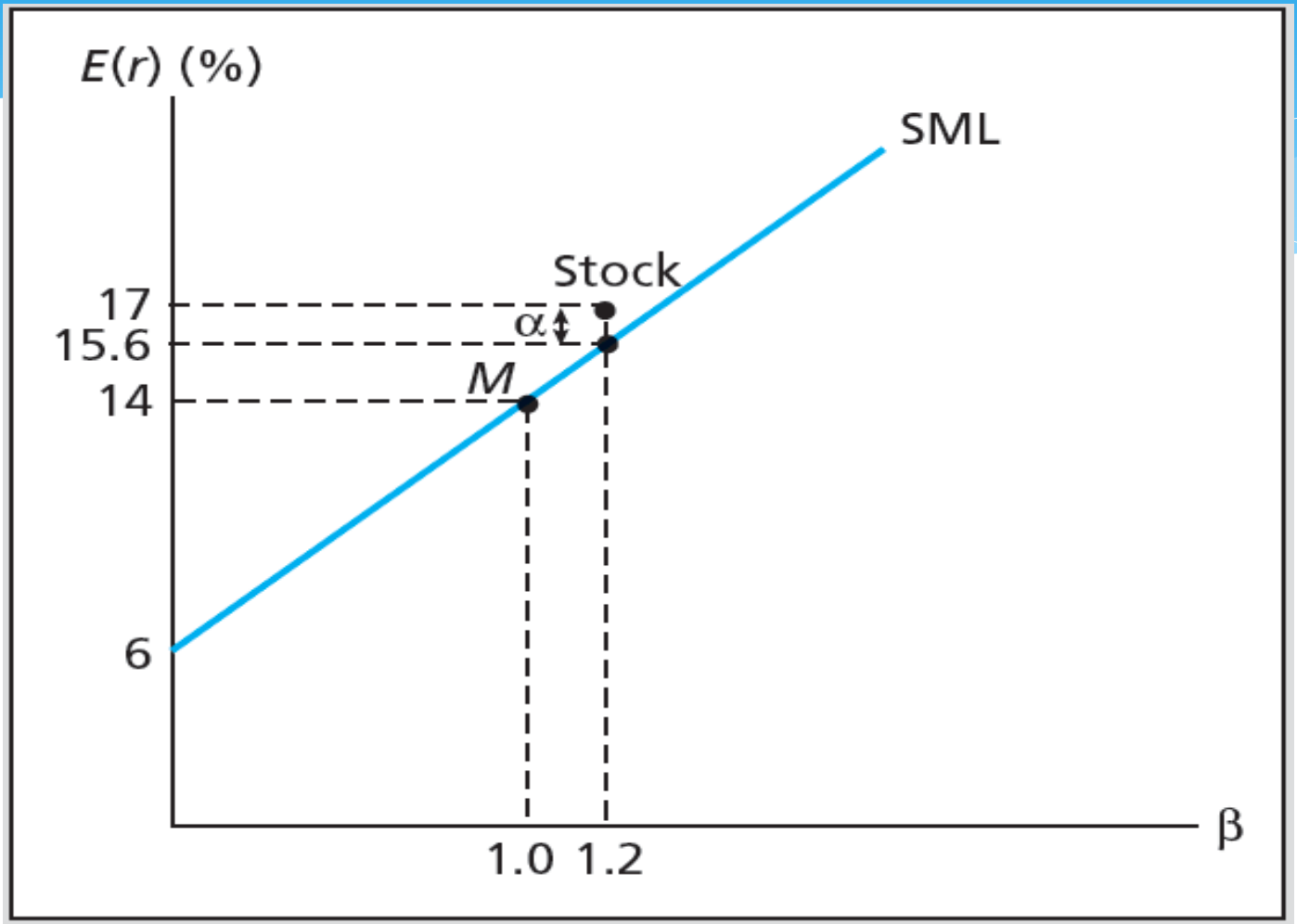
- Expected Returns on Individual Securities
  - Expected return-beta relationship
    - Implication of CAPM that security risk premiums (expected excess returns) will be proportional to beta

$$E(r_D) = r_f + \beta_D[E(r_M) - r_f]$$

# The Capital Asset Pricing Model

- The Security Market Line (SML)
  - Represents expected return-beta relationship of CAPM
  - Graphs individual asset risk premiums as function of asset risk
- Alpha
  - Abnormal rate of return on security in excess of that predicted by equilibrium model (CAPM)

# The SML and a Positive-Alpha Stock







IRMT

irmT
The Institute of Risk Management Tanzania

# The Capital Asset Pricing Model

- Applications of CAPM
  - Use SML as benchmark for fair return on risky asset
  - SML provides "hurdle rate" for internal projects

# CAPM and Index Models

- Index Model, Realized Returns, Mean-Beta Equation
  - $r_{it} - r_{ft} = \alpha_i + \beta_i(r_{Mt} - r_{ft}) + e_{it}$
    - $r_{it}$: HPR
      - $i$: Asset
      - $t$: Period
    - $\alpha_i$: Intercept of security characteristic line
    - $\beta_i$: Slope of security characteristic line
    - $r_M$: Index return
    - $e_{it}$: Firm-specific effects
  - $E(r_{it}) - r_{ft} = \alpha_i + \beta_i[E(r_{Mt}) - r_{ft}]$



IRMT

irmT The Institute of Risk Management Tanzania

# CAPM and Index Models

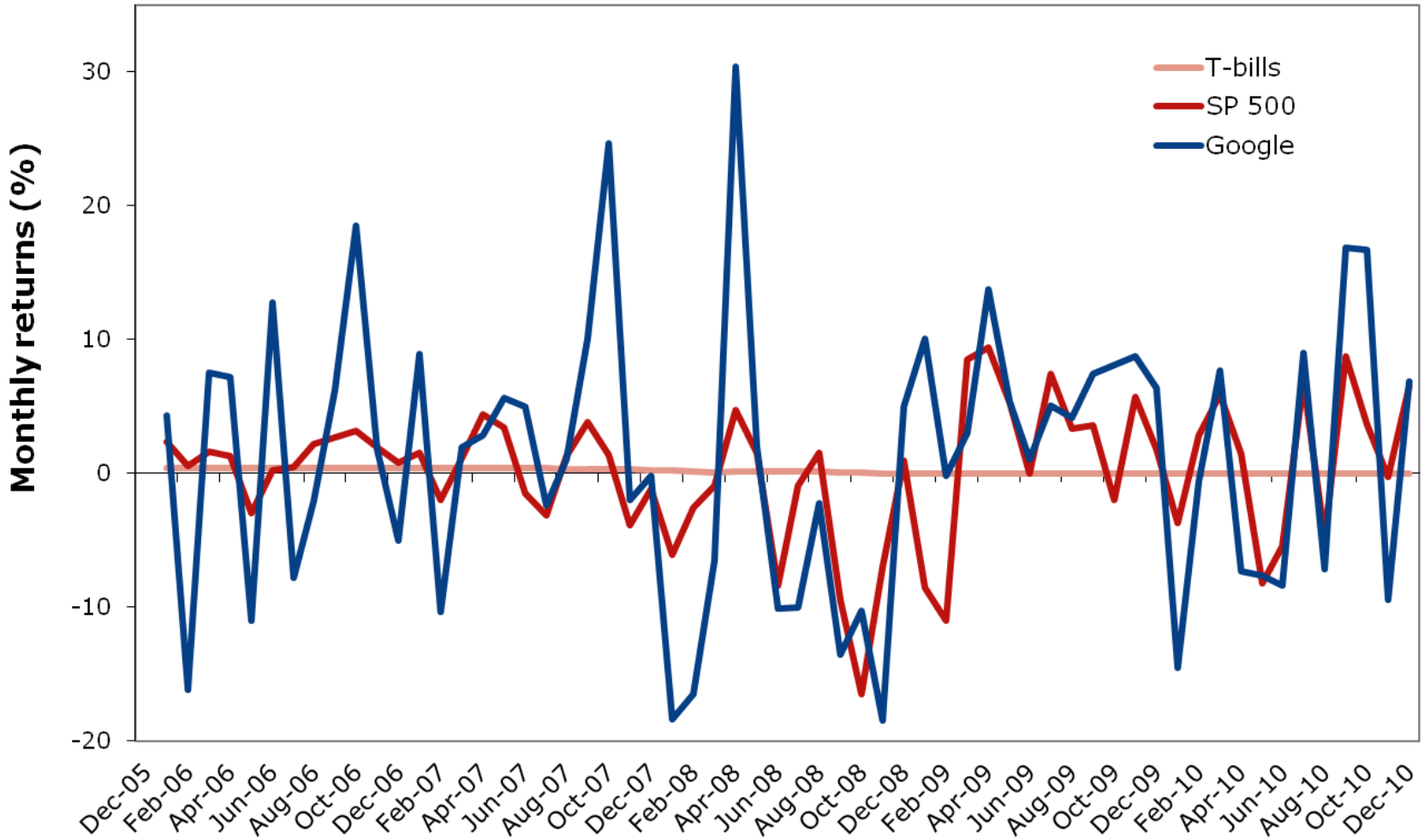
- Estimating Index Model
  - $R_{Gt} = \alpha_G + \beta_G R_{Mt} + e_{Gt}$
    - $R_G = r_G - r_f$, excess return
    - Residual = Actual return – Predicted return for Google
    - $e_{Gt} = R_{Gt} - (\alpha_G + \beta_G R_{Mt})$

# Monthly Return Statistics 01/06 - 12/10

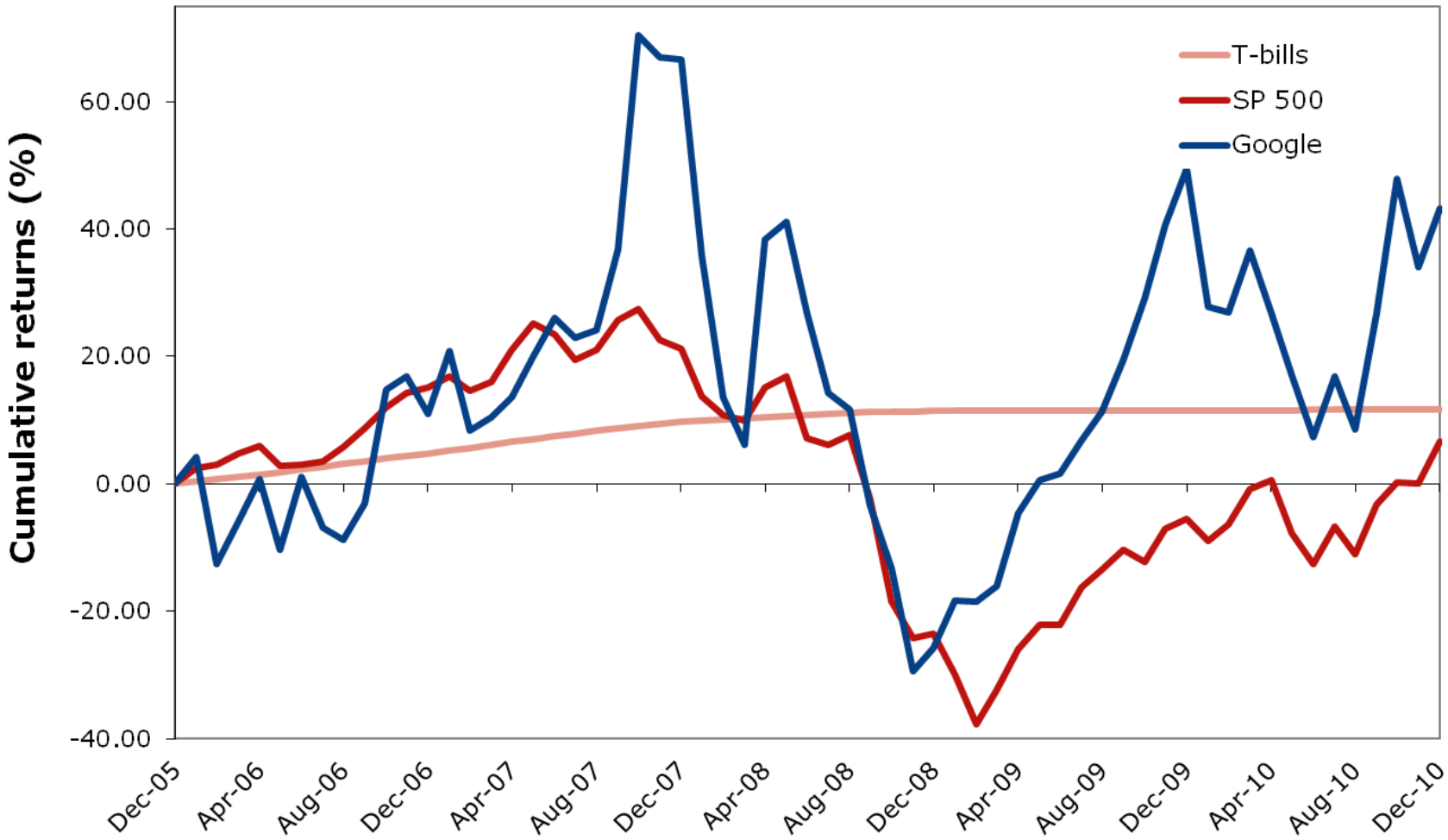
| Statistic (%) | T-Bills | S&P 500 | Google |
|---|---|---|---|
| Average rate of return | 0.184 | 0.239 | 1.125 |
| Average excess return | - | 0.055 | 0.941 |
| Standard deviation* | 0.177 | 5.11 | 10.40 |
| Geometric average | 0.180 | 0.107 | 0.600 |
| Cumulative total 5-year return | 11.65 | 6.60 | 43.17 |
| Gain Jan 2006-Oct 2007 | 9.04 | 27.45 | 70.42 |
| Gain Nov 2007-May 2009 | 2.29 | -38.87 | -40.99 |
| Gain June 2009-Dec 2010 | 0.10 | 36.83 | 42.36 |

* The rate on T-bills is known in advance, SD does not reflect risk.

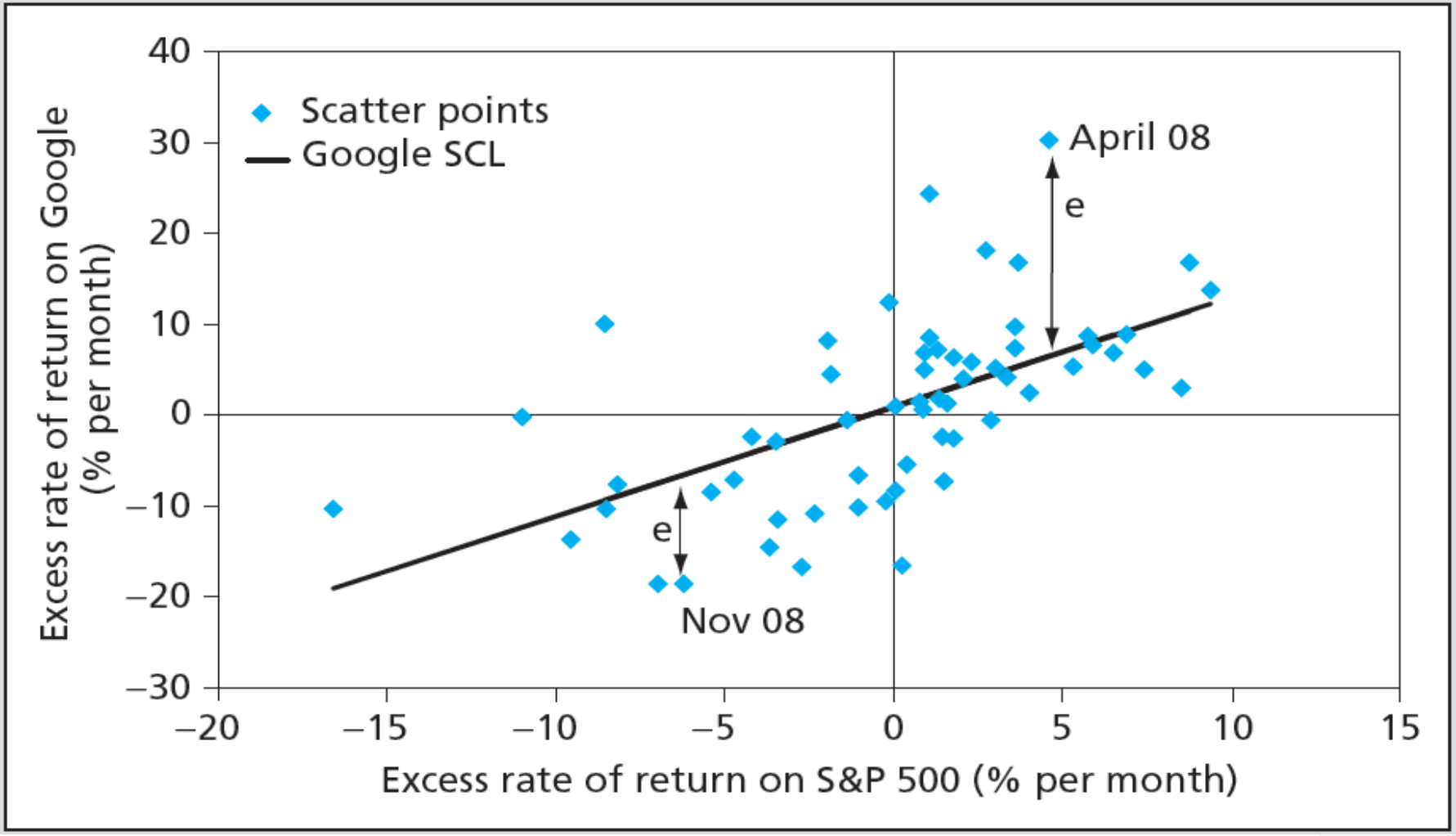
# Monthly Returns



# Monthly Cumulative Returns



# Scatter Diagram/SCL: Google vs. S&P 500, 01/06-12/10







IRMT

irmT The Institute of Risk Management Tanzania

# SCL for Google (S&P 500), 01/06-12/10

| Linear Regression | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Regression Statistics** | | | | | | | |
| *R* | 0.5914 | | | | | | |
| *R-square* | 0.3497 | | | | | | |
| *Adjusted R-square* | 0.3385 | | | | | | |
| *SE of regression* | 8.4585 | | | | | | |
| *Total number of observations* | 60 | | | | | | |
| **Regression equation: Google (excess return) = 0.8751 + 1.2031 × S&P 500 (excess return)** | | | | | | | |
| **ANOVA** | | | | | | | |
| | ***df*** | ***SS*** | ***MS*** | ***F*** | ***p*-level** | | |
| *Regression* | 1 | 2231.50 | 2231.50 | 31.19 | 0.0000 | | |
| *Residual* | 58 | 4149.65 | 71.55 | | | | |
| *Total* | 59 | 6381.15 | | | | | |
| | | | | | | | |
| | **Coefficients** | **Standard Error** | ***t*-Statistic** | ***p*-value** | **LCL** | **UCL** | |
| **Intercept** | 0.8751 | 1.0920 | 0.8013 | 0.4262 | -1.7375 | 3.4877 | |
| **S&P 500** | 1.2031 | 0.2154 | 5.5848 | 0.0000 | 0.6877 | 1.7185 | |
| *t-Statistic (2%)* | 2.3924 | | | | | | |
| *LCL - Lower confidence interval (95%)* | | | | | | | |
| *UCL - Upper confidence interval (95%)* | | | | | | | |

# CAPM and Index Models

- Estimation results
  - Security Characteristic Line (SCL)
    - Plot of security's expected excess return over risk-free rate as function of excess return on market
  - Required rate = Risk-free rate + β x Expected excess return of index

$$t = \frac{\text{estimated value} - \text{hypothesis value}}{\text{standard error of estimate}}$$



IRMT

irmT The Institute of Risk Management Tanzania

# CAPM and Index Models

- Predicting Betas
  - Mean reversion
    - Betas move towards mean over time
    - To predict future betas, adjust estimates from historical data to account for regression towards 1.0

# CAPM and the Real World

CAPM is false based on validity of its assumptions

* Useful predictor of expected returns
* Untestable as a theory
* Principles still valid
  * Investors should diversify
  * Systematic risk is the risk that matters
  * Well-diversified risky portfolio can be suitable for wide range of investors

# Multifactor Models and CAPM

- Multifactor models
  - Models of security returns that respond to several systematic factors
  - Two-index portfolio in realized returns
    - $R_{it} = \alpha_i + \beta_{iM} R_{Mt} + \beta_{iTB} R_{TBt} + e_{it}$
  - Two-factor SML
    - $E(r_i) = r_f + \beta_{iM}\left[E(r_M) - r_f\right] + \beta_{iTB}\left[E(r_{TB}) - r_f\right]$

# Multifactor Models and CAPM

- Fama-French Three-Factor Model
  - $r_G - r_f = \alpha_G + \beta_M(r_M - r_f) + \beta_{HML} r_{HML} + \beta_{SMB} r_{SMB} + e_G$
  - Estimation results
    - Three aspects of successful specification
      - Higher adjusted R-square
      - Lower residual SD
      - Smaller value of alpha

# Monthly Rates of Return, 01/06-12/10

| | Monthly Excess Return % * | | Total Return | |
|---|---|---|---|---|
| Security | Average | Standard Deviation | Geometric Average | Cumulative Return |
| T-bill | 0 | 0 | 0.18 | 11.65 |
| Market index ** | 0.26 | 5.44 | 0.30 | 19.51 |
| SMB | 0.34 | 2.46 | 0.31 | 20.70 |
| HML | 0.01 | 2.97 | -0.03 | -2.06 |
| Google | 0.94 | 10.40 | 0.60 | 43.17 |
| *Total return for SMB and HML | | | | |
| ** Includes all NYSE, NASDAQ, and AMEX stocks. | | | | |

# Regression Statistics: Alternative Specifications

| Regression statistics for: | 1.A Single index with S&P 500 as market proxy | | |
|---|---|---|---|
| | 1.B Single index with broad market index (NYSE+NASDAQ+AMEX) | | |
| | 2. Fama French three-factor model (Broad Market+SMB+HML) | | |
| Monthly returns January 2006 - December 2010 | | | |
| | Single Index Specification | | FF 3-Factor Specification |
| Estimate | S&P 500 | Broad Market Index | with Broad Market Index |
| Correlation coefficient | 0.59 | 0.61 | 0.70 |
| Adjusted R-Square | 0.34 | 0.36 | 0.47 |
| Residual SD = Regression SE (%) | 8.46 | 8.33 | 7.61 |
| Alpha = Intercept (%) | 0.88 (1.09) | 0.64 (1.08) | 0.62 (0.99) |
| Market beta | 1.20 (0.21) | 1.16 (0.20) | 1.51 (0.21) |
| SMB (size) beta | - | - | -0.20 (0.44) |
| HML (book to market) beta | - | - | -1.33 (0.37) |
| Standard errors in parenthesis | | | |

# Arbitrage Pricing Theory

Arbitrage

* Relative mispricing creates riskless profit

Arbitrage Pricing Theory (APT)

* Risk-return relationships from no-arbitrage considerations in large capital markets

Well-diversified portfolio

* Nonsystematic risk is negligible
* Arbitrage portfolio
* Positive return, zero-net-investment, risk-free portfolio

# Arbitrage Pricing Theory

Calculating APT

* $$r_P = r_f + \beta_P (r_M - r_f) + e_P$$

Returns on well-diversified portfolio

* $$E(r_P) = r_f + \beta_P [E(r_M) - r_f]$$



IRMT

irmT The Institute of Risk Management Tanzania

# Portfolio Conversion

Steps to convert a well-diversified portfolio into an arbitrage portfolio

| Portfolio Weight* | In Asset | Contribution to Excess Return |
|---|---|---|
| $w_P = 1$ | Portfolio $P$ | $w_P(\alpha_P + \beta_P R_M + e_P) = \alpha_P + \beta_P R_M + e_P$ |
| $w_M = -\beta_P$ | Benchmark | $w_M R_M = -\beta_P R_M$ |
| $w_f = \beta_P - 1$ | Risk-free asset | $w_f \cdot 0 = 0$ |
| $\sum w = 0$ | Portfolio $A$ | $\alpha_P + e_P$ |

When alpha is negative, you would reverse the signs of each portfolio weight to achieve a portfolio $A$ with positive alpha and no net investment.

# Largest Capitalization Stocks in S & P 500

| Stock | Weight | Stock | Weight |
|---|---|---|---|
| ExxonMobil | 3.26 | IBM | 1.73 |
| Microsoft | 2.37 | AT&T | 1.67 |
| Apple | 1.91 | JP Morgan Chase | 1.65 |
| Johnson & Johnson | 1.79 | GE | 1.62 |
| Proctor & Gamble | 1.78 | Chevron | 1.56 |
| Total for 10 largest firms: | | | 19.34 |

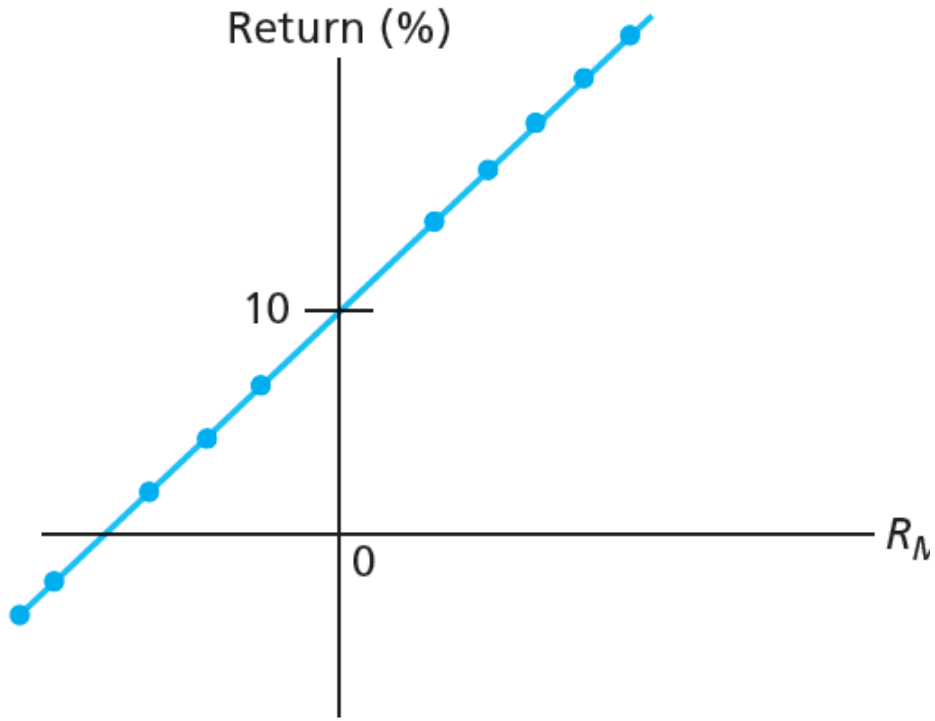
# Regression Statistics of S&P 500 Portfolio on Benchmark Portfolio, 01/06-12/10

| Linear Regression | | | | |
|---|---|---|---|---|
| **Regression Statistics** | | | | |
| *R* | 0.9933 | | | |
| *R*-square | 0.9866 | | | |
| Adjusted *R*-square | 0.9864 | | **Annualized** | |
| Regression SE | 0.5968 | | 2.067 | |
| Total number of observations | 60 | | | |
| **S&P 500 = - 0.1909 + 0.9337 × Benchmark** | | | | |
| | Coefficients | Standard Error | *t*-stat | *p*-level |
| **Intercept** | -0.1909 | 0.0771 | -2.4752 | 0.0163 |
| **Benchmark** | 0.9337 | 0.0143 | 65.3434 | 0.0000 |

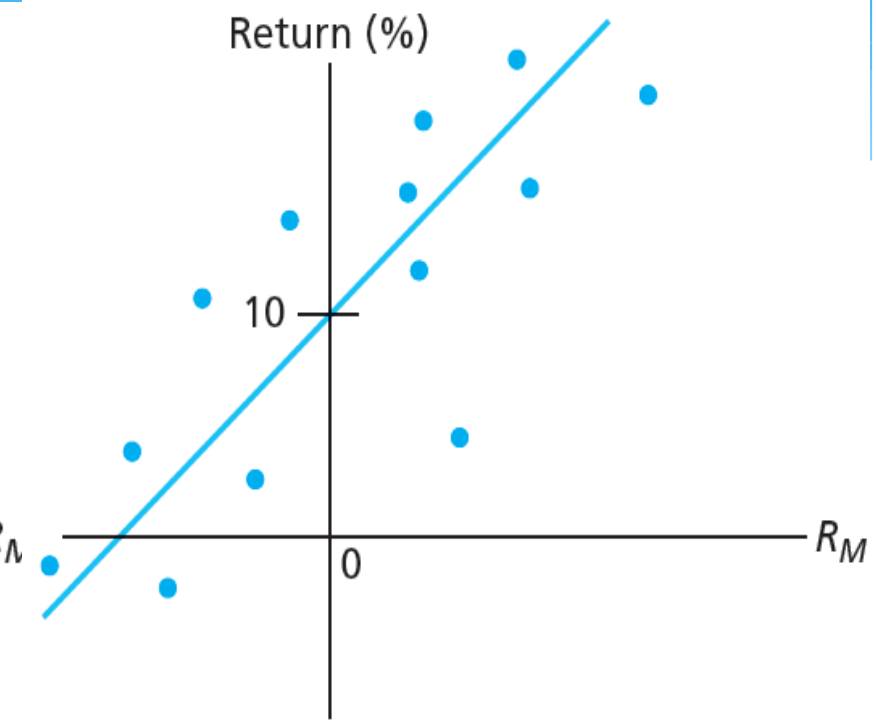
# Annual Standard Deviation

| Period | Real Rate | Inflation Rate | Nominal Rate |
|---|---|---|---|
| 1/1 /06 - 12/31/10 | 1.46 | 1.46 | 0.61 |
| 1/1/96 - 12/31/00 | 0.57 | 0.54 | 0.17 |
| 1/1/86 - 12/31/90 | 0.86 | 0.83 | 0.37 |

# Security Characteristic Lines




A: Well-diversified portfolio




B: Single stock

# Arbitrage Pricing Theory

- Multifactor Generalization of APT and CAPM
  - Factor portfolio
    - Well-diversified portfolio constructed to have beta of 1.0 on one factor and beta of zero on any other factor
  - Two-Factor Model for APT

$$R_i = \alpha_i + \beta_{i1} R_{M1} + \beta_{i2} R_{M2} + e_i$$



IRMT

irmT The Institute of Risk Management Tanzania

# Constructing an Arbitrage Portfolio

Constructing an arbitrage portfolio with two systemic factors

The picture can't be displayed.



IRMT

irmT The Institute of Risk Management Tanzania

# Selected Problems

# Problem 1

Karen Kay, a portfolio manager at Collins Asset Management, is using the capital asset pricing model for making recommendations to her clients. Her research department has developed the information shown in the following exhibit.

**Forecasted Returns, Standard Deviations, and Betas**

| | Forecasted Return | Standard Deviation | Beta |
|---|---|---|---|
| Stock X | 14.0% | 36% | 0.8 |
| Stock Y | 17.0 | 25 | 1.5 |
| Market index | 14.0 | 15 | 1.0 |
| Risk-free rate | 5.0 | | |

*a.* Calculate expected return and alpha for each stock.

*b.* Identify and justify which stock would be more appropriate for an investor who wants to

i. Add this stock to a well-diversified equity portfolio.

ii. Hold this stock as a single-stock portfolio.

CAPM: $E(r_i) = r_f + \beta(E(r_M)-r_f)$

a. CAPM: $E(r_i) = 5\% + \beta(14\% - 5\%)$

- $E(r_X) = 5\% + 0.8(14\% - 5\%) = 12.2\%$
- $\alpha_X = 14\% - 12.2\% = 1.8\%$
- $E(r_Y) = 5\% + 1.5(14\% - 5\%) = 18.5\%$
- $\alpha_Y = 17\% - 18.5\% = -1.5\%$



IRMT

irmT The Institute of Risk Management Tanzania

# Problem 1

Karen Kay, a portfolio manager at Collins Asset Management, is using the capital asset pricing model for making recommendations to her clients. Her research department has developed the information shown in the following exhibit.

**Forecasted Returns, Standard Deviations, and Betas**

| | Forecasted Return | Standard Deviation | Beta |
|---|---|---|---|
| Stock X | 14.0% | 36% | 0.8 |
| Stock Y | 17.0 | 25 | 1.5 |
| Market index | 14.0 | 15 | 1.0 |
| Risk-free rate | 5.0 | | |

*a.* Calculate expected return and alpha for each stock.
*b.* Identify and justify which stock would be more appropriate for an investor who wants to
  i. Add this stock to a well-diversified equity portfolio.
  ii. Hold this stock as a single-stock portfolio.

$\alpha_X = 1.8\%$

$\alpha_Y = -1.5\%$

b. Which stock?

i. **Well diversified:**

Relevant Risk Measure?

**β: CAPM Model**

Best Choice?

**Stock X with the positive alpha**

b. Which stock?

ii. **Held alone:**

Relevant Risk Measure?

Best Choice? **σ**

**Calculate Sharpe ratios**



IRMT

irmT The Institute of Risk Management Tanzania

# Problem 1

Karen Kay, a portfolio manager at Collins Asset Management, is using the capital asset pricing model for making recommendations to her clients. Her research department has developed the information shown in the following exhibit.

**Forecasted Returns, Standard Deviations, and Betas**

| | Forecasted Return | Standard Deviation | Beta |
|---|---|---|---|
| Stock X | 14.0% | 36% | 0.8 |
| Stock Y | 17.0 | 25 | 1.5 |
| Market index | 14.0 | 15 | 1.0 |
| Risk-free rate | 5.0 | | |

*a.* Calculate expected return and alpha for each stock.
*b.* Identify and justify which stock would be more appropriate for an investor who wants to
  i. Add this stock to a well-diversified equity portfolio.
  ii. Hold this stock as a single-stock portfolio.

b. (continued) Sharpe Ratios

$$\text{Sharpe Ratio} = \frac{E(r) - r_f}{\sigma}$$

ii. Held Alone:

Sharpe Ratio X = (0.14 – 0.05)/0.36 = 0.25
Sharpe Ratio Y = (0.17 – 0.05)/0.25 = 0.48
Sharpe Ratio Index = (0.14 – 0.05)/0.15 = 0.60

Better



IRMT
irmT The Institute of Risk Management Tanzania

# Problem 2

What is the beta of a portfolio with $E(r_P) = 20\%$, if $r_f = 5\%$ and $E(r_M) = 15\%$?

$$E(r_P) = r_f + b[E(r_M) - r_f]$$

$$20\% = 5\% + b(15\% - 5\%)$$

$$b = 15/10 = 1.5$$



IRMT

irmT The Institute of Risk Management Tanzania

# Problem 3

The market price of a security is $40. Its expected rate of return is 13%. The risk-free rate is 7%, and the market risk premium is 8%. What will the market price of the security be if its beta doubles (and all other variables remain unchanged)? Assume the stock is expected to pay a constant dividend in perpetuity.

$E(r_P) = r_f + \mathbf{b}[E(r_M) - r_f]$ **13%** = 7% + β(8%) or β = **0.75**

$E(r_p)$ when double the beta: $E(r_P)$ = 7% + **1.5**(8%) or $E(r_P)$ = **19%**

If the stock pays a constant dividend in perpetuity, then we know from the original data that the dividend (D) must satisfy the equation for a perpetuity:

Price = Dividend / E(r) so the Dividend = $40 x 0.13 = $5.20

$40 = Dividend / **0.13**

At the new discount rate of 19%, the stock would be worth:

$5.20 / **0.19** = $27.37



IRMT

irmT The Institute of Risk Management Tanzania

# Problem 4

Are the following statements true or false? Explain.

*a.* Stocks with a beta of zero offer an expected rate of return of zero.

*b.* The CAPM implies that investors require a higher return to hold highly volatile securities.

*c.* You can construct a portfolio with a beta of 0.75 by investing 0.75 of the budget in T-bills and the remainder in the market portfolio.

False. $\beta = 0$ implies $E(r) = r_f$, not zero.

Depends on what one means by 'volatility.' If one means the $\sigma$ then this statement is false. Investors require a risk premium for bearing systematic (i.e., market or un-diversifiable) risk.

False. You should invest 0.75 of your portfolio in the market portfolio, which has $\beta = 1$, and the remainder in T-bills. Then:

- $\beta_P = (0.75 \times 1) + (0.25 \times 0) = 0.75$



IRMT

irmT The Institute of Risk Management Tanzania

# Problems 5 & 6

If the simple CAPM is valid, which of the situations in Problems 8–14 below are possible? Explain. Consider each situation independently.

5.

| Portfolio | Expected Return | Beta |
|---|---|---|
| A | 20% | 1.4 |
| B | 25 | 1.2 |

6.

| Portfolio | Expected Return | Standard Deviation |
|---|---|---|
| A | 30% | 35% |
| B | 40 | 25 |

5. Not possible. Portfolio A has a higher beta than Portfolio B, but the expected return for Portfolio A is lower.

6. Possible: Portfolio A's lower expected rate of return can be paired with a higher standard deviation, as long as Portfolio A's beta is lower than that of Portfolio B.

# Problem 7

| Portfolio | Expected Return | Standard Deviation |
|---|---|---|
| Risk-free | 10% | 0% |
| Market | 18 | 24 |
| A | 16 | 12 |

$$\text{Sharpe Ratio} = \frac{E(r) - r_f}{\sigma}$$

7. Calculate Sharpe ratios for both portfolios:

$$\text{Sharpe}_M = \frac{.18 - .10}{.24} = 0.33 \qquad \text{Sharpe}_A = \frac{.16 - .10}{.12} = 0.5$$

Not possible. The reward-to-variability ratio for Portfolio A is better than that of the market, which is not possible according to the CAPM, since the CAPM predicts that the market portfolio is the portfolio with the highest return per unit of risk.

# Problem 8

I
R
M
T

8. Need to calculate Sharpe ratios?

Not possible. Portfolio A clearly dominates the market portfolio. It has a lower standard deviation with a higher expected return.

# Problem 9

9. Given the data, the SML is:

$E(r) = 10\% + \beta(18\% - 10\%)$

A portfolio with beta of 1.5 should have an expected return of:

$E(r) = 10\% + 1.5(18\% - 10\%) = 22\%$

Not Possible: The expected return for Portfolio A is 16% so that Portfolio A plots below the SML (i.e., has an $\alpha = -6\%$), and hence is an overpriced portfolio. This is inconsistent with the CAPM.



IRMT

irmT The Institute of Risk Management Tanzania

# Problem 10

10.

| Portfolio | Expected Return | Beta |
|---|---|---|
| Risk-free | 10% | 0 |
| Market | 18 | 1.0 |
| A | 16 | .9 |

$E(r) = 10\% + \beta(18\% - 10\%)$

10. The SML is the same as in the prior problem. Here, the required expected return for Portfolio A is:
$10\% + (0.9 \times 8\%) = 17.2\%$

Not Possible: The required return is higher than 16%. Portfolio A is overpriced, with $\alpha = -1.2\%$.



IRMT

irmT The Institute of Risk Management Tanzania

# Problem 11

| Portfolio | Expected Return | Standard Deviation |
|---|---|---|
| Risk-free | 10% | 0% |
| Market | 18 | 24 |
| A | 16 | 22 |

11. Sharpe A = (16% - 10%) / 22% = .27
Sharpe M = (18% - 10%) / 24% = .33

Possible: Portfolio A's ratio of risk premium to standard deviation is less attractive than the market's. This situation is consistent with the CAPM. The market portfolio should provide the highest reward-to-variability ratio.

# Problem 12

In Problems 16–18 below, assume the risk-free rate is 8% and the expected rate of return on the market is 18%.

16. A share of stock is now selling for $100. It will pay a dividend of $9 per share at the end of the year. Its beta is 1.0. What do investors expect the stock to sell for at the end of the year?

12. Since the stock's beta is equal to 1.0, its expected rate of return should be equal to the market return, or 18%

$$E(r) = \frac{D_1 + P_1 - P_0}{P_0}$$

$$0.18 = \frac{9 + P_1 - 100}{100} \quad \text{or} \quad P_1 = \$109$$

$$\text{In Equilibrium}: \frac{D_1 + P_1 - P_0}{P_0} = r_f + \beta(E(r_M) - r_f)$$



IRMT

irmT The Institute of Risk Management Tanzania

# Problem 13

Two investment advisers are comparing performance. One averaged a 19% return and the other a 16% return. However, the beta of the first adviser was 1.5, while that of the second was 1.0.

*a.* Can you tell which adviser was a better selector of individual stocks (aside from the issue of general movements in the market)?

*b.* If the T-bill rate were 6%, and the market return during the period were 14%, which adviser would be the superior stock selector?

*c.* What if the T-bill rate were 3% and the market return 15%?

a. $r_1 = 19\%$; $r_2 = 16\%$; $\beta_1 = 1.5$; $\beta_2 = 1.0$

We can't tell which adviser did the better job selecting stocks because we can't calculate either the alpha or the return per unit of risk.

CAPM: $r_i = 6\% + \beta(14\%-6\%)$

b. $r_1 = 19\%$; $r_2 = 16\%$; $\beta_1 = 1.5$; $\beta_2 = 1.0$, $rf = 6\%$; $r_M = 14\%$

$\alpha_1 =$ 19% – [6% + 1.5(14% – 6%)] = 19% – 18% = 1%

$\alpha_2 =$ 16% – [6% + 1.0(14% – 6%)] = 16% – 14% = 2%

The second adviser did the better job selecting stocks (bigger + alpha)

# Problem 13 Cont…

Two investment advisers are comparing performance. One averaged a 19% return and the other a 16% return. However, the beta of the first adviser was 1.5, while that of the second was 1.0.

*a.* Can you tell which adviser was a better selector of individual stocks (aside from the issue of general movements in the market)?

*b.* If the T-bill rate were 6%, and the market return during the period were 14%, which adviser would be the superior stock selector?

*c.* What if the T-bill rate were 3% and the market return 15%?

CAPM: $r_i = 3\% + \beta(15\%-3\%)$

c. $r_1 = 19\%$; $r_2 = 16\%$; $\beta_1 = 1.5$; $\beta_2 = 1.0$, rf = 3%; $r_M = 15\%$

$\alpha_1 = 19\% - [3\% + 1.5(15\% - 3\%)] = 19\% - 21\% = -2\%$

$\alpha_2 = 16\% - [3\% + 1.0(15\% - 3\%)] = 16\% - 15\% = 1\%$

Here, not only does the second investment adviser appear to be a better stock selector, but the first adviser's selections appear valueless (or worse).

# Problem 14

Joan McKay is a portfolio manager for a bank trust department. McKay meets with two clients, Kevin Murray and Lisa York, to review their investment objectives. Each client expresses an interest in changing his or her individual investment objectives. Both clients currently hold well-diversified portfolios of risky assets.

*a.* Murray wants to increase the expected return of his portfolio. State what action McKay should take to achieve Murray's objective. Justify your response in the context of the capital market line.

*b.* York wants to reduce the risk exposure of her portfolio, but does not want to engage in borrowing or lending activities to do so. State what action McKay should take to achieve York's objective. Justify your response in the context of the security market line.

a. McKay should borrow funds and invest those funds proportionally in Murray's existing portfolio (i.e., buy more risky assets on margin). In addition to increased expected return, the alternative portfolio on the capital market line (CML) will also have increased variability (risk), which is caused by the higher proportion of risky assets in the total portfolio.

b. McKay should substitute low beta stocks for high beta stocks in order to reduce the overall beta of York's portfolio. Because York does not permit borrowing or lending, McKay cannot reduce risk by selling equities and using the proceeds to buy risk free assets (i.e., by ending part of the portfolio).

# Problem 14

Consider the following data for a one-factor economy. All portfolios are well diversified.

| Portfolio | $E(r)$ | Beta |
|---|---|---|
| A | 10% | 1.0 |
| F | 4 | 0 |

Suppose another portfolio $E$ is well diversified with a beta of 2/3 and expected return of 9%. Would an arbitrage opportunity exist? If so, what would the arbitrage strategy be?

i. Since the beta for Portfolio F is zero, the expected return for Portfolio F equals the risk-free rate.
For Portfolio A, the ratio of risk premium to beta is: (10% - 4%)/1 = 6%
The ratio for Portfolio E is: (9% - 4%)/(2/3) = 7.5%

ii. Create Portfolio P by buying Portfolio E and shorting F in the proportions to give $\beta_p = \beta_A = 1$, the same beta as A. $\beta_p = \Sigma W_i \beta_i$
$1 = W_E(\beta_E) + (1-W_E)(\beta_F)$; $W_E = 1 / (2/3)$ $W_E = 1.5$ and $W_F = (1-W_E) = -.5$
$E(r_p) = 1.5(9) + -0.5(4) = 11.5\%$,

$\alpha_{p,-A} = 11.5\% - 10\% = 1.5\%$

Buying Portfolio P and shorting A creates an arbitrage opportunity since both have $\beta = 1$



IRMT

irmT The Institute of Risk Management Tanzania

# Problem 16

Suppose two factors are identified for the U.S. economy: the growth rate of industrial production, IP, and the inflation rate, IR. IP is expected to be 4% and IR 6%. A stock with a beta of 1.0 on IP and 0.4 on IR currently is expected to provide a rate of return of 14%. If industrial production actually grows by 5%, while the inflation rate turns out to be 7%, what is your best guess for the rate of return on the stock?

$E(IP) = 4\%$ & $E(IR) = 6\%$; $E(r_{stock}) = 14\%$

$\beta_{IP} = 1.0$ & $\beta_{IR} = 0.4$

Actual IP = 5%, so unexpected $\Delta IP = 1\%$

Actual IR = 7%, so unexpected $\Delta IR = 1\%$

The revised estimate of the expected rate of return of the stock would be the old estimate plus the sum of the unexpected changes in the factors times the sensitivity coefficients, as follows:

Revised estimate = $E(r_{stock}) + \Delta$ due to unexpected $\Delta$ Factors

$14\% + [(1 \times 1\%) + (0.4 \times 1\%)] = 15.4\%$



IRMT

irmT The Institute of Risk Management Tanzania

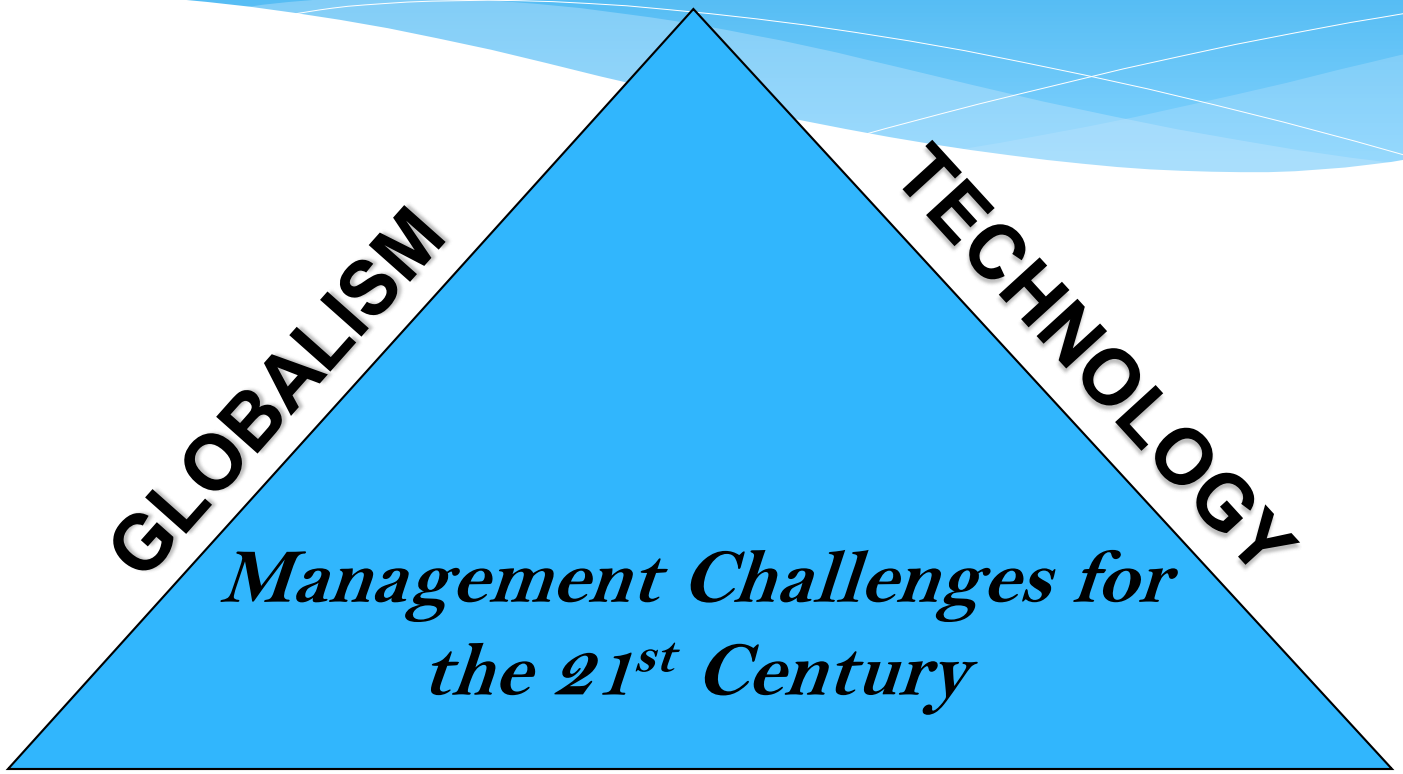
I
R
M
T

# Risk Management in Financial Institutions

# Coverage

- What is Risk ?
- Types of Capital and Role of Capital in Financial Institution
- Capital Allocation and RAPM
- Expected and Unexpected Loss
- Minimum Capital Requirements and Basel II Pillars
- Understanding of Value of Risk-VaR
- Basel II approach to Operational Risk management
- Basel II approach to Credit Risk management
- Credit Risk Mitigation-CRM, Simple and Comprehensive approach.
- The Causes of Credit Risk
- Best Practices in Credit Risk Management
- Correlation and Credit Risk Management.
- Credit Rating and Transition matrix.
- Issues and Challenges
- Summary

# Managing Risk Effectively: Three Critical Challenges




**CHANGE**

# What is Risk?

- Risk, in traditional terms, is viewed as a 'negative'. Webster's dictionary, for instance, defines risk as "exposing to danger or hazard".

危機

- The Chinese give a much better description of risk
  - > **The first is the symbol for "danger", while**
  - > **The second is the symbol for "opportunity", making risk a mix of danger and opportunity.**

# Risk Management

Risk management is present in all aspects of life; It is about the everyday trade-off between an expected reward an a potential danger. We, in the business world, often associate risk with some variability in financial outcomes. However, the notion of risk is much larger. It is universal, in the sense that it refers to human behaviour in the decision making process. ***Risk management is an attempt to identify, to measure, to monitor and to manage uncertainty.***

# Capital Allocation and RAPM

- The role of the capital in financial institutions and the different type of capital.
- The key concepts and objective behind regulatory capital.
- The main calculations principles in the Basel II the current Basel II Accord.
- The definition and mechanics of economic capital.
- The use of economic capital as a management tool for risk aggregation, risk-adjusted performance measurement and optimal decision making through capital allocation.

# Role of Capital in Financial Institution

- Absorb large unexpected losses
- Protect depositors and other claim holders
- Provide enough confidence to external investors and rating agencies on the financial heath and viability of the institution.

# Type of Capital

- **Economic Capital (EC) or Risk Capital**

  An estimate of the level of capital that a firm requires to operate its business.

- **Regulatory Capital (RC)**

  The capital that a bank is required to hold by regulators in order to operate.

- **Bank Capital (BC)**

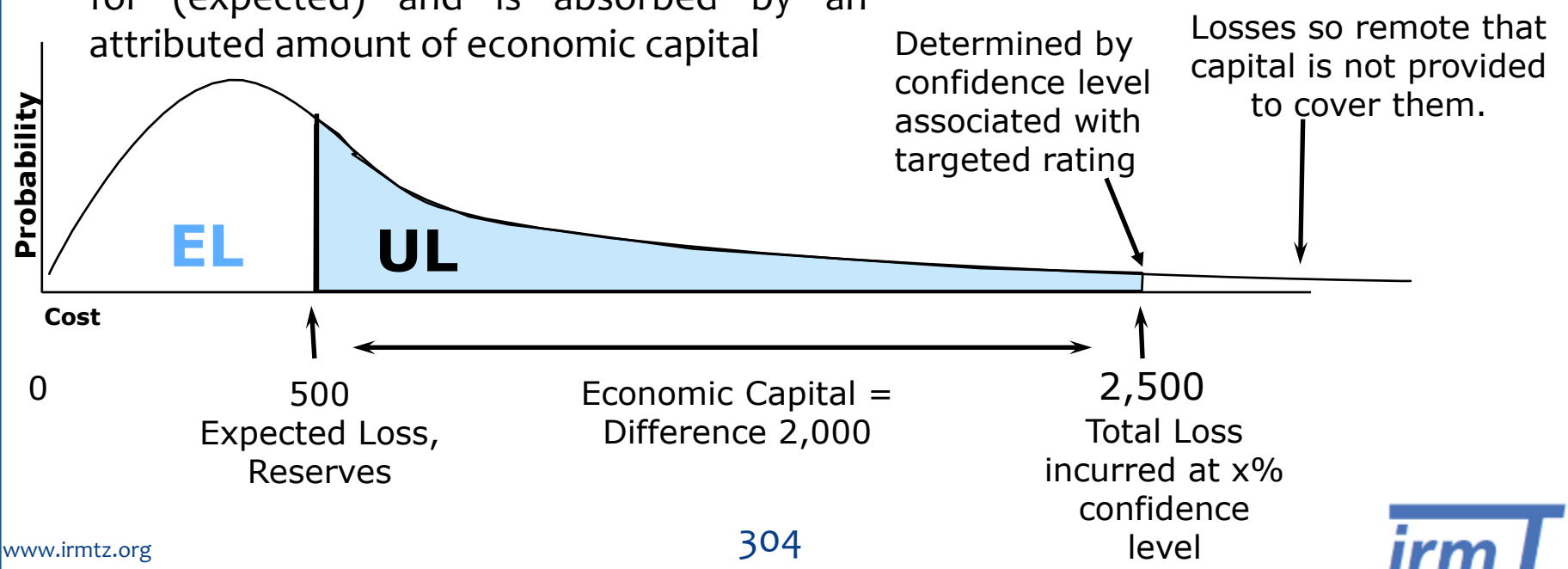
  The actual physical capital held

# Economic Capital

- Economic capital acts as a buffer that provides protection against all the credit, market, operational and business risks faced by an institution.
- EC is set at a confidence level that is less than 100% (e.g. 99.9%), since it would be too costly to operate at the 100% level.

# Risk Measurement- Expected and Unexpected Loss

- The Expected Loss (EL) and Unexpected Loss (UL) framework may be used to measure economic capital
  - Expected Loss: the mean loss due to a specific event or combination of events over a specified period
  - Unexpected Loss: loss that is not budgeted for (expected) and is absorbed by an attributed amount of economic capital






IRMT
irmT The Institute of Risk Management Tanzania

# Basel II
# And
# Risk Management

# History

| COUNTRY | YEAR | NATURE | RESULTS |
|---|---|---|---|
| Mexico | 1994-95 | Exchange rate crisis | Budget deficit increased leading to massive government borrowing. The resultant money supply expansion pushed up prices. |
| East Asia | 1997 | Bank run crisis | Capital flight. Bank run crises and currency run crises latter in 1999. |
| Russia | 1998 | Interest rate crisis. | Huge rise in budget deficit. |
| Ecuador | 1999 | Currency crisis | Currency depreciated by 66.3% against the US dollar. |
| Turkey | 2001-02 | Interest rate instability | Overnight interbank interest rate increased by 1700%. Domestic interest rate reached 60%. Domestic stock market crashed. |
| Argentina | 2001-02 | Debt crisis | Default on public debt. |

# Comparison

| Basel I | Basel 2 |
|---|---|
| Focus on a single risk measure | More emphasis on banks' internal methodologies, supervisory review and market discipline |
| One size fits all | Flexibility, menu of approaches. Provides incentives for better risk management |
| Operational risk not considered | Introduces approaches for Credit risk and Operational risk in addition to Market risk introduced earlier. |
| Broad brush structure | More risk sensitivity |

# Objectives

The objective of the New Basel Capital accord ("Basel II) is:

1. To promote safety and soundness in the financial system
2. To continue to enhance completive equality
3. To constitute a more comprehensive approach to addressing risks
4. To render capital adequacy more risk-sensitive
5. To provide incentives for banks to enhance their risk measurement capabilities

# Minimum Capital Requrements For Banks (Bot Circular No …..)

| IRAF Rating | Required CAR effective from | |
|---|---|---|
| Institutional Risk Assessment Framework (IRAF) | 31st Dec. 20….. | 31st Dec., 20….. and onwards |
| 1 & 2 | 8% | 8% |
| 3 | 9% | 10% |
| 4 | 10% | 12% |
| 5 | 12% | 14% |

# Overview of Basel II Pillars

**The new Basel Accord is comprised of 'three pillars'…**

## Pillar I

### Minimum Capital Requirements

Establishes minimum standards for management of capital on a more risk sensitive basis:

- Credit Risk
- Operational Risk
- Market Risk

## Pillar II

### Supervisory Review Process

Increases the responsibilities and levels of discretion for supervisory reviews and controls covering:

- Evaluate Bank's Capital Adequacy Strategies
- Certify Internal Models
- Level of capital charge
- Proactive monitoring of capital levels and ensuring remedial action

## Pillar III

### Market Discipline

Bank will be required to increase their information disclosure, especially on the measurement of credit and operational risks.

Expands the content and improves the transparency of financial disclosures to the market.

# Development of a Revised Capital Adequacy Framework Components of Basel II

## The three pillars of Basel II and their principles

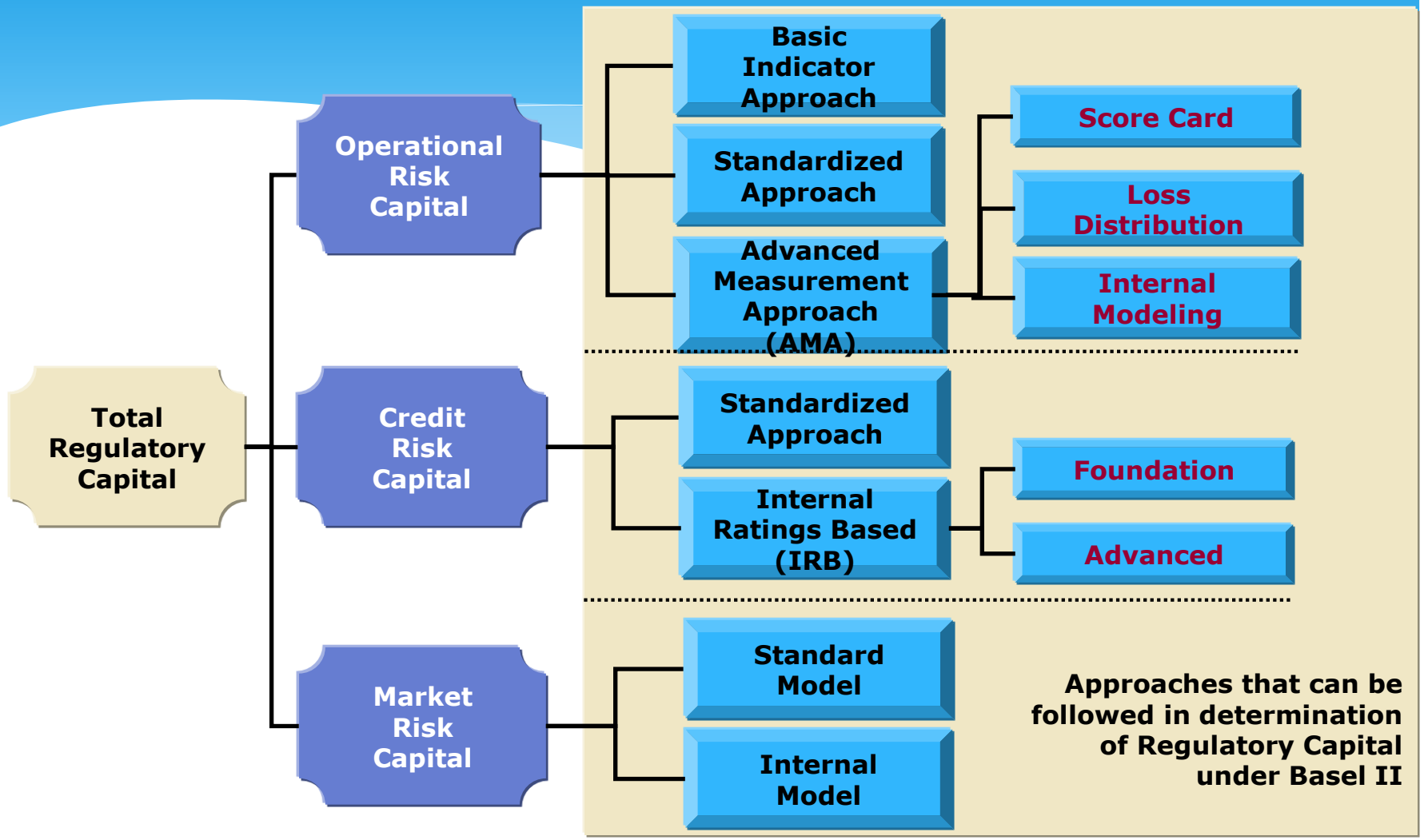
**Basel II**

| | Minimum capital requirements | Supervisory review process | Market disclosure |
|---|---|---|---|
| **Issue** | • How is capital adequacy measured particularly for Advanced approaches? | • How will supervisory bodies assess, monitor and ensure capital adequacy? | • What and how should banks disclose to external parties? |
| **Principle** | • Better align regulatory capital with economic risk<br>• Evolutionary approach to assessing credit risk<br>- Standardised (external factors)<br>- Foundation Internal Ratings Based (IRB)<br>- Advanced IRB<br>• Evolutionary approach to operational risk<br>- Basic indicator<br>- Standardised<br>- Adv. Measurement | • Internal process for assessing capital in relation to risk profile<br>• Supervisors to review and evaluate banks' internal processes<br>• Supervisors to require banks to hold capital in excess of minimum to cover other risks, e.g. strategic risk<br>• Supervisors seek to intervene and ensure compliance | • Effective disclosure of:<br>- Banks' risk profiles<br>- Adequacy of capital positions<br>• Specific qualitative and quantitative disclosures<br>- Scope of application<br>- Composition of capital<br>- Risk exposure assessment<br>- Capital adequacy |
| | **Pillar 1** | **Pillar 2** | **Pillar 3** |

## Objectives

- Continue to promote safety and soundness in the banking system
- Ensure capital adequacy is sensitive to the level of risks borne by banks
- Constitute a more comprehensive approach to addressing risks
- Continue to enhance competitive equality

# Overview of Basel II Approaches (Pillar I)



# Operational Risk and the New Capital Accord

- Operational risk is now to be considered as a fully recognized risk category on the same footing as credit and market risk.
- It is dealt with in every pillar of Accord, i.e., minimum capital requirements, supervisory review and disclosure requirements.
- It is also recognized that the capital buffer related to credit risk under the current Accord implicitly covers other risks.

# Operational Risk
# Background

**Operational risk is defined as the risk of loss resulting from inadequate or Failed internal processes, people and systems or from external events. This definition includes legal risk, but excludes strategic and reputation risk**

**Available approaches**

- Three methods for calculating operational risk capital charges are available, representing a continuum of increasing sophistication and risk sensitivity:

  **(i) the Basic Indicator Approach (BIA)**

  **(ii) The Standardised Approach (TSA) and**

  **(iii) Advanced Measurement Approaches (AMA)**
- BIA is very straightforward and does not require any change to the business
- TSA and AMA approaches are much more sophisticated, although there is still a debate in the industry as to whether TSA will be closer to BIA or to AMA in terms of its qualitative requirements
- AMA approach is a step-change for many banks not only in terms of how they calculate capital charges, but also how they manage operational risk on a day-to-day basis

# The Measurement Methodologies

Basic Indicator Approach:

1. Capital Charge = alpha X gross income

   * alpha is currently fixed as 15%

   * Standardized Approach:

2. Capital Charges = ∑beta X gross income

   (gross income for business line = i=1,2,3, ….8)

   * **Value of "Greeks" are supervisory imposed**



IRMT

irmT The Institute of Risk Management Tanzania

# The Measurement Methodologies

| * | Business Lines | Beta Factors |
|---|---|---|
| 1. | Corporate Finance | 18% |
| 2. | Trading & Sales | 18% |
| 3. | Retail Banking | 12% |
| 4. | Commercial Banking | 15% |
| 5. | Payment and Settlement | 18% |
| 6. | Agency Services | 15% |
| 7. | Asset Management | 12% |
| 8. | Retail Brokerage | 12% |

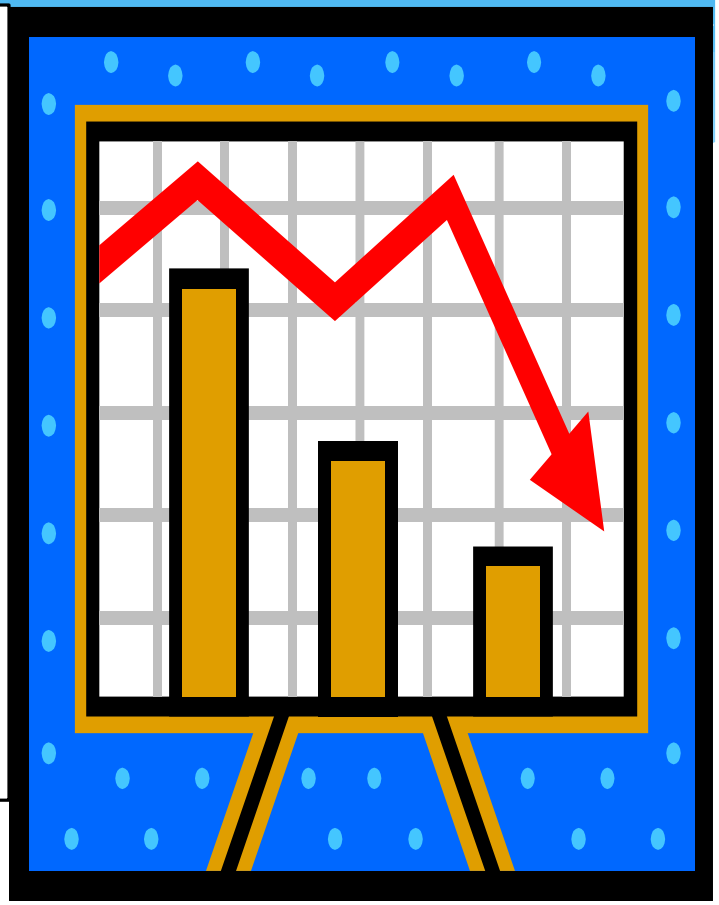
# The Measurement Methodologies

- Under the Advanced Measurement Approaches, the regulatory capital requirements will equal the risk measure generated by the bank's internal measurement system and this without being too prescription about the methodology used.

- This system must reasonably estimate unexpected losses based on the combined use of internal loss data, scenario analysis, bank-specific business environment and internal control events and support the internal economic capital allocation process by business lines.

# Understanding Market Risk

***It is the risk that the value of on and off-balance sheet positions of a financial institution will be adversely affected by movements in market rates or prices such as interest rates, foreign exchange rates, equity prices, credit spreads and/or commodity prices resulting in a loss to earnings and capital.***

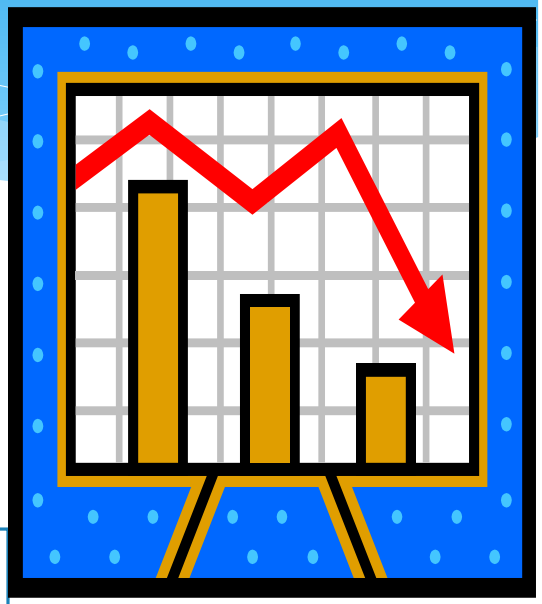


# Why the Focus on Market Risk Management ?

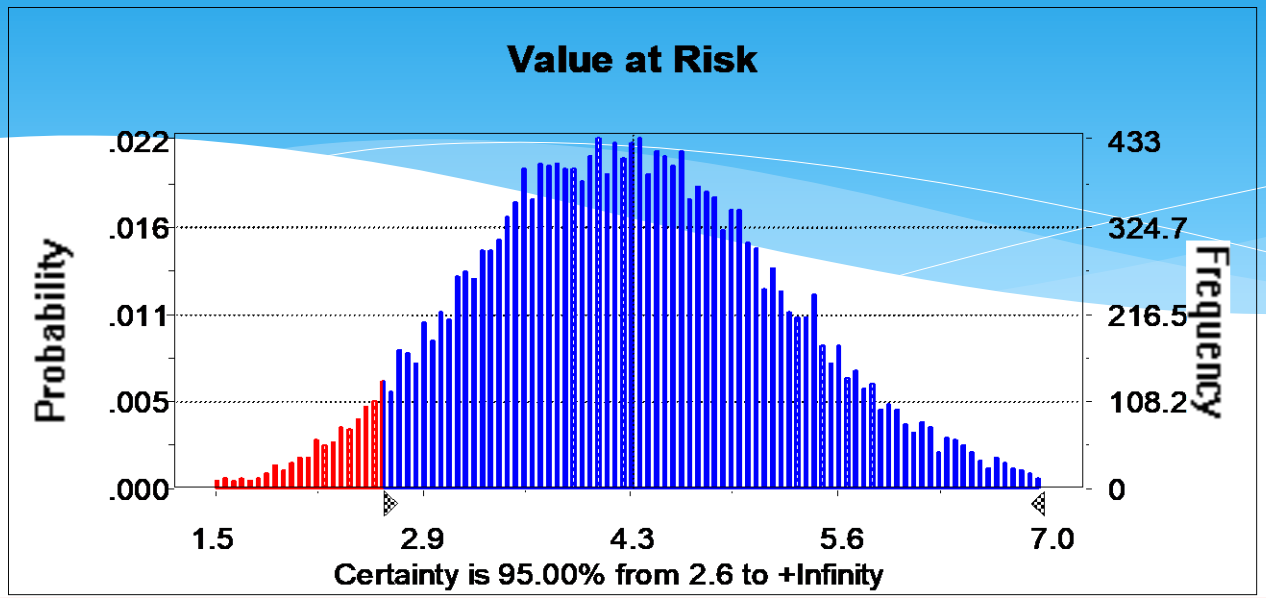
- Convergence of Economies
- Easy and faster flow of information
- Skill Enhancement
- Increasing Market activity

Leading to

- Increased Volatility
- Need for measuring and managing Market Risks
- Regulatory focus
- Profiting from Risk



# Measure, Monitor & Manage – Value at Risk

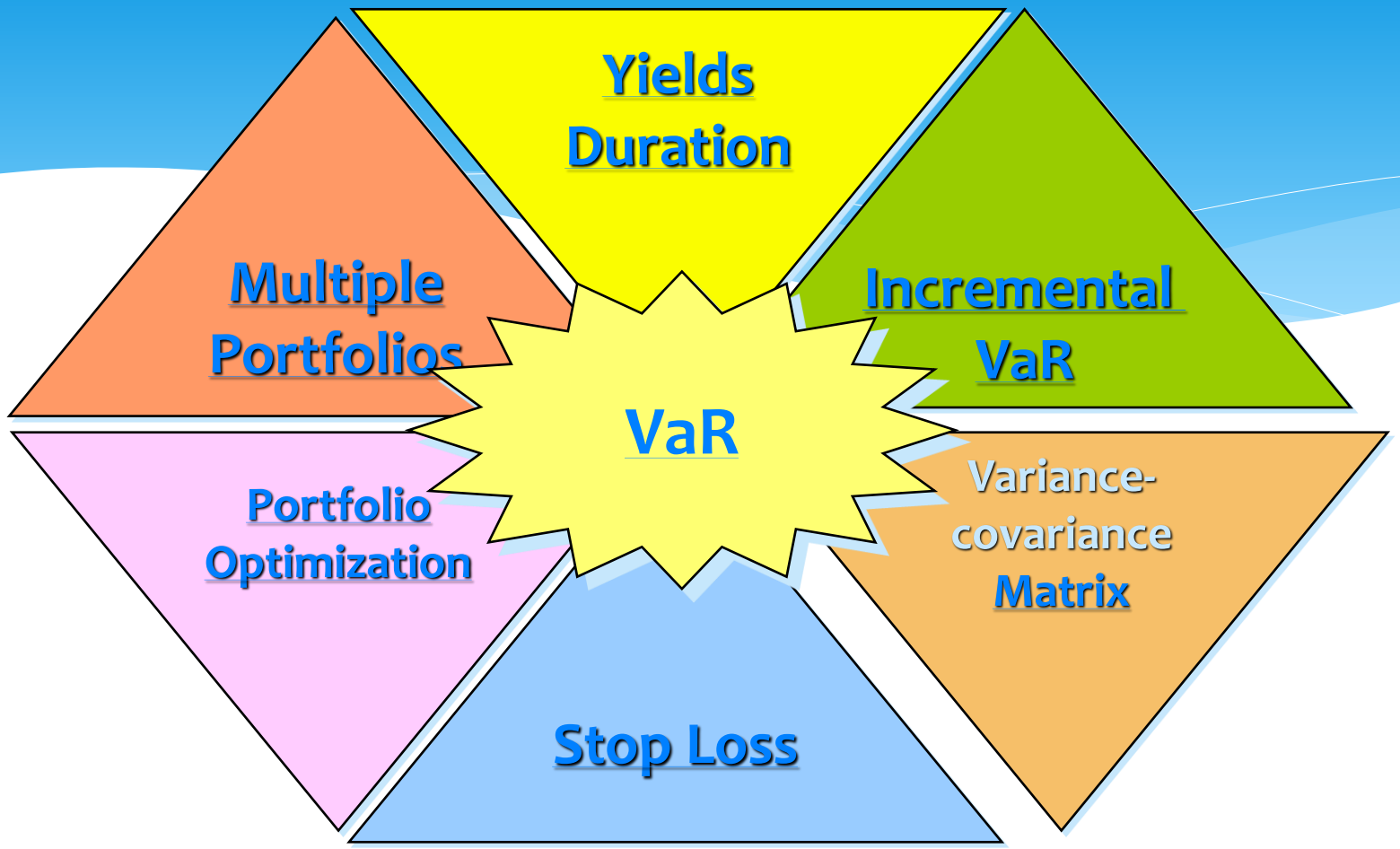



Value-at-Risk is a measure of Market Risk, which measures the maximum loss in the market value of a portfolio with a given confidence
VaR is denominated in units of a currency or as a percentage of portfolio holdings

For e.g.., a set of portfolio having a current value of say Tzs.100,000- can be described to have a daily value at risk of Tzs. 5000- at a 99% confidence level, which means there is a 1/100 chance of the loss exceeding Tzs. 5000/- considering no great paradigm shifts in the underlying factors.

It is a probability of occurrence and hence is a statistical measure of risk exposure

# Features of RMD VaR Model




Helps in optimizing portfolio in the given set of constraints

# Value at Risk-VAR

- Value at risk (VAR) is a probabilistic method of measuring the potentional loss in portfolio value over a given time period and confidence level.

- The VAR measure used by regulators for market risk is the loss on the trading book that can be expected to occur over a 10-day period 1% of the time

- The value at risk is $1 million means that the bank is 99% confident that there will not be a loss greater than $1 million over the next 10 days.

# Value at Risk-VAR

* $VAR\ (x\%) = Z_{x\%}\sigma$

VAR (x%) = the x% probability value at risk

$Z_{x\%}$ = the critical Z-value

$\sigma$ = the standard deviation of daily return's on a percentage basis

$VAR\ (x\%)_{\text{dollar basis}} =$

$VAR\ (x\%)_{\text{decimal basis}}$ X asset value



IRMT

irmT The Institute of Risk Management Tanzania

# Example: Percentage and Dollar VAR

* If the asset has a daily standard deviation of returns equal to 1.4 percent and the asset has a current value of $5.3 million calculate the VAR(5%) on both a percentage and dollar basis.
* Critical Z-value for a VAR(5%)= -1.65, VAR(10%)=-1.28, VAR(1%)=-2.32

$$VAR(5\%) = -1.65(\sigma) = -1.65(.014) = -2.31\%$$

VAR (x%)dollar basis= VAR (x%) decimal basis X asset value

VAR (x%)dollar basis= -.0231X5,300,000 = $-122,430

<u>Interpretation:</u>

There is a 5% probability that on any given day, the loss in value on this particular asset will equal or exceed 2.31% or $122,430

# Time Conversions for VAR

$$VAR(x\%) = VAR(x\%)_{1\text{-day}} \sqrt{J}$$

- Daily VAR: 1 day
- Weekly VAR: 5 days
- Monthly VAR: 20 days
- Semiannual VAR: 125 days
- Annual VAR: 250 days



IRMT

irmT The Institute of Risk Management Tanzania

# Converting Daily VAR to Other Time Bases:

* Assume that a risk manager has calculated the daily VAR(10%) dollar basis of a particular assets to be $12,500.

* **$VAR(10\%)_{5\text{-days(weekly)}} = 12{,}500\ \sqrt{5} = 27{,}951$**
* **$VAR(10\%)_{20\text{-days(monthy)}} = 12{,}500\ \sqrt{20} = 55{,}902$**
* **$VAR(10\%)_{125\text{-days}} = 12{,}500\ \sqrt{125} = 139{,}754$**
* **$VAR(10\%)_{250\text{-days}} = 12{,}500\ \sqrt{250} = 197{,}642$**



IRMT

irmT The Institute of Risk Management Tanzania

I
R
M
T

# Credit Risk Management

# Credit Risk

- Credit risk refers to the risk that a counter party or borrower may default on contractual obligations or agreements

# Standardized Approach (Credit Risk)

* **The Banks are required to use rating from External Credit Rating Agencies (ECAIS).** (Long Term)

| SBP Rating Grade | ECA Scores | PACRA | JCR-VIS | Risk Weight (Corporate) |
|---|---|---|---|---|
| 1 | 0,1 | AAA<br>AA+<br>AA<br>AA- | AAA<br>AA+<br>AA<br>AA- | 20% |
| 2 | 2 | A+<br>A<br>A- | A+<br>A<br>A- | 50% |
| 3 | 3 | BBB+<br>BBB<br>BBB- | BBB+<br>BBB<br>BBB- | 100% |
| 4 | 4 | BB+<br>BB<br>BB- | BB+<br>BB<br>BB- | 100% |
| 5 | 5,6 | B+<br>B<br>B- | B+<br>B<br>B- | 150% |
| 6 | 7 | CCC+ and below | CCC+ and below | 150% |
| Unrated | Unrated | Unrated | Unrated | 100% |

# Short-Term Rating Grade Mapping and Risk Weight

| External grade (short term claim on banks and corporate) | SBP Rating Grade | PACRA | JCR-VIS | Risk Weight |
|---|---|---|---|---|
| 1 | S1 | A-1 | A-1 | 20% |
| 2 | S2 | A-2 | A-2 | 50% |
| 3 | S3 | A-3 | A-3 | 100% |
| 4 | S4 | Other | Other | 150% |

# Methodology
# Calculate the Risk Weighted Assets

* Solicited Rating
* Unsolicited Rating

**Banks may use unsolicited ratings (if solicited rating is not available) based on the policy approved by the BOD.**

# Short-Term Rating

* Short term rating may only be used for short term claim.
* Short term issue specific rating cannot be used to risk-weight any other claim.

e.g. If there are two short term claims on the same counterparty.

1. Claim-1 is rated as S2
2. Claim-2 is unrated

| | Claim-1 rated as S2 | Claim-2 unrated |
|---|---|---|
| **Risk -weight** | **50%** | **100%** |



IRMT

irmT The Institute of Risk Management Tanzania

# Short-Term Rating (Continue)

e.g. If there are two short term claims on the same counterparty.

1. Claim-1 is rated as S4
2. Claim-2 is unrated

| | Claim-1 rated as S4 | Claim-2 unrated |
|---|---|---|
| **Risk -weight** | **150%** | **150%** |



IRMT

irmT The Institute of Risk Management Tanzania

# Ratings and ECAIs

## Rating Disclosure

- Banks must disclose the ECAI it is using for each type of claim.
- Banks are not allowed to "cherry pick" the assessments provided by different ECAIs



IRMT

irmT The Institute of Risk Management Tanzania

# Basel I v/s Basel II

**Basel: No Risk Differentiation**

**Capital Adequacy Ratio = Regulatory Capital / RWAs (Credit + Market)**

8 % = Regulatory Capital / RWAs

RWAs (Credit Risk) = Risk Weight * Total Credit Outstanding Amount

RWAs = 100 % * 100 M = 100 M

**8 % = Regulatory Capital / 100 M**

**Basel II: Risk Sensitive Framework**

RWA (PSO) = Risk Weight * Total Outstanding Amount

= 20 % * 10 M = 2 M

RWA (ABC Textile) = 100 % * 10 M = 10 M

Total RWAs = 2 M + 10 M =12 M



IRMT

irmT The Institute of Risk Management Tanzania

# RWA & Capital Adequacy Calculation

(In Million)

| Customer Title | Rating | Outstand | Risk | RWA = | CAR (%) | Total |
|---|---|---|---|---|---|---|
| PAKISTAN STATE OIL | AAA | 100 | 20% | 20 | 8% | 1.6 |
| DEWAN SALMAN FIBRE LIMITED | A | 100 | 50% | 50 | 8% | 4.0 |
| RELIANCE WEAVING MILLS (PVT) LTD | BBB+ | 100 | 100% | 100 | 8% | 8.0 |
| RUPALI POLYESTER LIMITED | B | 100 | 150% | 150 | 8% | 12.0 |
| Total: | | 400 | | 320 | | 25.6 |

# Credit Risk Mitigation (CRM)

- Where a transaction is secured by eligible collateral.
- Meets the eligibility criteria and Minimum requirements.
- Banks are allowed to reduce their exposure under that particular transaction by taking into account the risk mitigating effect of the collateral.

# Adjustment for Collateral

There are two approaches:

1. Simple Approach
2. Comprehensive Approach

# Simple Approach (S.A)

- Under the S. A. the risk weight of the counterparty is replaced by the risk weight of the collateral for the part of the exposure covered by the collateral.
- For the exposure not covered by the collateral, the risk weight of the counterparty is used.
- Collateral must be revalued at least every six months.
- Collateral must be pledged for at least the life of the exposure.

# Comprehensive Approach (C.A)

- Under the comprehensive approach, banks adjust the size of their exposure upward to allow for possible increases.
- And adjust the value of collateral downwards to allow for possible decreases in the value of the collateral.
- A new exposure equal to the excess of the adjusted exposure over the adjusted value of the collateral.
- counterparty's risk weight is applied to the new exposure.

e.g. *Suppose that an Rs 80 M exposure to a particular counterparty is secured by collateral worth Rs 70 M. The collateral consists of bonds issued by an A-rated company. The counterparty has a rating of B+. The risk weight for the counterparty is 150% and the risk weight for the collateral is 50%.*

* The risk-weighted assets applicable to the exposure using the simple approach is therefore:

**0.5 X 70 + 1.50 X 10 = 50 million**

**Risk-adjusted assets = 50 M**

* Comprehensive Approach: Assume that the adjustment to exposure to allow for possible future increases in the exposure is +10% and the adjustment to the collateral to allow for possible future decreases in its value is -15%. The new exposure is:

**1.1 X 80 -0.85 X 70 = 28.5 million**

A risk weight of 150% is applied to this exposure**:**

**Risk-adjusted assets = 28.5 X 1.5 =42.75 M**

I R M T

irmT The Institute of Risk Management Tanzania

# Credit risk

# Basel II approaches to Credit Risk

## Evolutionary approaches to measuring Credit Risk under Basel II

### Standardised Approach

- **RWA based on externally provided:**
  - Probability of Default (PD)
  - Exposure At Default (EAD)
  - Loss Given Default (LGD)
- **Limited recognition of credit risk mitigation & supervisory treatment of collateral and guarantees**

### Internal Ratings Based (IRB) Approaches

#### Foundation

- **RWA based on internal models for:**
  - Probability of Default (PD)
- **RWA based on externally provided:**
  - Exposure At Default (EAD)
  - Loss Given Default (LGD)
- **Limited recognition of credit risk mitigation & supervisory treatment of collateral and guarantees**

#### Advanced

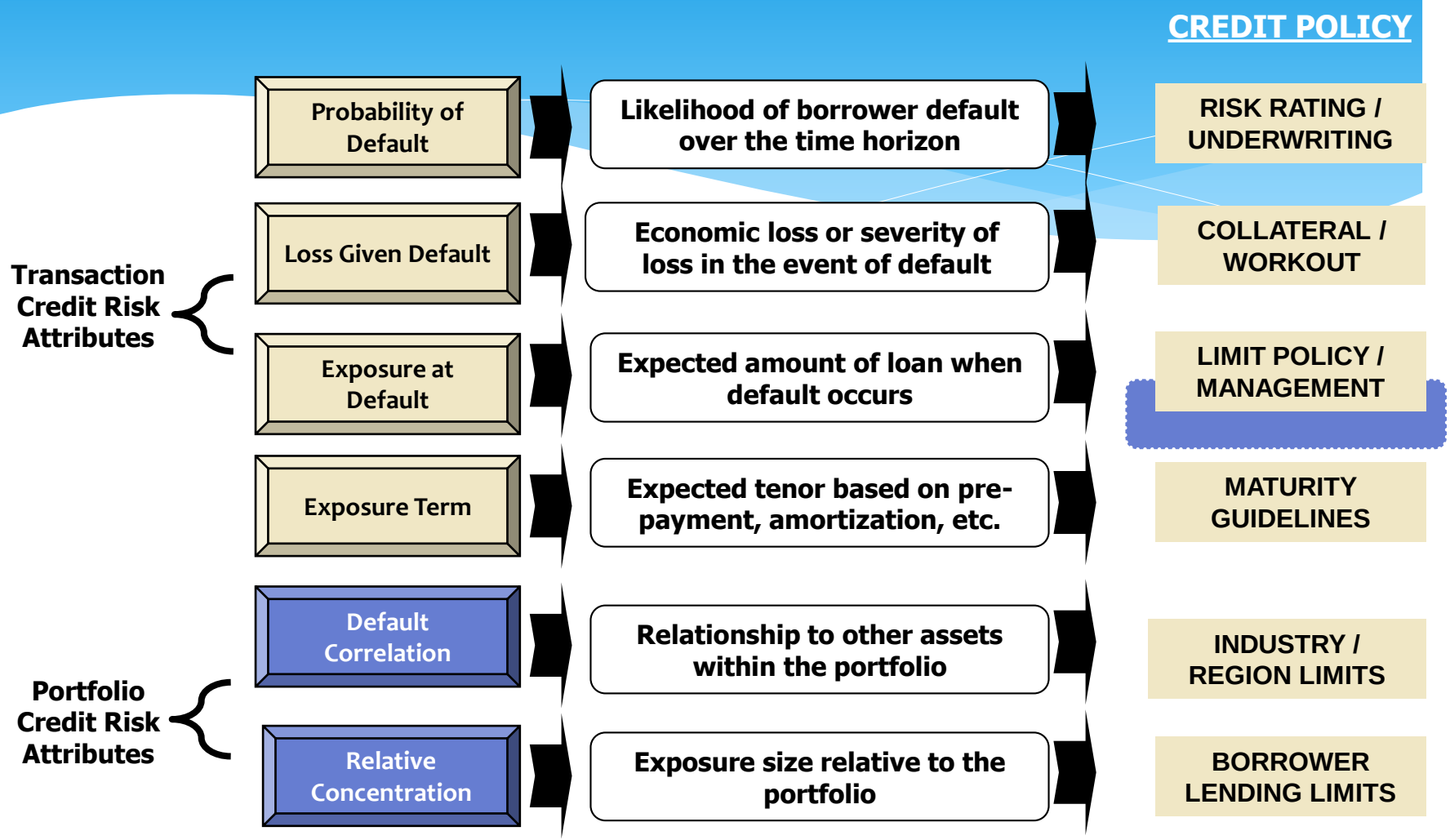
- **RWA based on internal models for**
  - Probability of Default (PD)
  - Exposure At Default (EAD)
  - Loss Given Default (LGD)
- **Internal estimation of parameters for credit risk mitigation – guarantees, collateral, credit derivatives**

***Increasing complexity and data requirement***

***Decreasing regulatory capital requirement***

***Basel II provides a 'tailored' or 'evolutionary' approach to banks that is sensitive to their credit risk profiles***

# Credit Risk – Linkages to Credit Process

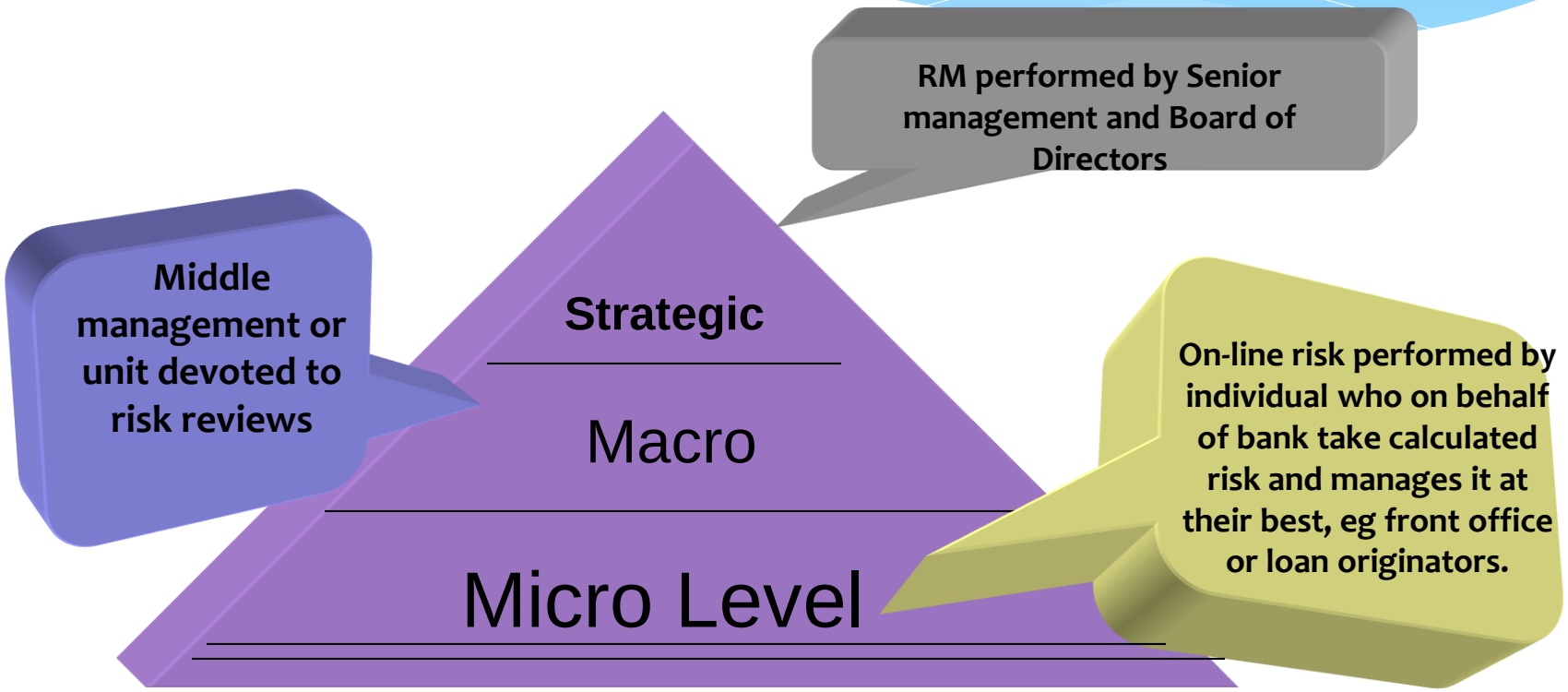


# The Causes of Credit Risk

- The underlying causes of the credit risk include the performance health of counterparties or borrowers.
- Unanticipated changes in economic fundamentals.
- Changes in regulatory measures
- Changes in fiscal and monetary policies and in political conditions.

# Risk Management

Risk Management activities are taking place simultaneously



# Best Practices in Credit Risk Management

1. **Rethinking** the credit process
2. **Deploy** Best Practices framework
3. **Design** Credit Risk Assessment Process
4. **Architecture** for Internal Rating
5. **Measure, Monitor & Manage** Portfolio Credit Risk
6. **Scientific** approach for Loan pricing
7. **Adopt** RAROC as a common language
8. Explore quantitative models for default prediction
9. **Use** Hedging techniques
10. **Create** Credit culture

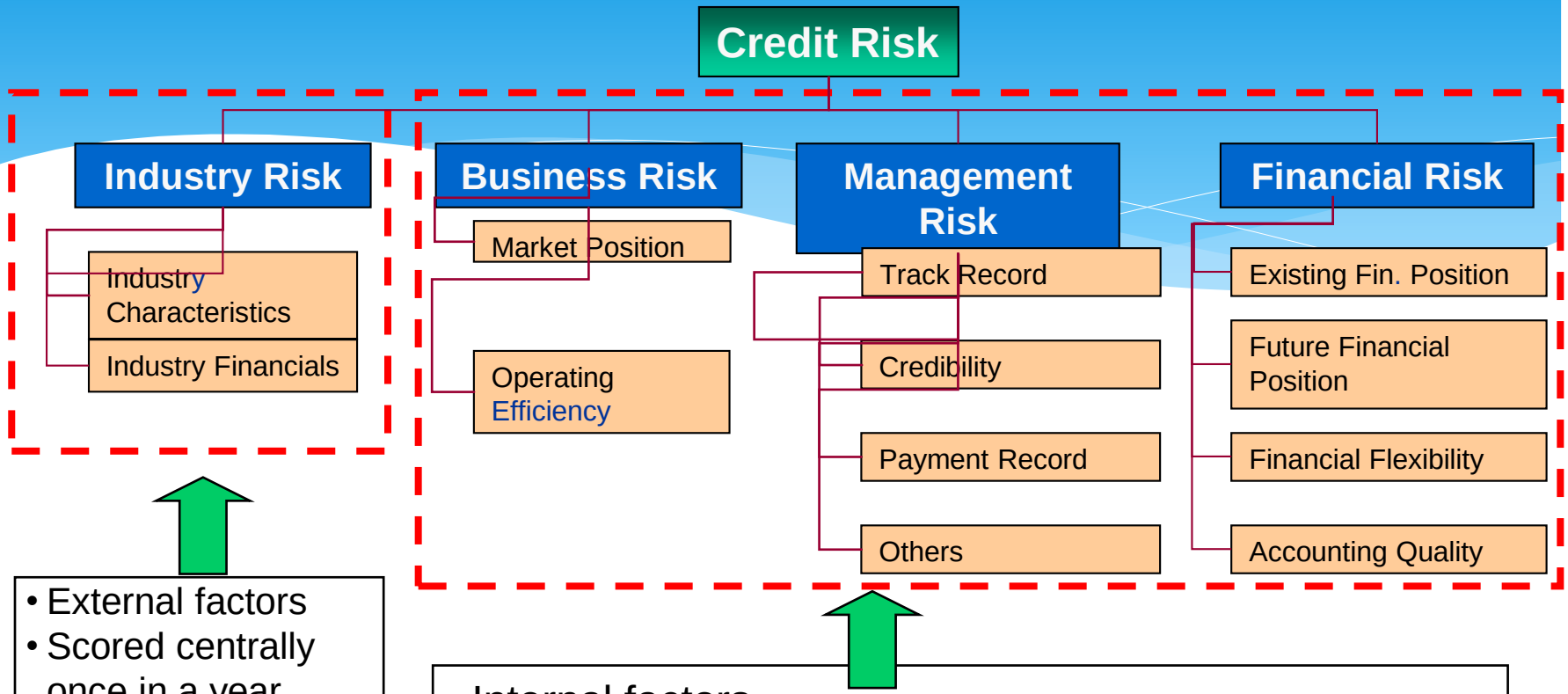
# 1. Rethinking the credit process

- ✓ Increased reliance on objective risk assessment
- ✓ Credit process differentiated on the basis of risk, not size
- ✓ Investment in workflow automation / back-end processes
- ✓ Align “Risk strategy” & “Business Strategy”
- ✓ Active Credit Portfolio Management

# 2. **Deploy** Best Practices framework

- ✓ Credit & Credit Risk Policies should be comprehensive
- ✓ Credit organisation - Independent set of people for Credit function & Risk function / Credit function & Client Relations
- ✓ Set Limits On Different Parameters
- ✓ Separate Internal Models for each borrower category and mapping of scales to a common scale
- ✓ Ability to Calculate a Probability of Default based on the Internal Score assigned

# 3. Design Credit Risk Assessment Process




- External factors
- Scored centrally once in a year

- Internal factors
- Scored for each borrowing entity by the concerned credit officer

**RMD provides well structured "ready to use" "value statements" to fairly capture and mirror the Rating officer's risk assessment under each specific risk factor as part of the Internal Rating Model**

# 4. **Architecture** for Internal Rating

Credit Rating System consists of all of the methods, processes, controls and data collection and IT systems that support the assessment of credit risk, the assignment of internal risk ratings and the quantification of default and loss estimates.

**The New Basle Capital Accord**

- Appropriate rating system for each asset class
- Multiple methodologies allowed within each asset class (large corporate , SME)

| CORPORATE/ BANK/ SOVEREIGN EXPOSURES | RETAIL EXPOSURES |
|---|---|
| • Each borrower must be assigned a rating<br>• Two dimensional rating system<br>  • Risk of borrower default<br>  • Transaction specific factors (For banks using advanced approach, facility rating must exclusively reflect LGD)<br>• Minimum of nine borrower grades for non-defaulted borrowers and three for those that have defaulted | • Each retail exposure must be assigned to a particular pool<br>• The pools should provide for meaningful differentiation of risk, grouping of sufficiently homogenous exposures and allow for accurate and consistent estimation of loss characteristics at pool level |

# 4. **Architecture** for Internal Rating Cont…

ONE DIMENSIONAL

| Risk Grade | I | II | III | IV | V | VI | VII |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Industry | | | X | | | | |
| Business | | | | X | | | |
| Management | | | | X | | | |
| Financial | | | X | | | | |
| Facility Strucure | X | | | | | | |
| Security | | X | | | | | |
| Combined | | | X | | | | |

Rating reflects Expected Loss

R
RMD's modified TWO DIMENSIONAL approach

CONCEPTUALLY SOUND INTERNAL RATING MODEL – CAPTURES PD, LGD SEPARATELY

Client Rating

| Risk Grade | I | II | III | IV | V | VI | VII |
|---|---|---|---|---|---|---|---|
| Industry | | | X | | | | |
| Business | | | | X | | | |
| Management | | | | X | | | |
| Financial | | | X | | | | |
| Client Grade | | | X | | | | |

Facility Rating

| Risk Grade | I | II | III | IV | V | VI | VII |
|---|---|---|---|---|---|---|---|
| Facility Structure | X | | | | | | |
| Collateral | | X | | | | | |
| LGD Grade | | X | | | | | |

The Facility grade explicitly measures LGD. The rater would assign a facility to one of several LGD grades based on the likely recovery rates associated with various types of collateral, guarantees or other factors of the facility structure.

Differs from the two dimensional system portrayed above in that it records LGD rather than EL as the second grade. The benefit of this approach is that rater's LGD judgment can be evaluated and refined over time by comparing them to loss experience.

# 5. Measure, Monitor & Manage Portfolio Credit Risk

## 'CREDIT CAPITAL'

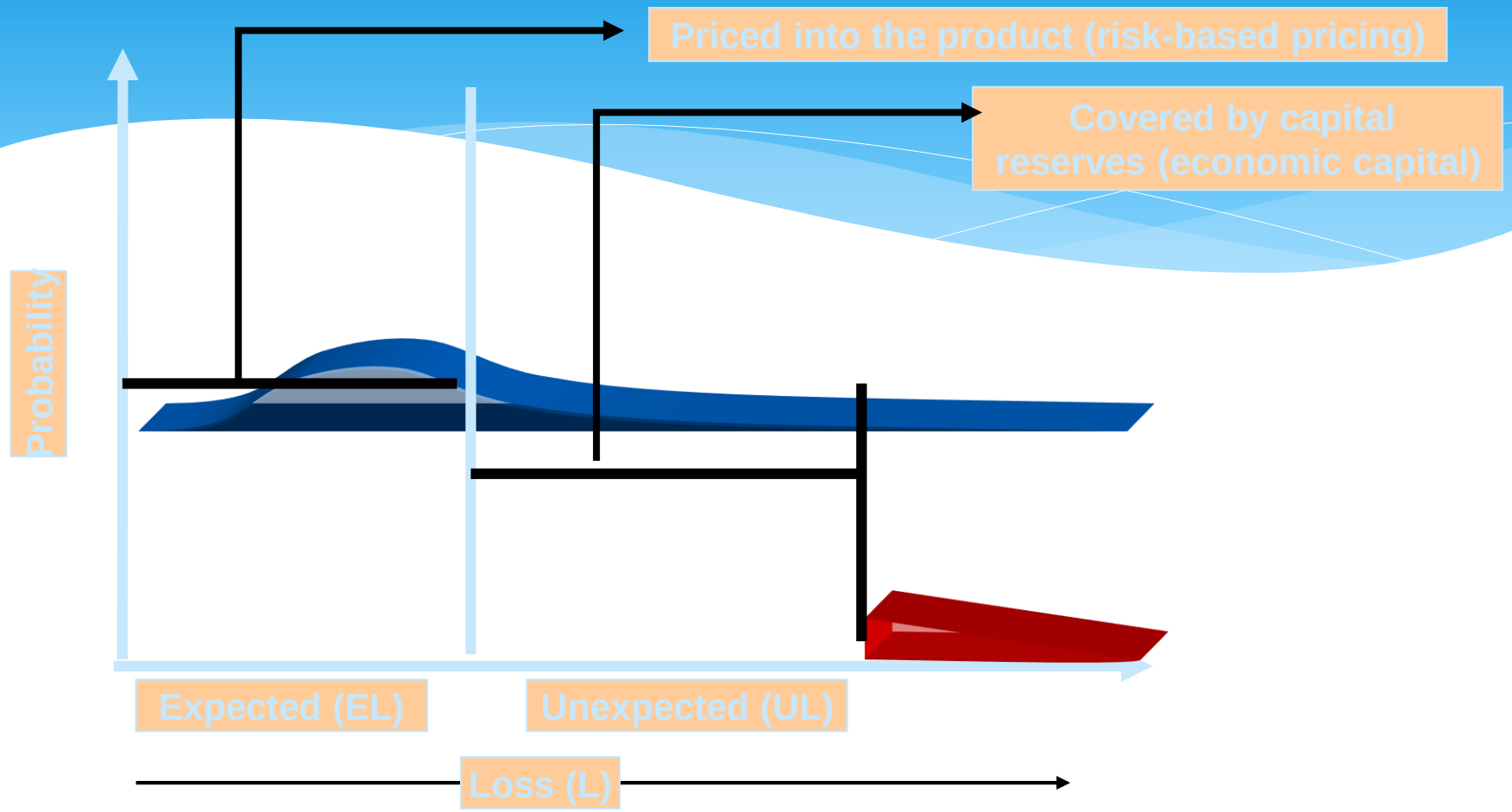
The portfolio approach to credit risk management integrates the key credit risk components of assets on a portfolio basis, thus facilitating better understanding of the portfolio credit risk.

The insight gained from this can be extremely beneficial both for proactive credit portfolio management and credit-related decision making.

1. It is based on a rating (internal rating of banks/ external ratings) based methodology.

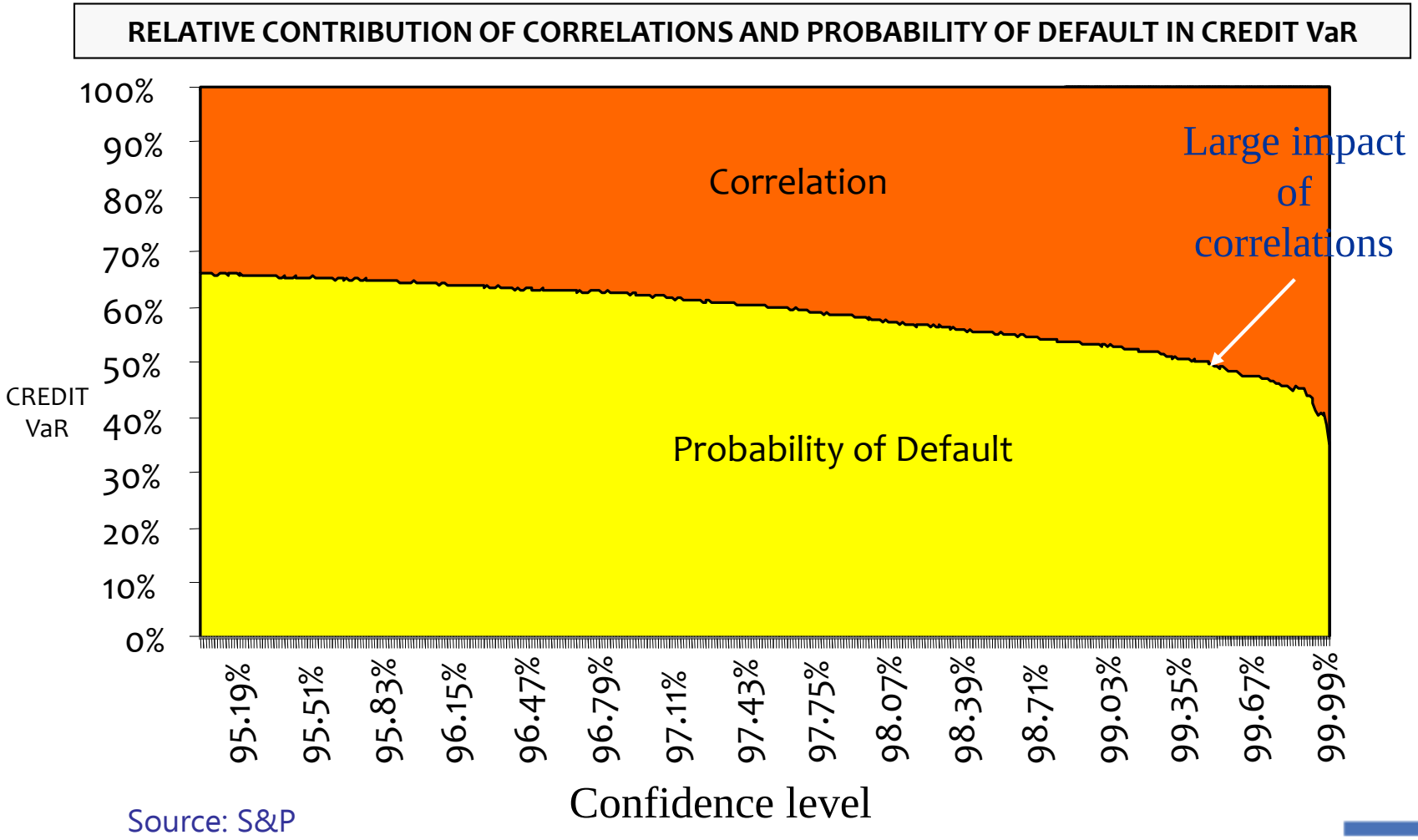
2. Being based on a loss distribution (CVaR) approach, it easily forms a part of the Integrated risk management framework.

# Portfolio Credit VaR




Credit Capital models the **loss to the value** of the portfolio due to changes in credit quality over a time frame

# Are Correlations Important



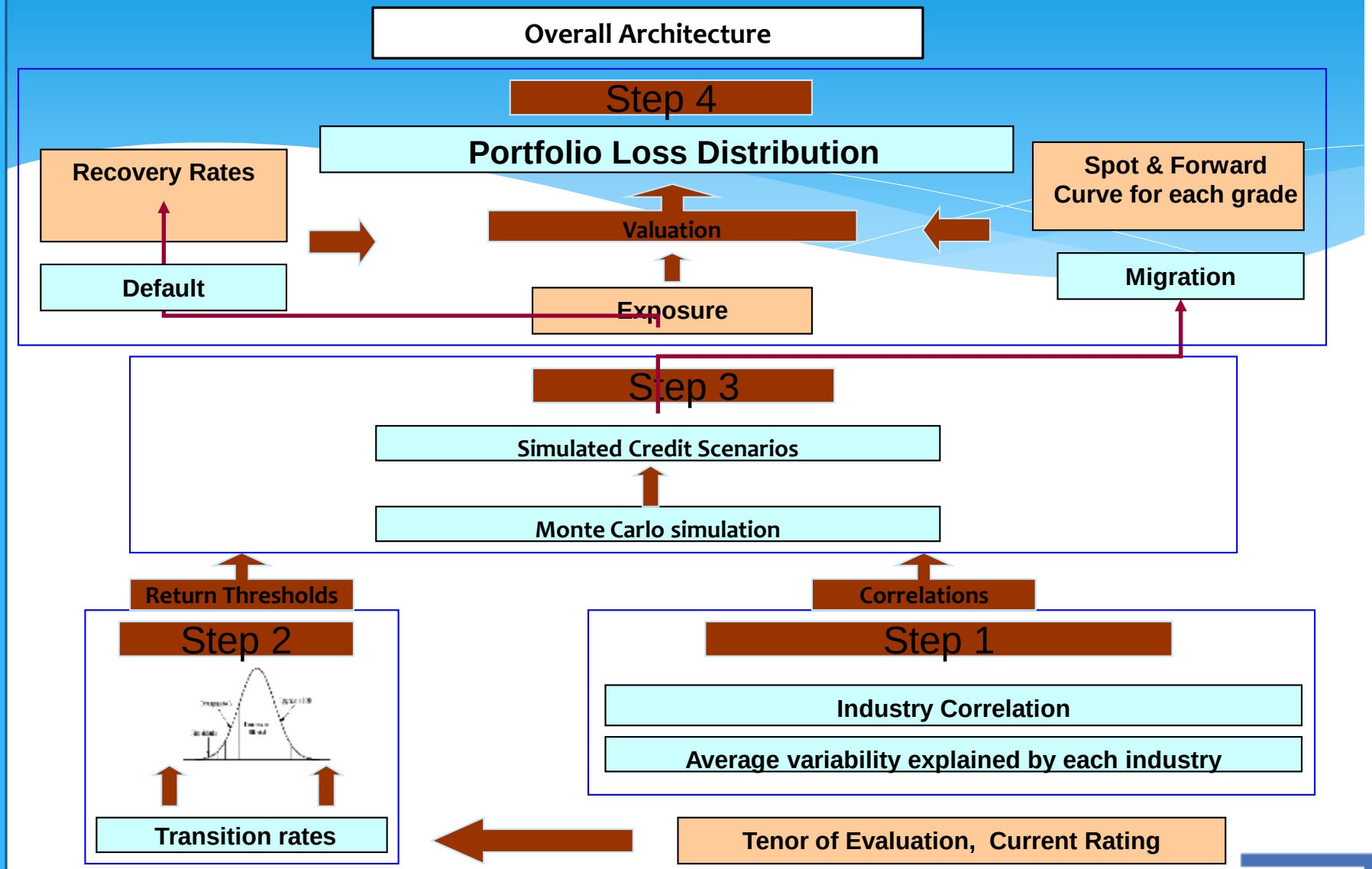

Source: S&P

# 3-Year Default Correlations

| | Auto | Cons | Energ | Finan | Build | Chem | Hi tech | Insur | Leisure | R.E. | Tele | Trans | Utility |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Auto** | **4.81** | 1.84 | 1.57 | 0.67 | 2.68 | 3.65 | 3.11 | 0.67 | 2.06 | 2.40 | 7.04 | 3.56 | 2.39 |
| **Cons** | 1.84 | **2.51** | -1.41 | 0.83 | 2.36 | 1.60 | 1.69 | 0.52 | 2.01 | 6.03 | 2.49 | 2.56 | 1.31 |
| **Energ** | 1.57 | -1.41 | **4.74** | -0.50 | -0.49 | 0.94 | 0.75 | 0.75 | -1.63 | 0.20 | -0.44 | -0.28 | 0.05 |
| **Finan** | 0.67 | 0.83 | -0.50 | **1.39** | 1.54 | 0.52 | 0.73 | -0.03 | 1.88 | 6.27 | -0.04 | 1.03 | 0.67 |
| **Build** | 2.68 | 2.36 | -0.49 | 1.54 | **3.81** | 2.09 | 2.78 | 0.41 | 3.64 | 7.32 | 3.85 | 3.29 | 1.78 |
| **Chem** | 3.65 | 1.60 | 0.94 | 0.52 | 2.09 | **3.50** | 2.34 | 0.41 | 2.12 | 0.91 | 5.21 | 2.61 | 1.30 |
| **High tech** | 3.11 | 1.69 | 0.75 | 0.73 | 2.78 | 2.34 | **3.01** | 0.47 | 2.45 | 3.83 | 4.63 | 2.82 | 1.67 |
| **Insur** | 0.67 | 0.52 | 0.75 | -0.03 | 0.41 | 0.41 | 0.47 | **96.00** | 0.10 | 0.46 | 0.50 | 1.08 | 0.22 |
| **Leisure** | 2.06 | 2.01 | -1.63 | 1.88 | 3.64 | 2.12 | 2.45 | 0.10 | **4.07** | 9.39 | 3.51 | 3.40 | 1.48 |
| **Real Est.** | 2.40 | 6.03 | -0.20 | 6.27 | 7.32 | 0.91 | 3.83 | 0.46 | 9.39 | **13.15** | -1.14 | 4.78 | 2.21 |
| **Telecom** | 7.04 | 2.49 | -0.44 | -0.04 | 3.85 | 5.21 | 4.63 | 0.50 | 3.51 | -1.14 | **16.72** | 5.63 | 4.33 |
| **Trans** | 3.56 | 2.56 | -0.28 | 1.03 | 3.29 | 2.61 | 2.82 | 1.08 | 3.40 | 4.78 | 5.63 | **3.85** | 1.99 |
| **Utility** | 2.39 | 1.31 | 0.05 | 0.67 | 1.78 | 1.30 | 1.67 | 0.22 | 1.48 | 2.21 | 4.33 | 1.99 | **2.07** |

$$Corr(X,Y)=\rho_{xy}=Cov(X,Y)/std(X)std(Y)$$

# RMD's Approach 'CREDIT CAPITAL'



# RMD's Approach 'CREDIT CAPITAL'

**Overall Architecture**

**STEP 1**

From the historical correlation data of industries, the firm-to-firm correlations are found.

**STEP 2**

Calculate asset value thresholds for entire transition matrix. This is done assuming that given current rating, the asset values have to move up/down by certain amounts (which can be read off a Standard Normal distribution) for it to be upgraded /downgraded.

**STEP 3**

Large no. of Simulations (Monte Carlo) of the asset value thresholds preserving the correlation structure using Cholesky Decomposition is carried out. Asset value thresholds are converted to simulated ratings for the portfolio for each of the simulation runs.

**STEP 4**

Using the forward yield curve (rating wise) and recovery data suitable valuation of each of the instruments in the portfolio is done for each simulation run. The distribution of portfolio values is subtracted from the original value to generate the loss distribution.

# **Adopt** RAROC as a Common Language

## What is RAROC ?

Revenues
-Expenses
-Expected Losses
+ Return on economic capital
+ transfer values / prices

$$\text{RAROC} = \frac{\text{Risk Adjusted Return}}{\text{Risk Adjusted Capital or Economic Capital}} = \frac{\quad}{\quad}$$

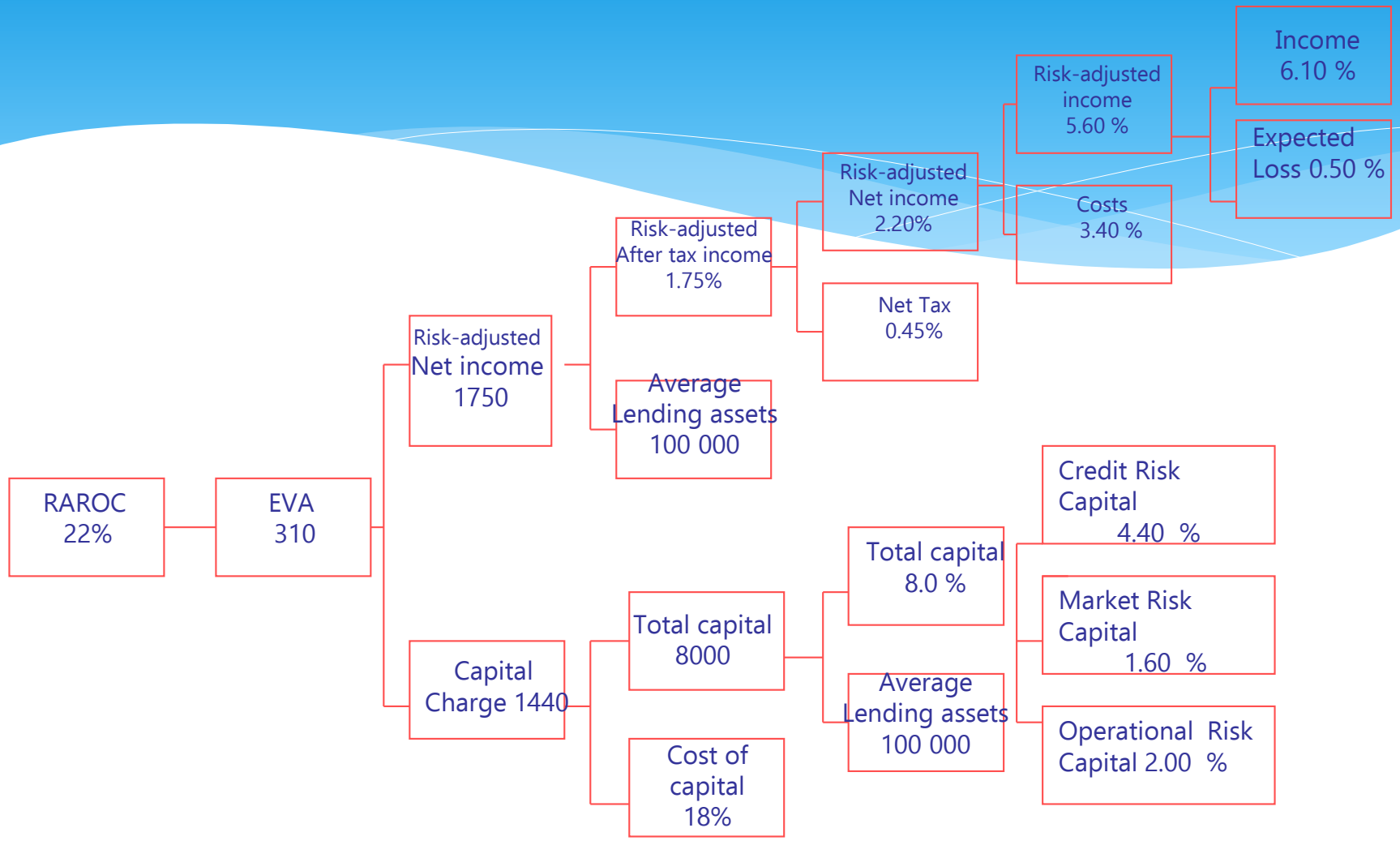
**Capital required for**
- Credit Risk
- Market Risk
- Operational Risk

The concept of RAROC (Risk adjusted Return on Capital) is at the heart of Integrated Risk Management.



IRMT
irmT The Institute of Risk Management Tanzania

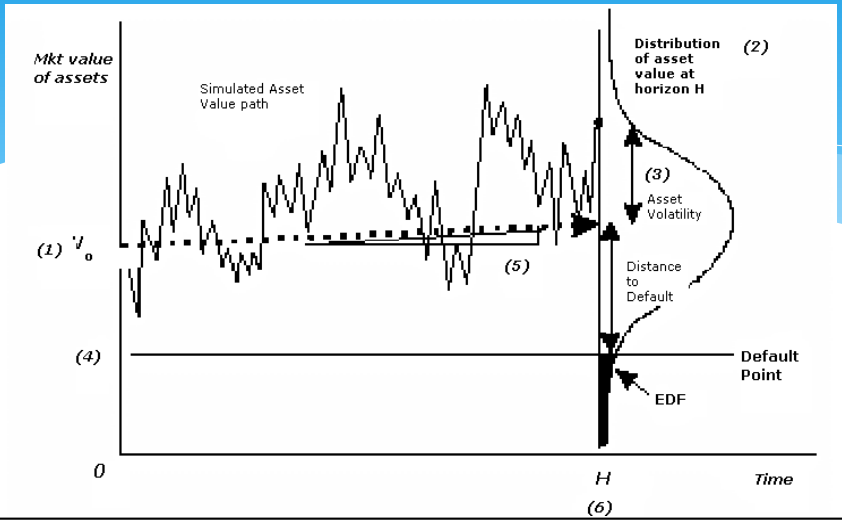
# RAROC Profitability Tree – an illustration






irmT The Institute of Risk Management Tanzania

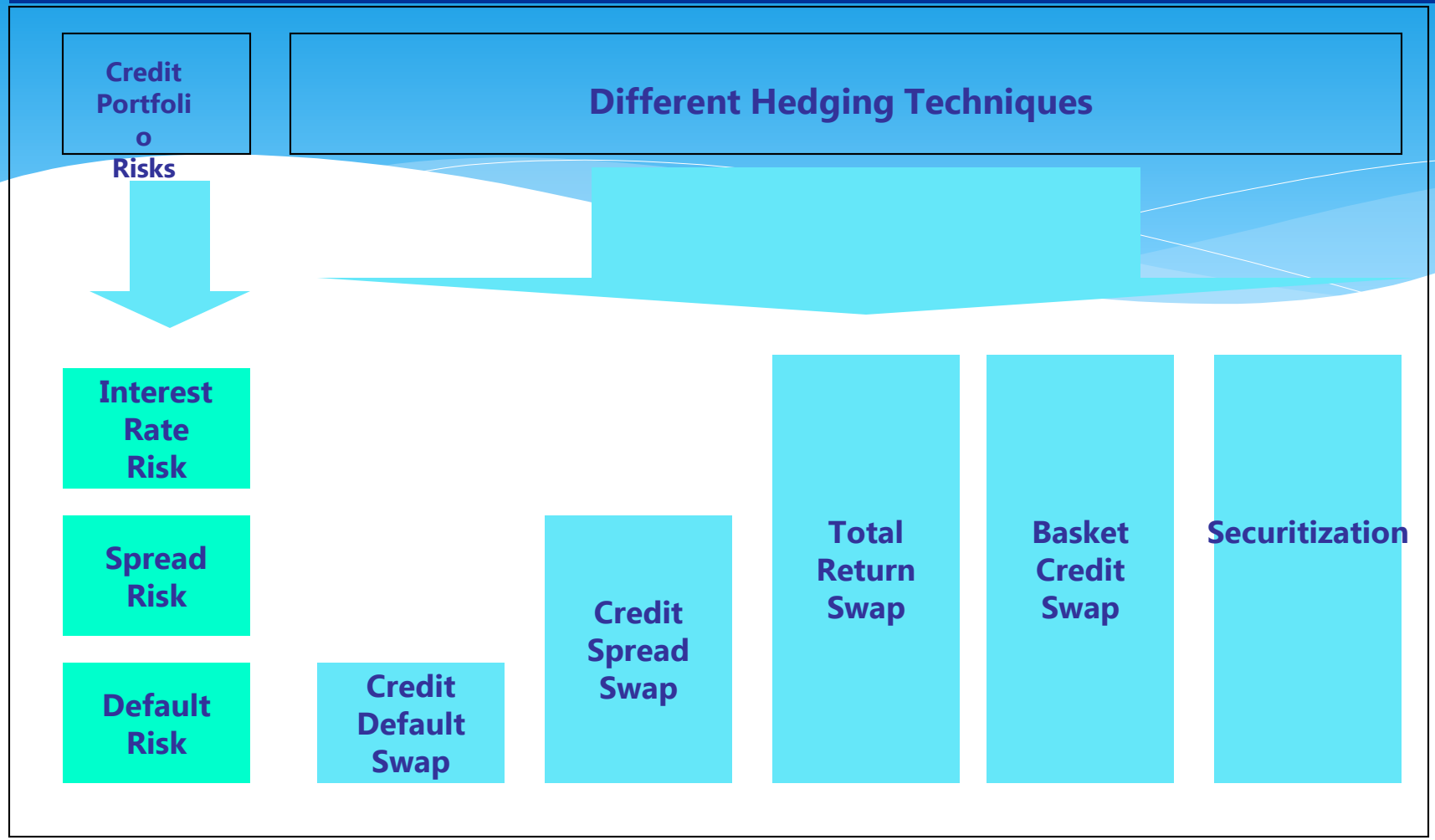
# 8. Explore Quantitative Models For Default Prediction




- Derivation of Asset value & volatility
  - Calculated from Equity Value , volatility for each company-year
  - Solving for firm Asset Value & Asset Volatility simultaneously from 2 eqns. relating it to equity value and volatility
- Calculate Distance to Default
  - Calculate default point (Debt liabilities for given horizon value)
  - Simulate the asset value and Volatility at horizon
- Calculate Default probability (EDF)
  - Relating distance to default to actual default experience
  - Use QRM & Transition Matrix
  - Calculate Default probability based on Financials
  - Arrive at a combined measure of Default using both

- **Corporate predictor Model** is a quantitative model to predict default risk dynamically
- Model is constructed by using the hybrid approach of combining Factor model & Structural model (market based measure)
- The inputs used include: Financial ratios, default statistics, Capital Structure & Equity Prices.
- The present coverage include listed & ECAIs rated companies
- The product development work related to private firm model & portfolio management model is in process
- The model is validated internally

# 9. **Use** Hedging techniques




go along, the extensive use of credit derivatives would become imm

# Sample Credit Rating Transition Matrix

## ( Probability of migrating to another rating within one year as a percentage)

## Credit Rating One year in the future

| CURRENT CREDIT RATING | | AAA | AA | A | BBB | BB | B | CCC | Default |
|---|---|---|---|---|---|---|---|---|---|
| | AAA | 87.74 | 10.93 | 0.45 | 0.63 | 0.12 | 0.10 | 0.02 | 0.02 |
| | AA | 0.84 | 88.23 | 7.47 | 2.16 | 1.11 | 0.13 | 0.05 | 0.02 |
| | A | 0.27 | 1.59 | 89.05 | 7.40 | 1.48 | 0.13 | 0.06 | 0.03 |
| | BBB | 1.84 | 1.89 | 5.00 | 84.21 | 6.51 | 0.32 | 0.16 | 0.07 |
| | BB | 0.08 | 2.91 | 3.29 | 5.53 | 74.68 | 8.05 | 4.14 | 1.32 |
| | B | 0.21 | 0.36 | 9.25 | 8.29 | 2.31 | 63.89 | 10.13 | 5.58 |
| | CCC | 0.06 | 0.25 | 1.85 | 2.06 | 12.34 | 24.86 | 39.97 | 18.60 |

# 10. **Create** Credit culture

- ✓ "Credit culture" refers to an implicit understanding among bank personnel that certain standards of underwriting and loan management must be maintained.
- ✓ Strong incentives for the individual most responsible for negotiating with the borrower to assess risk properly
- ✓ Sophisticated modelling and analysis introduce pressure for architecuture involving finer distinctions of risk
- ✓ Strong review process aim to identify and discipline among relationship managers

# Issues and Challenges…

IRMT

**Given that…**

- Fast evolution of Islamic financial system
- Rising competition from well established and emerging financial centres
- Untapped potential in the industry

**There is this need to…**

**Modernize and innovate Islamic financial system within Shariah boundary to meet customers' demand**

**Confront and resolve issues**

- Continuously review regulatory and legal framework to suit Shariah requirements
- Develop and standardize global Islamic banking practices – promote uniformity to facilitate cross border transaction and global convention – equivalent to ISDA, UCP
- Conduct in depth research and find solution on Shariah issues relating to risk mitigation, liquidity management and hedging
- Address shortage of talents in particular financial savvy Shariah Scholars and Shariah savvy financial practitioners
- Continuous adaptation of Islamic financial products - is it sustainable?

# Risk Management and Image of a Financial Institution

***" The way that risk is managed in any particular institution reflects its position in the marketplace, the products it delivers and perhaps, above all, its culture. "***

# To Summarise…

**Effective Management of Risk benefits the bank..**

- Efficient allocation of capital to exploit different risk / reward pattern across business
- Better Product Pricing
- Early warning signals on potential events impacting business
- Reduced earnings Volatility
- Increased Shareholder Value

No Risk …

No Gain!

I
R
M
T

# Credit Rating

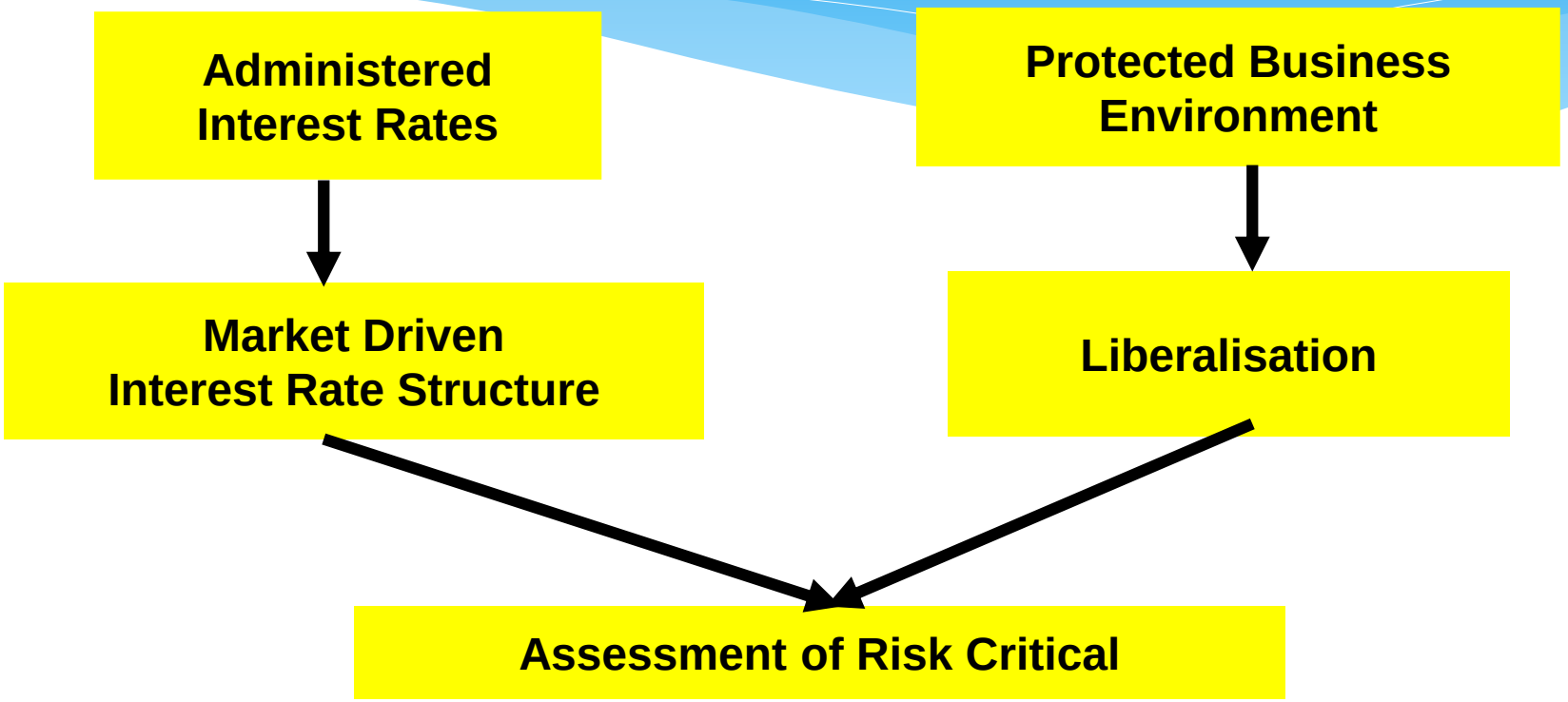
# What is a Credit Rating?

- Current opinion on credit quality
  - Issuers' ability and inclination to meet debt obligations in a timely manner
- Performs isolated function of credit risk evaluation
- Rating is an issue specific view
- Useful in differentiation of credit quality

# What a Credit Rating is Not

- General purpose evaluation of issuer
- Audit of the issuing company
- One time assessment valid over life of the instrument
- A recommendation to purchase, sell, or hold a security

# Debt Markets



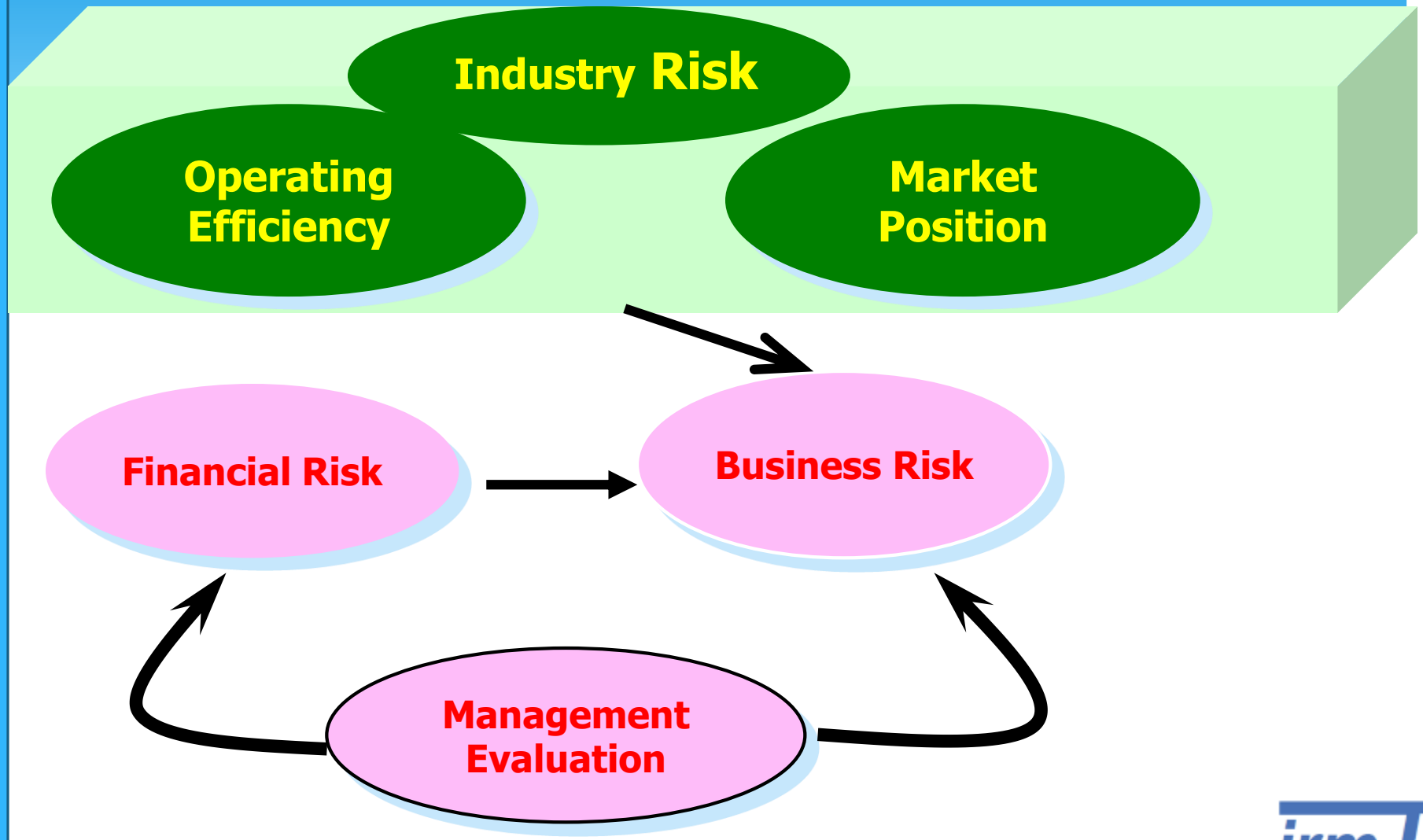
# Benefits of Ratings

- Regulatory Authorities
  - Investor protection
  - Market discipline
- Issuers
  - Accessibility to wider investor base
  - Encourages financial discipline
  - Lesser known companies can raise funds more optimally

# Benefits of Ratings (contd.)

- Intermediaries
  - Fixing coupon rates
  - Second opinion to supplement own assessment
- Investors
  - Eases risk identification and diversification
  - Improves liquidity of security

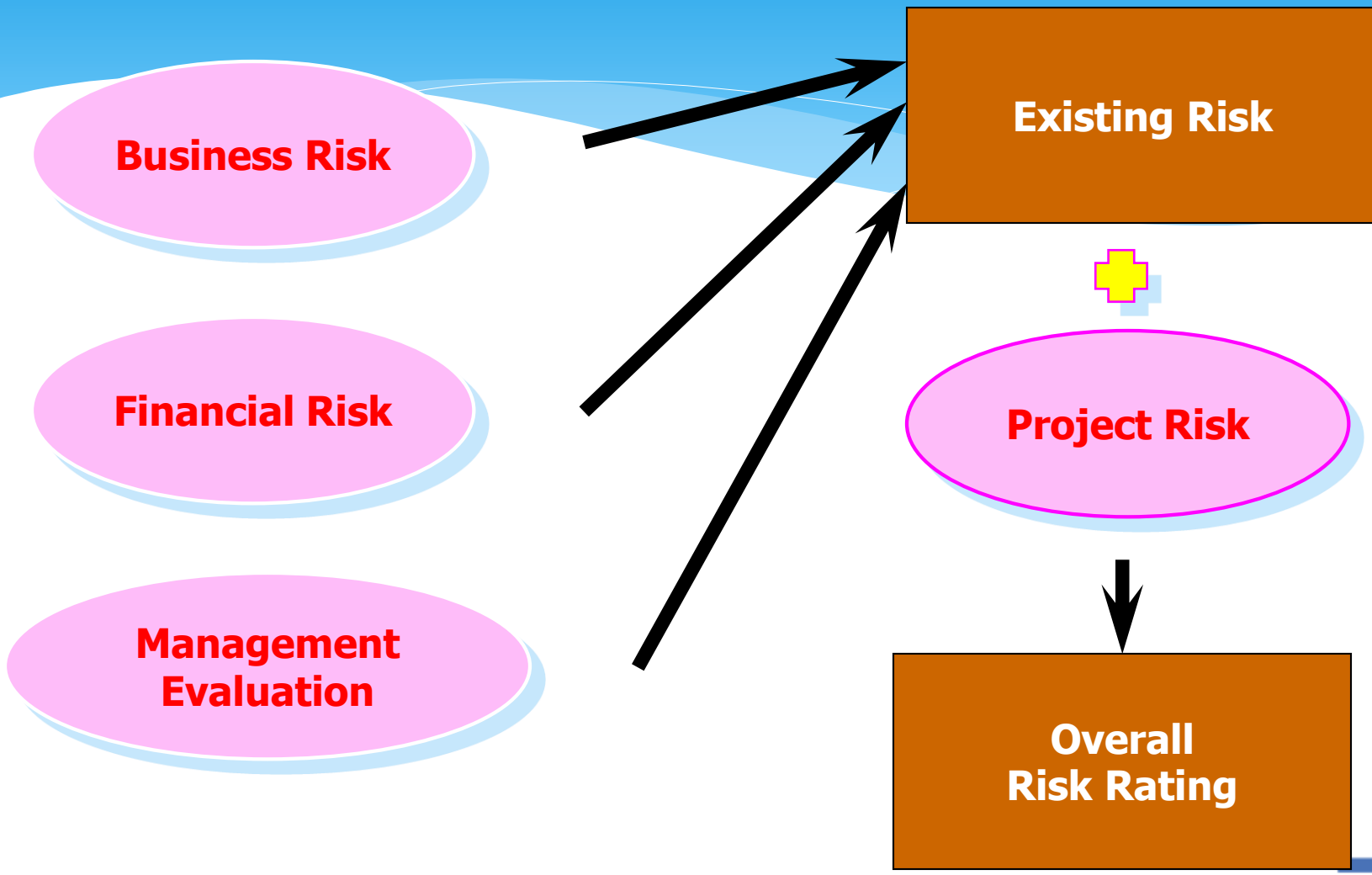
# Risk Assessment Model






IRMT
irmT The Institute of Risk Management Tanzania

# Risk Assessment Model



# Industry Risk

- Industry Structure
  - Industry size and importance to economy
  - Determinants of revenue growth
  - Entry barriers
- Extent of Competition
  - Nature and basis of competition
  - Threat from imports and substitutes
  - Presence of unorganized sector

# Market Position

- Market share
- Competitive advantages
  - Brand equity
  - Pricing flexibility
- Product and customer diversity
  - Proportion of exports
  - Nature & type of customer diversity

# Operating Efficiency

- Cost structure
- Manufacturing efficiency
- Production flexibility
- Technology risk
- Raw material sourcing
- Location factors

# Financial Risk Analysis

- Accounting Quality
  - Income recognition
  - Expense capitalisation
  - Depreciation and inventory valuation policies
  - Off-balance sheet and contingent liabilities
  - Non-operating income

# Financial Risk Analysis

- Earnings Protection
  - Profitability measures
  - Interest coverage
  - Capital structure
  - Debt service coverage
  - Working capital indicators
  - Return on capital employed

# Financial Risk Analysis

- Adequacy of Cash Flows
  - Debt servicing requirements
  - Sustainability of funds from operations
- Financial Flexibility
  - Ability to raise equity and debt funds
  - Alternatives in times of stress
  - Liquid assets available

# Management Evaluation

- Strength of linkage to parent/ group
  - Operational, financial, managerial support
- Systems and track record
  - Project implementation record
- Management talent and succession
- Financial Policies
  - Attitude to growth and debt orientation

# Project Risk

- Project size in relation to existing operations
- Means of financing
- Funding tie-up
- Extent of completion
- Adherence to implementation schedules

# INSTITUTE OF RISK MANAGEMENT TANZANIA (IRMT)

# STUDENTS SUMMARY NOTES

## MODULE IIB
## Risk Management in Banks

## CERTIFIED FINANICIAL SERVICES RISK MANAGEMENT PROFESSIONAL COURSE

## Certified Financial Services Risk Professional Examination (CFSRP)



I R M T

irmT The Institute of Risk Management Tanzania

# Knowledge Statements

At the end of this module; the potential trainer and student must learn and be conversant with the following:

a) Know Meaning of Risk Culture and Risk Intelligent Culture
b) Differentiate between Risk Intelligent Culture with Risk Culture
c) Steps in implementing Risk Intelligent Cultures
d) Different ways to measure Risk Intelligent Culture

# Task Statement

At the end of this module; the potential instructor and the candidate preparing to sit for exam, must be able to perform the following:

a) Be able to explain the concept of Risk Culture and Risk Intelligent Culture.
b) Be able to implement the Risk Culture in an organization
c) Be in a position to demonstrate and measure the risk intelligent culture in an organization
d) The candidate should be able to show and present some undesirable behavior which inhibit risk culture

# Risk Management in Banks

**Introduction**

From history perspective the word **"bank"** originates from the Italian word "banco." This is a desk or bench, covered by a green tablecloth, that was used several hundred years ago by Florentine bankers.

The traditional role of banks has been to take deposits and make loans. The interest charged on the loans is greater than the interest paid on deposits. The difference between the two has to cover administrative costs and loan losses (i.e., losses when borrowers fail to make the agreed payments of interest and principal), while providing a satisfactory return on equity.

# Risk Management in Banks Cont…

Today, most large banks engage in both commercial and investment banking. Commercial banking involves, among other things, the deposit-taking and lending activities.

Investment banking is concerned with assisting companies in raising debt and equity and providing advice on mergers and acquisitions, major corporate restructurings, and other corporate finance decisions. Large banks are also often involved in securities trading (e.g., by providing brokerage services).

# Risk Management in Banks Cont…

Commercial banking can be classified as ***retail banking* or *wholesale banking*.** Retail banking, as its name implies, involves taking relatively small deposits from private individuals or small businesses and making relatively small loans to them.

Wholesale banking involves the provision of banking services to medium and large corporate clients, fund managers and other financial institutions. Both loans and deposits are much larger in wholesale banking than in retail banking. Sometimes banks fund their wholesale or retail lending by borrowing in financial markets themselves.

# Risk Management in Banks Cont…

Typically the spread between the cost of funds and the lending rate is smaller for wholesale banking than for retail banking. However, this tends to be offset by lower costs.

Commercial banking was introduced in Tanzania for the first time in the year 1905, when the Deutsch-Ostafrikanische Bank opened its office in Dar es Salaam. This bank had a concession from the German Government to issue its own notes and coins, which helped the bank to meet the demand for coins in exchange for its notes.

A temporary mint was set up in Tabora. In 1911, another German bank, namely the Handelsbank fuer Ostafrika, opened a branch in Tanga.

# The Bank Balance Sheet

The Balance Sheet is a list of a bank's assets and liabilities

Total assets = total liabilities + capital

A bank's balance sheet lists sources of bank funds (liabilities) and uses to which they are put (assets)

Banks invest these liabilities (sources) into assets (uses) in order to create value for their capital providers.

An hypothetical example of Balance Sheet of a commercial banks follows in Table 17.1

# The Bank Balance Sheet

TABLE 17.1 Balance Sheet of All Commercial Banks (items as a percentage of the total, 2010)

| Assets | | Liabilities | |
|---|---|---|---|
| Reserves and cash items | 2 | Checkable deposits | 4 |
| Securities | | Nontransaction deposits | |
| U.S. government and agency | 9 | | |
| State and local government and other securities | 8 | Small-denomination time deposits (<$100,000) + savings deposits | 62 |
| Loans | | Large-denomination time deposits | 12 |
| Commercial and industrial | 9 | | |
| Real estate | 25 | Other liabilities | 4 |
| Interbank | 3 | | |
| Consumer | 5 | Borrowings | 12 |
| Other | 32 | Bank capital | 6 |
| Other assets (for example, physical captial) | 7 | | |
| Total | 100 | Total | 100 |

*Source:* http://www.federalreserve.gov/releases/h8/Current

Pay no interest

Secondary reserves

74% of Assets

Lowest cost source of funds-- payable on demand

Deposit with no check writing

Discount loans Fed Funds,

Corporate Loans have grown by factor of 10 since 1960 as % of Liab

**Bank Equity** = Assets - Liabilities, listed as Liab because Bank owes this to owners. Also includes **Loan Loss Reserves**



irmT The Institute of Risk Management Tanzania

# Basics of Banking

Asset transformation is, for example, when a bank takes your savings deposits and uses the funds to make, say, a mortgage loan. Banks tend to "borrow short and lend long" (in terms of maturity).

T-account Analysis:

Deposit of $100 cash into First National Bank

| First National Bank | | | |
|---|---|---|---|
| **Assets** | | **Liabilities** | |
| Vault cash | +$100 | Checkable deposits | +$100 |



IRMT

irmT The Institute of Risk Management Tanzania

# Basics of Banking Cont…

- Deposit of $100 check

| Assets | | Liabilities | |
|---|---|---|---|
| Cash items in process of collection | +$100 | Checkable deposits | +$100 |

| First National Bank | | | |
|---|---|---|---|
| **Assets** | | **Liabilities** | |
| Reserves | +$100 | Checkable deposits | +$100 |

| Second National Bank | | | |
|---|---|---|---|
| **Assets** | | **Liabilities** | |
| Reserves | –$100 | Checkable deposits | –$100 |

- Conclusion: When bank receives deposits, reserves ↑ by equal amount; when bank loses deposits, reserves ↓ by equal amount

# Basics of Banking Cont…

- Deposit of $100 cash into First National Bank assuming Required Reserve ratio of 10%

First National Bank

| Assets | | Liabilities | |
|---|---|---|---|
| Required reserves | +$10 | Checkable deposits | +$100 |
| Excess reserves | +$90 | | |

  - $10 of the deposit must remain in reserves to meet federal regulations (10% reserve req.).
  - Now, the bank is free to work with the $90 in its asset transformation function. In this case, the bank loans the $90 to its customers.

# Basics of Banking Cont…

Loaning out excess reserves

| Assets | | Liabilities | |
|---|---|---|---|
| Required reserves | +$10 | Checkable deposits | +$100 |
| Loans | +$90 | | |



IRMT

irmT The Institute of Risk Management Tanzania

# General Principles of Bank Management

Now let's look at how a bank manages its assets and liabilities. The bank has four primary concerns:

1. Liquidity management
2. Asset management
   * Managing credit risk
   * Managing interest-rate risk
3. Liability management
4. Managing capital adequacy

# Principles of Bank Management

## Liquidity Management

Reserves requirement = 10%, Excess reserves = $10 million

| Assets | | Liabilities | |
|---|---|---|---|
| Reserves | $20 million | Deposits | $100 million |
| Loans | $80 million | Bank Capital | $10 million |
| Securities | $10 million | | |

Deposit outflow
– 10 m

– 10 m

**Deposit outflow of $10 million**

| Assets | | Liabilities | |
|---|---|---|---|
| Reserves | $10 million | Deposits | $90 million |
| Loans | $80 million | Bank Capital | $10 million |
| Securities | $10 million | | |

With 10% reserve requirement, bank still has **excess reserves** of $1 million: **no changes needed in balance sheet**

# Liquidity Management

**No excess reserves**

| Assets | | Liabilities | |
|---|---|---|---|
| Reserves | $10 million | Deposits | $100 million |
| Loans | $90 million | Bank Capital | $10 million |
| Securities | $10 million | | |

– 10 m

– 10 m

Deposit outflow of $10 million

| Assets | | Liabilities | |
|---|---|---|---|
| Reserves | $0 million | Deposits | $90 million |
| Loans | $90 million | Bank Capital | $10 million |
| Securities | $10 million | | |

With 10% reserve requirement, bank has $9 million **reserve shortfall**

# Liquidity Management Cont…

1. Borrow from other banks or corporations

| Assets | | | Liabilities | | |
|---|---|---|---|---|---|
| Reserves | + 9 m | $9 million | Deposits | $90 million | |
| Loans | | $90 million | Borrowings | $9 million | + 9 m |
| Securities | | $10 million | Bank Capital | $10 million | |

2. Sell securities

| Assets | | | Liabilities | |
|---|---|---|---|---|
| Reserves | + 9 m | $9 million | Deposits | $90 million |
| Loans | | $90 million | Bank Capital | $10 million |
| Securities | - 9 m | $1 million | | |

# Liquidity Management Cont…

## 3. Borrow from Fed

| Assets | | | Liabilities | | |
|---|---|---|---|---|---|
| Reserves | + 9 m | $9 million | Deposits | $90 million | |
| Loans | | $90 million | Discount Loans | $9 million | + 9 m |
| Securities | | $10 million | Bank Capital | $10 million | |

## 4. Call in or sell off loans

| Assets | | | Liabilities | |
|---|---|---|---|---|
| Reserves | + 9 m | $9 million | Deposits | $90 million |
| Loans | - 9 m | $81 million | Bank Capital | $10 million |
| Securities | | $10 million | | |

Conclusion: Excess reserves are insurance against above 4 costs from deposit outflows

# Asset Management

Asset Management: the attempt to earn the highest possible return on assets while minimizing the risk.

1. Get borrowers with low default risk, paying high interest rates
2. Buy securities with high return, low risk
3. Diversify
4. Manage liquidity

# Liability Management

Liability Management: managing the source of funds, from deposits, to CDs, to other debt.

1. No longer primarily depend on deposits
2. When see loan opportunities, borrow or issue CDs to acquire funds

# Capital Adequacy Management

1. Bank capital is a cushion that prevents bank failure. For example, consider these two banks:

**High Capital Bank**

| Assets | | Liabilities | |
|---|---|---|---|
| Reserves | $10 million | Deposits | $90 million |
| Loans | $90 million | Bank capital | $10 million |

**Low Capital Bank**

| Assets | | Liabilities | |
|---|---|---|---|
| Reserves | $10 million | Deposits | $96 million |
| Loans | $90 million | Bank capital | $ 4 million |



IRMT

irmT The Institute of Risk Management Tanzania

# Capital Adequacy Management Cont…

What happens if these banks make loans or invest in securities (say, subprime mortgage loans, for example) that end up losing money? Let's assume both banks lose $5 million from bad loans.



IRMT

irmT The Institute of Risk Management Tanzania

# Capital Adequacy Management Cont…

- Impact of $5 million loan loss

**High Capital Bank**

| Assets | | Liabilities | |
|---|---|---|---|
| Reserves | $10 million | Deposits | $90 million |
| Loans | $85 million | Bank capital | $ 5 million |

**Low Capital Bank**

| Assets | | Liabilities | |
|---|---|---|---|
| Reserves | $10 million | Deposits | $96 million |
| Loans | $85 million | Bank capital | –$ 1 million |

Conclusion: A bank maintains reserves to lessen the chance that it will become insolvent.

# Capital Adequacy Management Cont…

So, why don't banks hold want to hold a lot of capital??

2. Higher is bank capital, lower is return on equity

- *ROA* = Net Profits/Assets
- *ROE* = Net Profits/Equity Capital
- *EM* = Assets/Equity Capital
- *ROE* = *ROA* × *EM*
- Capital ↑, *EM* ↓, *ROE* ↓

# Capital Adequacy Management Cont…

3. Tradeoff between safety (high capital) and ROE
4. Banks also hold capital to meet capital requirements (more on this in Chapter 20). The Basel Committee on Banking Supervision sets **minimum capital requirements — the ratio of bank capital to risk weighted assets**.

# Practical Cases (Manager)

Strategies for Managing Capital: what should a bank manager do if she feels the bank is holding too **much** capital?

- Sell or retire stock
- Increase dividends to reduce retained earnings
- Increase asset growth via debt (like CDs)

Reversing these strategies will help a manager if she feels the bank is holding too **little** capital?

- Issue stock
- Decrease dividends to increase retained earnings
- Slow asset growth (retire debt)

# How a Capital Crunch Caused a Credit Crunch in 2008

The slowdown in growth of credit triggered a crunch in 2007—credit was hard to get. What caused the credit crunch?

- Housing boom and bust led to large bank losses, including losses on SIVs which had to be recognized on the balance sheet.
- The losses reduced bank capital.

# How a Capital Crunch Caused a Credit Crunch in 2008 Cont…

Banks were forced to either (1) raise new capital or (2) reduce lending. Guess which route they chose? Why would banks be hesitant to raise new capital (equity) during an economic downturn?

# Off-Balance-Sheet Activities

1. Loan sales (secondary loan participation)
2. Fee income from
   - Foreign exchange trades for customers
   - Servicing mortgage-backed securities
   - Guarantees of debt
   - Backup lines of credit
3. Trading Activities and Risk Management Techniques
   - Financial futures and options
   - Foreign exchange trading
   - Interest rate swaps

- **All these activities involve risk and potential conflicts**

# Off Balance Sheet Cases

To highlight the problems that some of these off-balance sheet activities generate, we will briefly look at two incidences with devastating results.

**Barings**: Nick Leeson engaged in speculative trades on the Nikkea, and personally generated ***$1.3 billion*** in losses over a 3-year period. Barings had to close!

**Daiwa Bank**: Toshihide Iguchi racked up **$1.1 billion** in losses in trading. When he fessed-up, the bank decided to hide this from regulators. The bank was eventually fined $340 million and barred from U.S. operations

# Measuring Bank Performance

Much like any business, measuring bank performance requires a look at the income statement. For banks, this is separated into three parts:

- Operating Income
- Operating Expenses
- Net Operating Income

Note how this is different from, say, a manufacturing firm's income statement.

# Measuring Bank Performance Cont…

TABLE 17.2 Income Statement for All Federally Insured Commercial Banks, 2009

| | Amount ($ billions) | | Share of Operating Income or Expenses (%) | |
|---|---|---|---|---|
| **Operating Income** | | | | |
| Interest income | | 482.1 | | 66.5% |
| Interest on loans | 368.8 | | 50.9% | |
| Interest on securities | 86.2 | | 11.9% | |
| Other interest | 27.1 | | 3.7% | |
| Noninterest income | | 242.5 | | 33.5% |
| Service charges on DA | 41 | | 5.7% | |
| Other noninterest income | 201.5 | | 27.8% | |
| Total operating income | | 724.6 | | 100% |
| **Operating Expenses** | | | | |
| Interest expense | | 122.3 | | 17.3% |
| Interest on deposits | 84 | | 11.9% | |
| Interest on fed funds and repos | 5.3 | | 0.8% | |
| Other | 33 | | 4.7% | |

# Measuring Bank Performance Cont…

| | | | | |
|---|---|---|---|---|
| Noninterest expenses | | 353.1 | | 50.0% |
| Salaries and empolyee benefits | 151 | | 21.4% | |
| Premises and equipment | 41.4 | | 5.9% | |
| Other | 160.7 | | 22.8% | |
| Provisions for loan losses | | 230.9 | | 32.7% |
| Total operating expense | | 706.3 | | 100.0% |
| **Net Operating Income** | | 18.3 | | |
| Gain loss on securities | | –0.9 | | |
| Extraordinary items net | | –3.8 | | |
| Income taxes | | –4 | | |
| **Net Income** | | 9.6 | | |

# Recent Trends in Bank Performance Measures

- *ROA* = Net Profits/ Assets
- *ROE* = Net Profits/ Equity Capital
- *NIM* = [Interest Income – Interest Expenses]/ Assets
- http://www2.fdic.gov/qbp/

TABLE 17.3 Measures of Bank Performance, 1980–2009

| Year | Return on Assets (ROA) (%) | Return on Equity (ROE) (%) | Net Interest Margin (NIM)(%) |
|---|---|---|---|
| 1980 | 0.77 | 13.38 | 3.33 |
| 1981 | 0.79 | 13.68 | 3.31 |
| 1982 | 0.73 | 12.55 | 3.39 |
| 1983 | 0.68 | 11.60 | 3.34 |
| 1984 | 0.66 | 11.04 | 3.47 |
| 1985 | 0.72 | 11.67 | 3.62 |
| 1986 | 0.64 | 10.30 | 3.48 |
| 1987 | 0.09 | 1.54 | 3.40 |
| 1988 | 0.82 | 13.74 | 3.57 |
| 1989 | 0.50 | 7.92 | 3.58 |
| 1990 | 0.49 | 7.81 | 3.50 |
| 1991 | 0.53 | 8.25 | 3.60 |
| 1992 | 0.94 | 13.86 | 3.89 |
| 1993 | 1.23 | 16.30 | 3.97 |

# Recent Trends in Bank Performance Measures Cont…

- *ROA* = Net Profits/ Assets
- *ROE* = Net Profits/ Equity Capital
- *NIM* = [Interest Income – Interest Expenses]/ Assets

| | | | |
|---|---|---|---|
| 1994 | 1.20 | 15.00 | 3.95 |
| 1995 | 1.17 | 14.66 | 4.29 |
| 1996 | 1.19 | 14.45 | 4.27 |
| 1997 | 1.23 | 14.69 | 4.21 |
| 1998 | 1.18 | 13.30 | 3.47 |
| 1999 | 1.31 | 15.31 | 4.07 |
| 2000 | 1.19 | 14.02 | 3.95 |
| 2001 | 1.15 | 13.09 | 3.90 |
| 2002 | 1.30 | 14.08 | 3.96 |
| 2003 | 1.38 | 15.05 | 3.73 |
| 2004 | 1.28 | 13.20 | 3.54 |
| 2005 | 1.30 | 12.73 | 3.50 |
| 2006 | 1.28 | 12.31 | 3.31 |
| 2007 | 0.81 | 7.75 | 3.29 |
| 2008 | 0.03 | 0.35 | 3.16 |
| 2009 | 0.05 | 0.7 | 2.03 |

# Deposit Insurance

To maintain confidence in banks, government regulators in many countries have introduced guaranty programs. These typically insure depositors against losses up to a certain level.

The Deposit Insurance Fund was established in Tanzania under Section 23(1) of the Banking and Financial Institutions Act, 1991 and became operational in January 1994.

The main objective of the scheme is to protect small depositors from risks of losses of their savings arising from bank failures, thereby maintaining public confidence in the nation's banking and financial system.

# Deposit Insurance Cont…

The scheme does not provide 100% insurance coverage but from the standpoint of priorities, protecting small depositors (i.e. unsophisticated and unprofessional) and maintaining their confidence in the banking system is considered appropriate.

Every bank and non-bank financial institution which is licensed to carry on banking business in Tanzania must be a contributor of premium to the Fund. The premiums allow the scheme to build up ample insurance resources over the time to pay claims to depositors of a failed bank or non-bank financial institution.

# Deposit Insurance Cont…

Section 23(3) of the Banking and Financial Institutions Act, 1991 provides a number of sources of finance to sustain the activities of the Deposit Insurance Board.

The main source of income is annual insurance premium contributions from member institutions, which are calculated by reference to the size of the contributory institution's deposit base.

This source is supplemented by income from investment of the Fund's resources, mainly in the Government Treasury Bills. initial contribution towards the capitalization of the Fund of TShs.1,500 million was made by the Government.

# Deposit Insurance Cont…

The level of contribution is assessed by an applied uniformity to all banks and financial institutions based on one variable irrespective of risk involved to which a particular institution may be exposed to.

However, the assessment rate, in most instances is tied up with the need to hasten accumulation of reserves in line with increase in risk exposure to the Fund.

# Deposit Insurance Assessment

Definitions

- ✓ *Assessment base* is the base of deposits on which premiums are assessed. It may include only insured deposits, but can include all types of deposits that are potentially insurable or all deposits
- ✓ *Premium* is the amount a member institution pays for deposit insurance for a given period of time such as a year.

Defining an assessment base

- ✓ The most common assessment bases are insured and total deposits.
- ✓ *Insurable deposits* are defined as all deposits in all categories that are insured, including amounts in excess of the limit on insurance claims.

# Deposit Insurance Assessment Cont…

- *Insured deposits* are the amount of deposits that are protected within the limit of insurance claims. Premium systems: flat rate and risk-adjusted:
  - ✓ *Flat-rate premium system* means all member institutions are assessed at the same rate given the assessment base
  - ✓ *Risk-adjusted (differentiated) premium system* means the risk posed by a member institution to the deposit insurer is incorporated into the premium structure.

# Deposit Insurance Assessment Cont…

- Flat-rate premium system
  - ✓ Advantage: Relatively straight forward to implement
  - ✓ Disadvantage: Inequitable since low risk institutions subsidize high risk institutions.

- Risk-adjusted premium system
  - ✓ Advantage: More equitable since cross-subsidization among institutions is reduced
  - ✓ Disadvantage: more complex and expensive to administer

# Deposit Insurance Funding Methods

- **Three types of funding methods**
  - ✓ *Ex ante funding system* involves the advance accumulation and maintenance of a fund to cover deposit insurance claims. The fund is primarily premiums collected from the members of the deposit insurance system.
  - ✓ *Ex post system* means that funds to cover claims are only collected from members when a member institution fails and there is a need to cover deposit insurance claims.
  - ✓ *A hybrid system* combines elements of ex ante and ex post funding.

# Deposit Insurance Funding Methods Cont…

## Suggested Guidance

- ✓ Policymakers can choose among ex-ante, ex-post and combined (i.e. hybrid) approaches; however, an ex ante approach is preferable in most circumstances particularly for newly established systems.

- ✓ A disadvantage of systems that mainly rely on ex post funding is that they exacerbate financial cycles. Member institutions may be called on to make substantial payments into the system when they are least able to do so.

# Sources of Funds for the Deposit Insurance System

**Sources of funds**

The sources of funds for a deposit insurance system can come from the private sector, the public sector or both. Most countries operate a system that relies on private funding to a large extent.

- Private sources

  Member institutions pay mandatory premiums as one of the conditions of membership.

- Public sources

  Most DIS have access to public sector fund in the form of initial contributions, loans from government or central bank and grants to cover losses.

# Sources of Funds for the Deposit Insurance System Cont…

**Suggested Guidance**

- ✓ The cost of a DIS should be borne by its member banks, since they and their clients are the direct beneficiaries of a DIS. However, the impact of premium levels on the financial health of the banking industry should be taken into account.

- ✓ It is important for policy makers to take into account the impact of the establishment and operation of a deposit insurance fund on the capital base and lending capacity of member banks.

# Sources of Funds for the Deposit Insurance System Cont…

**Rationale**

Member institutions and their clients receive benefits from DIS so most countries operate a system that relies on private funding to a large extent.

Excess premium may weaken capital base of member institutions and lead to the instability of financial system.

# Investment Banking and Security Trading

The main activity of investment banking is raising debt and equity financing for corporations or governments. This involves originating the securities, underwriting them and then placing them with investors.

In a typical arrangement a corporation approaches an investment bank indicating that it wants to raise a certain amount of finance in the form of debt, equity, or hybrid instruments such as convertible bonds.

The securities are originated complete with legal documentation outlining the rights of the security holder

# Investment Banking

Investment banking is the marketing of securities when they are initially sold.

Some securities are sold to private buyers. Others are sold to the public. The exact difference is a technical legal issue.

Public offerings must be registered with the Securities and Exchange Commission (SEC).

# Security Trading

Banks often get involved in securities trading, providing brokerage services, and making a market in individual securities. In doing so, they compete with smaller securities firms that do not offer other banking services.

A broker assists in the trading of securities by taking orders from clients and arranging for them to be carried out on an exchange.

**Investment banking** firms sell public offerings. They are essentially marketers of securities and charge a fee for their services. This is often called an **underwriting fee.**

# Security Trading Cont…

Syndicates of investment banks are often involved in public offerings. This spreads the resale risk.

Firm Commitments. The investment banker purchases the security issue outright and bears the resale risk.

Best Efforts. The investment bankers sell whatever they're able.

Fees for firm commitments are much higher. Most bond issues are sold by firm commitment.

# Secondary Market

Many securities are traded on organized exchanges such as the New York Stock Exchange or DSE.

Most bonds are traded over-the-counter (OTC). The OTC market is a network of dealers located throughout the country.

Some securities are traded over anonymous electronic trading systems.

**Dealers** are market makers for securities. They maintain an inventory and buy and sell from that inventory. A dealer offers to buy at the bid price and offers to sell at the asked price.

# Secondary Market Cont…

The size of the bid-asked spread depends upon two major factors. Volume of trading. Inherent price risk.

**Brokers** are agents who carry out transactions for buyers or sellers. Brokers charge commissions for their services.

There are different types of brokers.

**Full-service brokers** provided execution and advice and charge the highest fees.

**Discount brokers** provided execution only.

Banks are often market makers for instruments such as forward contracts, swaps, and options trading in the over-the-counter (OTC) market.

# The Risks Facing Banks

A bank's operations give rise to many risks. Central bank regulators require banks to hold capital for the risks they are bearing. Capital is now required for each of three types of risk: ***credit risk, market risk, and operational risk.***

a) ***Credit risk*** is the risk that counterparties in loan transactions and derivatives transactions will default. This has traditionally been the greatest risk facing a bank and is usually the one for which the most regulatory capital is required.

b) **Market risk** arises primarily from the bank's trading operations. It is the risk relating to the possibility that instruments in the bank's trading book will decline in value

# The Risks Facing Banks Cont…

**Operational risk** is the risk that losses are made because internal systems fail to work as they are supposed to or because of external events. The time horizon for considering losses from credit risks and operational risks is one year, whereas the time horizon for considering losses from market risks is ten days.

The objective of regulators is to keep the total capital of a bank sufficiently high that the chance of a bank failure is very low. For example, in the case of credit risk and operational risk, the capital is chosen so that the chance of unexpected losses exceeding the capital in a year is 0.1%.

# The Risks Facing Banks Cont…

Banking risks are defined as adverse impacts on profitability of several distinct sources of uncertainty.

Risk measurement requires capturing the source of the uncertainty and the magnitude of its potential adverse effect on profitability. Profitability refers to both accounting and mark-to-market measures.

# The Risks Facing Banks Cont…

For over-the-counter instruments, such as derivatives (swaps and options), whose development has been spectacular in the recent period, sale is not readily feasible. The bank faces the risk of losing the value of such instruments when it is positive. Since this value varies constantly with the market parameters, credit risk changes with market movements during the entire residual life of the instrument. Credit risk and market risk interact because these values depend on the market moves.

# The Risks Facing Banks Cont…

Other Bank risk includes;

**Leverage Risk**

* **Leverage**—Combine debt with equity to purchase assets
* Leveraging with debt increases risk because debt requires fixed payments in the future
* The more leveraged a bank is, the less its ability to absorb a loss in asset value
* **Leverage Ratio**—Ratio of bank's equity capital to total assets [9% in 2002]
* Regulators in US and other countries impose **risk-based requirements—riskier the asset, higher the capital requirement**

# The Risks Facing Banks Cont…

**Interest Rate Risk**

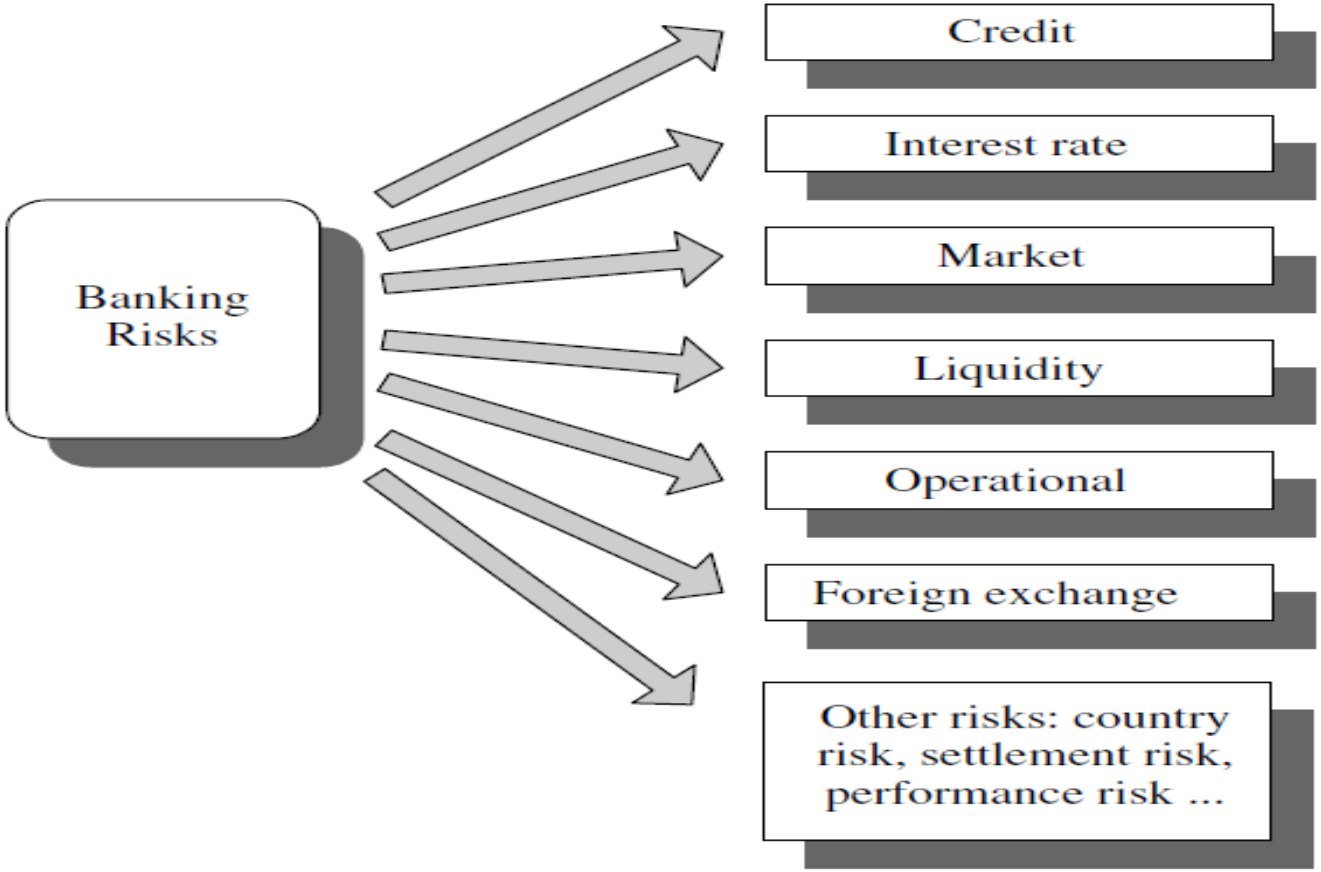
* Mismatch in maturity of a bank's assets and liabilities
* Traditionally banks have **borrowed short and lent long**
* Profitable if short-term rates are lower than long-term rates
* Due to discounting, increasing interest rates will reduce the **present value** of bank's assets
* Use of **floating interest rate** to reduce risk
* The **one-year re-pricing GAP** is the simplest and most commonly used measure of interest rate risk

# The Risks Facing Banks Cont…

## Liquidity Risk

* Possibility that transactions deposits and savings account can be withdrawn at any time
* Banks may need additional cash if withdrawals significantly exceed new deposits
* Traditionally banks provided liquidity through the **holding of liquid assets (cash and government securities)**
* Historically these holdings were a measure of a bank's liquidity, but have declined as a percentage of total assets during the past 30 years (41%-1970; 24%-2002)
* During past 30 years banks have used **miscellaneous liabilities** to increase their liquidity

# Summary of Bank Risks



I
R
M
T

# RISK MANAGEMENT IN INSURANCE COMPANIES AND PENSION PLANS

# Life Insurance

# Life Insurance Cont…

**Introduction**

Everyone needs medical care sometime and the most common way to pay for it may be through Government funding or through private health insurance.

While most Tanzanian have some type of private health insurance coverage and some few citizen have formal Government sponsorship, however there is strong Government initiatives to take on board low income earners in the formal system of life insurance.

# Life Insurance Cont…

I
R
M
T

The Government has introduced Community Health Fund. Health care financing study undertaken between 1990-1992 recommended introduction of cost sharing and National Health Insurance. Community Health Fund was conceived later to mitigate the shortfall of National Health Insurance **coverage.**

# Life Insurance Cont…

Health insurance refers to a type of insurance offered by private insurance companies or the government that covers health care expenses incurred by policyholders for necessary medical care.

Cost of providing health care is rising, health insurance decision is not whether to obtain it, but which health plan to purchase and how much coverage to purchase it is still dilemma sort of as many options available

# Private Health Insurance

Private health insurance: Health insurance that can be purchased from private insurance companies to provide coverage for health care expenses.

Their various types of private health insurance coverage; Hospital insurance, physician insurance, and surgical insurance.

# Private Health Insurance Cont…

I
R
M
T

**Options for purchasing private health insurance**

Options for purchasing private health insurance are offered more frequently by employers do offers health insurance as part of benefit package, Cost usually shared between employee and employer Self-employed individuals must pay entire cost of their health insurance.

**Private health care plans**

**Indemnity plan:** Health insurance that reimburses individuals for part or all of the expenses they incur from health care providers; individuals are free to decide whether to seek care from a primary care physician or a specialist.

# Private Health Insurance Cont…

Managed health care plan: a health insurance policy under which individuals receive services from specific doctors or hospitals that are part of the plan; these may include;

a) Health maintenance organization (HMO): a health insurance plan that covers health care services approved by doctors; a primary care physician provided general health services and refers patients to a specialist as necessary.
b) Preferred provider organization (PPO): a health insurance plan that allows individuals to select a health care provider and covers most of the fees for services. These could include;

# Private Health Insurance Cont…

Discount on charge arrangement: an arrangement in which the preferred provider organization agrees to pay a specific percentage of the health care provider's charges.

Per diem rate arrangement: an arrangement in which the preferred provider organization pays the provider a specific sum per day a patient is hospitalized.

# Private Health Insurance

| Type of Private Health Plan | Premium | Selection of Physician |
|---|---|---|
| Indemnity Plan | High | Flexibility to select physician or specialist |
| Managed Care: HMOs | Relatively low | Primary care physician refers patients to specialist |
| Managed Care: PPOs | Low, but usually higher than HMOs | There is a greater number of physicians to choose from in PPOs than HMOs. |

# Government Health Care Plans

## Table 1: Tanzania Administrative and Health System

| Administrative Level | | Public Health Facility | Ownership of Facility | | |
|---|---|---|---|---|---|
| | | | Public | Voluntary | Private |
| Level | No. | Facility Type | Number | Number | Number |
| Zone | 6 | Tertiary hospitals | 4 | - | - |
| Region | 21 | Secondary hospitals 1 in each region | 17 | - | - |
| District | 121 | Primary hospital 1 in each district | 85 | 81 | 42 |
| Division | 372 | Health centre | 292 | 69 | 41 |
| Ward | 2000 | Dispensary | 2683 | 598 | 1099 |
| Village | 11000 | Village health post | 4000 | - | - |

# Health Financing Options in Tanzania

These are such as:

- National Health Insurance Fund (NHIF)
- Community Health Funds (CHF)*
- Micro-health Insurance Schemes (MHIS)

Other Funding sources include:

- Government and Local Governments
- Basket Funding
- NGOs
- Private Financing
- Community Financing*
- Donor Funding

# Health Financing Options in Tz Cont…

**National Health Insurance Fund … Aims**

- To strengthen cost-sharing by providing an opportunity for the formal sector employees to contribute through their contributions
- To provide free choice of providers to Public servants who were formerly restricted to government health facilities.
- To enhance health equity among formal sector employees in the provision of health care services.
- To institute a permanent and reliable system for the provision of health services to formal sector employees.
- To improve accessibility and quality of health services by introducing competition among health care providers from Public, Faith-based, Non Government Organizations and Private Health Providers.
- To reduce the financing gap by supplementing the Government budgetary allocation to the health sector by contributions from formal sector employees.

# Description of the NHIF

- The (NHIF) was established in 1999 by a parliamentary Act No. 8 of 1999.
- The operations of the scheme commenced on the 1st July 2001.
- The benefits to Members started from October 2001.
- The scheme is based on internationally accepted insurance principles.

# Description of the NHIF Cont…

- The scheme provides a wide range of short term benefits to her members.
- Currently, the NHIF serves for the Public service employees including their spouses and four children and/or legal dependents.
- It is a **compulsory** scheme for public servants.

# Community Health Funds in Tanzania

**Introduction**

It is part of the health financing reforms that begun in 1990.

Health care financing study undertaken between 1990-1992 recommended introduction of cost sharing and National Health Insurance. Community Health Fund was conceived later to mitigate the shortfall of National Health Insurance **coverage.**

Started on pilot basis in one district. The pilot was then extended to nine more districts after evaluation. Policy decision has now been reached to cover all districts. It is taken as one of the conditions to extend cost sharing in primary health care facilities.

# Community Health Funds in Tanzania Cont…

- Risk pooling among families in the informal sector.
- Households pay once a predetermined premium for the medication of the whole family per year.
- Payment is often made at the time of harvesting or when the season of income has arrived.
- Since the premiums are in the form of capitation, providers and contributors have the liberty to spend in preventive and promote health services.
- Contributors have a choice of providers.
- Provides opportunity for providers to increase efficiency.

# Community Financing

* These are informal contributions for the purpose of health.
* Are solidarity funds and/or special arrangements made for health e.g. with individual companies, collections.

# Why Community Financing?

The community financing are very essential to;

a) Improves efficiency and equity
b) Allows sharing of risk (community-rating)
c) Allows collection of resources
d) Facilitates community participation (contribution to the general welfare of the community)

# Impact of Community-based Schemes

* Increase access
* Generate resources
* Improve equity
* Improved Access for members of Schemes
* Increased utilization of the members as compared to non-members
* Reduced out-of-pocket payment for members as compared to non-members

# Types of Life Insurance Products

There are many different types of life insurance products. The products available vary from country to country. We will now describe some of the more common ones.

## a) Term Life Insurance

Term life insurance (sometimes referred to as temporary life insurance) lasts a predetermined number of years. If the policyholder dies during the life of the policy, the insurance company makes a payment to the specified beneficiaries equal to the face amount of the policy. If the policyholder does not die during the term of the policy, no payments are made by the insurance company.

# Types of Life Insurance Products Cont…

The policyholder is required to make regular monthly or annual premium payments to the insurance company for the life of the policy or until the policyholder's death (whichever is earlier).

The face amount of the policy typically stays the same or declines with the passage of time. One type of policy is an annual renewable term policy.

# Types of Life Insurance Products Cont…

b) **Whole Life Insurance**

Whole life insurance (sometimes referred to as *permanent life insurance*) provides protection for the life of the policyholder. The policyholder is required to make regular monthly or annual payments until his or her death. The face value of the policy is then paid to the designated beneficiary.

# Types of Life Insurance Products Cont…

In the case of term life insurance, there is no certainty that there will be a payout, but in the case of whole life insurance, a payout is certain to happen providing the policyholder continues to make the agreed premium payments.

The only uncertainty is when the payout will occur. Not surprisingly, whole life insurance requires considerably higher premiums than term life insurance policies. Usually, the payments and the face value of the policy both remain constant through time.

# Types of Life Insurance Products Cont…

c) **Variable Life Insurance**

Given that a whole life insurance policy involves funds being invested for the policyholder a natural development is to allow the policyholder to specify how the funds are invested. Variable life (VL) insurance is a form of whole life insurance where the surplus premiums discussed earlier are invested in a fund chosen by the policyholder.

This could be an equity fund, a bond fund, or a money market fund

# Types of Life Insurance Products Cont…

**d) Universal Life**

Universal life (UL) insurance is also a form of whole life insurance. The policyholder can reduce the premium down to a specified minimum without the policy lapsing. The surplus premiums are invested by the insurance company in fixed income products such as bonds, mortgages, and money market instruments.

The insurance company guarantees a certain minimum return, say 4%, on these funds. The policyholder can choose between two options. Under the first option, a fixed benefit is paid on death; under the second option, the policyholder's beneficiaries receive more than the fixed benefit if the investment return is greater than the guaranteed minimum.

# Types of Life Insurance Products Cont…

e) **Variable-Universal Life Insurance**

Variable-universal life (VUL) insurance blends the features found in variable life insurance and universal life insurance. The policyholder can choose between a number of alternatives for the investment of surplus premiums.

The insurance company guarantees a certain minimum death benefit and interest on the investments can sometimes be applied toward premiums. Premiums can be reduced down to a specified minimum without the policy lapsing.

# Types of Life Insurance Products Cont…

f) **Endowment Life Insurance**

Endowment life insurance lasts for a specified period and pays a lump sum either when the policyholder dies or at the end of the period, whichever is first. There are many different types of endowment life insurance contracts.

The amount that is paid out can be specified in advance as the same regardless of whether the policyholder dies or survives to the end of the policy. Sometimes the payout is also made if the policyholder has a critical illness. In a *with-profits* endowment life insurance policy, the insurance company declares periodic bonuses that depend on the performance of the insurance company's investments.

# Types of Life Insurance Products Cont…

g) **Group Life Insurance**

Group life insurance covers many people under a single policy. It is often purchased by a company for its employees. The policy may be *contributory*, where the premium payments are shared by the employer and employee, or *noncontributory*, where the employer pays the whole of the cost. There are economies of scale in group life insurance. The selling and administration costs are lower.

An individual is usually required to undergo medical tests when purchasing life insurance in the usual way, but this may not be necessary for group life insurance. The insurance company knows that it will be taking on some better-than-average risks and some worse-than-average risks.

# Annuity Contract

An annuity is a contract that provides for the liquidation of a sum of money through a series of payments during a specified period of time.

Often the period coincides with the lifetime of one or more persons.

The person receiving the payments (the annuitant) is protected against the risk of outliving his or her financial resources.

# Annuity Contracts Cont…

Many life insurance companies also offer annuity contracts. Where a life insurance contract has the effect of converting regular payments into a lump sum, an annuity contract has the opposite effect: that of converting a lump sum into regular payments.

In a typical arrangement, the policyholder makes a lump sum payment to the insurance company and the insurance company agrees to provide the policyholder with an annuity that starts at a particular date and lasts for the rest of the policyholder's life.

# Annuity Contracts Cont…

In some instances, the annuity starts immediately after the lump sum payment by the policyholder. More usually, the lump sum payment is made by the policyholder several years ahead of the time when the annuity is to start and the insurance company invests the funds to create the annuity. (This is referred to as a *deferred annuity*).

Instead of a lump sum, the policyholder sometimes saves for the annuity by making regular monthly, quarterly, or annual payments to the insurance company.

# Structure of Annuities

Are structured so that annuitants' payments are composed of both interest earnings and a partial liquidation of principal.

For contracts guaranteeing payments for as long as an annuitant is alive, each payment consists not only of interest and principal but also of a third element called the survivorship benefit

# How are Annuity Premiums Paid?

An annuity can be purchased with one lump-sum payment called a **single-premium annuity** Or it can be purchased in installments over a period of years Called an **annual-premium annuity.**

Considerable latitude is allowed regarding the timing and amount of premiums.

The installment arrangement is a flexible-premium annuity.

The size of the eventual annuity benefit is a function of the accumulated premium dollars at the time the annuitant decides to begin collecting benefits.

# When Do Benefits Begin?

Benefits can begin as soon as the annuity is purchased and continue at specified intervals thereafter Called an **immediate annuity.**

**Deferred Annuity**

Benefits are deferred until some future time .The particular time when benefits are to begin may or may not be specified ahead of time If such a time is designated, changes usually can be made if desired.

# MEASURES OF MORTALITY & MORTALITY IN DIFFERENCE POPULATIONS



IRMT

irmT
The Institute of Risk Management Tanzania

# Mortality Tables

I
R
M
T

Mortality is a term which means "death" or describes death and related issues.

Mortality tables are the key to valuing life insurance contracts.

# Mortality Table

Table 4.1 Mortality Table for the United States - 1990

| Age | Total Deaths | Rate per 100,000 Population: Both Sexes | Male | Female |
|---|---|---|---|---|
| All ages | 2,175,000 | 867.7 | 922.0 | 816.1 |
| Under 1 year | 38,200 | 944.0 | 1,042.9 | 839.7 |
| 1–4 years | 6,859 | 45.7 | 50.7 | 40.4 |
| 5–14 years | 8,600 | 24.1 | 28.8 | 19.2 |
| 15–24 years | 37,280 | 103.7 | 154.3 | 51.7 |
| 25–34 years | 60,910 | 139.2 | 204.4 | 73.9 |
| 35–44 years | 83,790 | 221.9 | 307.2 | 138.5 |
| 45–54 years | 118,550 | 465.4 | 603.6 | 334.4 |
| 55–64 years | 253,280 | 1,181.7 | 1,516.7 | 880.8 |
| 65–74 years | 483,490 | 2,624.8 | 3,384.1 | 2,013.4 |
| 75–84 years | 611,220 | 6,137.4 | 7,992.3 | 4,999.8 |
| 85 and older | 471,090 | 14,974.3 | 17,743.4 | 13,897.8 |
| Not stated | 1,440 | — | — | — |

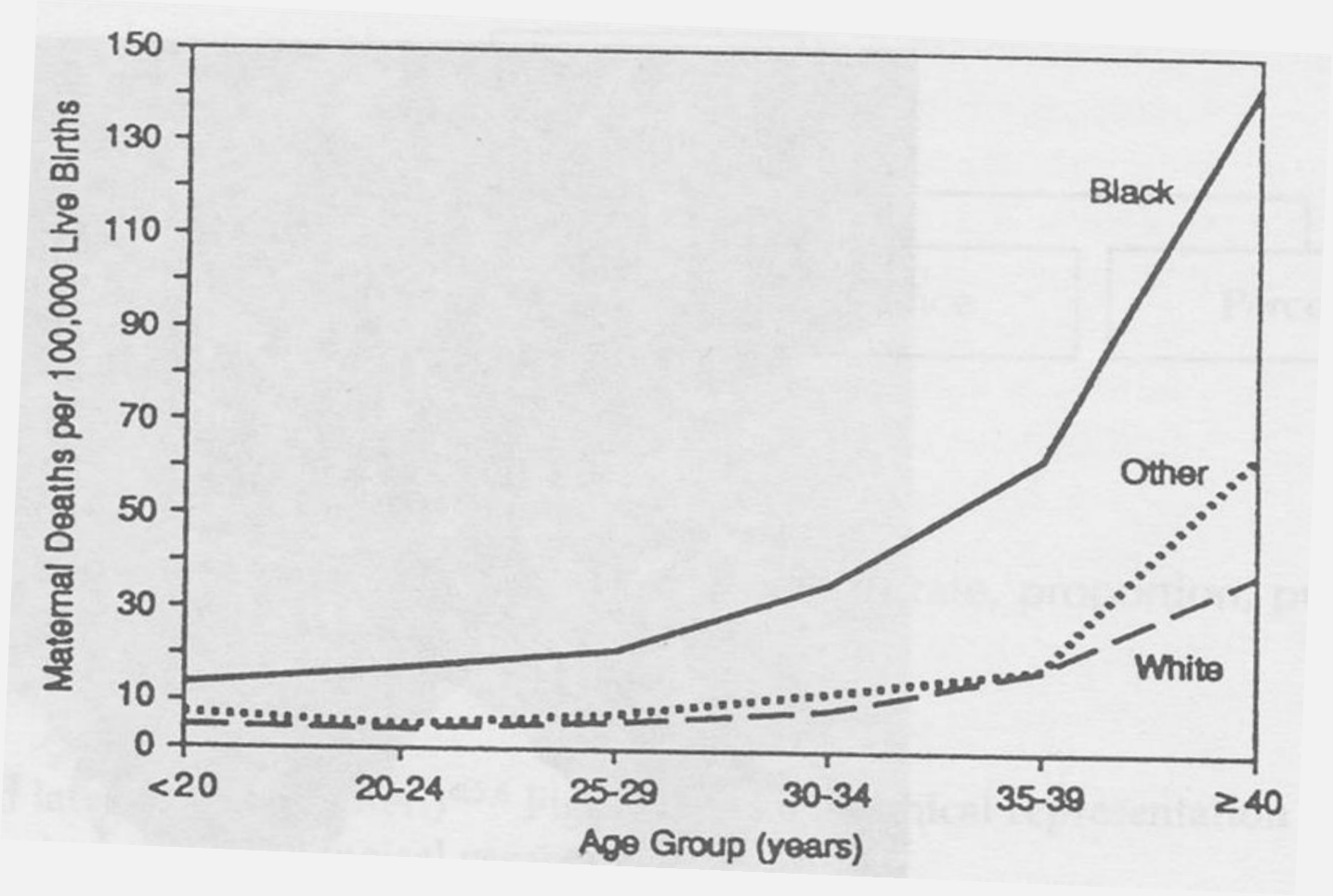
# Selected Mortality Rates

Table 4.2 Table of Selected Mortality Rates for the United States

| *Selected Mortality Statistics* | *1980* | *1986* | *1988* |
|---|---|---|---|
| Deaths (in thousands) | 1,990 | 2,105 | 2,168 |
| Death rate, crude (per 100,000) | 878.3 | 873.2 | 882.0 |
| Death rate, adjusted (per 100,000) | 585.8 | 541.7 | 535.5 |
| Infant mortality (per 1,000 live births) | 12.6 | 10.4 | 10.0 |
| Fetal death rate (per 1,000 live births) | 9.1 | 7.7 | 7.5 |
| Life Expectancy at birth (in years) | 73.7 | 74.8 | 74.9 |

(Source: National Center for Health Statistics, *Health—United States, 1990*, Public Health Service, U.S. Department of Health and Human Services, Vol. 40, No. SS–2, July 1991)

# Maternal Mortality



# Rates

$$Rate = \frac{Number\ of\ Cases}{Population\ of\ the\ Area\ in\ a\ Specific\ Time\ Period} \times 1000$$

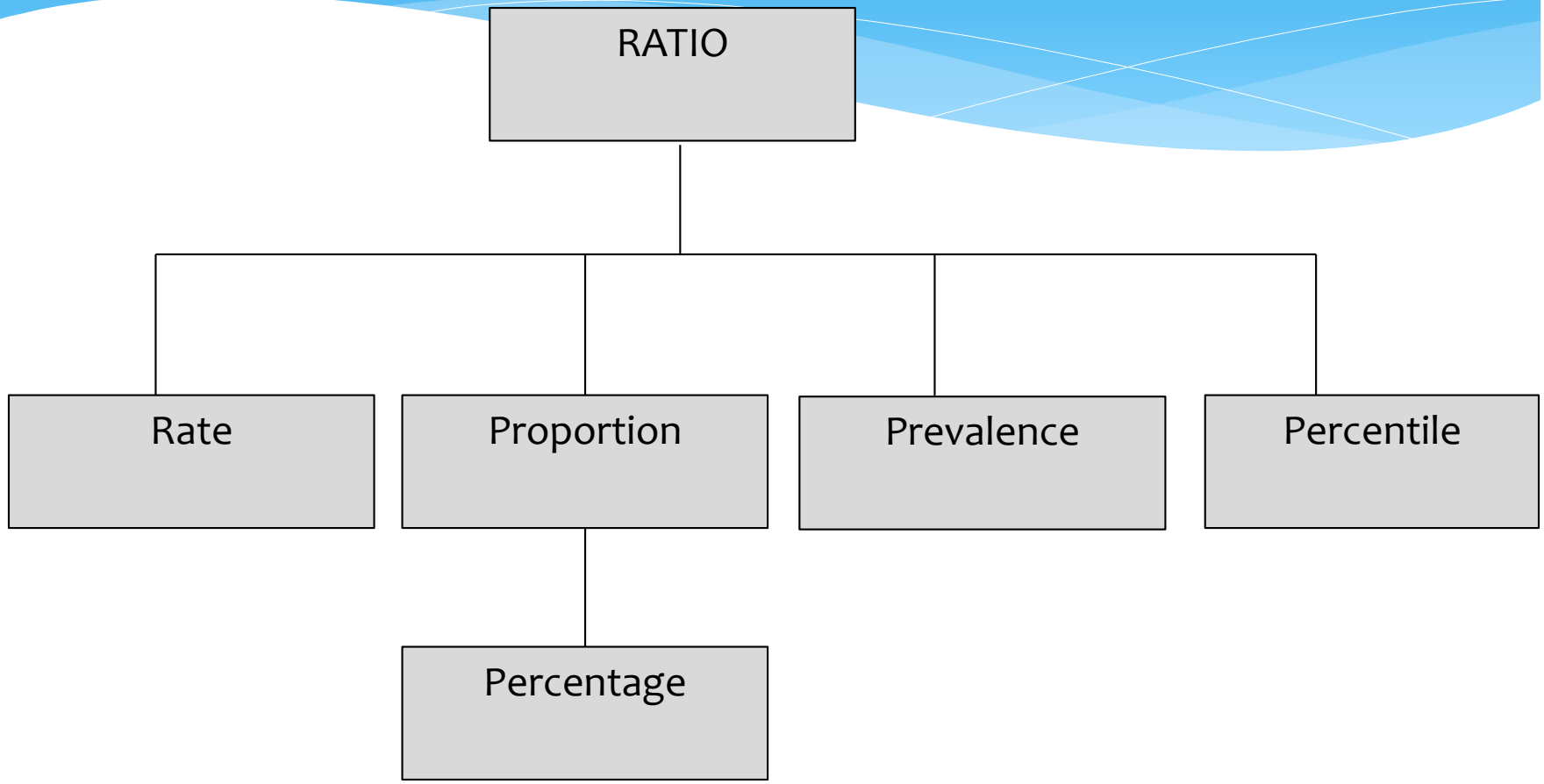
- With rates, the numerator is included in the denominator
- Rate is the number of or frequency of a disease per unit size of population



IRMT

irmT The Institute of Risk Management Tanzania

# Ratio






IRMT

irmT
The Institute of Risk Management Tanzania

# Ratios

- Ratio – the relation in number, degree or quantity existing between two similar things

25♀ : 30♂

- Ratio as a fraction

25/30 or 5/6



IRMT

irmT The Institute of Risk Management Tanzania

# Proportions

Compare like populations or like illnesses within a population

For example, 40 children are currently ill with measles, while 80 children all together have or have had the measles

$$\frac{40\ currently\ ill}{80\ total\ cases\ of\ measles} = 40 \text{ divided by } 80$$

$$= .50 \times 100$$

$$= 50\% \text{ are ill.}$$

(.50 is the proportion. 50% is the percentage)



IRMT

irmT The Institute of Risk Management Tanzania

# Mortality

- Deaths; describes death; related issues

- Graunt
  - ✓ 1600s – Bills of Mortality

- Farr (1807-1883)
  - ✓ Registrar general; vital statistics
  - ✓ Causes
  - ✓ Registration

# Three Levels of Rates

* Crude rates
* Adjusted rates
* Specific rates/ratios



IRMT

irmT
The Institute of Risk Management Tanzania

# Annual Death Rates

- "General" (crude) mortality rate
  - ✓ A population group exposed to risk of death
  - ✓ A time period
- **Crude Mortality Rate** = # of deaths occurring in <u>that</u> population during <u>that</u> period of time

$$\text{Annual death rate from all causes} = \frac{\text{Total numbers of death during a specific 12-month time period}}{\text{Number of persons in the total population at middle of the time period}} \times 1{,}000$$



IRMT

irmT The Institute of Risk Management Tanzania

# Crude Death Rates

- Does NOT account for differences of age, sex, etc. in any aspect of death
- Info needed:
  - Total deaths
  - Total population
  - A given period of time

$$\text{CDR} = \frac{\text{Total deaths per year}}{\text{Average total population of that year}} \times 100{,}000$$



IRMT

irmT The Institute of Risk Management Tanzania

# Cause Specific Mortality Rate

$$\text{Cause specific mortality rate} = \frac{\text{Number of deaths by a certain disease for a select subgroup in a given year}}{\text{Total mortality cause population (or sub-group) in the same period (1 year) (population at risk)}} \times 100{,}000$$



IRMT

irmT The Institute of Risk Management Tanzania

# Case Fatality Rate

$$\text{Case fatality rate (1)} = \frac{\text{Number of deaths by a certain disease in a given time period}}{\text{Number of diagnosed cases in the same period}} \times 100$$

$$\text{Case fatality rate (2)} = \frac{\text{Number of deaths by a certain disease or cause in a specified time period}}{\text{Number of cases which occurred in the same period}} \times 100$$

# Specific Death Rates

## For the example: Early Life Mortality Measures

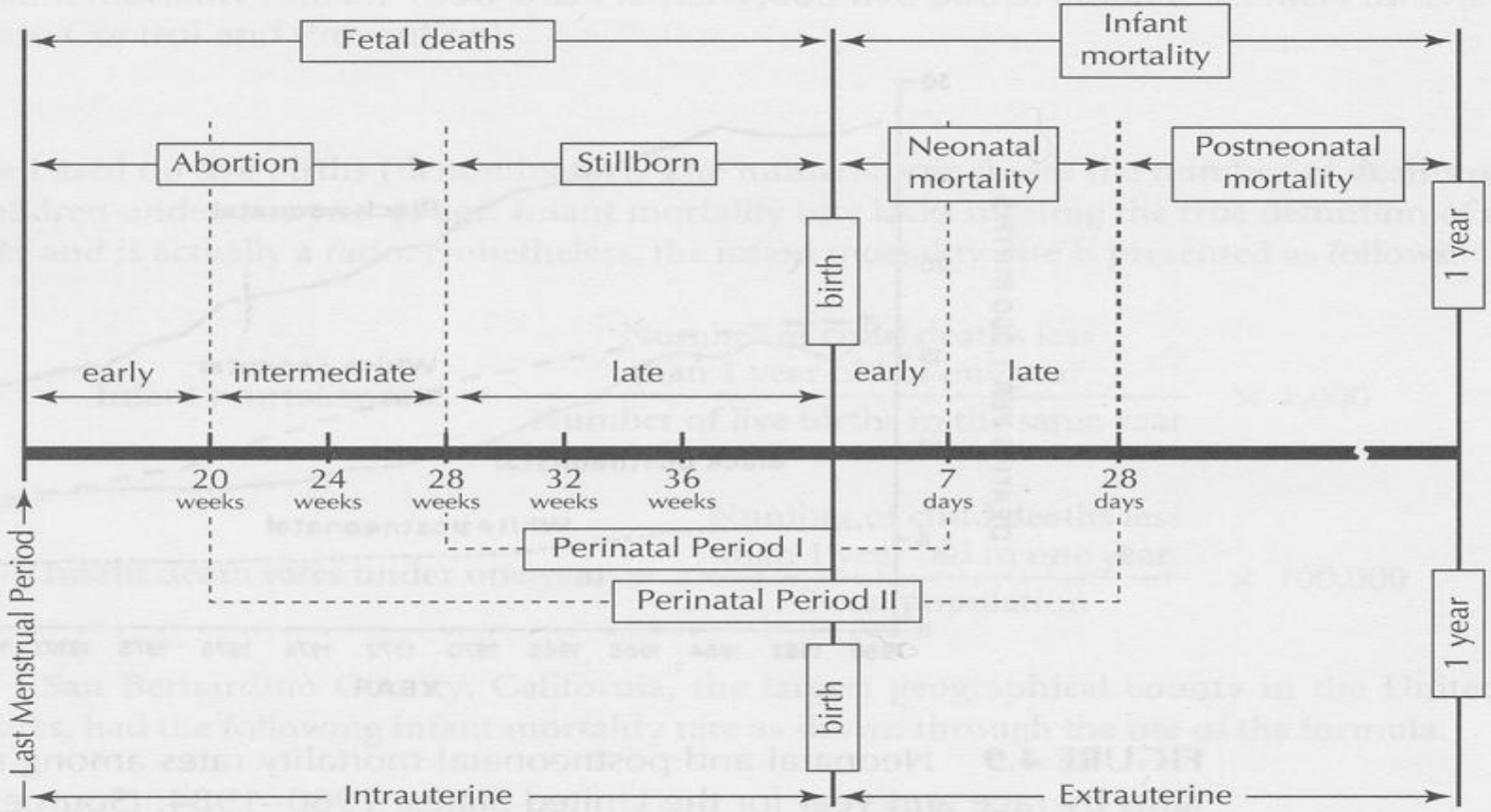



**FIGURE 4.10** Chart of early life mortality measures.




IRMT

irmT The Institute of Risk Management Tanzania

# Specific Death Rates Cont…

- For example: infant mortality

$$\text{Infant mortality rate} = \frac{\text{Number of child deaths less than 1 year old in one year}}{\text{Number of live births in the same year}} \times 1{,}000$$

$$\text{Infant death rates under one year} = \frac{\text{Number of child deaths less than 1 year old in one year}}{\text{Total population}} \times 100{,}000$$



IRMT

irmT The Institute of Risk Management Tanzania

# Specific Death Rates Cont…

- Neonatal Mortality Rate

$$\text{Neonatal mortality rate} = \frac{\text{Number of infant deaths under 28 days old}}{\text{Number of live births in the same year}} \times 1{,}000$$

- Postneonatal Mortality Rate

$$\text{Postneonatal mortality rate} = \frac{\text{Number of infant deaths between 28 days of age and 1 year of age}}{\text{Number of live births in the same year}} \times 1{,}000$$



IRMT

irmT The Institute of Risk Management Tanzania

# Specific Death Rates Cont…

## Perinatal Mortality Rates

$$\text{Perinatal mortality rate (Period I)} = \frac{\text{Number of fetal deaths of 28 or more weeks gestation + postnatal deaths (7 days)}}{\text{Total fetal deaths + live births in the same period}} \times 1{,}000$$



IRMT

irmT The Institute of Risk Management Tanzania

# Specific Death Rates Cont…

- Fetal Death Rate

$$\text{Fetal death rate} = \frac{\text{Number of fetal deaths in a time period (1 year)}}{\text{Total number of fetal deaths + live births in the same period}} \times 1{,}000$$



IRMT

irmT The Institute of Risk Management Tanzania

# Maternal Mortality Rates

$$\text{Maternal mortality rate} = \frac{\text{Number of deaths from puerperal causes in a given year and population}}{\text{Total number of live births in the same period (1 year) and population}} \times 100{,}000$$



IRMT

irmT The Institute of Risk Management Tanzania

# Adjusted Death Rates

* Allows comparisons by controlling for differences in some variables
  - Standardized Mortality Ratio (SMR)
  - Proportionate Mortality Ratio (PMR)
  - Specific Mortality Rates
* Does NOT account for differences for age, sex, etc. in any aspect of death
* Info needed:
  - Total deaths
  - Total population
  - A given period of time

# Standardized Mortality Ratio (SMR)

$$\text{Standard mortality ratio} = \frac{\text{Observed deaths}}{\text{Expected deaths}} \times 100$$



IRMT

irmT The Institute of Risk Management Tanzania

# Standardized Mortality Ratio (SMR)

**TABLE 3–19.** *Computation of an SMR for Tuberculosis, All Forms (TBC), for White Miners Ages 20 to 59 Years, United States, 1950*

| Age (yr) | Estimated Population of White Miners (1) | Death Rate (per 100,000) for TBC in Males in the General Population (2) | Expected Deaths From TBC in White Miners if They Had the Same Risk as the General Population (3) = (1) × (2) | Observed Deaths from TBC in White Miners (4) |
|---|---|---|---|---|
| 20–24 | 74,598 | 12.26 | 9.14 | 10 |
| 25–29 | 85,077 | 16.12 | 13.71 | 20 |
| 30–34 | 80,845 | 21.54 | 17.41 | 22 |
| 35–44 | 148,870 | 33.96 | 50.55 | 98 |
| 45–54 | 102,649 | 56.82 | 58.32 | 174 |
| 55–59 | 42,494 | 75.23 | 31.96 | 112 |
| Totals | 534,533 | | 181.09 | 436 |

$$\text{SMR} = \frac{\text{Observed deaths for an occupation – cause – race group}}{\text{Expected deaths for an occupation – cause – race group}} \times 100$$

$$\text{SMR (for 20–59-yr-olds)} = \frac{436}{181.09} \times 100 = 241$$

Adapted from Vital statistics: Special reports. Washington, DC, Department of Health, Education, and Welfare, vol 53(5), 1963.

# Standardized Mortality Ratio (SMR)

| Age Group | Number of Farmers and Farm Managers (Census, 1951) (1) | Standard Death Rates per 1,000,000 (All Causes of Death) (2) | Expected Number of Deaths for Farmers and Farm Managers per 1,000,000 (3) = (1) × (2) |
|---|---|---|---|
| 20–24 | 7,989 | 1,383 | 11 |
| 25–34 | 37,030 | 1,594 | 59 |
| 35–44 | 60,838 | 2,868 | 174 |
| 45–54 | 68,687 | 8,212 | 564 |
| 55–64 | 55,565 | 22,953 | 1,275 |

Total expected deaths per year: 2,083
Total observed deaths per year: 1,464

$$\text{SMR} = \frac{1{,}464}{2{,}083} \times 100 = 70.3\%$$



IRMT

irmT The Institute of Risk Management Tanzania

# Specific Mortality Rates

## Age Specific Mortality Rate

$$\text{Age specific mortality rate} = \frac{\text{Number of deaths of persons age 1–14 in a given year}}{\text{Total persons aged 1–14 in the same period (1 year)}} \times 100{,}000$$

$$\text{Age specific mortality rate} = \frac{\text{Number of deaths of rural elderly age 55+ in a given year}}{\text{Average population of rural elderly in the same period}} \times 100{,}000$$



IRMT

irmT The Institute of Risk Management Tanzania

# Other Issues Related to Mortality

* Mortality Cross-over

  Death of a subject that started in one group but "crossed over" to another group during course of study.

* Mortality Time Trends
* Years of Potential Life Lost (YPLL)
  - YPLL Rate

$$\text{YPLL rate} = \frac{\text{Years of potential life lost}}{\text{Population under age 65}} \times 1{,}000$$



IRMT

irmT The Institute of Risk Management Tanzania

# Longevity and Mortality Risk

**Introduction**

*Longevity risk* is the risk that advances in medical sciences and lifestyle changes will lead to people living longer. Increases in longevity adversely affect the profitability of most types of annuity contracts (because the annuity has to be paid for longer), but increases the profitability of most life insurance contracts (because the final payout is either delayed or, in the case of term insurance, less likely to happen).

Life expectancy has been steadily increasing in most parts of the world.

# Longevity and Mortality Risk Cont…

***Mortality risk* is** the risk that wars, epidemics such as AIDS, or pandemics such as Spanish flu will lead to people living not as long as expected. This adversely affects the payouts on most types of life insurance contracts (because the insured amount has to be paid earlier than expected), but should increase the profitability of annuity contracts (because the annuity is not paid out for as long).

In calculating the impact of mortality risk, it is important to consider the age groups within the population that are likely to be most affected by a particular event.

# Longevity and Mortality Risk Cont…

To some extent, the longevity and mortality risks in the annuity business of a life insurance company offset those in its regular life insurance contracts.

Actuaries must carefully assess the insurance company's net exposure under different scenarios. If the exposure is unacceptable, they may decide to enter into reinsurance contracts for some of the risks.

# Property Causality Insurance

Property-casualty insurance can be subdivided into property insurance and casualty insurance. Property insurance provides protection against loss of or damage to property (from fire, theft, water damage, etc.). Casualty insurance provides protection against legal liability exposures (from, for example, injuries caused to third parties).

Casualty insurance might more accurately be referred to as liability insurance. Sometimes both types of insurance are included in a single policy.

# Property Causality Insurance Cont…

I
R
M
T

For example, a home owner might buy insurance that provides protection against various types of loss such as property damage and theft as well as legal liabilities if others are injured while on the property.

Similarly, car insurance typically provides protection against theft of, or damage to, one's own vehicle as well as protection against claims brought by others.

# Moral Hazard and Adverse selection

**Introduction**

Insurance company faces number of risk, at this juncture let focus on two key risks facing insurance companies: moral hazard and adverse selection.

Adverse selection arises from the information asymmetry about health risks between the insurance company and the insured person.

Insurance company (principal) only knows average risk in a population.

Individual (the agent) knows more about own health risk

# Moral Hazard

*Moral hazard* is the risk that the existence of insurance will cause the policyholder to behave differently than he or she would without the insurance. This different behavior increases the risks and the expected payouts of the insurance company.

Three examples of moral hazard are:

a) A car owner buys insurance to protect against the car being stolen. As a result of the insurance, he or she becomes less likely to lock the car.
b) An individual purchases health insurance. As a result of the existence of the policy, more health care is demanded than previously.

# Moral Hazard Cont…

c) As a result of a government-sponsored deposit insurance plan, a bank takes more risks because it knows that it is less likely to lose depositors because of this strategy.

Moral hazard in health care provision and finance involves two fundamental types:

* Consumer moral hazard
* Supplier moral hazard

# Consumer Moral Hazard

Consumer moral hazard arises because insurance (private and social) reduces the cost of consuming health care at the point of consumption. This can be described in three scenario:

a. As the cost of consumption falls, the cost of being ill is reduced
b. Incentives to reduce the risk of falling ill are reduced
c. People take risks with their health through health related (bad) behavior e.g Smoking, driving recklessly, poor diet, less exercise

# Consumer Moral Hazard Cont…

Less personal investment in health implies higher consumption of health care than if there were no insurance.

Incidence like:

a) Socially inefficient outcome
b) Higher costs for private (and public) health insurance companies – lower profits (higher taxes)

# Measures to Counter Consumer Moral Hazard

1. Insurance based
2. Insurance + organization based
3. Non-price rationing (state provision)



IRMT

irmT
The Institute of Risk Management Tanzania

# Supplier Moral Hazard

Provider moral hazard derives from the infrastructure of modern health care, where a third party (insurance or state) pays for the health care provided by the doctor.

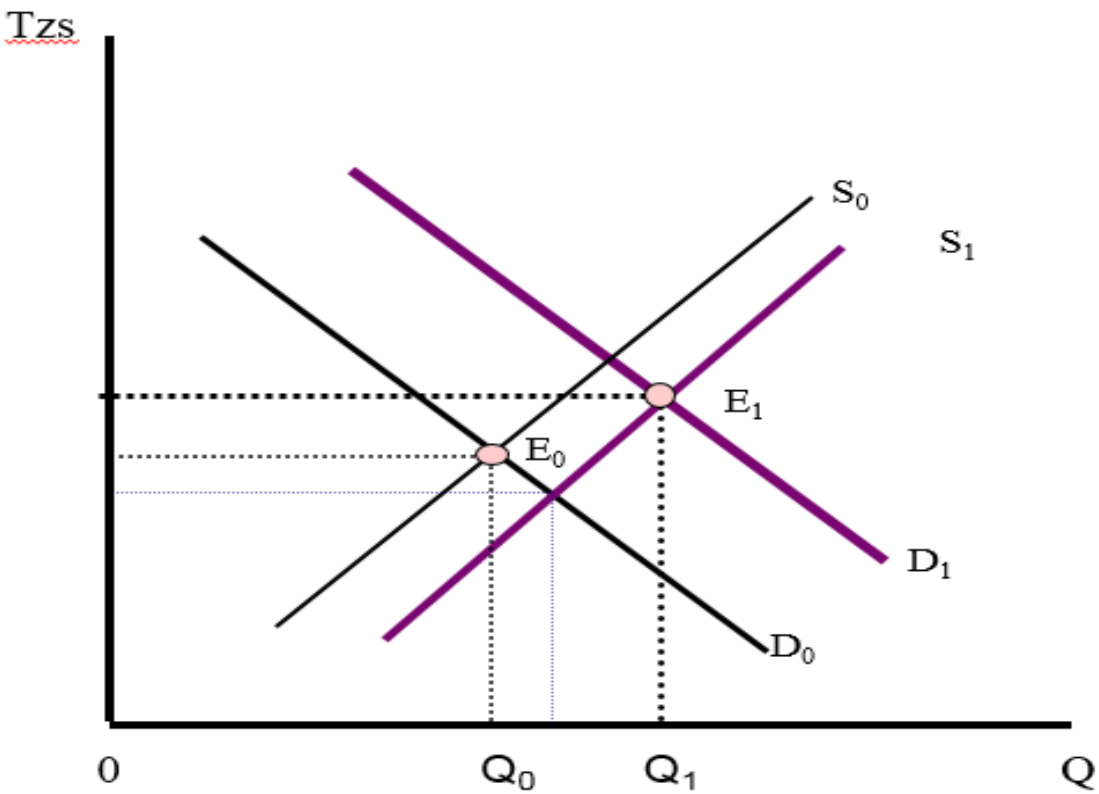
The payer may have different priorities to either the doctor or patient. Systems will reflect the payer's utility function; e.g. maximizing population health gain Impacts on pay contracts (for medics) e.g. treatment fees

# Supplier Induced Demand (SID)

Supplier induced demand is the amount of demand created by doctors, which exists beyond that which would have occurred in a market in which consumers are fully informed." Donaldson & Gerard (1992)

Supplier induced demand exists when the physician influences a patient's demand for care against the physicians interpretation of the best interest of the patient." McGuire, T. (2000)

# Diagrammatic illustration




- $E_0$ = Initial equilibrium
- Following an increase in overall supply (to $S_1$) due to an increase in funding (new doctors or hospitals etc), doctors increase demand (to $D_1$) to maintain (or increase) target income.
- $E_1$= resulting equilibrium




IRMT

irmT The Institute of Risk Management Tanzania

# Implications

SID (excess demand) can lead to:

- Higher service costs and fees: rising health care costs
- Higher usage of new and expensive technology, Potentially less of a problem when there are state imposed spending limits



IRMT

irmT The Institute of Risk Management Tanzania

# Adverse Selection

**Adverse selection** is the phrase used to describe the problems an insurance company has when it cannot distinguish between good and bad risks. It offers the same price to everyone and inadvertently attracts more of the bad risks.

If an insurance company is not able to distinguish good drivers from bad drivers and offers the same auto insurance premium to both, it is likely to attract more bad drivers.

If it is not able to distinguish healthy from unhealthy people and offers the same life insurance premiums to both, it is likely to attract more unhealthy people.

# Adverse Selection Cont…

To lessen the impact of adverse selection, an insurance company tries to find out as much as possible about the policyholder before committing itself. Before offering life insurance, it often requires the policyholder to undergo a physical examination by an approved doctor.

Before offering auto insurance to an individual, it will try to obtain as much information as possible about the individual's driving record.

In the case of auto insurance, it will continue to collect information on the driver's risk (number of accidents, number of speeding tickets, etc.) and make year-to-year changes to the premium to reflect this.

# Adverse Selection Cont…

Adverse selection can never be completely overcome. It is interesting that, in spite of the physical examinations that are required, individuals buying life insurance tend to die earlier than mortality tables would suggest.

But individuals who purchase annuities tend to live longer than mortality tables would suggest.

# The Risk facing Insurance Companies and Pension Plans

The most obvious risk for an insurance company is that the **policy reserves** are not sufficient to meet the claims of policyholders.

Although the calculations of actuaries are usually fairly conservative, there is always the chance that payouts much higher than anticipated will be required.

Insurance companies also face risks concerned with the performance of their **investments.** Many of these investments are in corporate bonds. If defaults on corporate bonds are above average the profitability of the insurance company will suffer.

# The Risk facing Insurance Companies and Pension Plans Cont…

It is important that an insurance company's bond portfolio be diversified by business sector and geographical region. An insurance company also needs to monitor the **liquidity** risks associated with its investments.

Illiquid bonds (e.g., those the insurance company might buy in a private placement) tend to provide higher yields than bonds that are publicly owned and actively traded. Like banks, insurance companies are also exposed to **operational risks** and business risks.

# Pension Plans

**Introduction**

Pension plans are set up by companies for their employees. Typically, contributions are made to a pension plan by both the employee and the employer while the employee is working.

When the employee retires, he or she receives a pension until death. A pension fund therefore involves the creation of a lifetime annuity from regular contributions and has similarities to some of the products offered by life insurance companies.

# Types of Pensions Plans

There are two types of pension plans which commonly known:

a) Defined benefit and

b) Defined contribution.



IRMT

irmT The Institute of Risk Management Tanzania

# Types of Pensions Plans Cont…

***Defined benefit plan:*** the pension that the employee will receive on retirement is defined by the plan. Typically it is calculated by a formula that is based on the number of years of employment and the employee's salary.

For example, the pension per year might equal the employee's average earnings per year during the last three years of employment multiplied the number of years of employment multiplied by 2%. The employee's spouse may continue to receive a (usually reduced) pension if the employee dies before the spouse. In the event of the employee's death

# Types of Pensions Plans Cont…

While still employed, a lump sum is often payable to dependents and a monthly income may be payable to a spouse or dependent children. Sometimes pensions are adjusted for inflation. This is known as indexation. For example, the indexation in a defined benefit plan might lead to pensions being increased each year by 75% of the increase in the consumer price index.

Pension plans that are sponsored by governments (such as Social Security in the United States) are similar to defined benefit Plans in that they require regular contributions up to a certain age and then provide lifetime pensions.

# Types of Pensions Plans Cont…

***Defined contribution plan;*** This is the plan where the employer and employee contributions are invested on behalf of the employee. When employees retire, there are typically a number of options open to them.

The amount to which the contributions have grown can be converted to a lifetime annuity. In some cases, the employee can opt to receive a lump sum instead of an annuity.

# Distinction and Similarities of DC and DB

The key difference between a **defined contribution** and a **defined benefit** plan is that, in the former, the funds are identified with individual employees.

An account is set up for each employee and the pension is calculated only from the funds contributed to that account.

By contrast, in a defined benefit plan, all contributions are pooled and payments to retirees are made out of the pool.

# Distinction and Similarities of DC and DB Cont…

An important aspect of both defined benefit and defined contribution plans is the deferral of taxes. No taxes are payable on money contributed to the plan by the employee and contributions by a company are deductible.

Taxes are payable only when pension income is received (and at this time the employee may have a relatively low marginal tax rate).

**Longevity risk** is a major concern for pension plans. We mentioned earlier that life expectancy increased by about 20 years between 1929 and 2009.

# Distinction and Similarities of DC and DB Cont…

If this trend continues and life expectancy increases by a further five years by 2029, the underfunding problems of defined benefit plans (both those administered by companies and those administered by national governments) will become more severe.

It is not surprising that, in many jurisdictions, individuals have the right to work past the normal retirement age.

I
R
M
T



irmT
The Institute of Risk Management Tanzania

# INSTITUTE OF RISK MANAGEMENT TANZANIA (IRMT)

# STUDENTS SUMMARY NOTES

## MODULE IV
## TRADING IN FINANCIAL MARKETS

## CERTIFIED FINANICIAL SERVICES RISK MANAGEMENT PROFESSIONAL COURSE

## Certified Financial Services Risk Professional Examination (CFSRP)

I R M T



irmT The Institute of Risk Management Tanzania

# MODULE IV

I
R
M
T

# Trading in the Financial Markets

# Part I

Aim and objectives

1. Describe the structure and functions of financial markets.
2. Distinguish between commercial banks and other financial institutions in the financial marketplace.
3. Describe the different securities markets for bonds and stock.

# Principles Used in this Part

Principle 2: There is a Risk-Return Tradeoff.

Financial markets are organized to offer investors a wide range of investment opportunities that have different risk and different expected rates of return that reflect those risks.

# Principles Used in this Part (cont.)

Principle 4: Market Prices Reflect Information.

It is through the operations of the financial markets that new information is efficiently impounded in security prices.



IRMT

irmT The Institute of Risk Management Tanzania

# Three Players in the Financial Markets

There are three principal sets of players that interact within the financial markets:

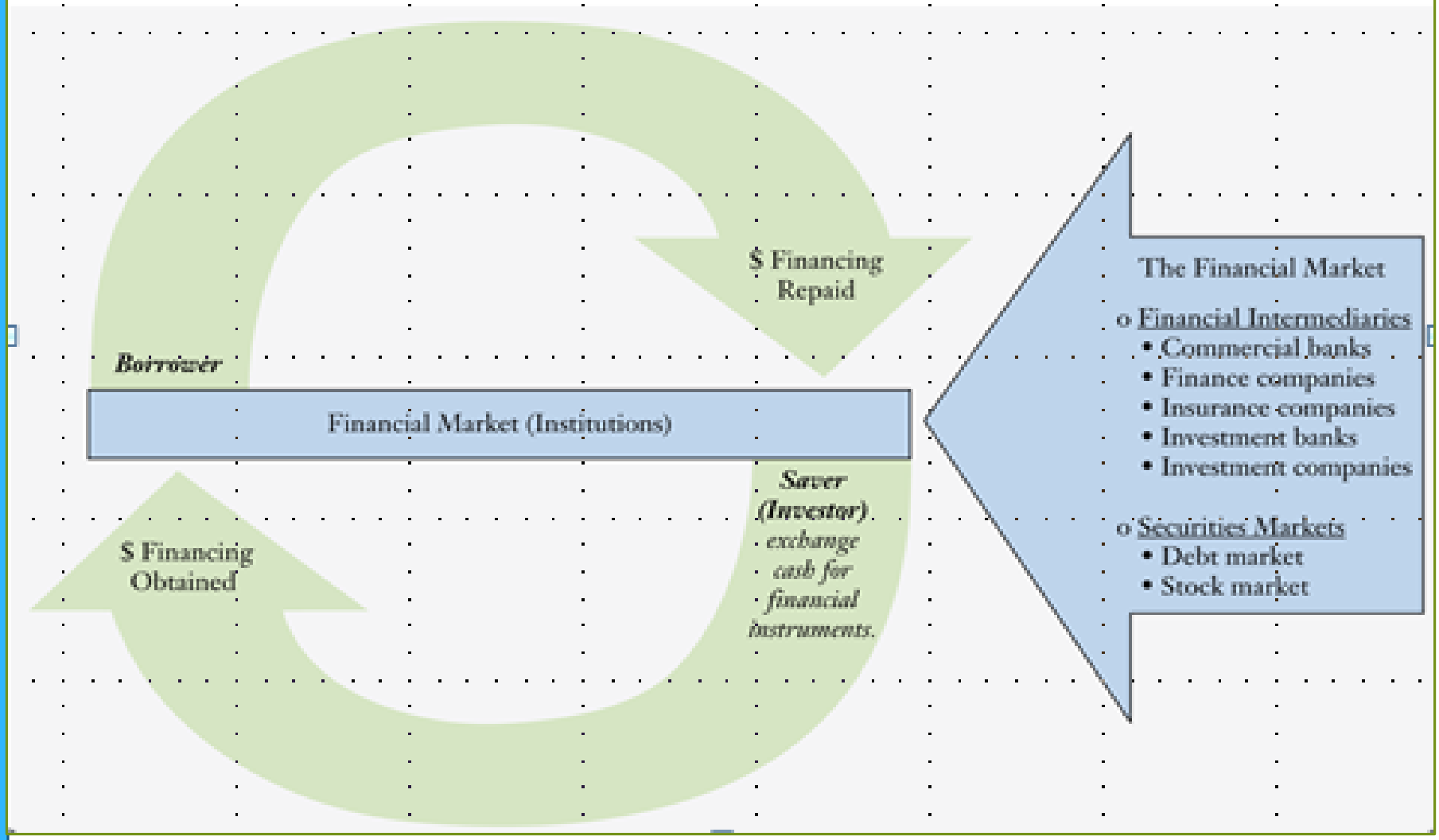
1. Borrowers
2. Savers (or sometimes called lenders)
3. Financial Institutions (or sometimes called Financial Intermediaries)

# Three Players in the Financial Markets (cont.)

1. Borrowers: Individuals and businesses that need money to finance their purchases or investments.
2. Savers (Investors): Those who have money to invest. These are principally individuals although firms also save when they have excess cash.
3. Financial Institutions (Intermediaries): The financial institutions and markets help bring borrowers and savers together.

## Financial Markets, Institutions, and the Circle of Money

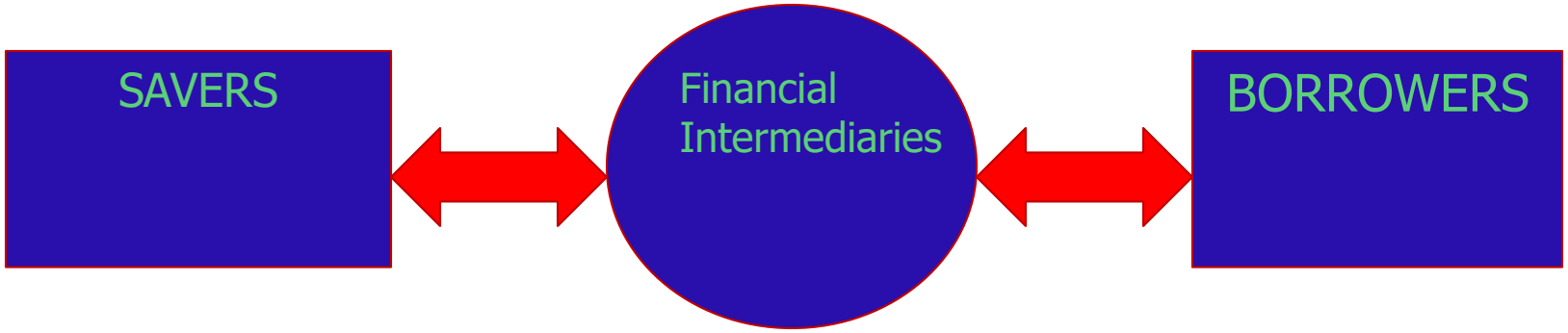
Financial markets consist of institutions that facilitate the transfer of savings from individuals and firms with excess cash to borrowers who have less cash than they need.



I
R
M
T

# THE FINANCIAL MARKETPLACE
# FINANCIAL INSTITUTIONS

# Financial Intermediaries






IRMT

irmT
The Institute of Risk Management Tanzania

# Financial Intermediaries

* Example on Intermediaries
* John's three sons are grown up and are looking to buy their first home.
  * There is no intermediation if John directly gives them the funds they need
  * There is intermediation where a bank doles out the funds and John is free to place his monies in any bank he chooses to do so.

# Financial Intermediaries (cont.)

* Financial institutions like commercial banks, finance companies, insurance companies, investment banks, and investment companies are called **financial intermediaries** as they help bring together those who have money (savers) and those who need money (borrowers).

# Money versus Capital Market

- The **money market** refers to debt instruments with maturity of one year or less.
  - Examples: Treasury bills (T-bills), Commercial paper (CP).
- The **capital market** refers to long-term debt and equity instruments.
  - Examples: Common stock, Preferred stock, Corporate bond, Treasury bond, Municipal bond.

# Commercial Banks – Everyone's Financial Marketplace

* **Commercial banks** collect the savings of individuals as well as businesses and then lend those pooled savings to other individuals and businesses.

* They make money by charging a rate of interest to borrowers that exceeds the rate they pay to savers.

* In the United States, banks cannot own industrial corporations.

**Table 2.1** **Four Largest Commercial Banks in the United States at the End of 3rd Quarter 2009**

Commercial banks are ranked by the total dollar value of their deposits. Most large banks are owned by holding companies, which are companies that own other types of businesses in addition to the bank. However, the types of businesses that holding companies can own are restricted by Federal law. Any firm that owns or controls 25% or more of a commercial bank is classified as a bank holding company and must register with the Federal Reserve System, which is the primary regulator of commercial banking in the United States. The financial crisis of 2008–09 led to consolidations of weaker banks, most notably the acquisition of Wachovia by Wells Fargo.

| Institution Name | Description | Total Deposits ($ in thousands) |
|---|---|---|
| Bank of America Corporation (BAC) | As of December 31, 2008, the company operated approximately 6,100 retail banking offices and 18,700 automated teller machines. Bank of America was founded in 1874 and is headquartered in Charlotte, North Carolina. | $1,002,708,983 |
| JPMorgan Chase & Co. (JPM) | This financial holding company provides a range of financial services worldwide through six segments: Investment Banking, Retail Financial Services, Card Services, Commercial Banking, Treasury and Securities Services, and Asset Management. The company was founded in 1823 and is headquartered in New York, New York. | $ 962,505,000 |
| Citigroup, Inc. (C) | As of December 31, 2008, Citigroup operated through a network of 7,730 branches. The company was founded in 1812 and is based in New York, New York. | $ 785,801,000 |
| Wells Fargo Bank (WFC) | Wells Fargo & Company was founded in 1852 and is headquartered in San Francisco, California. The bank acquired Wachovia Corporation in 2008, resulting in 11,000 branches and 12,160 automated teller machines. | $ 438,737,000 |

**Source: http://www.ibanknet.com/scripts/callreports/fiList.aspx?type=031**

# Non-Bank Financial Intermediaries

* These include:
  - Financial services corporations, like GE Capital Division;
  - Insurance companies, like Prudential;
  - Investment banks, like Goldman Sachs;
  - Investment companies including mutual funds, hedge funds and private equity firms.

# Financial Services Corporations

* **Financial services corporation** are in the lending or financing business, but they are not commercial banks.

* One well known financial service corporation is GE capital, the finance unit of the General Electric Corporation.



IRMT

irmT The Institute of Risk Management Tanzania

# Financial Services Corporations (cont.)

* GE capital provides commercial loans, financing programs, commercial insurance, equipment leasing, and other services in over 35 countries around the world.

* GE capital also provides credit services to more than 130 million customers that range from retailers, auto dealers, consumers offering products and services from credit cards to debt consolidation to home equity loans.

# Insurance Companies

* **Insurance companies** sell insurance to individuals and businesses to protect their investments.

* They collect premium and hold the premium in reserves until there is an insured loss and then pay out claims to the holders of the insurance contracts. Later, these reserves are deployed in various types of investments including loans to individuals, businesses and the government.

# Investment Banks

- **Investment banks** are specialized financial intermediaries that:
  - help companies and governments raise money
  - provide advisory services to client firms on major transactions such as mergers
- Firms that provide investment banking services include Bank of America, Goldman Sachs, Morgan Stanley and JP Morgan Chase.

# Investment Companies

* **Investment companies** are financial institutions that pool the savings of individual savers and invest the money in the securities issued by other companies purely for investment purposes.

# Mutual Funds and Exchange Traded Funds (ETFs)

* **Mutual funds** are professionally managed according to a stated investment objective.

* Individuals can invest in mutual funds by buying shares in the mutual fund at the net asset value (NAV). NAV is calculated daily based on the total value of the fund divided by the number of mutual fund shares outstanding.

# Mutual Funds and Exchange Traded Funds (ETFs) (cont.)

* Mutual funds can either be load or no-load funds. The term load refers to the sales commission that you pay when acquiring ownership shares in the fund. These commissions typically range between 4.0 to 6.0%.

* A mutual fund that does not charge a commission is referred to as a no-load fund.

# Mutual Funds and Exchange Traded Funds (ETFs) (cont.)

* An **exchange-traded fund** (ETF) is similar to a mutual fund except that the ownership shares in the ETF can be bought and sold on the stock exchange.

* Most ETFs track an index, such as the Dow Jones Industrial Average or the S&P 500, and generally have relatively low expenses.

# Mutual Funds and Exchange Traded Funds (ETFs) (cont.)

* Mutual funds and ETFs provide a cost-effective way to diversify and reduce risk.
* If you had only $10,000 to invest, it would be difficult to diversify since you will have to pay commission for each individual stock. However, by buying a mutual fund that invests in S&P 500,you can indirectly purchase a portfolio that tracks 500 stocks with just one transaction. Alternatively, you might purchase an ETF, such as SPDR S&P 500 (SPY), which tracks S&P 500.

# Hedge Funds

* **Hedge funds** are similar to mutual funds but they tend to take more risk and are generally open only to high net worth investors.

* Management fees also tends to be higher for hedge funds and most funds include an incentive fee based on the fund's overall performance, which typically runs at 20% of profits.

# Private Equity Firms

* Private equity firms include two major groups: Venture capital (VC) firms and Leveraged buyout firms (LBOs).
* **Venture capital firms** raise money from investors (wealthy individuals and other financial institutions) that they then use to provide financing for private start-up companies when they are first founded.
* For example, Venture capital firm, Kleiner Perkins Caufield & Byers (KPCB) was involved in the initial financing of Google.

# Private Equity Firms (cont.)

* **Leveraged buyout firms** acquire established firms that typically have not been performing very well with the objective of making them profitable again and selling them. An LBO typically uses debt to fund the purchase of a firm. LBO transactions grew from $7.5 billion in 1991 to $500 billion in 2006.
* Prominent LBO private equity firms include Cerberus Capital Management, L.P., TPG (formerly Texas Pacific Group), and KKR (Kohlberg, Kravis, and Roberts).

# THE FINANCIAL MARKETPLACE – SECURITIES MARKET



IRMT

irmT
The Institute of Risk Management Tanzania

# Security

* A security is a negotiable instrument that represents a financial claim and can take the form of ownership (such as stocks) or debt agreement (such as bonds).

* The securities market allow businesses and individual investors to trade the securities issued by public corporations.

# Primary versus Secondary Market

* A **primary market** is a market in which securities are bought and sold for the first time. In this market, the firm selling securities actually receives the money raised. For example, securities sold by a corporation to investment bank.



IRMT

irmT The Institute of Risk Management Tanzania

# Primary versus Secondary Market (cont.)

* A **secondary market** is where all subsequent trading of previously issued securities takes place. In this market, the issuing firm does not receive any new financing. The securities are simply transferred from one investor to another. Thus secondary markets provide liquidity to the investor. For example, the New York Stock Exchange.

# How Securities Markets Bring Corporation and Investors Together

* Figure 2-2 describes the role of securities market in bringing investors together with businesses looking for financing.



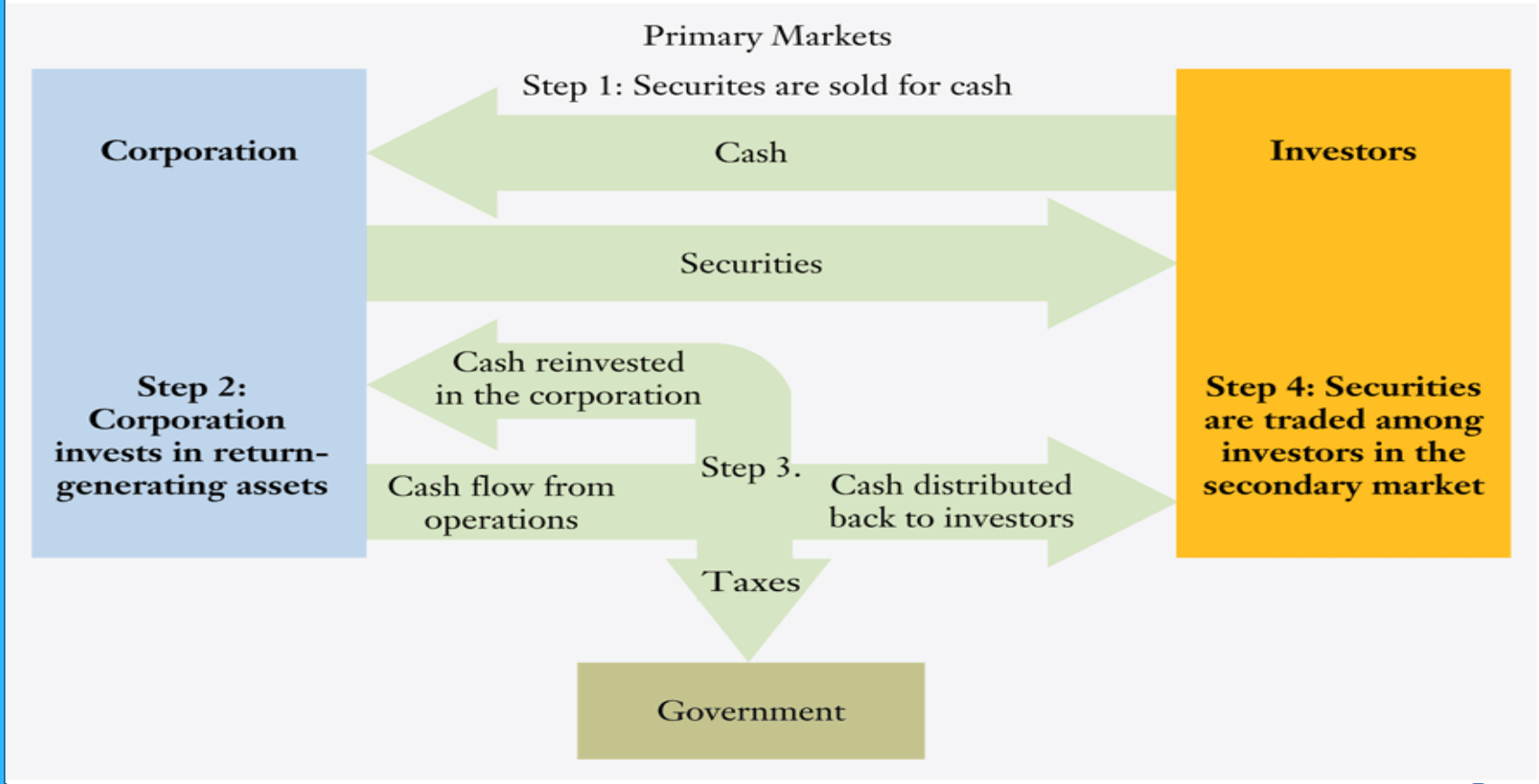
IRMT

irmT The Institute of Risk Management Tanzania

**Figure 2.2**

**Security Markets Provide a Link between the Corporation and Investors**

Step 1: Initially, the corporation raises funds in the financial markets by selling securities (a primary market transaction); Step 2: The corporation then invests this cash in return-generating assets—new projects; Step 3: The cash flow from those assets is either reinvested in the corporation, given back to the investors, or paid to the government in the form of taxes; and Step 4: Immediately after the securities have been issued they are traded among investors in the secondary market, thereby setting their market price.



# Process of Raising Money in the Securities Market (Figure 2-2)

1. The firms sells securities (debt or equity) to investors in the primary market.
2. The firm invests the funds it raises in its business.
3. The firm distributes the cash earned from its investments.
4. Security continues to trade in the secondary market.

# Types of Securities

* **Debt Securities:** Firms borrow money by selling debt securities in the debt market.
* If the debt has a maturity of less than one year, it is typically called notes, and is traded in the money market.
* If the debt has a maturity of more than one year, it is called bond and is traded in the capital market.

# Types of Securities (cont.)

* Most bonds pay a fixed interest rate on the **face** or **par value** of bond.

* For example, a bond with a face value of $1,000 and semi-annual **coupon rate** of 9% will pay an interest of $45 every 6 months or $90 per year, which is 9% of $1,000. When the bond matures, the owner of the bond will receive $1,000.

# Types of Securities (cont.)

* **Equity securities** represent ownership of the corporation.

* There are two major types of equity securities: common stock and preferred stock.



IRMT

irmT The Institute of Risk Management Tanzania

# Types of Securities (cont.)

* **Common stock** is a security that represents equity ownership in a corporation, provides voting rights, and entitles the holder to a share of the company's success in the form of **dividends** and any capital appreciation in the value of the security.

* Common stockholders are residual owners of the firm i.e. they earn a return only after all other security holder claims (debt and preferred equity) have been satisfied in full.

# Types of Securities (cont.)

* Dividend on common stock are neither fixed nor guaranteed. Thus a company can choose to reinvest all of the profits in a new project and pay no dividends.



IRMT

irmT The Institute of Risk Management Tanzania

# Types of Securities (cont.)

- **Preferred stock** is an equity security. However, preferred stockholders have preference with regard to:
  - Dividends: They are paid before the common stockholders.
  - Claim on assets: They are paid before common stockholders if the firm goes bankrupt and sells or liquidates its assets.

# Types of Securities (cont.)

- Preferred stock is also referred to as a hybrid security as it has features of both common stock and bonds.
- Preferred stock is similar to common stocks in that:
  - It has no fixed maturity date,
  - The nonpayment of dividends does not result in bankruptcy of the firm, and
  - The dividends are not deductible for tax purposes.

# Types of Securities (cont.)

Preferred stock is similar to corporate bonds in that:

- The dividends are typically a fixed amount, and
- There are no voting rights.



IRMT

irmT The Institute of Risk Management Tanzania

# Stock Markets

* A stock market is a public market in which the stocks of companies is traded.

* Stock markets are classified as either organized security exchanges or over-the-counter (OTC) market.



IRMT

irmT The Institute of Risk Management Tanzania

# Stock Markets (cont.)

* **Organized security exchanges** are tangible entities; that is, they physically occupy space and financial instruments are traded on their premises. For example, the New York Stock Exchange (NYSE) is located at 11 Wall Street in Manhattan, NY. The total value of stocks listed on the NYSE fell from $18 trillion in 2007 to just over $10 trillion at the beginning of 2009.

# Stock Markets (cont.)

* The **over-the-counter markets** include all security market except the organized exchanges.

* NASDAQ (National Association of Securities Dealers Automated Quotations) is an over-the-counter market and describes itself as a "screen-based, floorless market". In 2009, nearly 3,900 companies were listed on NASDAQ, including Starbucks, Google, Intel.

# Reading Stock Price Quotes

* Figure 2-3 illustrates how to read stock price quotes from www.google.com/finance.

* Similar information is available at http://finance.yahoo.com



IRMT

irmT The Institute of Risk Management Tanzania

**Figure 2.3**

**Common Stock Price Quotes**

The following is typical of what you would see if you looked at www.google.com/finance.

**Stock Price and Change from Previous Day:** For Disney, the current price is $23.19, which represents a decline of 1.53% or $0.36 from the previous day's closing price.

**Name and Symbol:** These are used to identify the stock. For example, the symbol for Disney is "DIS." You can also use the stock's symbol when using online systems to look up information on the stock.

**Open, High, and Low:** On this day, Disney's stock price opened the day at $23.08, and ranged between a high of $23.25 and a low of $22.95.

**Mkt Cap:** Market Cap refers to the total value of all the company's common stock outstanding.

**52Wk High and 52Wk Low:** These are the highest and lowest prices paid for the stock over the past 52 weeks, excluding the latest day's trading. These prices will give you a sense of the direction the stock price is taking–whether its price is generally going up or down and by how much.

**The Walt Disney Company** (Public, NYSE: DIS)

**23.19**
-0.36 (-1.53%)
Real-time: 12:40PM EDT

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Open: | 23.08 | Mkt Cap: | 43.06B | P/E: | 12.59 | Dividend: | 0.35 |
| High: | 23.25 | 52Wk High: | 34.85 | FP/E: | - | Yield: | 1.51 |
| Low: | 22.95 | 52Wk Low: | 15.14 | Beta: | 1. 11 | Shares: | 1.86B |
| Volume: | 5.02M | Avg Vol: | 17.60M | EPS: | 1. 84 | Inst. Own: | 67% |

**Dividend and Yield:** Dividend is the stock's annual cash dividend, while Yield is the dividend yield, which is obtained by dividing the firm's annual cash dividend by the closing price of the stock that day.

**Vol and Avg. Vol:** Vol represents the number, or volume, of shares of stock that were traded so far during the day, while Avg Vol represents the average volume on a typical day.

**P/E, F P/E:** P/E stands for *price-earnings ratio (P/E ratio, also called the "earnings multiple")*. The P/E ratio is the stock's price divided by the income, or profit, earned by the firm on a per-share basis over the previous 12 months. In effect, it states the multiple that investors are willing to pay for one dollar of earnings. High P/Es may result as investors are willing to pay more for a dollar of earnings because they believe that earnings will grow dramatically in the future. Low P/Es are generally interpreted as an indication of poor or risky future prospects. F P/E is the forward price-earnings ratio, and uses estimated earnings over next 12 months. If there is no estimate, it is not given.

**EPS:** The earnings per share.

**Beta:** A measure of the relationship between an investment's returns and the market's returns. It will be discussed in detail later.

**Shares, Inst. Own:** Shares represents number of shares outstanding while Inst. Own identifies the percent of the shares outstanding that are owned by institutions such as mutual funds and institutional ownership.

# Other Financial Instruments

* Table 2-2 provides a list of different financial instruments used by firms to raise money beginning with the shortest maturity instruments that are traded in the money market and moving through to the longest maturity instruments that are traded in the capital market.

**Table 2.2** Characteristics of Different Financial Instruments

**Money Market Debt**

**For the Borrower:**

- Good way of inexpensively raising money for short periods of time.
- Rates tend to be lower than long-term rates.
- Can borrow money to match short term needs.
- If interest rates rise, the cost of borrowing will immediately rise accordingly.

**For the Investor:**

- Very Liquid—you have access to your money when you need it.
- Safe—generally invested in high quality investments for brief periods.
- Low Returns—rates tend to be close to the rate of inflation.

| Instrument | Market | Major Participants | Riskiness | Original Maturity | Interest Rates* |
|---|---|---|---|---|---|
| U.S. Treasury bills | Money-Debt | Issued by U.S. Treasury | Default-free | 4 weeks to 1 year | 0.033% to 0.286% |
| Bankers' acceptances | Money-Debt | A firm's promise to pay, guaranteed by a bank | Low risk of default, dependent on the risk of the guaranteeing bank | Up to 180 days | 0.22% to 0.36% |
| Commercial paper | Money-Debt | Issued by financially secure firms to fund operating expenses or current assets (e.g., inventories and receivables) | Low default risk | Up to 270 days | 0.13% to 0.30% |
| Negotiable certificates of deposit (CDs) | Money-Debt | Issued by major money-center commercial banks with a denomination of at least $100,000 to large investors | Default risk depends on the strength of the issuing bank | 2 weeks to 1 year | 0.20% to 0.25% |
| Money market mutual funds | Money-Debt | Issued by mutual funds and invested in debt obligations like Treasury bills, CDs and commercial paper, held by individuals and businesses | Low degree of risk | No specific maturity date (can be redeemed any time) | 0.88% |
| Consumer credit, including credit card debt | Money-Debt | Non-mortgage consumer debt issued by banks/credit unions/finance companies | Risk is variable | Varies | Variable depending upon the risk level |

**Long-Term Debt and Fixed Income Securities Market**

**For the Borrower:**

- Interest rates are locked in over the entire life of the debt.
- Has a tax advantage over common stock in that interest payments are tax deductible while dividend payments are not.

**For the Investor:**

- Can be used to generate dependable current income.
- Some bonds produce tax-free income.
- Long-term debt tends to produce higher returns than short-term debt.
- Less risky than common stock.
- Investor can lock in an interest rate and know the future returns (assuming the issuer does not default on its payments).

# Key Terms

- Accredited investor
- Bond
- Capital market
- Commercial bank
- Common stock
- Coupon rate
- Credit default swaps

# Key Terms (cont.)

- Debt securities
- Equity securities
- Exchange-traded funds (ETFs)
- Face or par value
- Financial intermediaries
- Hedge fund
- Investment bank

# Key Terms (cont.)

- Investment companies
- Leveraged buyout fund
- Load funds
- Maturity
- Money market
- Mutual fund
- Net asset value

# Key Terms (cont.)

- Notes
- No-load fund
- Organized security exchanges
- Over-the-counter markets
- Preferred stock
- Primary market
- Secondary market
- Security
- Venture Capital firm

I
R
M
T



irmT
The Institute of Risk Management Tanzania

I
R
M
T

# Topic 2

# Long and Short Positions in Assets

# Hedging

**Hedge: engage in a financial transaction that reduces or eliminates risk**

**Basic hedging principle:**

Hedging risk involves engaging in a financial transaction that offsets a *long* position by taking a *short* position, or offsets a *short* position by taking a additional *long* position



IRMT

irmT The Institute of Risk Management Tanzania

# Interest-Rate Forward Markets

**Long position** = agree to buy securities at future date

Hedges by locking in future interest rate if funds coming in future

**Short position** = agree to sell securities at future date

Hedges by reducing price risk from change in interest rates if holding bonds

***Pros***

1. Flexible

***Cons***

1. Lack of liquidity: hard to find counterparty
2. Subject to default risk: requires information to screen good from bad risk

# Financial Futures Markets

**Financial Futures Contract**

1. Specifies delivery of type of security at future date
2. Arbitrage ⇒ at expiration date, price of contract = price of the underlying asset delivered
3. *i* ⇑, long contract has loss, short contract has profit
4. Hedging similar to forwards
   Micro (individual securities) vs. macro hedge (entire portfolio)

**Traded on Exchanges:** Global competition
Regulated by Commodity Futures Trading Commission



IRMT

irmT The Institute of Risk Management Tanzania

# Financial Futures Markets Cont…

**Success of Futures Over Forwards**

1. Futures more liquid: standardized, can be traded again, delivery of range of securities
2. Delivery of range of securities prevents corner (somebody buys out certain type of security)
3. Mark to market and margin requirements: avoids default risk
4. Don't have to deliver: netting

# Widely Traded Financial Futures Contracts

**Table 1 Widely Traded Financial Futures Contracts**

| Type of Contract | Contract Size | Exchange* | Open Interest January 30, 2003 Reflects March 2003 Futures |
|---|---|---|---|
| **Treasury Rate Contracts** | | | |
| Treasury bonds | $100,000 | CBT | 393,546 |
| Treasury notes | $100,000 | CBT | 746,015 |
| Five-year Treasury notes | $100,000 | CBT | 683,499 |
| Two-year Treasury notes | $200,000 | CBT | 106,184 |
| Thirty-day Fed levels | $5 million | CBT | 49,069 |
| Treasury bills | $1 million | CME | 292 |
| One-month LIBOR | $3 million | CME | 6,389 |
| Municipal Bond Index | $1,000 | CBT | 2,683 |
| Eurodollar | $4 million | CME | 747,691 |
| Euroyen | $100 million | CME | 10,765 |
| Sterling | £500,000 | LIFFE | 159,800 |
| Long Gilt | £100,000 | LIFFE | 90,093 |
| Three-month Euribor | € 1 million | LIFFE | 497,688 |
| Euroswiss franc | SF 1 million | LIFFE | 85,366 |
| Ten-year Euronational bonds | € 100,000 | EUREX | 812,029 |
| Canadian banker's acceptance | C$1 million | ME | 64,333 |

*Exchange abbreviations: CBT, Chicago Board of Trade; CME, Chicago Mercantile Exchange; LIFFE, London International Financial Futures Exchange; EUREX, European Exchange; ME, Montreal Exchange.

*Source: Wall Street Journal*, January 31, 2003, p. C21.

# Widely Traded Financial Futures Contracts

**Table 1 Widely Traded Financial Futures Contracts**

| Type of Contract | Contract Size | Exchange* | Open Interest January 30, 2003 Reflects March 2003 Futures |
|---|---|---|---|
| **Stock Index Contracts** | | | |
| Standard & Poor's 500 Index | $250 × index | CME | 577,661 |
| Standard & Poor's MIDCAP 400 | $500 × index | CME | 13,652 |
| NASDAQ 100 | $100 × index | CME | 71,233 |
| Nikkei 225 Stock Average | $5 × index | CME | 16,193 |
| Financial Times–Stock Exchange 100-Share Index | £10 per index point | LIFFE | 460,997 |
| **Currency Contracts** | | | |
| Yen | 12,500,000 yen | CME | 90,508 |
| Euro | 125,000 euros | CME | 102,536 |
| Canadian dollar | 100,000 Canadian $ | CME | 89,651 |
| British pound | 100,000 pounds | CME | 102,536 |
| Swiss franc | 125,000 francs | CME | 55,402 |
| Mexican peso | 500,000 new pesos | CME | 29,774 |

*Exchange abbreviations: CBT, Chicago Board of Trade; CME, Chicago Mercantile Exchange; LIFFE, London International Financial Futures Exchange; EUREX, European Exchange; ME, Montreal Exchange.

*Source: Wall Street Journal*, January 31, 2003, p. C21.

# Hedging FX Risk

**Example: Customer due 10 million euro in two months, current rate: 1 euro = $1**

1. Forward contract to sell 10 million euros for $10 million, two months in future
2. Sell 10 million of euro futures



IRMT

irmT The Institute of Risk Management Tanzania

# Options

**Options Contract**

Right to buy (call option) or sell (put option) instrument at exercise (strike) price up until expiration date (American) or on expiration date (European)

**Hedging with Options**

Buy same # of put option contracts as would sell of futures

***Disadvantage:*** pay premium

***Advantage:*** protected if *i* ⍰, gain if *i* ⍰

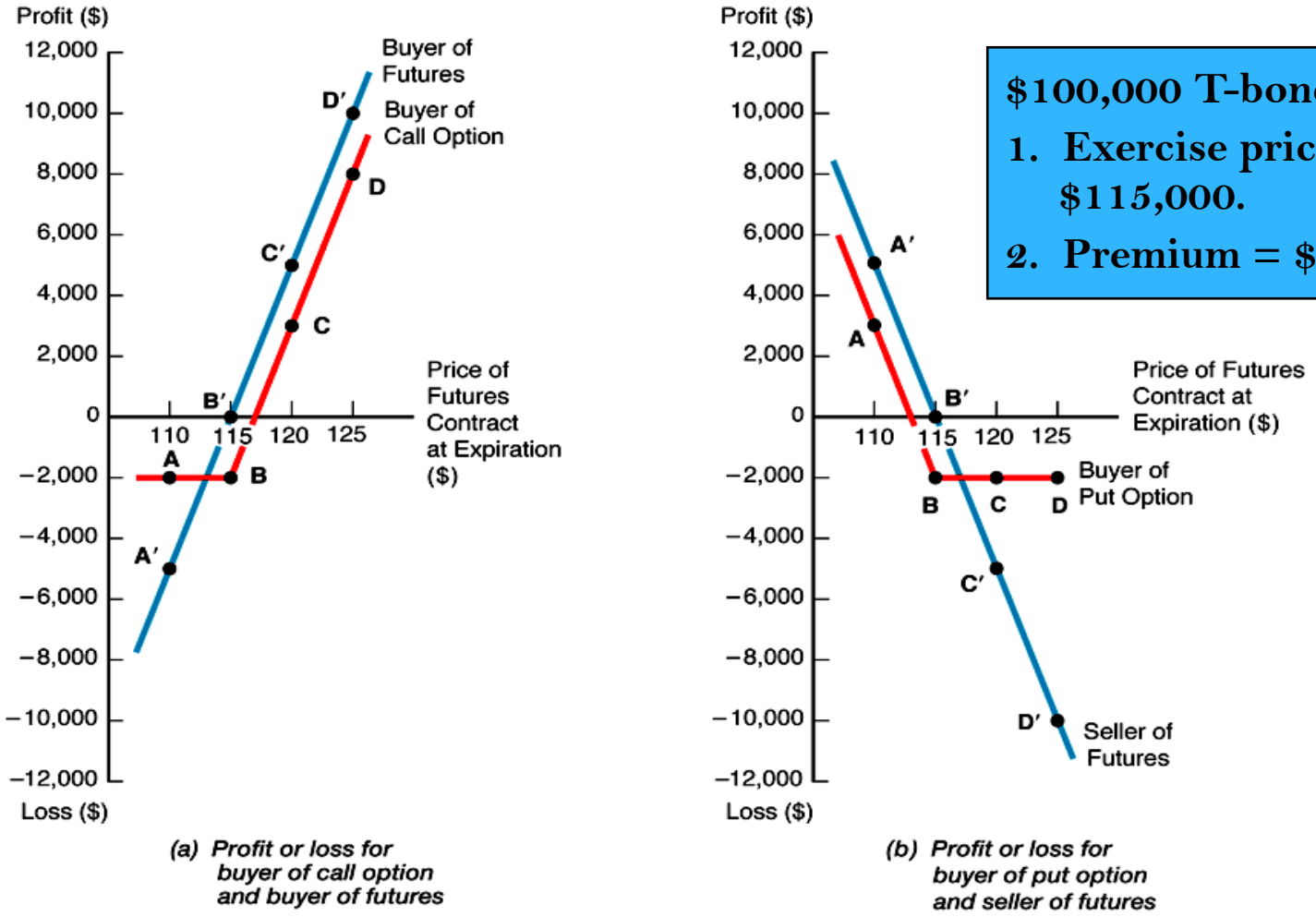
Additional advantage if macro hedge: avoids accounting problems, no losses on option when *i* ⍰



IRMT

irmT The Institute of Risk Management Tanzania

# Profits and Losses: Options vs. Futures




**$100,000 T-bond contract,**

1. **Exercise price of 115, $115,000.**
2. **Premium = $2,000**




IRMT

irmT The Institute of Risk Management Tanzania

# Factors Affecting Premium

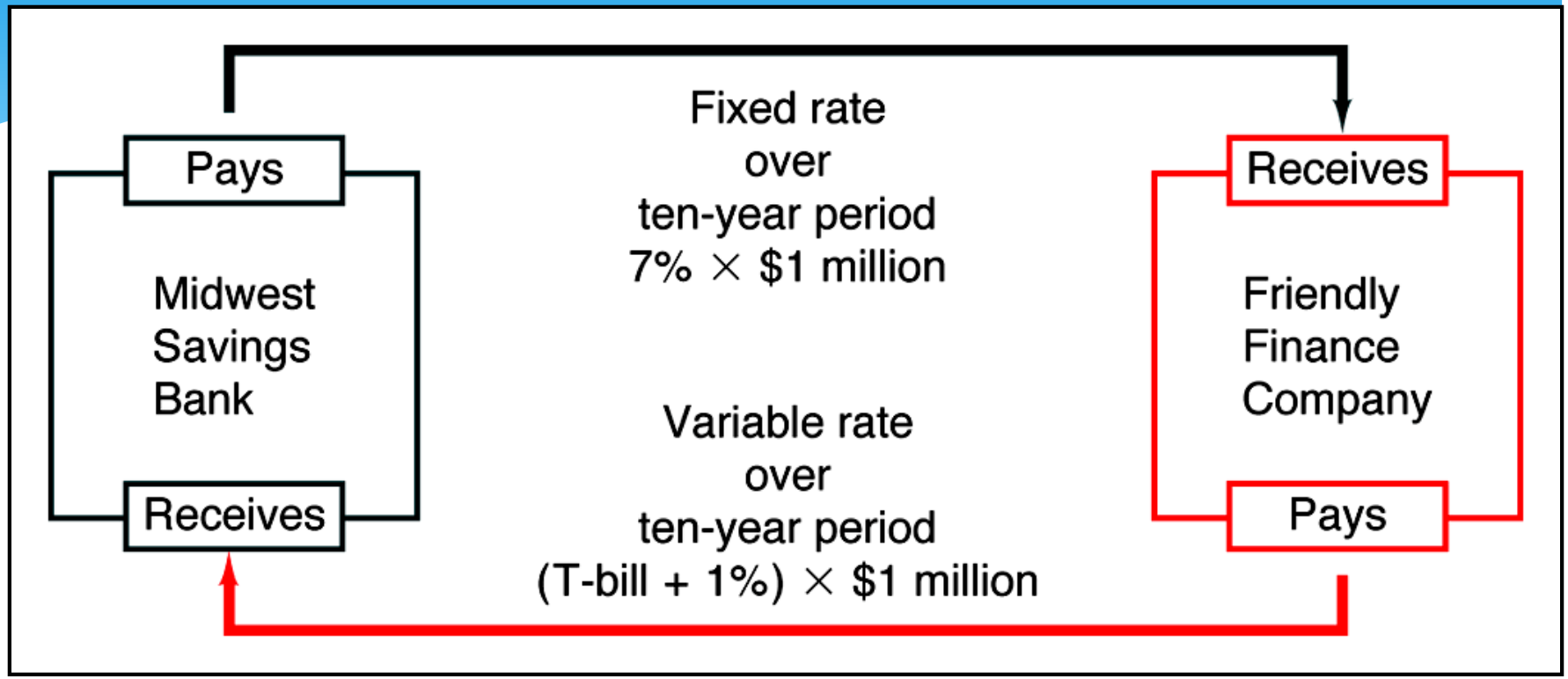
1. Higher strike price ⇒ lower premium on call options and higher premium on put options
2. Greater term to expiration ⇒ higher premiums for both call and put options
3. Greater price volatility of underlying instrument ⇒ higher premiums for both call and put options



IRMT

irmT The Institute of Risk Management Tanzania

# Interest-Rate Swap Contract




1. **Notional principle of $1 million**
2. **Term of 10 years**
3. **Midwest SB swaps 7% payment for T-bill + 1% from Friendly Finance Co.**

# Hedging with Interest-Rate Swaps

**Reduce interest-rate risk for both parties**

1. Midwest converts $1m of fixed rate assets to rate-sensitive assets, *Rate Sens. Assets* ⍰, lowers *gap (liabilities-assets)*
2. Friendly Finance *RSA* ⍰, lowers *gap*

**Advantages of swaps**

1. Reduce risk, no change in balance-sheet
2. Longer term than futures or options

**Disadvantages of swaps**

1. Lack of liquidity
2. Subject to default risk

**Financial intermediaries help reduce disadvantages of swaps**

I
R
M
T

I
R
M
T

# Topic 3
# Derivative Markets



irmT
The Institute of Risk Management Tanzania

# Derivatives and Risk Management

- Derivative securities
- Fundamentals of risk management
- Using derivatives

# Are stockholders concerned about whether or not a firm reduces the volatility of its cash flows?

- Not necessarily.
- If cash flow volatility is due to systematic risk, it can be eliminated by diversifying investors' portfolios.

# Reasons that Corporations Engage in Risk Management

- Increase their use of debt.
- Maintain their optimal capital budget.
- Avoid financial distress costs.
- Utilize their comparative advantages in hedging, compared to investors.
- Reduce the risks and costs of borrowing.
- Reduce the higher taxes that result from fluctuating earnings.
- Initiate compensation programs to reward managers for achieving stable earnings.

# What is an Option?

- A contract that gives its holder the right, but not the obligation, to buy (or sell) an asset at some predetermined price within a specified period of time.
- Most important characteristic of an option:
  - It does not obligate its owner to take action.
  - It merely gives the owner the right to buy or sell an asset.

# Option Terminology

- Call option – an option to buy a specified number of shares of a security within some future period.
- Put option – an option to sell a specified number of shares of a security within some future period.
- Exercise (or strike) price – the price stated in the option contract at which the security can be bought or sold.
- Option price – the market price of the option contract.

# Option Terminology

- Expiration date – the date the option matures.
- Exercise value – the value of an option if it were exercised today (Current stock price - Strike price).
- Covered option – an option written against stock held in an investor's portfolio.
- Naked (uncovered) option – an option written without the stock to back it up.

# Option Terminology

- In-the-money call – a call option whose exercise price is less than the current price of the underlying stock.
- Out-of-the-money call – a call option whose exercise price exceeds the current stock price.
- LEAPS: Long-term Equity AnticiPation Securities are similar to conventional options except that they are long-term options with maturities of up to 2 1/2 years.

# Option Example

* A call option with an exercise price of $25, has the following values at these prices:

| Stock price | Call option price |
|---|---|
| $25 | $3.00 |
| 30 | 7.50 |
| 35 | 12.00 |
| 40 | 16.50 |
| 45 | 21.00 |
| 50 | 25.50 |



IRMT

irmT The Institute of Risk Management Tanzania

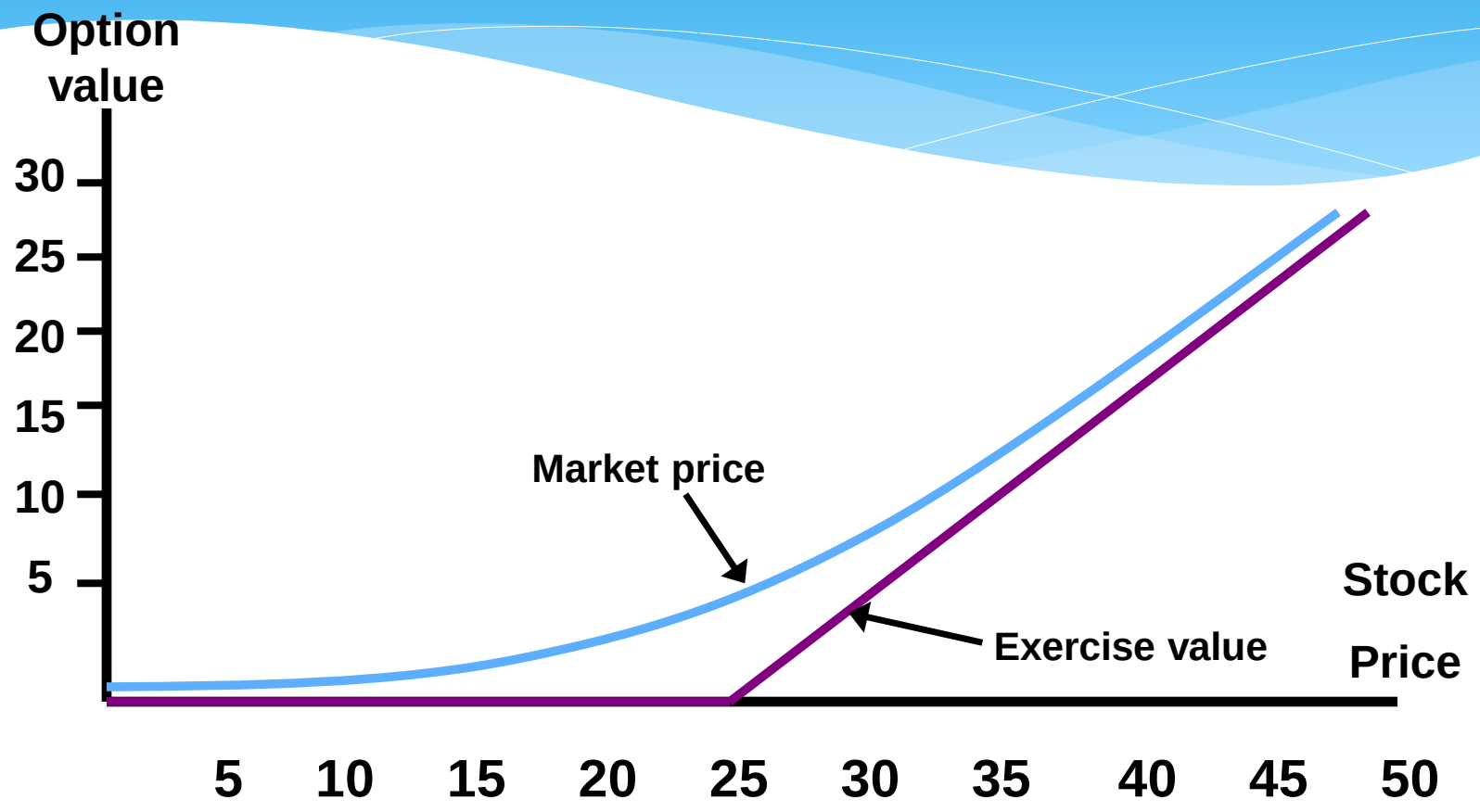
# Determining Option Exercise Value And Option Premium

| Stock price | Strike price | Exercise value | Option price | Option premium |
|---|---|---|---|---|
| $25.00 | $25.00 | $0.00 | $3.00 | $3.00 |
| 30.00 | 25.00 | 5.00 | 7.50 | 2.50 |
| 35.00 | 25.00 | 10.00 | 12.00 | 2.00 |
| 40.00 | 25.00 | 15.00 | 16.50 | 1.50 |
| 45.00 | 25.00 | 20.00 | 21.00 | 1.00 |
| 50.00 | 25.00 | 25.00 | 25.50 | 0.50 |

# How does the Option Premium Change as the Stock Price Increases?

- The premium of the option price over the exercise value declines as the stock price increases.
- This is due to the declining degree of leverage provided by options as the underlying stock price increases, and the greater loss potential of options at higher option prices.

# Call Premium Diagram






IRMT

irmT The Institute of Risk Management Tanzania

# What are the Assumptions of the Black-Scholes Option Pricing Model?

- The stock underlying the call option provides no dividends during the call option's life.
- There are no transactions costs for the sale/purchase of either the stock or the option.
- $k_{RF}$ is known and constant during the option's life.
- Security buyers may borrow any fraction of the purchase price at the short-term, risk-free rate.

# What are the Assumptions of the Black-Scholes Option Pricing Model?

* No penalty for short selling and sellers receive immediately full cash proceeds at today's price.
* Call option can be exercised only on its expiration date.
* Security trading takes place in continuous time, and stock prices move randomly in continuous time.

# Which Equations Must be Solved to find the Black-Scholes Option Price?

$$d_1 = \frac{\ln(P/X) + [k_{RF} + \left(\frac{\sigma^2}{2}\right) t]}{\sigma\sqrt{t}}$$

$$d_2 = d_1 - \sigma\sqrt{t}$$

$$V = P[N(d_1)] - Xe^{-k_{RF}t}[N(d_2)]$$



IRMT

irmT The Institute of Risk Management Tanzania

# Use the B-S OPM to find the option value of a call option with P = \$27, X = \$25, $k_{RF}$ = 6%, t = 0.5 years, and $\sigma^2$ = 0.11.

$$d_1 = \frac{\ln(\$27/\$25) + [(0.06 + 0.11/2)](0.5)}{(0.3317)(0.7071)} = 0.5736$$

$$d_2 = 0.5736 - (0.3317)(0.7071) = 0.3391$$

From Table A - 5 in the textbook

$$N(d_1) = N(0.5736) = 0.5000 + 0.2168 = 0.7168$$

$$N(d_2) = N(0.3391) = 0.5000 + 0.1327 = 0.6327$$



IRMT

irmT The Institute of Risk Management Tanzania

# Solving for Option Value

$$V = P[N(d_1)] - Xe^{-k_{RF}t}[N(d_2)]$$

$$V = \$27[0.7168] - \$25e^{-(0.06)(0.5)}[0.6327]$$

$$V = \$4.0036$$



IRMT

irmT The Institute of Risk Management Tanzania

# How do the Factors of the B-S OPM Affect a Call Option's Value?

| As the factor increases … | Option value … |
|---|---|
| Current stock price | Increases |
| Exercise price | Decreases |
| Time to expiration | Increases |
| Risk-free rate | Increases |
| Stock return variance | Increases |

# What is Corporate Risk Management, and why is it Important to All Firms?

* Corporate risk management relates to the management of unpredictable events that would have adverse consequences for the firm.

* All firms face risks, but the lower those risks can be made, the more valuable the firm, other things held constant. Of course, risk reduction has a cost.

# Definitions of Different Types of Risk

- Speculative risks – offer the chance of a gain as well as a loss.
- Pure risks – offer only the prospect of a loss.
- Demand risks – risks associated with the demand for a firm's products or services.
- Input risks – risks associated with a firm's input costs.
- Financial risks – result from financial transactions.

# Definitions of Different Types of Risk Cont…

* Property risks – risks associated with loss of a firm's productive assets.
* Personnel risk – result from human actions.
* Environmental risk – risk associated with polluting the environment.
* Liability risks – connected with product, service, or employee liability.
* Insurable risks – risks that typically can be covered by insurance.

# What are the Three Steps of Corporate Risk Management?

I
R
M
T

1. Identify the risks faced by the firm.
2. Measure the potential impact of the identified risks.
3. Decide how each relevant risk should be handled.

# What can Companies do to Minimize Or Reduce Risk Exposure?

* Transfer risk to an insurance company by paying periodic premiums.
* Transfer functions that produce risk to third parties.
* Purchase derivative contracts to reduce input and financial risks.
* Take actions to reduce the probability of occurrence of adverse events and the magnitude associated with such adverse events.
* Avoid the activities that give rise to risk.

# What is Financial Risk Exposure?

* Financial risk exposure refers to the risk inherent in the financial markets due to price fluctuations.
* Example: A firm holds a portfolio of bonds, interest rates rise, and the value of the bond portfolio falls.

# Financial Risk Management Concepts

* Derivative – a security whose value is derived from the values of other assets. Swaps, options, and futures are used to manage financial risk exposures.
* Futures – contracts that call for the purchase or sale of a financial (or real) asset at some future date, but at a price determined today. Futures (and other derivatives) can be used either as highly leveraged speculations or to hedge and thus reduce risk.

# Financial Risk Management Concepts

- Hedging – usually used when a price change could negatively affect a firm's profits.
  - Long hedge – involves the purchase of a futures contract to guard against a price increase.
  - Short hedge – involves the sale of a futures contract to protect against a price decline.
- Swaps – the exchange of cash payment obligations between two parties, usually because each party prefers the terms of the other's debt contract. Swaps can reduce each party's financial risk.

# How can Commodity Futures Markets Be Used to Reduce Input Price Risk?

* The purchase of a commodity futures contract will allow a firm to make a future purchase of the input at today's price, even if the market price on the item has risen substantially in the interim.

I
R
M
T

# Topic 4
# Plain Vanilla Derivatives



irmT
The Institute of Risk Management Tanzania

# Outline

* Interest rate swaps
* Foreign currency swaps
* Circus swap
* Interest rate options

# Introduction

- Both swaps and interest rate options are relatively new, but extensively used
  - In mid-2000, there was over $60 trillion outstanding in interest rate swaps, foreign currency swaps, and other interest rate options

# Interest Rate Swaps

* Hedging with interest rate swaps
* Immunizing with interest rate swaps
* Exploiting comparative advantage in the credit market

# Interest Rate Swaps

- Popular with bankers, corporate treasurers, and portfolio managers who need to manage interest rate risk
- A swap enables you to alter the level of risk without disrupting the underlying portfolio:
  - asset
  - liability

# Interest Rate Swaps

- The most common type of *interest rate swap* is the *fixed for floating rate swap*
  - One party makes a fixed interest rate payment to another party making a floating interest rate payment
  - Only the net payment is made (*difference check*)
  - The firm paying the floating rate is the *swap seller*
  - The firm paying the fixed rate is the *swap buyer*

# Interest Rate Swaps

- Typically, the floating interest rate is linked to a market rate such as
  - LIBOR or
  - T-bill rates
  - BA's in Canada
- The swap market is standardized partly by the *International Swaps and Derivatives Association* (ISDA)
  - ISDA provisions are *master agreements*

# ‘Plain Vanilla’ Swap – Hedging Interest Rate Risk

- A *plain vanilla swap* refers to a standard contract with no unusual features or bells and whistles
- The *swap facilitator* will find a counterparty to a desired swap for a fee or take the other side
  - A facilitator acting as an agent is a *swap broker*
  - A swap facilitator taking the other side is a *swap dealer* (*swap bank*)

# Plain Vanilla Swap

## Plain Vanilla Swap Example

A large firm pays a fixed interest rate to its bondholders, while a smaller firm pays a floating interest rate to its bankers.

The two firms could engage in a swap transaction which results in the larger firm paying floating interest rates to the smaller firm, and the smaller firm paying fixed interest rates to the larger firm



IRMT

irmT The Institute of Risk Management Tanzania

# Plain Vanilla Swap - Motivations

Large firm with a strong credit rating

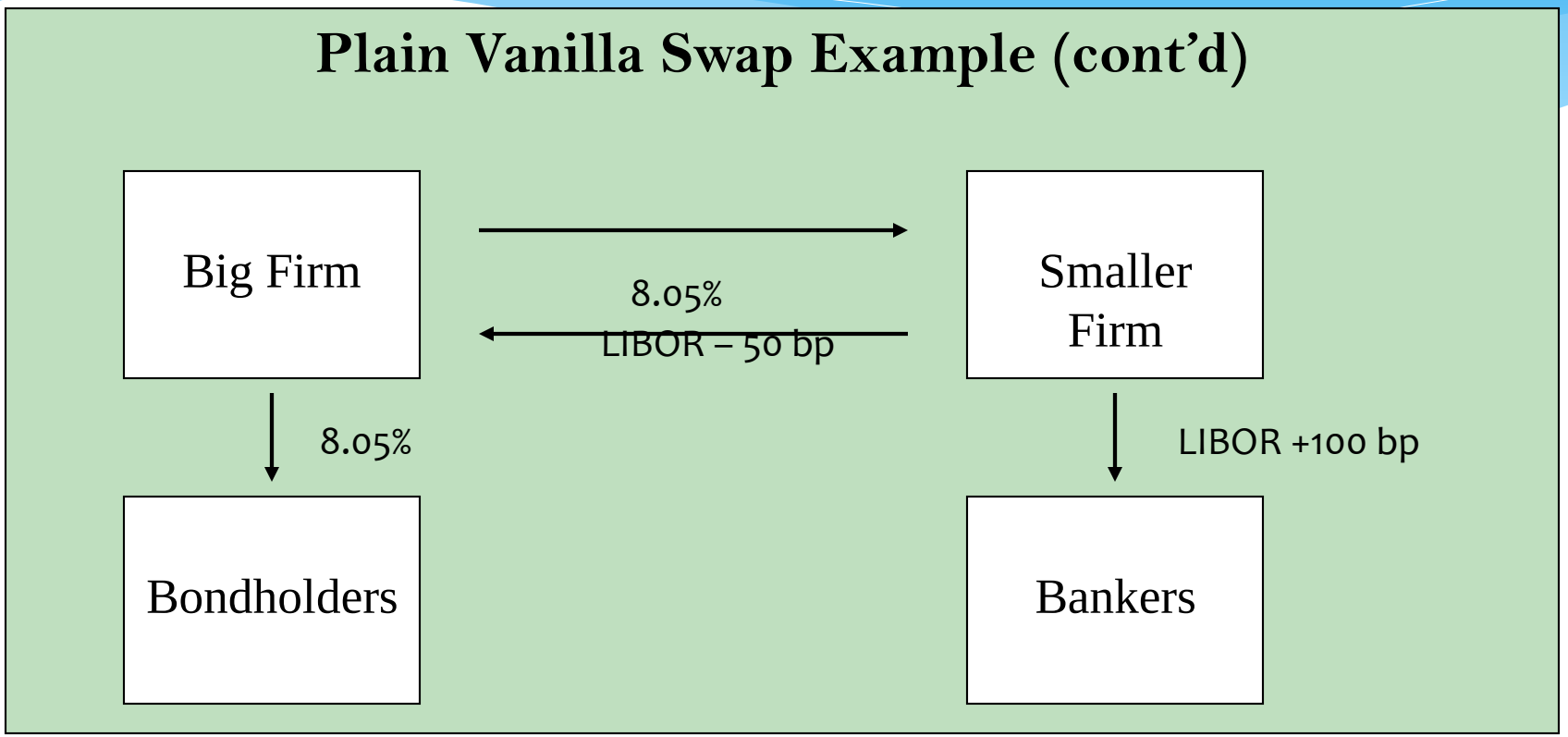
* takes advantage of it s borrowing capacity and borrows fixed term in the bond market
* interest rate outlook - declining rates
* enters into a swap agreement to move to floating rate debt but still leveraging its strong credit rating and borrowing capacity

# Plain Vanilla Swap - Motivations

Smaller firm with weaker credit rating

- no/minimal access to long term bond market due to its relatively weak credit rating
- typically borrows floating rate from its bank(s)
- would like to fix its borrowing rate as part of its risk management program
- can achieve its fixed rate objectives by entering into a swap agreement

# Plain Vanilla Swap



# Plain Vanilla Swap

## Plain Vanilla Swap Example

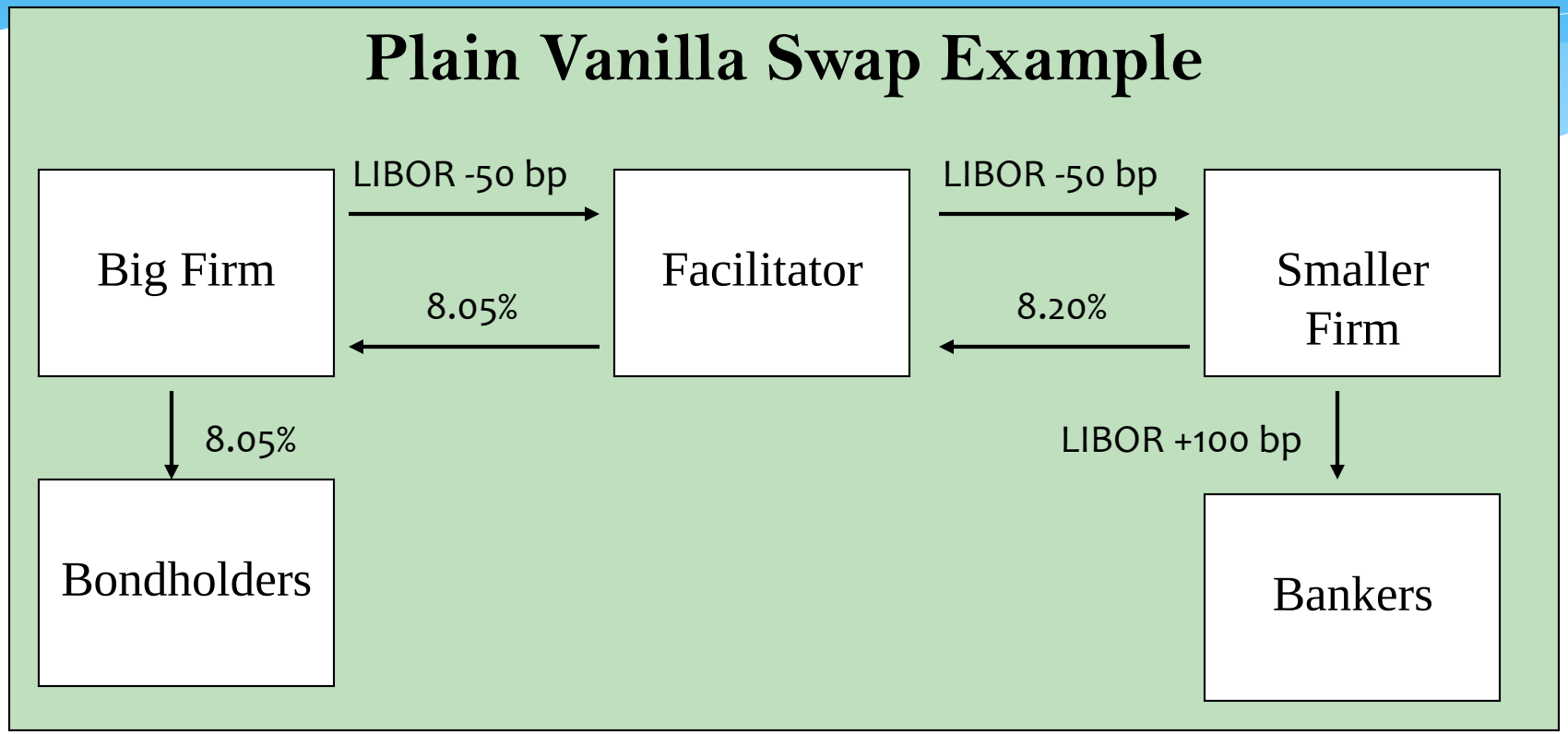
**A facilitator might act as an agent in the transaction and charge a 15 bp fee for the service.**



IRMT

irmT The Institute of Risk Management Tanzania

# Plain Vanilla Swap






IRMT

irmT The Institute of Risk Management Tanzania

# Plain Vanilla Swaps - Timing

* Swaps can be entered into at same time the firm accesses the bond market - e.g. 5 year fixed rate bond issue immediately swapped into floating rate via a swap agreement

or

* A swap can be negotiated at any time over the life of an existing borrowing e.g. 7 year bond issue two years prior - firm now expects interest rates to decline - 5 years remaining on the bond issue - firm enters into a 5 year fixed to floating rate swap

# Plain Vanilla Swap

- The *swap price* is the fixed rate that the two parties agree upon
- The *tenor* is the term of the swap
- The *notional value* determines the size of the interest rate payments
- *Counterparty risk* refers to the risk that one party to the swap will not honor its part of the agreement

# Interest Rate Risk Management - Considerations

- Interest rate outlook over expected borrowing horizon
  - Use swaps where the borrowing horizon is longer term
  - use futures where the interest rate risk is short term

- absolute interest rate levels and or yield curve shape
- credit or 'swap' spreads

# Immunizing With Interest Rate Swaps

* Interest rate swaps can be used by corporate treasurers to adjust their exposure to interest rate risk.
* The duration gap is:

$$D_{gap} = D_{asset} - \frac{\text{Total Liabilitie s}}{\text{Total assets}} \times D_{liabilities}$$



IRMT

irmT The Institute of Risk Management Tanzania

# Immunizing With Interest Rate Swaps (cont'd)

- A positive duration gap means a bank's net worth will suffer if interest rates rise
  - The treasurer may choose to move the duration gap to zero
    - This could be accomplished by selling some of the bank's loans and holding cash equivalent securities instead

      or
    - using interest rate swaps to close the duration gap

# Exploiting Comparative Advantage in the Credit Market

* Interest rate swaps can be used to exploit differentials in the credit market

## Credit Market Example

**AAA Bank and BBB Bank currently face the following borrowing possibilities:**

| Firm | Fixed Rate | Floating Rate |
|---|---|---|
| AAA | Current 5-yr T-bond + 25 bp | LIBOR |
| BBB | Current 5-yr T-bond + 85 bp | LIBOR + 30 bp |
| Quality Spread | 60 bp | 30 bp |

# Exploiting Comparative Advantage in the Credit Market

## Credit Market Example (cont'd)

**AAA Bank has an absolute advantage over BBB in both the fixed and the floating rate markets. AAA has a comparative advantage in the fixed rate market.**

**The total gain available to be shared among the swap participants is the differential in the fixed rate market minus the differential in the variable rate market, or 30 bps.**

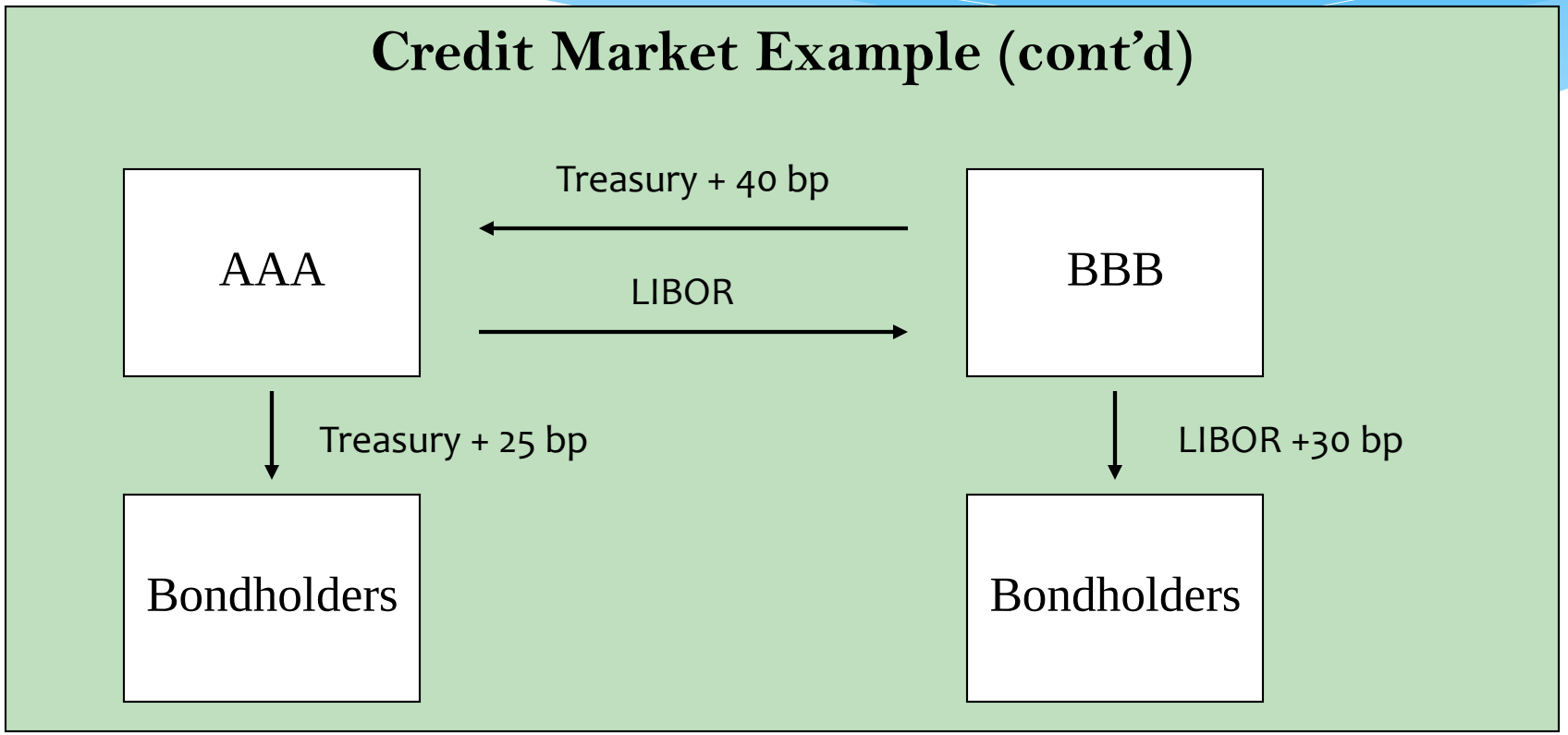
# Exploiting Comparative Advantage in the Credit Market

## Credit Market Example (cont'd)

**AAA Bank wants to issue a floating rate bond, while BBB wants to borrow at a fixed rate. Both banks will borrow at a lower cost if they agree to an interest rate swap.**

**AAA Bank should issue a fixed rate bond because it has a comparative advantage in this market. BBB should borrow at a floating rate. The swap terms split the rate savings 50-50. The current 5-yr T-bond rate is 4.50%.**

# Exploiting Comparative Advantage in the Credit Market



# Exploiting Comparative Advantage in the Credit Market

## Credit Market Example (cont'd)

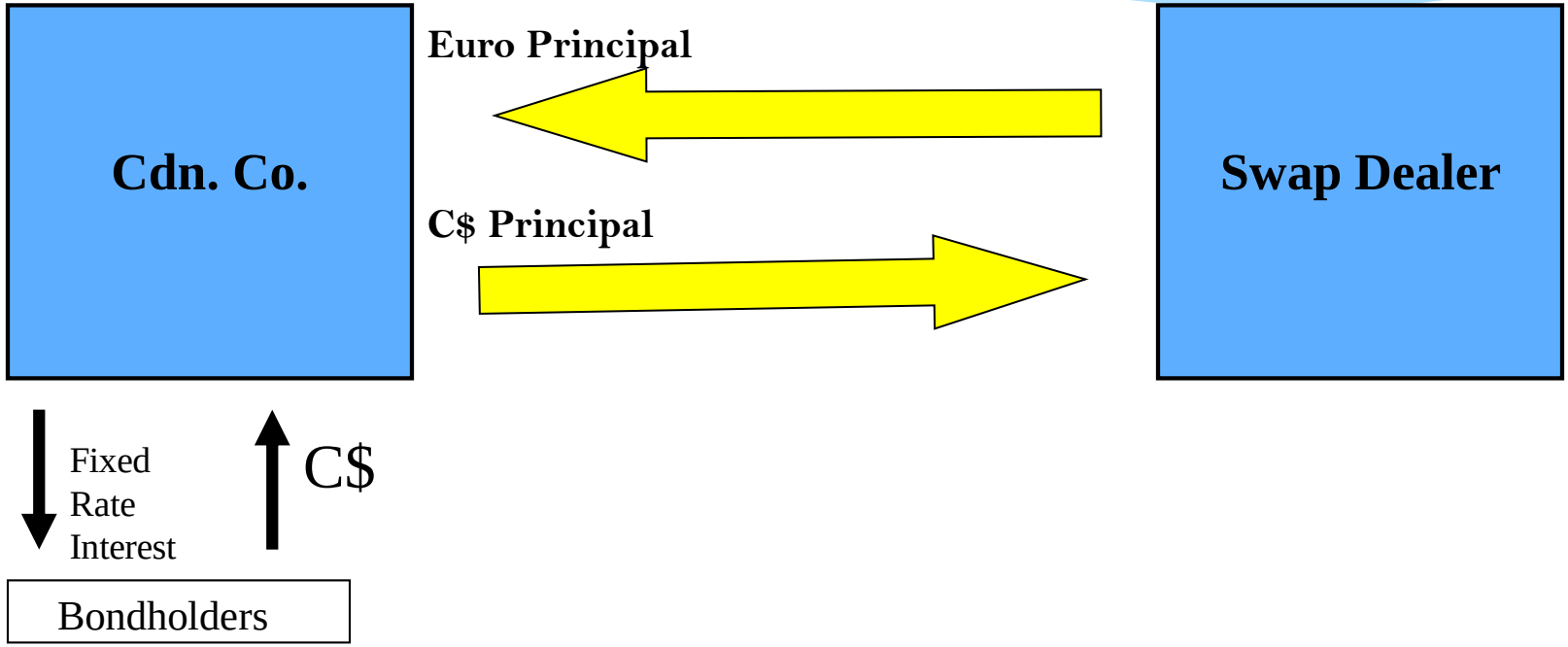
- The net borrowing rate for AAA is LIBOR – 15 bps
- The net borrowing rate for BBB is Treasury + 70 bps
- The net rate for both parties is 15 bps less than without the swap.

# Foreign Currency Swaps

- In a *currency swap*, two parties
  - Exchange currencies at the prevailing exchange rate
  - Then make periodic interest payments to each other based on a predetermined pair of interest rates, and
  - Re-exchange the original currencies at the conclusion of the swap

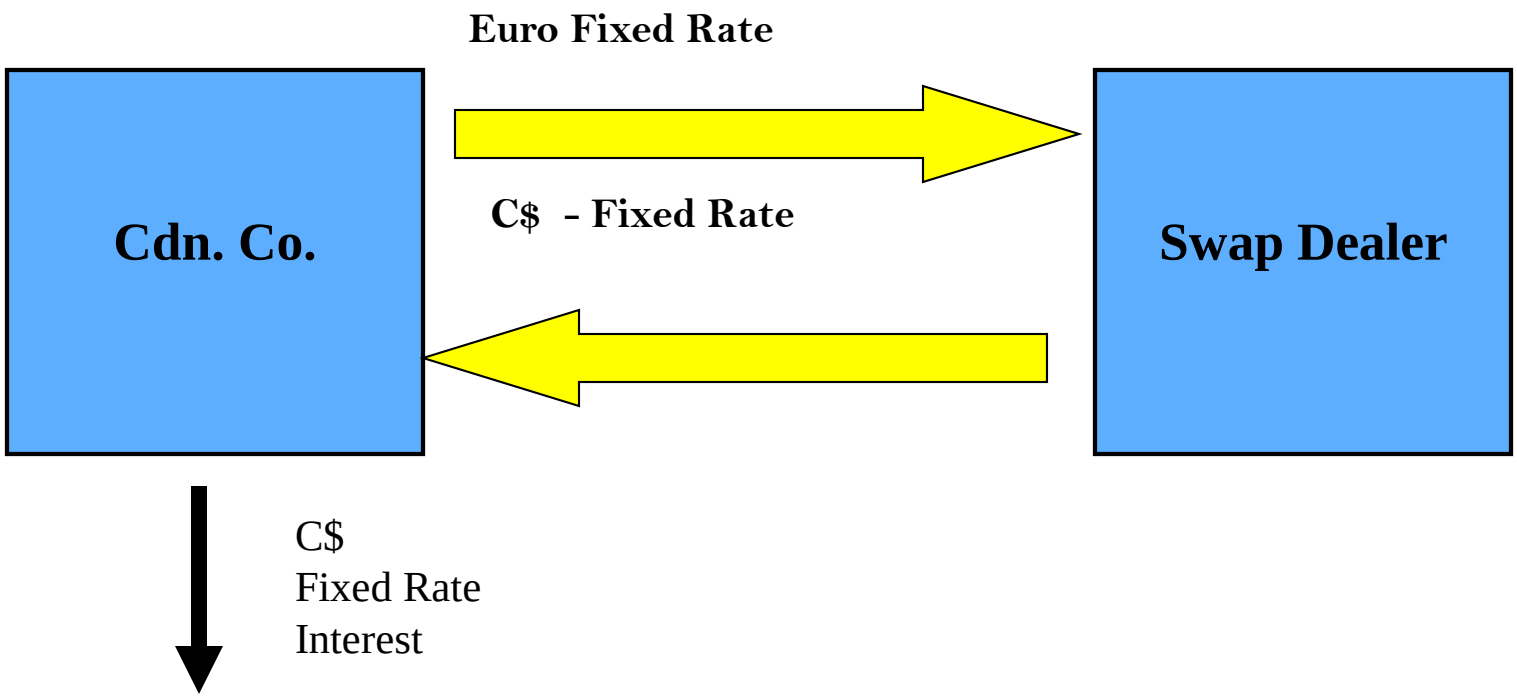
# Foreign Currency Swaps (cont'd)

* **Cash flows at origination:**



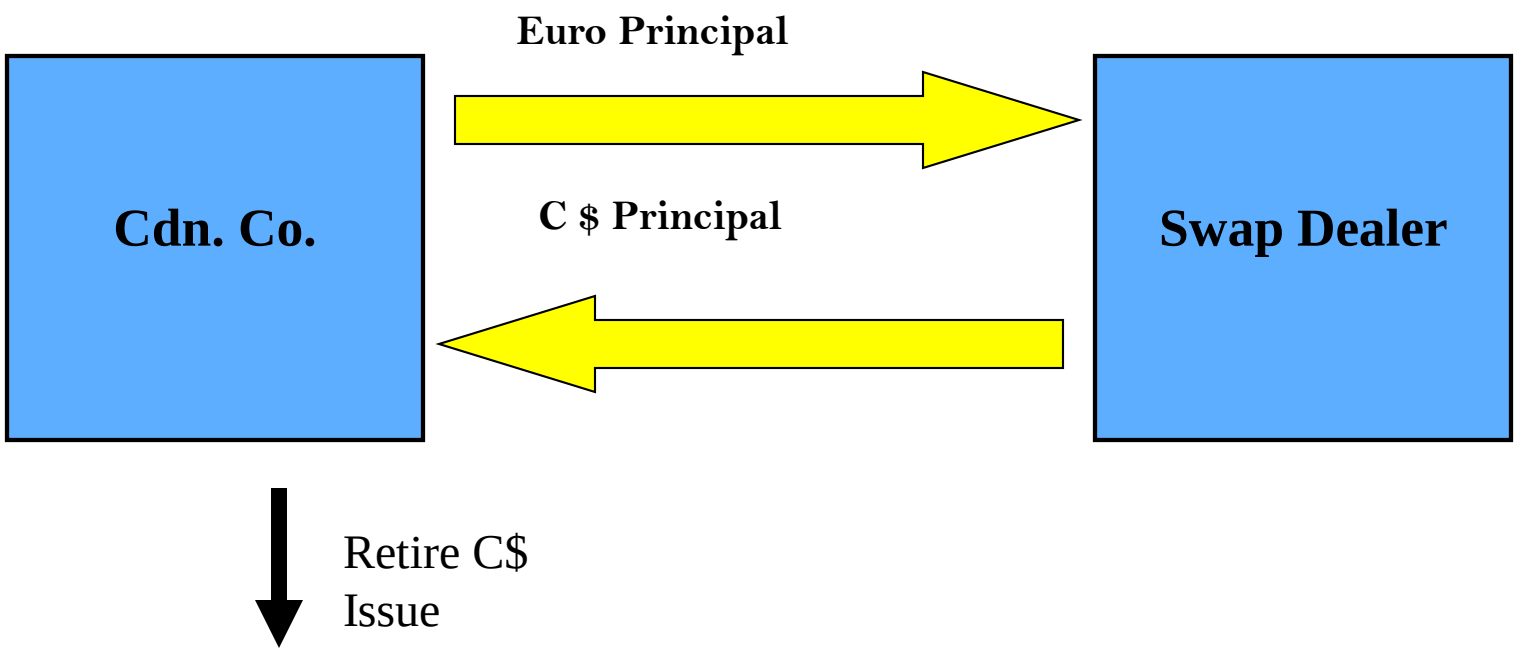
# Foreign Currency Swaps (cont'd)

* **Cash flows at each settlement:**



# Foreign Currency Swaps (cont'd)

* **Cash flows at maturity:**





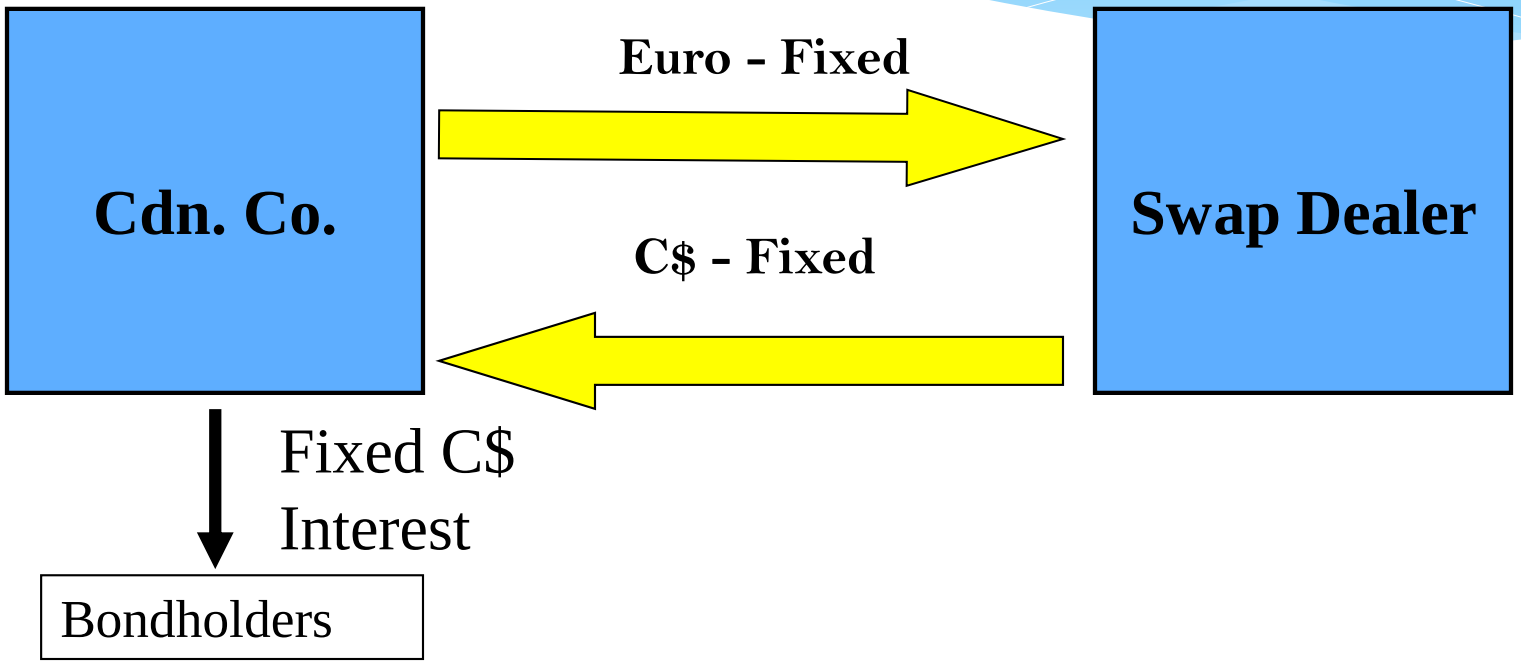

IRMT
irmT
The Institute of Risk Management Tanzania

# Circus Swap

- Combining both interest rate and currency swaps
- A *circus swap* combines an interest rate and a currency swap
  - Involves a plain vanilla interest rate swap and an ordinary currency swap
  - Both swaps might be with the same counterparty or with different counterparties

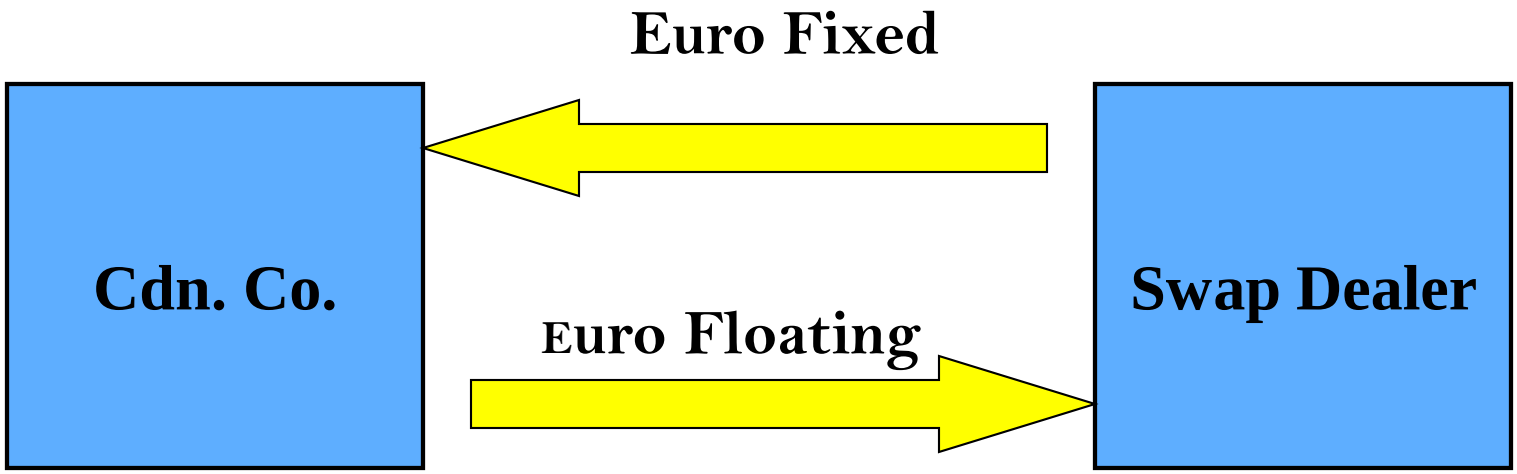
# Circus Swap

* Interest associated with original currency swap



# Circus Swap

* Interest rate swap to move from fixed euros to floating rate euros



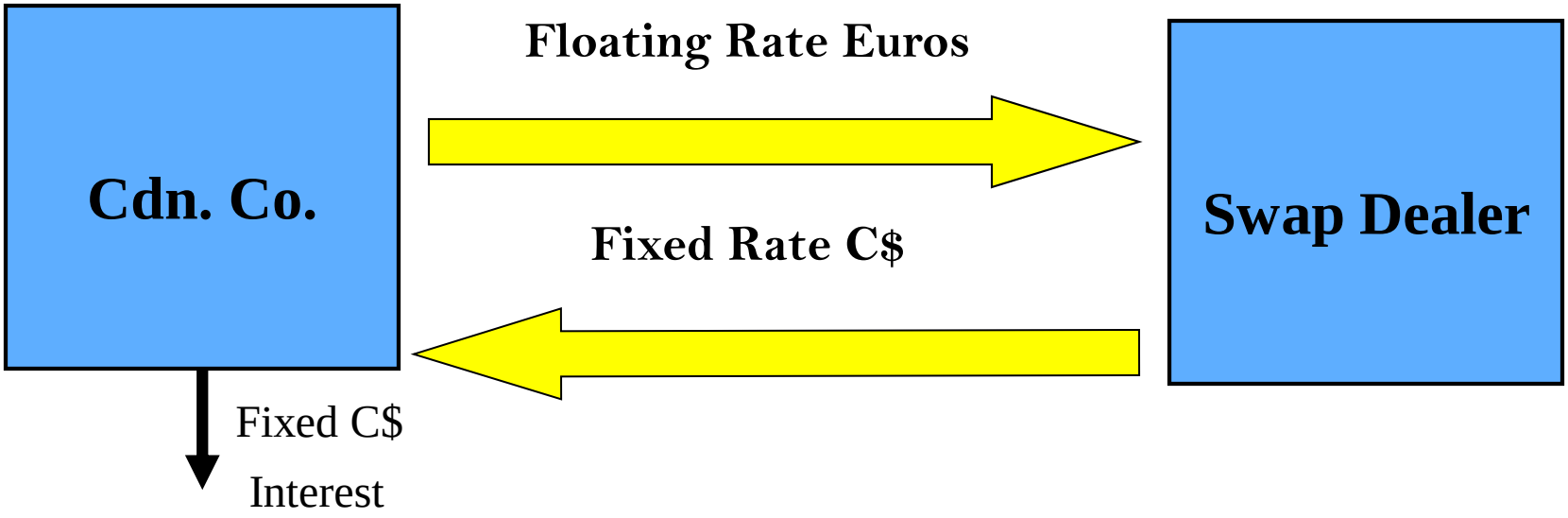



IRMT

irmT The Institute of Risk Management Tanzania

# Circus Swap

* Circus swap with two counterparties = net position of:






IRMT
irmT The Institute of Risk Management Tanzania

# Swap Variations

* **Deferred swap**
* **Floating for floating swap**
* **Amortizing swap**
* **Accreting swap**

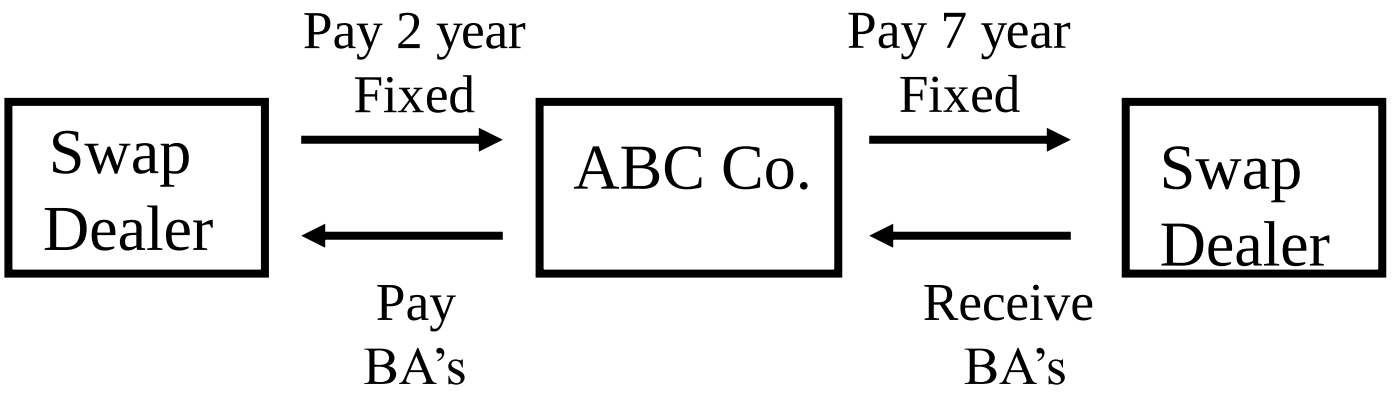
# Deferred Swap

- In a *deferred swap* (*forward start swap*), the cash flows do not begin until sometime after the initiation of the swap agreement
- Motivation - desire to manage future interest rate risk but reflecting today's interest rate conditions

# Deferred Swap - Example

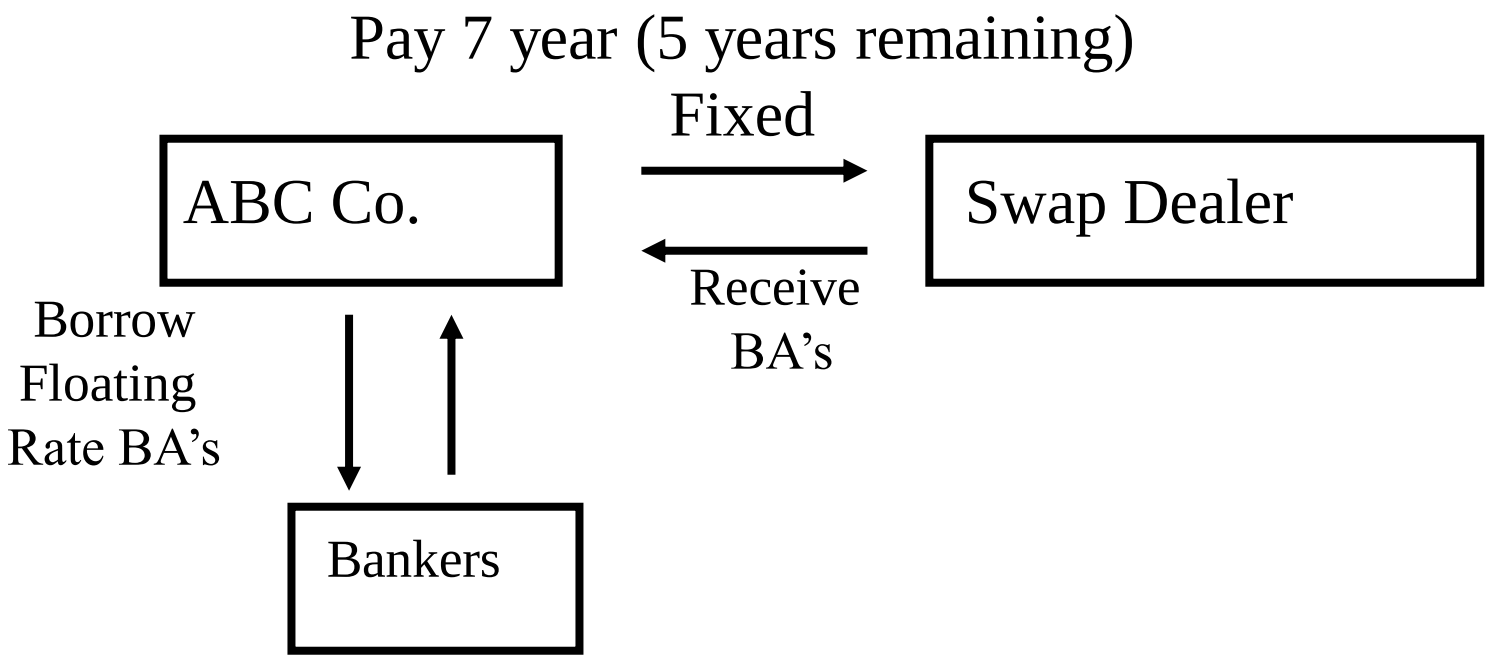
- ABC corporation has a required borrowing 2 years from now
- interest rate outlook is for rates trending upward
- deferred swap could lock in today's fixed rates for a premium
- a deferred or forward swap is in effect 2 swaps

# Deferred Swap - Example



# Deferred Swap - Example

...in two years time






IRMT

irmT
The Institute of Risk
Management Tanzania

# Deferred Swap - Example

- Dealer factors in the 'cost of carry' in offering the deferred 5 year rate (one swap)
- Considerations
  - interest rate outlook
  - time frame
  - cost of carry - the cost of the 'hedge'
    - steep yield curve - higher cost of carry
    - flat yield curve - minimal cost of carry

# Floating for Floating Swap

* In a *floating for floating swap*, both parties pay a floating rate, but with difference benchmark indices



IRMT

irmT The Institute of Risk Management Tanzania

# Amortizing Swap

* In an *amortizing swap*, the notional value declines over time according to some schedule



IRMT

irmT The Institute of Risk Management Tanzania

# Accreting Swap

* In an *accreting swap*, the notional value increases through time according to some schedule.

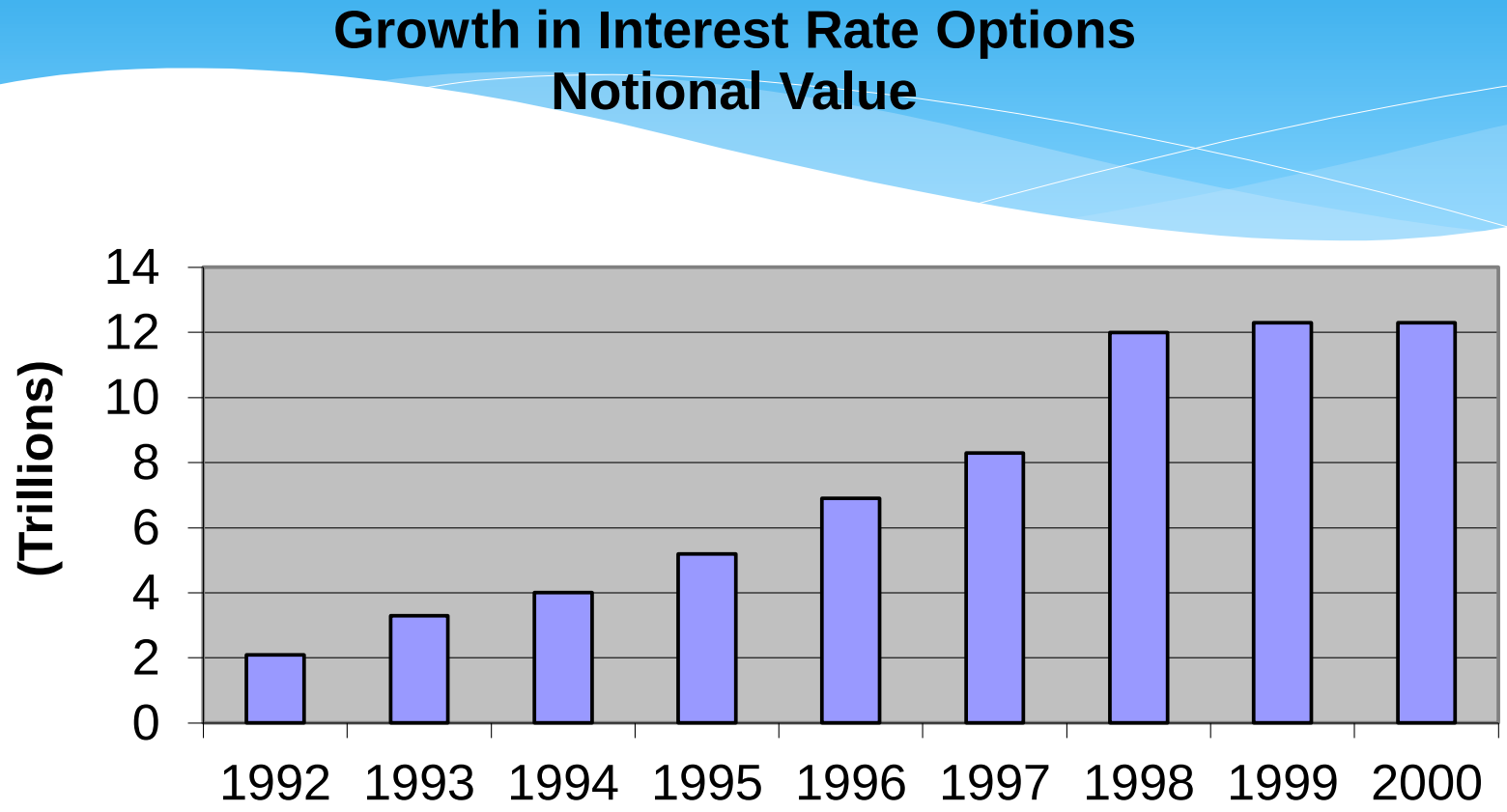
# Interest Rate Options

- Interest rate cap
- Interest rate floor
- Calculating cap and floor payoffs
- Interest rate collar
- Swaption

# Interest Rate Options

- Most of the trading done off the exchange floors
- The interest rate options market is:
  - Very large
  - Highly efficient
  - Highly liquid
  - Easy to use

# Interest Rate Options

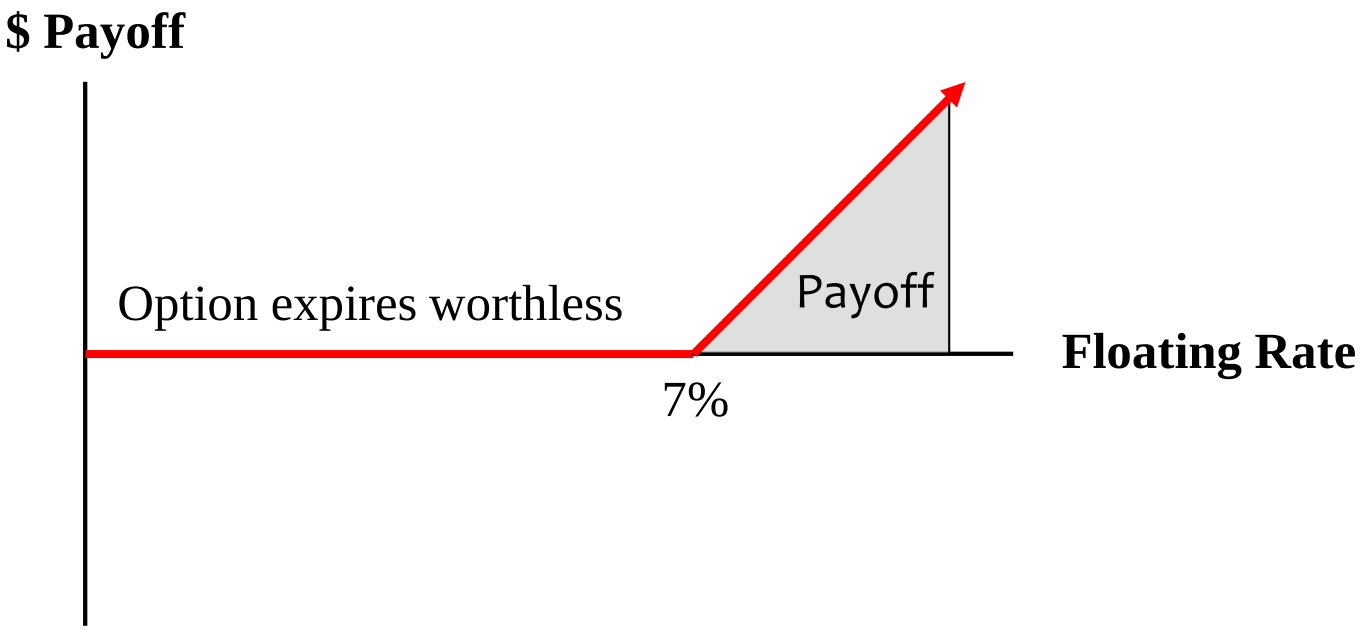


# Interest Rate Cap

- An *interest rate cap*
  - Is like a portfolio of European call options (*caplets*) on an interest rate
    - On each interest payment date over the life of the cap, one option in the portfolio expires
  - Is useful to firms with floating rate liabilities
  - Caps the periodic interest payments at the caplet's exercise price

# Interest Rate Cap (cont'd)

* **Long interest rate cap (exercise price 7%)**





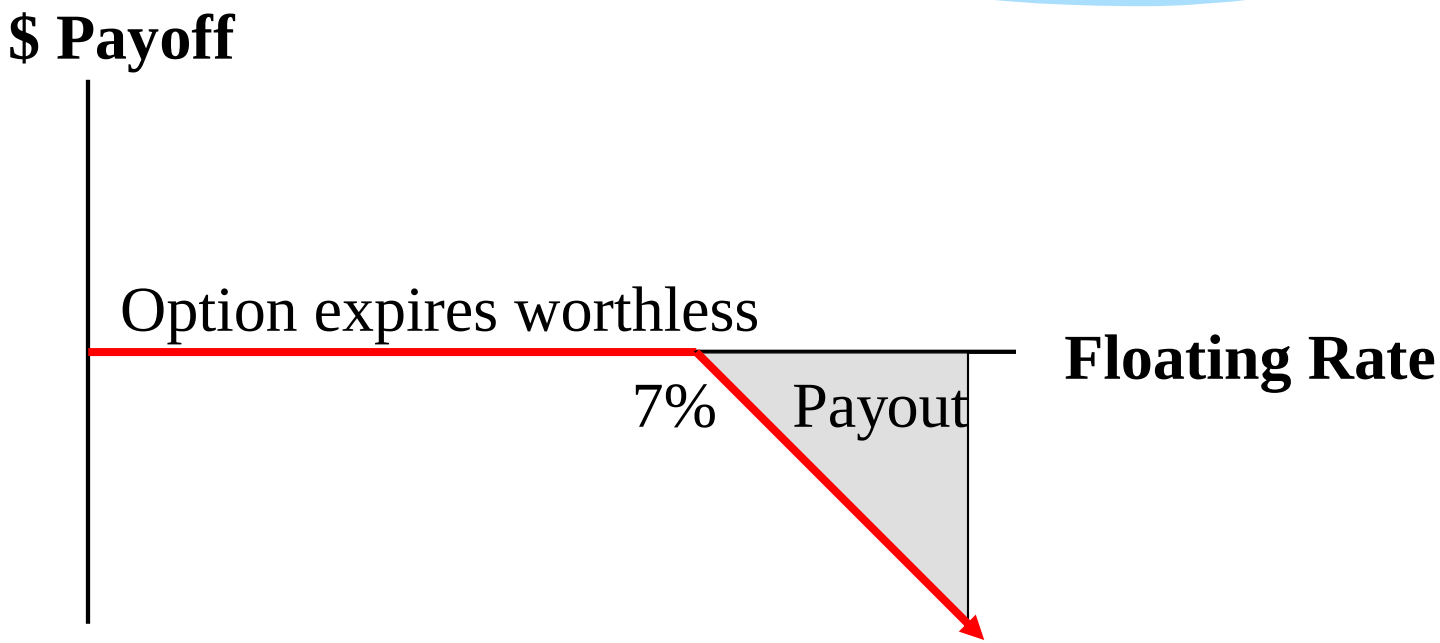


IRMT

irmT The Institute of Risk Management Tanzania

# Interest Rate Cap (cont'd)

* **Short interest rate cap (exercise price 7%)**

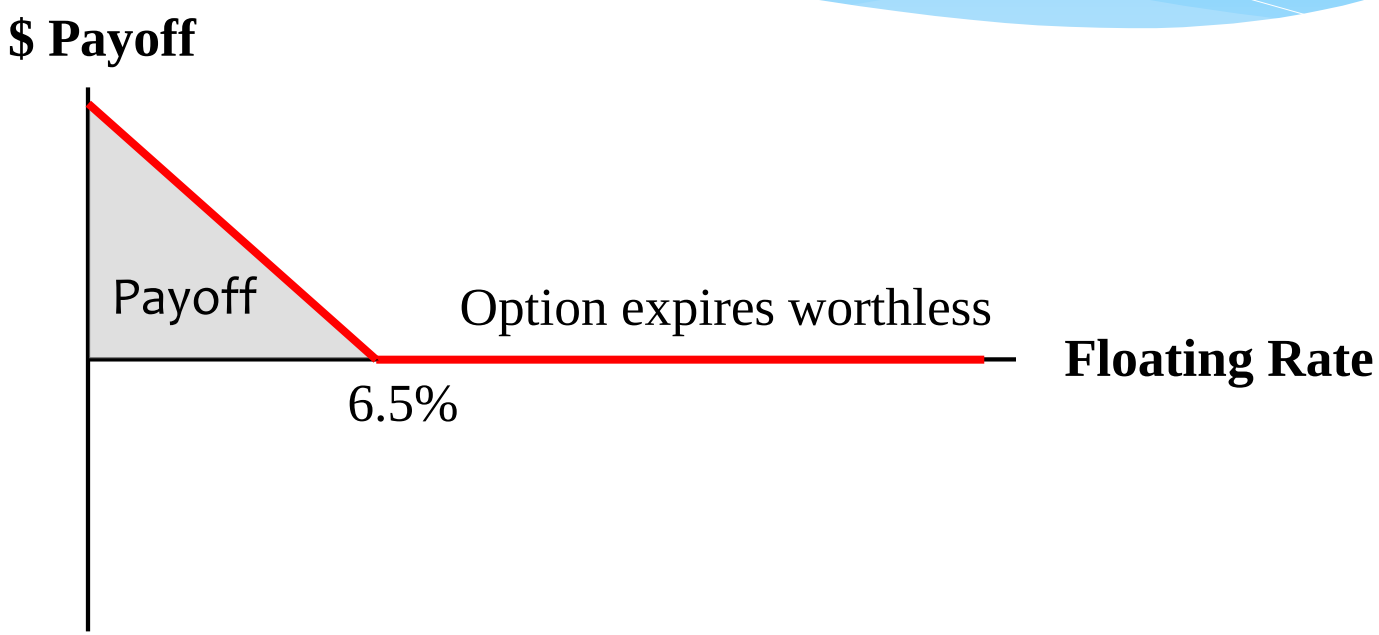


# Interest Rate Floor

- An *interest rate floor*
  - Is related to a cap in the same way that a put is related to a call
  - like a portfolio of European put options (*floorlets*) on an interest rate
    - On each interest payment date over the life of the cap, one option in the portfolio expires
  - Is useful to firms with floating rate assets
  - Puts a lower limit on the periodic interest payments at the floorlet's exercise price

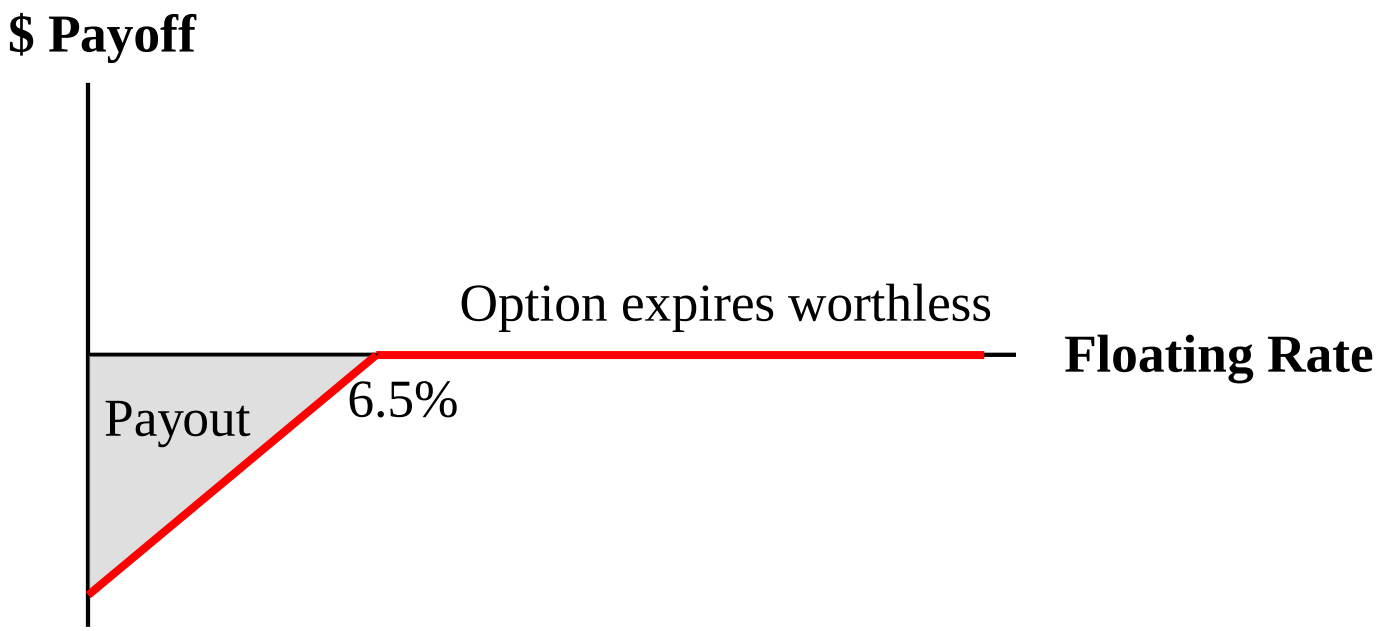
# Interest Rate Floor (cont'd)

* Long interest rate floor (exercise price 6.5%)



# Interest Rate Floor (cont'd)

* Short interest rate floor (exercise price 6.5%)






IRMT

irmT
The Institute of Risk Management Tanzania

# Calculating Cap and Floor Payoffs

- There are no universally acceptable terms to caps and floors
- However, frequently the terms provide for the cash payment on an in-the-money caplet or floor let to be based on a 360-day year

# Calculating Cap and Floor Payoffs (cont'd)

* Cap payout formula:

$$\text{cap payout} = (\text{notional value}) \times \frac{\text{days in payment period}}{360} \times (\text{benchmark rate} - \text{striking price})$$

* If the benchmark rate is less than the exercise price, the payout is zero

# Calculating Cap and Floor Payoffs (cont'd)

* Floor payout formula:

$$\text{floor payout} = (\text{notional value}) \times \frac{\text{days in payment period}}{360} \times (\text{striking price} - \text{benchmark rate})$$



IRMT

irmT The Institute of Risk Management Tanzania

# Interest Rate Collar

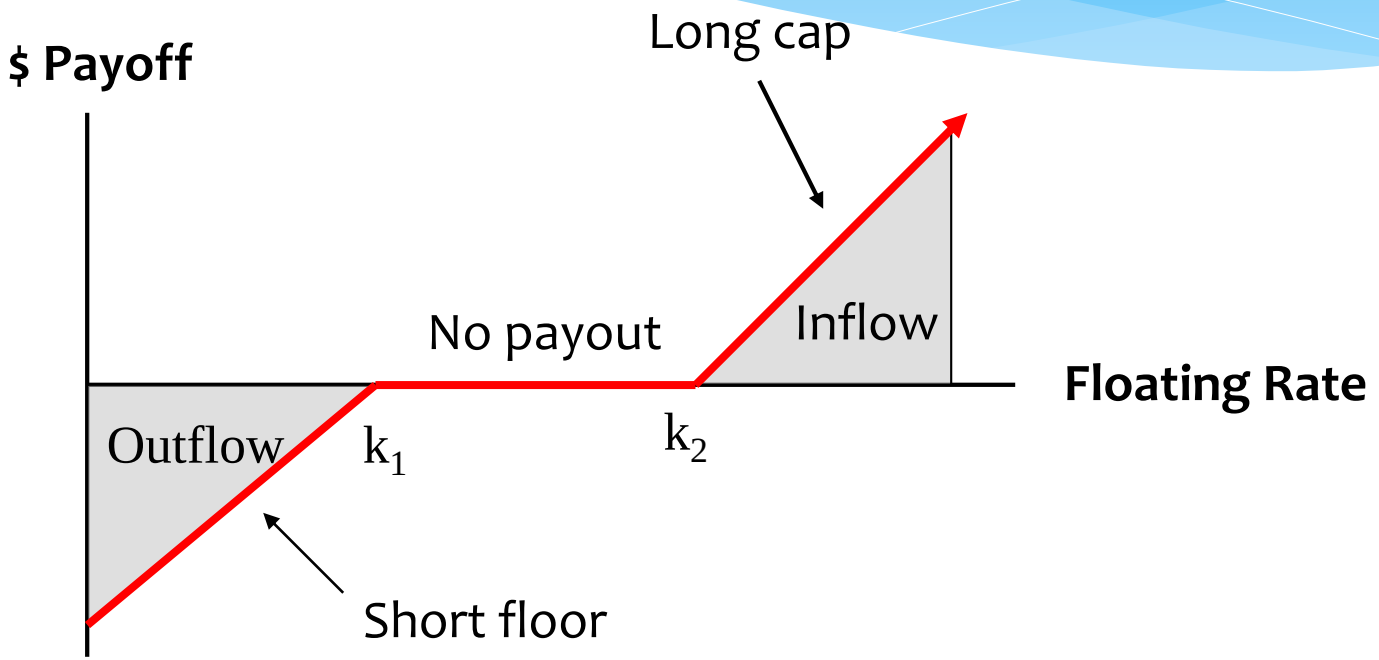
- *An interest rate* collar is simultaneously long an interest rate cap and short an interest rate floor
- Sacrifices some upside potential in exchange for a lower position cost
  - Premium from writing the floorlets reduces position costs



IRMT

irmT The Institute of Risk Management Tanzania

# Interest Rate Collar (cont'd)






IRMT

irmT
The Institute of Risk Management Tanzania

# Swaption

- A *swaption* is an option on a swap
- Can be either American or European style
- A *payer swaption* (*put swaption*) gives its owner the right to pay the fixed interest rate on a swap
- A *receiver swaption* (*call swaption*) gives its owner the right to receive the fixed rate and pay the floating rate

I
R
M
T

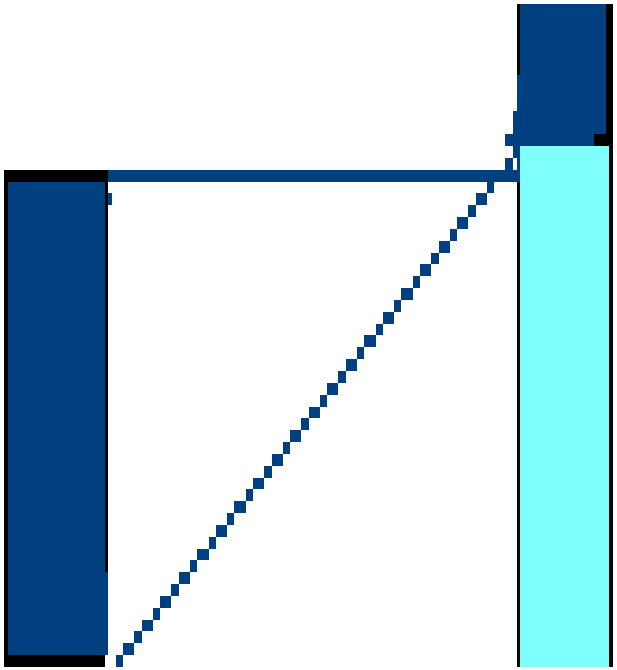
I
R
M
T

# Topic 5

# Exotic Options and Structured Products

# What are Structured Products

- Structured Product is a combination of bond + derivative
- It has flexibility with respect to the underlying asset





IRMT

irmT The Institute of Risk Management Tanzania

# Derivatives

- An option gives its owner the right to buy or sell an underlying asset on or before a given date at a fixed price
- Options are a part of a broader asset class called contingent claims. The payoff of this asset in future depends on the outcome of an uncertain event.

| | |
|---|---|
| Call | Option to Buy |
| Put | Option to sell |
| Exercise Price/Striking Price | Fixed price at which the option holder can buy/sell the underlying |
| Expiration Date/Maturity Date | Option expires or matures on this date |
| European Option | Can be exercised only on the expiration date |
| American Option | Can be exercised on or before the expiration date |

# Some Definitions

| | Call | Put |
|---|---|---|
| At the Money | Exercise price = Market Price | Exercise price = Market Price |
| In The Money | Exercise price < Market Price | Exercise price > Market price |
| Out of the Money | Exercise price > Market price | Exercise price < Market Price |

# Types of Structured Products

- CPPI (Constant Proportion Portfolio Insurance) Based Structures : The client is not guaranteed a participation in the index, but principal protection is guaranteed by dynamically reducing risk as we approach the floor.
- Dynamic Portfolio Protection : This is based on the CPPI model with modifications like a moving floor due to multiplier.
- Option Based Structures with Simple Payoff : Here the clients capital is locked in for a certain time and a minimum return (could be zero) and an upside participation (typically less than 100% or with a cap) in an equity index or a set of stocks is guaranteed.

# Types of Structured Products

- Range accruals/Digitals: In these products instead of capital guarantee and upside participation, the client gets a constant coupon if the underlying stock or basket is above a certain level.

- Option Based Structures with Complex Payoffs

# CPPI

Constant Proportion Portfolio Insurance (CPPI) is the name given to a trading strategy that is designed to ensure that a fixed minimum return is achieved either at all times or more typically, at a set date in the future.

I R M T

irmT
The Institute of Risk Management Tanzania

# CPPI-Jargon

- Floor: Present Value of desired capital to be preserved at maturity. If the product comes with an 80% capital guarantee, the floor is 80% of the initial capital.

- Cushion: Portfolio value less Floor. In the above example cushion will be 100-80 i.e.20%.

- Multiplier: Leverage applied to cushion.

IRMT

irmT
The Institute of Risk Management Tanzania

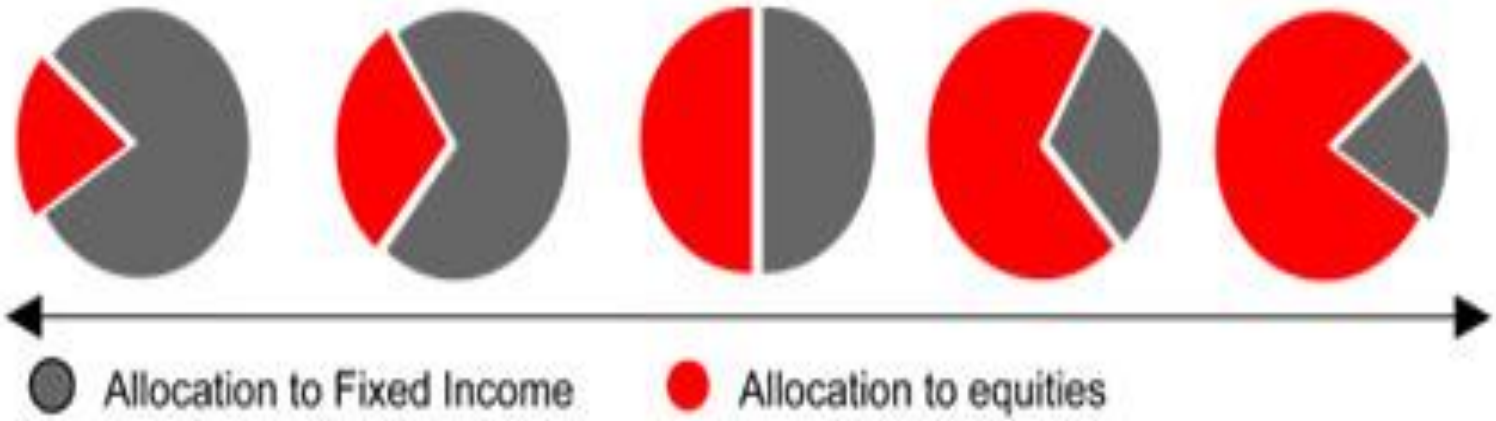
# How CPPI Operates

- Essentially the strategy involves continuously re-balancing the portfolio of investments during the term of the product between performance assets and safe assets using a set formula or mathematical algorithm. CPPI is totally rules based and non-discretionary.
- Principal protection is achieved by adjusting the exposure to the performance assets such that the underlying portfolio (ie the mix of safe assets and performance assets) is able to absorb a defined decrease in value before the value of the portfolio falls below the level required to achieve principal protection.

IRMT

irmT
The Institute of Risk Management Tanzania

# How CPPI Operates




- Equity value decline → Increase in the percentage allocated to fixed income
- Equity value increase → Increase in the percentage allocated to equity

IRMT

irmT
The Institute of Risk Management Tanzania

# Example of CPPI

- Initial Investment : 100
- Minimum Guarantee : 80 after 5years
- Investment pattern if worst case scenario is taken as fall in equity of 50% overnight
- 60 in Deposit 40 in Equity
- 50% fall in equity makes equity portion to 20. Still guarantee of 80 stands (60+20)

IRMT

irmT
The Institute of Risk Management Tanzania

# Example of CPPI

- Same example if market rises and value of equity goes up from 40 to 50. Total portfolio value becomes 110 (60+50).
- Fund provider can put 60 in equity as 50% fall will bring equity value to 30. Which still gives investor guarantee plus returns.
- As the fund rises so does the minimum guaranteed investment. If initial investment of 100 becomes 125, 80% of that is 100, which the investor can be assured of getting at any point in time after that.

IRMT

irmT
The Institute of Risk Management Tanzania

# Risk in CPPI-Cash Locked

* In the worst case scenario the market trends downwards. Then the risky asset contentiously loses value and in order to protect the floor, more and more assets are allocated to the risk-free asset. In this worst case scenario, as soon as all assets are allocated to the risk free asset. The total value of all assets equals the floor and the is no room left for an allocation to risky assets. The strategy is "**cash locked**". Upside potential disappeared and only the interest earned from the cash position can be invested in the risky asset.

I R M T

irmT
The Institute of Risk Management Tanzania

# Risk in CPPI-Model Risk

* Another risk is known as **Model risk**. This is the risk that the market overnight collapses and more value is lost then assumed when the multiplier was set. The model risk or gap risk is either ran by the investor or by the manager. In the latter case a gap risk insurance will be charged. This risk is often reduced by a long put option position.

IRMT

irmT
The Institute of Risk Management Tanzania

# Risk in CPPI-Trading Band Width

According to the CPPI methodology, risky assets are being bought in rising markets and sold in falling markets. If then after a boost, the underlying market corrects downwards to the previous level, the same number of risky assets that were first bought at a high price now needs to be sold at a low price. A loss is recorded and a smaller allocation to the risky asset is necessary. The trading band-with should be set as wide as to prevent this, but at the same time, as small as to reduce the gap risk. Next to the multiplier the trading band-width is a key to a successful CPPI product.

I R M T

irmT
The Institute of Risk Management Tanzania

# Gap Protection

Banks that provide CPPI underwrite this so-called 'Gap Risk' and guarantee to stand by the stated minimum return whatever occurs in the market. A non-bank provider of CPPI product would typically purchase Gap Protection from a third party in order to maintain their Minimum Return Guarantee

IRMT

irmT
The Institute of Risk Management Tanzania

# The Difference Between CPPI and Standard Fixed Participation Methodology

* Unlike a standard structured product which places a set amount in a zero coupon deposit on day one and purchases a call option with the remaining funds in order to provide a set participation level, a CPPI based structure varies cash allocation between so-called **safe assets** (ie bonds and cash) and the **performance assets** (equities or other 'risky assets') depending upon market performance.

IRMT

irmT
The Institute of Risk Management Tanzania

# The Difference Between CPPI and Standard Fixed Participation Methodology

The key difference between CPPI based capital protected products and option-based products are:

- The participation in any rise in the underlying is not fixed at the start
- It is possible to have a higher initial participation than with an equivalent option-based product



IRMT

irmT The Institute of Risk Management Tanzania

# Some Structured Products

# HSBC Capital Guard Portfolio

The key features of this product are:

- **100% Capital Protection Guaranteed** – 100% of initial investment back at maturity (after 4 years). For the guarantee to be applicable, the investor will need to remain invested till maturity
- **100% Initial Equity Exposure** – Optimal allocation to actively managed equities aimed at Capital Appreciation
- **Profit Lock-in Mechanism** – The portfolio endeavours to capture upside by providing a 3% lock-in for every 10% increase in initial portfolio

# HSBC Capital Guard Portfolio

- **Easy Liquidity –** 4 year tenor with liquidity provided through the tenor of the product (subject to applicable exit loads)
- **Minimum Investment Amount –** Rs 25 lacs
- Guarantee has been provided by HSBC Bank plc subject to terms and conditions.
- This portfolio is currently not available for subscription.

# JM Financial's Triple AAAce Scheme

JM Financial's Triple AAAce Scheme, will invest in equity funds for five years and provide investors at least 85% of the maximum peak value of the underlying portfolio of funds, at the time of maturity. It has tied up with Societe Generale Asset Management and has been rated by Crisil Ltd, a subsidiary of ratings agency Standard & Poor's

# Example of CPPI

* HDFC (PMS) DPP Strategy 2006



IRMT

irmT The Institute of Risk Management Tanzania

# Asset Linked Portfolio- Accelerator Series 8

(By Birla Sunlife Asset Management Company under Birla Sunlife Privileged Account Service)

**Key Features:**

- Tenure 24 months
- NCD's offering participation in upside of S&P CNX Nifty
- Principal +Payoff at Maturity
- Endeavor to deliver 100% principal protection
- 100% Participation in S&P CNX Nifty returns
- Barrier 145% - If S&P CNX Nifty breaches 145% at any of the observation dates, the investor gets payout of face value of NCD+23% face value of NCD

# Structured Products in Global Markets

## Some Examples



IRMT

irmT The Institute of Risk Management Tanzania

# Exotics

- Exotics are exotic options which are different from the plain vanilla European and American Options.
- Banks and institutions globally use exotics to create a variety of Structured Products.
- Examples of Exotics:
  - Non standard American Options (Bermudan Options)
  - Forward Start Options
  - Compound Options
  - Chooser Options
  - Barrier options
    - Knock-out or knock-in options

# Exotics Cont…

- Down and Out Call
- Down and In Call
- Up and Out Call
- Up and In Call
- Binary Option
  - Cash or Nothing Call/Put
  - Asset or Nothing Call/Put
- Lookback Options
- Shout Options
- Rainbow Options
- Basket Options

# Structured Products-Growth

- Protected Note
- Turbo Note
- Digital Plus
- Lock-in Accumulator
- Delta One Certificate
- Outperformer
- Sprint
- Best of /Worst Of
- Airbag
- Twin Win
- Condor

# Structured Products-Income

- Callable Corridor
- Scoop
- Reverse Convertible
- Reverse Discount
- FX Target
- Callable Stability Note
- Phoenix Note
- Phoenix Plus
- Eagle Note
- Eagle Pl

# Protected Note

A Protected Note is a structured procuct,100% Capital Guaranteed at maturity, which allows the investor to benefit from participation in the increase (or the decrease) of the underlying

**Mechanism**

At maturity the investor receives maximum between:

- 100% of the capital invested
- 100% + x% of the performance of the underlying

# Protected Note

**Advantages**

- 100% capital protection
- Investor can benefit from a high return

**Disadvantages**

- The redemption at maturity can be lower than the redemption of a standard deposit product over the same period
- The capital is only guaranteed at maturity

**Structure**

- Buy a zero coupon bond
- Buy x% of a call (for participation in increase) or a Put (for a participation in the decrease)

# Example of Protected Note

Example 1: Increase of the underlying on the final observation date.

If the underlying has increased (from 100 to 120 for eg) the investor receives at maturity:

- 100% of the capital invested + 100% of the underlying
- 100% +(100%*20*) = 120% of the capital invested

Example 2: Stability or Decrease of the underlying on the final observation date.

If the underlying has decreased (from 100 to 40 for eg) the investor receives at maturity:

- 100% of the capital invested

# Turbo Note

A Turbo Note is a structured product,100% Capital Guaranteed at maturity, which allows the investor to benefit from a high participation in the increase of the underlying up to a predefined deactivating **barrier level**.

**Mechanism**

At maturity: If the underlying closes at or above its initial level and has never reached the barrier during the life of the product, the investor receives

- 100% + x% of the performance of the underlying
- x% being the participation in the increase of the underlying

IRMT

irmT
The Institute of Risk Management Tanzania

# Turbo Note

If the underlying closes below its initial level but has never reached the barrier during the life of the product

- 100% of the capital invested

If the underlying has reached the barrier during the life of the product

- 100% of the capital invested



IRMT

irmT The Institute of Risk Management Tanzania

# Turbo Note

**Advantages**

- 100% capital protection
- The product provides higher participation in the increase of an underlying than other structures (for eg protected notes)

**Disadvantages**

- The capital is only guaranteed at maturity
- The investor may no longer benefit from the increase if the underlying reaches the barrier.

**Structure**

- Buy a zero coupon bond
- Buy a call  At the money Up and Out (American Barrier)

IRMT

irmT
The Institute of Risk Management Tanzania

# Example of Turbo Note

Participation : 100% of increase of the underlying Barrier : 130%

- Example 1: Increase of the underlying on the final observation date

If the underlying closes at 125% on the final observation date i.e. above its initial level and has never reached the barrier during the life of the product, the investor receives at maturity:

- 100% of the capital invested + 100% of the underlying
- 100% +(100%*25%) = 125% of the capital invested

IRMT

irmT
The Institute of Risk Management Tanzania

# Example of Turbo Note

- Example 2: Increase of the underlying beyond the barrier

If the underlying closes at 110% on the final observation date i.e. above its initial level but has reached the barrier during the life of the product, the investor receives at maturity:

100% of the capital invested

* Example 3: Decrease of the underlying on the final observation date

If the underlying closes at 80% on the final observation date the investor receives at maturity:

100% of the capital invested



IRMT

irmT The Institute of Risk Management Tanzania

# Digital Plus

- A Digital Plus is a structured product ,100% capital guaranteed at maturity, which allows the investor to benefit from the maximum between the entire increase of an underlying and a high Digital Bonus if the underlying closes at or above its initial level on the final observation day.
- Mechanism
  - At maturity
    - If the underlying closes at or above its initial level on the final observation date, the investor receives the maximum between:
      - 100% of the capital invested + Digital Bonus
      - 100% of the capital invested + 100% of the performance of the underlying

IRMT

irmT
The Institute of Risk Management Tanzania

# Digital Plus

- If the underlying closes below its initial level on the final observation date, the investor receives
  - 100% of the capital invested
- **Advantages**
  - The investor can benefit from the entire positive performance of the underlying
  - A high Digital bonus is guaranteed if the underlying closes at or above its initial level on the final observation date
  - The capital is 100% guaranteed at maturity

# Digital Plus

- **Disadvantages**
  - The capital is 100% guaranteed only at maturity

- **Structure**
  - Buy a zero coupon bond
  - Buy a Digital Option
  - Buy a Call 'Out of the money'

IRMT

irmT
The Institute of Risk Management Tanzania

# Example of Digital Plus

Maturity 2years: Participation 100% of the increase of underlying:

- Digital Bonus Level 120%
- Capital 100% Guaranteed

* Example 1: Underlying Performance
  - The basket closes at 125% on the final observation date
  - The investor receives at maturity 125% of the capital invested

IRMT

irmT
The Institute of Risk Management Tanzania

# Example of Digital Plus

- Example 2: Digital Bonus
  - The basket closes at 110% on the final observation date i.e. above its initial level but below the digital bonus level
  - The investor receives the digital bonus i.e. 120% of the capital invested

- Example 3: Capital Guarantee
  - The basket closes at 90% on the final observation date i.e. below its initial level
  - The investor receives 100% of the capital invested

# Lock-in Accumulator

A lock-in Accumulator is a structured product, 100% capital guaranteed, which allows the investor to benefit from participation in the increase of underlying- periodically capped until a pre-defined level. This product offers a mechanism to set up to lock the accumulated performances when one or several levels of performance are reached.

- Mechanism
  - The investor participated in the evolution of the underlying by accumulating positive and negative performances period by period
  - The performance observed at the end of each period are capped on the upside but not floored on the downside

IRMT

irmT
The Institute of Risk Management Tanzania

# Lock-in Accumulator

* A lock-in mechanism of accumulated performance at one or several pre-defined levels (lock-in levels) is ensured
* The investor benefits at maturity from the maximum between
  * 100% of the capital invested plus the maximum lock-in level reached during the life of the product
  * 100% of the capital invested plus sum of the accumulated performances capped on the upside and not floored on the downside
  * 100% of the capital invested

# Lock-in Accumulator

* Advantages
  * The capital is 100% guaranteed at maturity
  * The investor can benefit from a high return
  * The investor benefits from 100% of the increase of the underlying until a certain level each period
  * A lock-in mechanism of performance is offered
  * As soon as the sum of calculated profits and losses reaches a predefined lock-in level, this level of performance then becomes secured and is guaranteed at maturity

IRMT

irmT
The Institute of Risk Management Tanzania

# Lock-in Accumulator

- Disadvantages
  - The capital is only guaranteed at maturity
  - The performances each period are not floored on the downside but capped on the upside
- Structure
  - Buy a zero coupon bond
  - Buy a strip of call spread 100% /100% +Cap
  - Sell a strip of Put 100%
  - Buy a Put plus one or several options 'Lock-in" on the performances generated by the strips of Call Spread and Put

# Example of Lock-in Accumulator

* Maturity 18 months
* Observations : Monthly
* Monthly Cap on Upside : 2.4%
* Lock-in levels : 10% & 20%

(Once a lock-in level has been reached a floor of performance is guaranteed at maturity)

# Example of Lock-in Accumulator

| Month | Observed Perf | Capped Perf | Sum of Capped Performace | Locked Perf |
|---|---|---|---|---|
| 1 | 2% | 2.0% | 2.0% | |
| 2 | -1% | -1.0% | 1.0% | |
| 3 | 3% | 2.4% | 3.4% | |
| 4 | 1% | 1.0% | 4.4% | |
| 5 | 4% | 2.4% | 6.8% | |
| 6 | 3% | 2.4% | 9.2% | |
| 7 | -2% | -4.0% | 7.2% | |
| 8 | 2% | 2.0% | 9.2% | |
| 9 | 4% | 2.4% | 11.6% | 10.0% |
| 10 | 2% | 2.0% | 13.6% | |
| 11 | -1% | -1.0% | 12.6% | |
| 12 | 3% | 2.4% | 15.0% | |
| 13 | 3% | 2.4% | 17.4% | |
| 14 | 4% | 2.4% | 19.8% | |
| 15 | 2% | 2.0% | 21.8% | 20.0% |
| 16 | 1% | 1.0% | 22.8% | |
| 17 | 2% | 2.0% | 24.8% | |
| 18 | 2% | 2.0% | 26.8% | |

# Example of Lock-in Accumulator

**Redemption at Maturity**

The investor benefits from the maximum between 100% of capital invested + Lock-in level reached during the life of the product i.e.100%+20%

100% of capital invested + the sum of accumulated monthly performances capped on the upside and not floored on the downside i.e. 126.8%

100% of the capital invested

# Delta One Certificate

- A Delta One Certificate I a structured product which allows the investor to be exposed to 100% of the performance of an underlying (positive or negative)
- Mechanism
  - At Maturity
    - If the underlying closes at or above its initial level on the final observation date, the investor receives 100% of the capital invested + 100% of the positive performance of the underlying
    - If the underlying closes below its initial level on the final observation date, the investor receives 100% of the capital invested reduced by the negative performance of the underlying (physical delivery or cash settlement) (Loss in capital scenario)

# Delta One Certificate

* **Advantages**
  * The product reflects at anytime the performance of the underlying
* **Disadvantages**
  * The capital is not guaranteed
  * If the underlying closes below its initial level on the final observation day, the investor is subject to a loss in capital equivalent to the one associated with the underlying

# Example of Delta One Certificate

* Example 1: Increase of Underlying
  - The basket closes at 120% on the final observation date i.e. above its initial level
  - The investor receives at maturity 100% of the capital invested + 100% of the performance of the underlying i.e. 120% of the capital invested
* Example 2: Decrease in the Underlying
  - The basket closes at 90% on the final observation date i.e. below its initial level
  - The investor receives 90% of the capital invested

# Outperformer

- An outperformer is a structured product which allows the investor to benefit from a high level of participation in the rise of the underlying while being only exposed to 100% of the decrease

- Mechanism
  - IF the underlying closes above its initial level on the final observation date, the investor receives
    - 100% + x% of the positive performance of he underlying (x% being the participation in the rise of the underlying)
  - IF the underlying closes below its initial level on the final observation date, the investor receives
    - 100% of the capital invested minus the negative performance of the underlying (physical or cash delivery) ( Loss in capital scenario)

# Outperformer

* **Advantages**
  - The product offers strong participation in the upside without any upside limit
  - The product is very sensitive to the evolution of the underlying on the secondary market
* **Disadvantages**
  - The capital is not guaranteed
  - If the underlying closes below its initial level on the final observation day, the investor is subject to a loss in capital equivalent to the one associated with the underlying
  - Structure
  - Buy a Call Zero (in order to arbitrate the dividends)
  - Buy x% of a Call At The Money

# Example of Outperformer

* Underlying XYZ Stock Maturity : 12 months Capital : Not Guaranteed
* Participation 130% of the increase of the underlying
  100% of the decrease of the underlying
* Capital Not Guaranteed

* Example 1: Increase of Underlying on the final observation date

  If the underlying has increased ( from 100 to 120 for example), the investor receives at maturity

  100% of the capital invested + 130% of the performance of the underlying

  i.e. 100% +(130% *20%)=126% of the capital invested



IRMT
irmT The Institute of Risk Management Tanzania

# Example of Outperformer

- Example 2: Decrease of Underlying on the final observation date

If the underlying has increased (from 100 to 80 for example), the investor receives at maturity

A number n of stocks paid at their initial level

In our example, if the stocks are immediately sold, the loss is less than 20%

# Sprint

* A sprint is a structured product which allows the investor to benefit from a very high leveraged participation in the rise of the underlying capped on the upside, while being only exposed to 100% of the decrease
* Mechanism
  * IF the underlying closes above its initial level but below the Target on the final observation date, the investor receives
    * 100% + 200% of the positive performance of he underlying
  * IF the underlying at or above the Target the final observation date, the investor receives
    * The Maximum Redemption (200%*Targeted Performance)

# Sprint Cont…

* IF the underlying closes below its initial level on the final observation date, the investor receives
  * 100% of the capital invested minus the negative performance of the underlying (physical or cash delivery) ( Loss in capital scenario)

**Advantages**

* The product offers strong leveraged participation in the upside
* The investor benefits from an improved return when anticipated a moderate increase of the underlying

# Sprint Cont…

- **Disadvantages**
  - The capital is not guaranteed
  - If the underlying closes below its initial level on the final observation day, the investor is subject to a loss in capital equivalent to the one associated with the underlying
  - The performance is capped above predefined level

- Structure
  - Buy a Call Zero ( In order to arbitrate the dividends)
  - Buy 100% of a call At The Money
  - Sell 2 Calls Out of The money 'Strike Target'

# Example of Sprint

* Underlying XYZ Stock Maturity : 12 months
* Capital : Not Guaranteed
* Participation:
  - 200% of the increase of the underlying upto the Target
  - 100% of the decrease of the underlying
* Target 115% Max Redemption 130%
  Capital Not Guaranteed
* **Example 1:** Increase of Underlying on the final observation date

  If the underlying closes at or above its initial level but below the Target( say 110%), the investor receives at maturity
  - 100% + 200% of the positive performance of the underlying i.e. 100% +200%*10%=120%



IRMT
irmT The Institute of Risk Management Tanzania

# Example of Sprint

**Example 1:** Increase of Underlying on the final observation date

* **Example 2:** Increase of Underlying beyond the Target on the final observation date
  - If the underlying closes at or above its initial level but below the Target ( say 115%), the investor receives at maturity

The Maximum Redemption i.e.130% of the capital invested

* **Example 3:** Decrease of Underlying on the final observation date
  - If the underlying has decreased ( from 100 to 80 for example), the investor receives at maturity
  - A number n of stocks paid at their initial level
  - In our example, if the stocks are immediately sold, the loss is less than 20%

# Best of / Worst of

- A Best Of/ Worst Of is a structured product which allows the investor to benefit from the increase of the Best Performance Underlying of a basket with leverage if the Worst Performing Underlying closes at or above its initial level on the final observation date.

- Mechanism
  - On the final observation date, if the Worst Performing Underlying of the basket closes at or above its initial level, the investor receives
    - 100% + x% of the Best Performing Underlying (x% being the participation in the increase of this underlying)

# Best of / Worst of

- On the final observation date, if the Worst Performing Underlying of the basket closes strictly below its initial level the investor receives 100% of the capital invested reduced by the negative performance of the Worst Performing Underlying (Loss of Capital Scenario)

- **Advantages**
  - The investor benefits from a high leveraged participation in the increase of the Best Performing Underlying if the condition if fulfilled

# Best of / Worst of

- Disadvantages
  - The capital is not guaranteed
  - The condition to benefit from the leverage is applied on the Worst Performing Underlying. Therefore a high return is possible only if all underlyings close at or above their initial levels. If the Worst Performing Underlying closes below is initial level on the final observation date, the investor is subject to a loss in capital equivalent to the one associated with the underlying.

# Example of Best Of/Worst Of

- Underlying: ABC Stock and XYZ Stock
- Maturity : 12months
- Participation : 200% of the increase of the Best Performing Stock

- **Example 1 :** Participation in increase
  - If ABC stock closes at 120% and XYZ at 105% on the final observation date. Then, the investor receives
    - 100% of capital invested+200%of increase of ABC Stock

    i.e. 100%+200%*20%=140% of the capital invested



IRMT

irmT The Institute of Risk Management Tanzania

# Example of Best Of/Worst Of

* **Example 2 :** Loss in Capital
  * If ABC stock closes at 105% and XYZ at 95% on the final observation date. Then, the investor receives

    - N number of XYZ stocks paid at their initial level (in the example, if the stocks are immediately sold, the loss is less than 5%)



IRMT

irmT The Institute of Risk Management Tanzania

# Callable Corridor

- A Callable Corridor is a structured product , 100% capital protected at maturity, which allows the investor to accumulate a bonus every day where the underlying has remained within a predefined range.

  The product can be early redeemed by the issuer at its sole discretion at 100% +accrued bonus

- Mechanism
  - At the end of each period, we observe the number of days where the underlying has remained within the predefined range to calculate the bonus for that period.

# Callable Corridor

- **Advantages**
  - The capital is 100% guaranteed at maturity
  - The investor can benefit from a high return
  - Even if the underlying exits the range, the mechanism of bonus payment does not deactivate. The investor receives on each payment date a bonus weighted according to the number of days where the underlying remains within the predefined ranges

- **Disadvantages**
  - The return can be lower than a classical monetary deposit if the underlying remains within the predefined ranges for an insufficient amount of time.

# Callable Corridor

- The product may be redeemed by the issuer in the case of a favourable evolution of the underlying (Callable Effect)

- Structure
  - Buy a strip of daily binary European Options
  - Buy a zero coupon
  - Sella Bermudan Call on the structure

# Example of Callable Corridor

* Currency: USD Maturity: 6years
* Bonus: A maximum quarterly bonus of 6.5% annualised
* Underlying 6 month USD LIBOR
* Bonus Payment Quarterly
* Ranges Year 1: 0%-5.5% Year 4: 0%-5.75%
  Year 2: 0%-5.5% Year 5: 0%-6%
  Year 3: 0%-5.75% Year 6: 0%-6%
* Redemption Scenarios
  * At the end of each quarter, we observe the number of days where the underlying has remained strictly within the predefined ranges
    * The underlying has remained strictly remained within the ranges during the entire reference period, the investor receives a 6.5% annualised bonus, paid quarterly

# Example of Callable Corridor

- The underlying has not remained strictly within the ranges during the entire reference period
  - The investor receives a 6.5% annualised bonus weighted according to the number of days where the underlying has remained within the range
  - Suppose the number of days within the range is 60, the payout will be 6.5%*(60/90)*(90/360)

    i.e 1.08% of the capital invested for that quarter.

# How to Create Your Own Structured Product

- Strategy A1
  - Using Fixed Deposits and Equity
- Strategy A2
  - Using Fixed Deposits and Options
- Strategy B
  - Using Fixed Income products like SCSS and Postal Savings Products with Equity
- Strategy C
  - Using derivative models like bull call spread

# Strategy A1

| Product | Amount | Rate of Return | Tenure | Maturity |
|---|---|---|---|---|
| FD | 100000 | 0.07 | 6 | Rs.151,644 |
| | | | | |
| FD | 66000 | 0.07 | 6 | **Rs.100,085** |
| Equity/MF | 34000 | 0.12 | 6 | Rs.67,110 |
| | | | | |
| NSC | 62500 | 0.08 | 6 | **Rs.100,527** |
| Equity/MF | 37500 | 0.12 | 6 | Rs.74,018 |
| | | | | |
| Equity/MF | 100000 | 0.12 | 6 | Rs.197,382 |

# Strategy A2

| | | | | |
|---|---|---|---|---|
| FD | 66000 | 0.07 | 6 | **Rs.100,085.22** |
| Money Available | 34000 | | | |
| **CALL** | | | | **PUT** |
| NFTY 30 DEC 2010 | | | | NFTY 30 DEC 2010 |
| Nifty Current Level | 5900 | | | 5900 |
| Strike Price | 6300 | | | 5700 |
| Premium | 113 | | | 85 |
| Market Lot | 50 | | | 50 |
| No of Contracts | 6 | | | 8 |
| Nifty Level on 30 Dec 2010 | 6600 | | | 5500 |
| Gain per option | 300 | | | 200 |
| Profit per option | 187 | | | 115 |
| Total Profit | Rs.56,100 | | | Rs.46,000 |

# Strategy B

| | Amount | Rate Of Interest | Tenure | Monthly/ Qtly outflow | Maturity | Total Maturity |
|---|---|---|---|---|---|---|
| | | | | | | |
| Postal MIS | 100000 | 8% | 6 | 667 | Rs.105,000 | |
| SIP (Monthly) | 667* | 12% | 6 | | Rs.69,841 | Rs.174,841 |
| | | | | | | |
| Postal MIS | 100000 | 8% | 6 | 667 | Rs.105,000 | |
| Postal RD | 667 | 8% | 6 | | Rs.60,702 | Rs.165,702 |
| | | | | | | |
| SCSS | 100000 | 9% | 5** | 2250 | Rs.100,000 | |
| SIP (Quarterly) | 2250 | 12% | 5 | | Rs.60,458 | Rs.160,458 |

# Strategy C

| NIFTY SPOT | Long Call | Short Call | Premium for Long Call | Premium For Short call | Profit on Long Call | Profit on Short Call | TOTAL PROFIT |
|---|---|---|---|---|---|---|---|
| 6100 | 6200 | 6900 | 415 | 195 | -415 | 195 | -220 |
| 6200 | 6200 | 6900 | 415 | 195 | -415 | 195 | -220 |
| 6300 | 6200 | 6900 | 415 | 195 | -415 | 195 | -220 |
| 6400 | 6200 | 6900 | 415 | 195 | -415 | 195 | -220 |
| 6500 | 6200 | 6900 | 415 | 195 | -415 | 195 | -220 |
| 6600 | 6200 | 6900 | 415 | 195 | -15 | 195 | 180 |
| 6700 | 6200 | 6900 | 415 | 195 | 85 | 195 | 280 |
| 6800 | 6200 | 6900 | 415 | 195 | 185 | 195 | 380 |
| 6900 | 6200 | 6900 | 415 | 195 | 285 | 195 | 480 |
| 7000 | 6200 | 6900 | 415 | 195 | 385 | 95 | 480 |
| 7100 | 6200 | 6900 | 415 | 195 | 485 | -5 | 480 |
| 7200 | 6200 | 6900 | 415 | 195 | 585 | -105 | 480 |
| 7300 | 6200 | 6900 | 415 | 195 | 685 | -205 | 480 |
| 7400 | 6200 | 6900 | 415 | 195 | 785 | -305 | 480 |

# Strategy C

* Maximum Loss
  = Difference in the premium of Long and Short Call
  =415-195
  =220
* Maximum Gain
  = Difference between strike price and the net premium outgo
  =(6900-6200)-(415-195)
  =480

IRMT

irmT
The Institute of Risk Management Tanzania

# Strategy C

For making structured product

| | | | | |
|---|---|---|---|---|
| NIFTY Spot 6100 | | | | |
| Lot size 50 | | | Premium | Paid/ Received |
| Buy (One) | NIFTY 30June2011 | Call | 415 | -20750 |
| Sell (Three) | NIFTY 30June2011 | Call | 195 | 29250 |
| | | | Net Cost | 8500 |

Investor earns Rs.8500/- net on the buy and sell of call.So He has the entire Rs.1lac plus Rs.8500 at his disposal for FD

# Strategy C

| NIFTY SPOT | Long Call | Short Call | Premium for Long Call | Premium for Short Call | Profit on Long Call | Profit on Short Call | TOTAL PROFIT |
|---|---|---|---|---|---|---|---|
| 6100 | 6200 | 6900 | 415 | 195 | -415 | 195 | -220 |
| 6000 | 6200 | 6900 | 415 | 195 | -415 | 195 | -220 |
| 5900 | 6200 | 6900 | 415 | 195 | -415 | 195 | -220 |
| 5800 | 6200 | 6900 | 415 | 195 | -415 | 195 | -220 |
| 5700 | 6200 | 6900 | 415 | 195 | -415 | 195 | -220 |
| 5600 | 6200 | 6900 | 415 | 195 | -415 | 195 | -220 |
| 5500 | 6200 | 6900 | 415 | 195 | -415 | 195 | -220 |
| 5400 | 6200 | 6900 | 415 | 195 | -415 | 195 | -220 |
| 5300 | 6200 | 6900 | 415 | 195 | -415 | 195 | -220 |
| 5200 | 6200 | 6900 | 415 | 195 | -415 | 195 | -220 |
| 5100 | 6200 | 6900 | 415 | 195 | -415 | 195 | -220 |
| 5000 | 6200 | 6900 | 415 | 195 | -415 | 195 | -220 |
| 4900 | 6200 | 6900 | 415 | 195 | -415 | 195 | -220 |
| 4800 | 6200 | 6900 | 415 | 195 | -415 | 195 | -220 |

# Risk in Structured Products

* Issuers Credit Risk
* Market Risk : The value of investment changes with the movement of interest rates and volatilities
* Liquidity Risk : Premature withdrawal is on best effort basis
* Premature redemption risk : The is no capital guarantee if there is a withdrawal before maturity

# Distribution Platforms

* PMS :
* FMP/Insurance
* Direct Distribution
* Issuers are NBFC's
* Platform providers are MF's, PMS providers, insurance companies

# Why Structured Products Market in Tanzania is not Developed

* Booming stock market
* Preference for traditional products
* Long term options not available (max 3months)
* OTC derivatives use by SP issuers is not permitted*
* In Tanzania there is a restriction on direct access to derivatives
* Size required for direct access is huge

I
R
M
T

I
R
M
T

# Topic 6

# Risk Management for Financial Markets



irmT
The Institute of Risk Management Tanzania

# Areas Covered on This Module

- Market Risk Management: Outstanding Issues
- Impact of Regulations
- Measures of Market Risk
- Modeling Challenges
  - Valuation of Illiquid Instruments
  - Measurement: Illiquidity Discount
  - Computational Trade-offs
- Data Management Issues
- Trends in Market Risk Systems
- Organizational Culture

# Market Risk Management: Outstanding Issues

IRMT

## Modeling Challenges

- Valuation of illiquid products
- Correlation under stressed environment
- Model calibration
- Tradeoffs: speed vs. accuracy

## Regulatory Issues

- Reliability of various measures of risk such as VaR, Expected Shortfall
- Validation and back-testing of models to reduce model risk
- Trading vs. banking book boundaries

## System and Data Issues

- Incomplete and/or inaccurate data
- Lack of unified data processing model
- Limited involvement of business
- Real-time computation, lack of integrated systems

## Organizational Culture

- Silo approach to risk management
- Limited role of risk managers in decision making
- Narrow, compliance-focused approach

# Impact of Regulations (1/2)

**Basel III regulations on "Fundamental review of the Trading Book" will have a significant impact on banks' market risk management**

| Change to Market Risk Framework | Impact |
|---|---|
| ▪ Redefinition of Trading and Banking book boundaries | ▪ Difficult to move assets between the trading and banking books |
| ▪ Increased scrutiny of models | ▪ Ensuring validation and periodic revalidation<br>▪ Rigorous model testing and model documentation |
| ▪ Emphasis on expected shortfall (ES) | ▪ New models to be created<br>▪ Capturing extreme scenarios tail risk |

# Impact of Regulations (2/2)

**Basel III regulations on "Fundamental review of the Trading Book" will have a significant impact on banks' market risk management**

| Change to Market Risk Framework | Impact |
|---|---|
| ▪ Increased regulatory reporting requirements | ▪ Trading-desk level reporting of risk measures<br>▪ Daily back-testing and P&L attribution of all the trading books to test model performance<br>▪ Increase in number of risk factors to be captured for capital calculations |
| ▪ Modeling of stress period capital requirement | ▪ Calibration of capital with stress periods is made mandatory to reduce cyclicality<br>▪ Incorporating liquidity horizons |

# Measures of Market Risk

**There is no single measure of risk that can provide a consistent view of risk across market participants and regulators**

| Measure | Pros | Cons | Key Use |
|---|---|---|---|
| Value at Risk (VaR) | ▪ Simple, established<br>▪ Single view of risk | ▪ Lacks coherence<br>▪ Extreme tails<br>▪ Inconsistencies | ▪ Regulatory reporting<br>▪ Setting risk limits |
| Expected Shortfall (ES) | ▪ Conservative<br>▪ Size and likelihood of losses<br>▪ Reduces cyclicality | ▪ Difficult to back-test<br>▪ Prone to optimization errors | ▪ Regulatory reporting<br>▪ Economic risk capital |
| Sensitivities | ▪ Easy to interpret<br>▪ Simple modeling procedure | ▪ Can be misleading<br>▪ Cannot be aggregated | ▪ Key measure used for hedging risk<br>▪ Setting risk limits |

# Modeling Challenges: Valuation of Illiquid Instruments

- FASB valuation categories are based on complexity – Level 1/2/3
- Level 3 assets are priced using in-house valuation models
- Models built can only be as good as the underlying data !

| Technique | Description | Type of Products |
|---|---|---|
| **Discounting** | ▪ By discounting cashflows at future dates | ▪ IRS, Bonds, Floaters |
| **PDE-based** | ▪ Closed-form pricing for low factor/low dimension models; path independent | ▪ First generation structures |
| **Lattice-based** | ▪ Closed-form pricing for low factor/low dimension models; path dependent | ▪ Caps/Floors, CBs, TS models |
| **MC Simulation** | ▪ Simulation pricing for high factor/high dimension models; path dependent | ▪ Highly complex structures |

# Measurement: Illiquidity Discount

- Initial steps being taken towards better management of the market impact of illiquidity; measures include
  - Checking for variability in liquidation times for illiquid positions
  - Setting up processes for measuring impact of trade volumes on market prices
  - Monitoring widening bid-ask spreads, specially in times of adverse market conditions
- CCPs started for most liquid OTC derivatives; liquidity adjustment challenges seen in more exotic products
- Methods for incorporating the illiquidity discounts in OTC valuation models

| | |
|---|---|
| **Bid-ask Spread Adjustment** | ▪ Adjustment of bid-ask spread for specific market risk parameters |
| **Bounding Approach** | ▪ Determine lower and upper limit price by relying on reasonable limits to trade performance |

# Computational Trade-offs

- Choice between delta-based methods and the full revaluation method
- Control and agility often contradictory and difficult to implement simultaneously
- An optimum balance needs to be maintained for both these trade offs

- Centralized management
- Top-down policies
- Standard model
- Overnight batch processing

CONTROL

**Full Revaluation Approach**

- Robust
- Computationally intense

CONTROL

**Decreasing cost of computation is helping reduce the impact of tradeoffs**

# Data Management Issues

**Increased regulatory focus on providing granular and frequent analysis of real time data**

**Data Management Process**

**Data Acquisition**
- Trade Data
- Market Data

**Data Management**
- Validate
- Enrich

**Data Distribution**
- Reports
- Ad hoc Queries

- **ETL model is inappropriate to provide real time view of risk. Viable alternatives to ETL are:**
  - ***ELT:*** Data transformation after the data load
  - ***Data Federation:*** Single virtual view without actually moving the data
  - ***Real Time Data Integration:*** Integration of data using message-based technologies

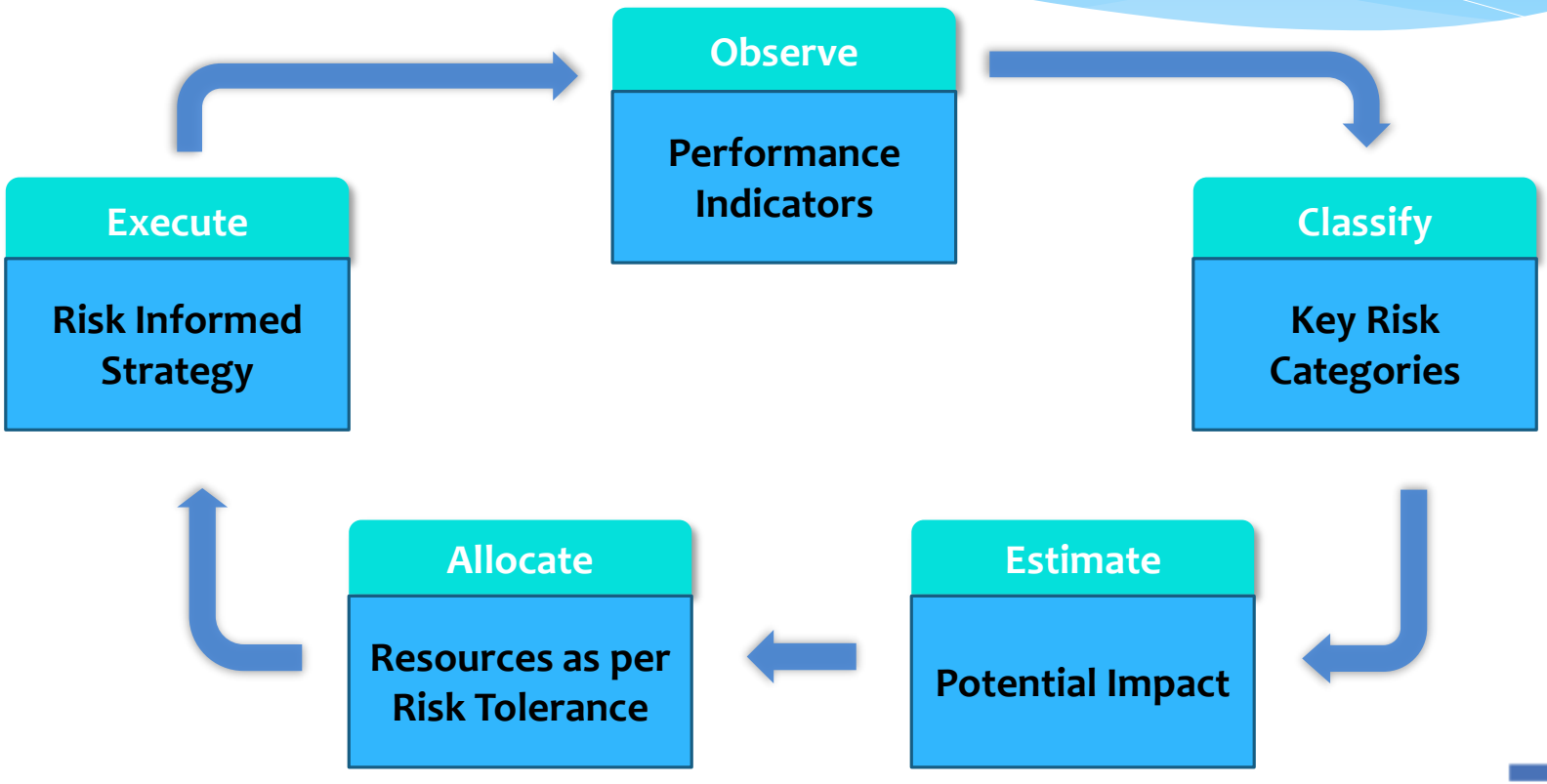
# Trends in Market Risk Systems

**Increase 'risk velocity' and 'risk management' clock-speed**

| Data/Reporting Attribute | Measure |
|---|---|
| **Timeliness and Accuracy** | ▪ Automation of stress testing and reporting framework<br>▪ GPU based farms enabling move to full revaluation approach |
| **Comprehen-siveness** | ▪ Cloud Computing, a natural solution for higher data capacity needed for granular regulatory reporting |
| **Adaptability** | ▪ Service-based architecture with detailed data captured at trade level<br>▪ Flexible data capture and storage solutions |

# Organisational Culture

- Risk measurement and analysis methods need to be based on strategic objectives, diversity of business and level of complexity
- Banks are aligning financial incentives with risk management using risk-informed performance indicators



I
R
M
T



irmT
The Institute of Risk
Management Tanzania

# TOPIC 7

# Mutual Funds and Hedge Funds



IRMT

irmT
The Institute of Risk Management Tanzania

# Learning Objectives

* Understand the structure and pricing of mutual funds
* Know the advantages and disadvantages of buying mutual funds
* Be able to assess mutual fund performance
* Assess mutual fund manager incentives
* Recognize the impact of taxable distributions on fund returns

IRMT

irmT
The Institute of Risk Management Tanzania

# Mutual Funds

- An investment company that issues its portfolio shares to investors.
- Money from shareholders are pooled and invested in a wide range of stocks, bonds, or money market securities.
  - Managed by professional managers
- Each investor shares proportionately in the income and investment gains and losses, as well as the brokerage expenses and management fees.
- Open end fund: # of shares issued solely depends on investor demand
  - Bought and sold directly through the investment company (not an exchange)

# Net asset Value

* NAV: per share value of a mutual fund's investment holding.

$$\text{NAV} = \frac{\text{Market Value of Assets} - \text{Portfolio Liabilities}}{\text{\# of Shares Outstanding}}$$

<u>Example</u>

A mutual fund has $100 mil in assets and $3 mil in short term liabilities. 10.765 mil shares outstanding. What is the NAV?

<u>Solution</u>

($100 mil - $3 mil) / 10.765 mil = $9.0107 per share

IRMT

irmT
The Institute of Risk Management Tanzania

| Types of Mutual Funds | Objective | Funds Hold | Growth Potential | Income Potential | Stability |
|---|---|---|---|---|---|
| **Money Market Funds** | | | | | |
| Taxable money market | Current income stability of principal | Cash investments | None | Moderate | Very high |
| Tax-exempt money market | Tax-free income, stability of principal | Municipal cash investments | None | Moderate | Very high |
| **Bond Funds** | | | | | |
| Taxable bond | Current income | Wide range of government and/or corporate bonds | None | Moderate to high | Low to moderate |
| Tax-exempt bond | Tax-free income | Wide range of municipal bonds | None | Moderate to high | Low to moderate |

| Common Stock Funds | | | | | |
|---|---|---|---|---|---|
| Balanced | Current income capital growth | Stocks and bonds | Moderate | Moderate to high | Low to moderate |
| Equity income | | High-yielding stocks, convertible bonds | Moderate to high | Moderate | Low to moderate |
| Value funds | | Low P/E, P/B stocks | Moderate to high | Low to moderate | Low to moderate |
| Growth and income | | Dividend-paying stocks | Moderate to high | Low to moderate | Low to moderate |
| Domestic growth | Capital growth | U.S. stocks with high potential for growth | High | Very low | Low |
| International growth | | Stocks of companies outside U.S. | High | Very low to low | Very low |
| Aggressive growth | Aggressive growth of capital | Stocks with very high potential for growth | Very high | Very low | Very low |
| Small cap | | Stocks of small companies | Very high | Very low | Very low |
| Specialized | | Stocks of industry sectors | High to very high | Very low to moderate | Very low to low |

# Sources of Information

* Lipper Inc.: leading provider of data and analysis on the investment company business ( www.lipperweb.com )
* Morningstar.com: provide unbiased data and analysis and candid editorial commentary (www.morningstar.com)
* Vanguard Group: providing competitive investment performance and lowest operating expenses ( www.vanguard.com )

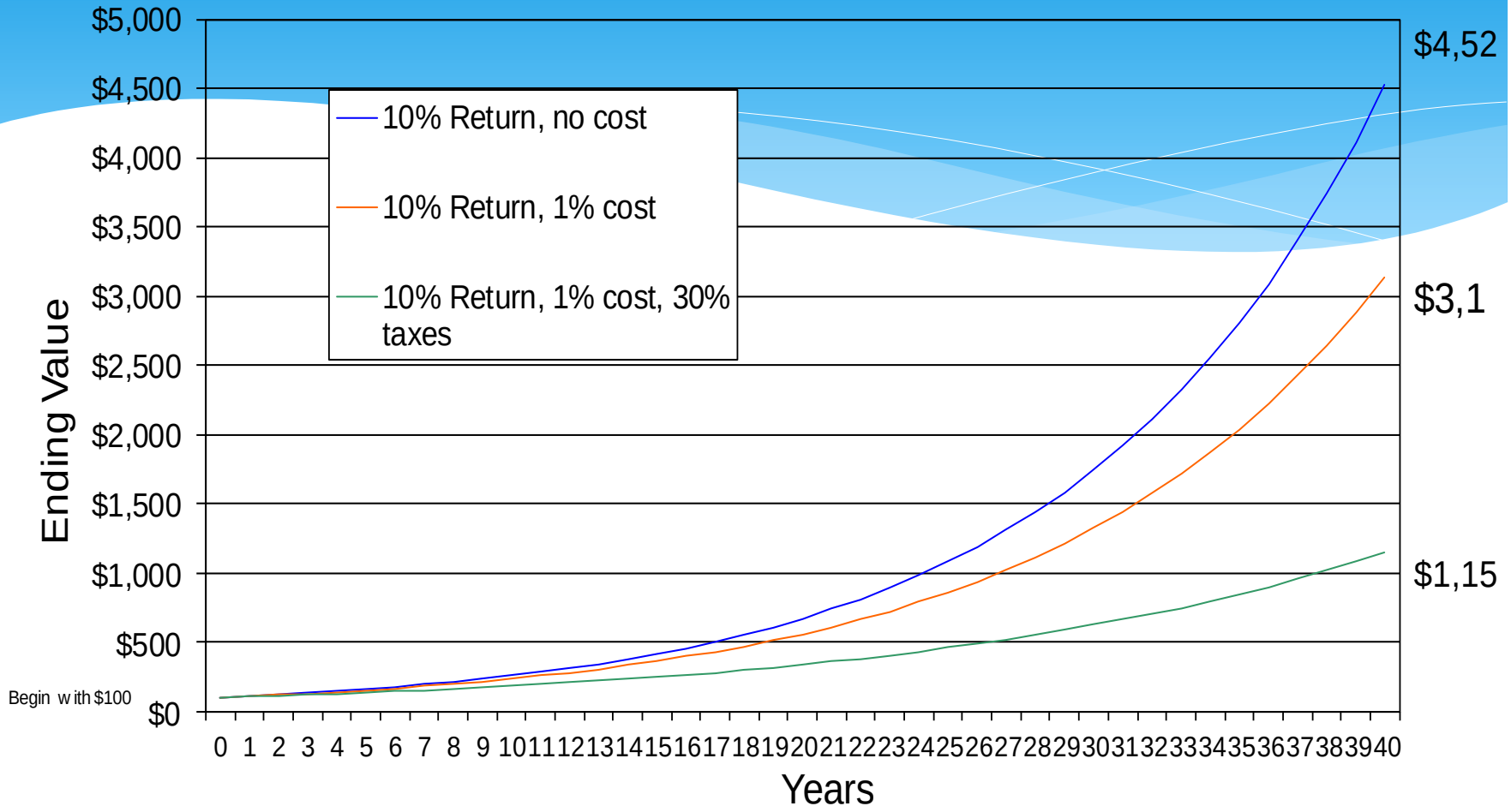
# Mutual Fund Advantages

- Broad diversification
  - Diversified stock funds hold large and small company stocks broadly spread across industries and economic sectors
  - Diversified bond funds hold bonds with different maturities, coupon, and credit quality
    - Ability to retain professional investment management at a reasonable cost
    - Investor convenience
      - Many offer "fund family"

# Mutual Fund Disadvantages

- Volatility can be significant
  - Diversification doesn't protect investors from the risk of loss from an overall decline in financial markets
  - Mutual fund regulation doesn't eliminate the risk of an investment falling in value
    - High management fees and sales commissions
    - No-load funds

# Figure 16.2 Impact of Costs and Taxes on 10% Return







IRMT

irmT The Institute of Risk Management Tanzania

# Sources of Investment Returns

* Total Return: dividend and interest income and realized and unrealized appreciation
* Income distribution: interest and dividend income after expenses.
* Capital gains unrealized until the fund sells the shares (Unrealized capital gains)
* The realized capital gains are paid out to shareholders at the end of the year (capital gains distributions)

IRMT

irmT
The Institute of Risk Management Tanzania

# Mutual Fund Expenses

- Operating expense ratio: total of investment advisory fees and costs of legal and accounting services, etc., expressed as a percentage of the fund's average net assets (range from 0.2% to 2%)
  - Lowest for money market mutual fund and highest for international stock funds
  - Tend to be lowest for large, liquid funds
- Load charges: one time sales commissions
  - Front-end loads (charged at the time of purchase)
  - Back-end loads (charged at the time of sales of shares)
  - Low-end funds: sales fee ranging from 1% to 3%
  - 12b-1 fees: marketing and distribution costs
  - No-load funds: fund without front-end or back-end load charges

# Table 16.4
## A. Typical fee tables found in three different mutual fund prospectuses

| | Fund A | Fund B | Fund C |
|---|---|---|---|
| **Shareholder Transaction Expenses** | | | |
| Sales load imposed on purchases | None | None | 4.75% |
| Sales load imposed on reinvested dividends | None | None | 4.75 |
| Redemption fees | None | None | None |
| Exchange fees | None | None | None |
| **Annual Fund Operating Expenses** | | | |
| Management and administrative expenses | 0.22% | 0.60% | 0.70% |
| Investment advisory expenses | 0.02 | — | — |
| 12b-1 marketing fees | — | 0.30 | — |
| Marketing and distribution costs | 0.02 | — | — |
| Miscellaneous expenses | 0.03 | 0.32 | 0.26 |
| **Total Operating Expenses** | **0.29%** | **1.22%** | **0.96%** |
| **Expenses on a $10,000 Investment** | | | |
| 1 year | $ 30 | $ 124 | $ 587 |
| 3 years | 93 | 387 | 823 |
| 5 years | 163 | 670 | 1,077 |
| 10 years | 368 | 1,477 | 1,805 |

# B. The Impact of Equity Mutual Fund Costs on Long-term Investor Returns

| | Fund A | Fund B | Fund C |
|---|---|---|---|
| Initial investment | $ 10,000 | $10,000 | $10,000 |
| Day 1 | 10,000 | 10,000 | 9,525 |
| 5 years | 18,189 | 17,451 | 16,186 |
| 10 years | 33,084 | 30,565 | 29,689 |
| 15 years | 60,178 | 53,145 | 52,416 |
| 20 years | 109,458 | 92,743 | 92,539 |
| Gross return | 13.00% | 13.00% | 13.00% |
| Operating expenses | 0.29% | 1.22% | 0.96% |
| Net return | 12.71% | 11.78% | 12.04% |

Fund A : typical cost efficient index fund
Fund B : conventional no-load stock mutual fund
Fund C : low-load stock mutual fund with less than typical annual operating expenses

# Style Boxes

| | Value Strategy (Score <1.75) | Blend (1.75 £ Score £ 2.25) | Growth Strategy (Score > 2.25) |
|---|---|---|---|
| **Large-cap (Top 5%)** | | S & P 500 Benchmark | |
| **Mid-cap (Next 15%)** | | Wilshire 4500 Benchmark | |
| **Small-cap (Bottom 80%)** | | Russell 2000 Benchmark | |

- Characterize mutual funds by market capitalization (large, mid, and small cap)
- Next, determine how cheap or expensive portfolio holdings are relative to the overall market using P/E and P/B ratios (Value, Blend and Growth)

# Dreyfus Appreciation (DGAGX)

On Feb 10: 39.74 ↑ 0.04 (0.10%)

**MORE ON DGAGX**

**Quotes**
Summary
Historical Prices

**Charts**
Basic Chart
Technical Analysis

**News & Info**
Headlines

**Fund**
Profile
Performance
Holdings
Risk
Purchase Info

**Analyst**
Research Reports

## Profile As of 31-Jan-06

Get **Profile** for: GO

**Dreyfus Appreciation**
200 Park Avenue New York NY 10166
Phone: 800-373-9387

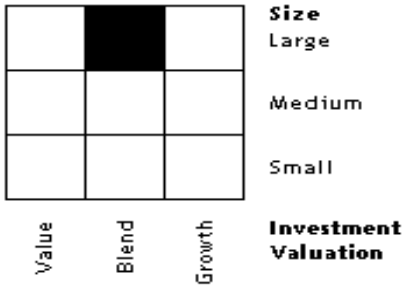
Free prospectuses for
more than 1,000 funds!
View List of Free Prospectuses

**FUND OVERVIEW**

| | |
|---|---|
| Category: | Large Blend |
| Fund Family: | Dreyfus |
| Net Assets: | 4.40B |
| Year-to-Date Return: | 1.28% |
| Yield: | 1.35% |
| Morningstar Rating: | ★★★ |
| Fund Inception Date: | 18-Jan-84 |

**MORNINGSTAR STYLE BOX**

**Large Blend**
[View Category Definition]




**FUND SUMMARY**

The investment seeks long-term growth consistent with the preservation of capital; current income is a secondary consideration. The fund normally invests at least 80% of its assets in common stock. It focuses on blue chip companies with total market capitalizations of more than $5 billion at the time of purchase, including multi-national companies. Management employs a buy-and-hold investment strategy, and seeks to keep annual portfolio turnover below 15%. The fund may also invest in money market securities.

**FUND OPERATIONS**

| | |
|---|---|
| Last Dividend (28-Dec-05): | 0.54 |
| Last Cap Gain (28-Mar-02): | 0.02 |
| Annual Holdings Turnover | 8.00% |
| Average for Category: | 75.61% |

**FEES & EXPENSES**

| Expense | DGAGX | Category Avg |
|---|---|---|
| Total Expense Ratio: | 0.95% | 1.18% |
| Max 12b1 Fee: | 0.00% | N/A |
| Max Front End Sales Load: | 0.00% | 5.05% |
| Max Deferred Sales Load: | 0.00% | 2.71% |
| 3 Yr Expense Projection*: | $303 | $619 |
| 5 Yr Expense Projection*: | $525 | $913 |
| 10 Yr Expense Projection*: | $1,166 | $1,802 |

# Mutual Fund Organization

- Mutual fund shareholders: own mutual funds, elect the board of directors
- Majority of the directors must be independent directors
- Investment advisor: manages the day-to-day operations
- Principal underwriter, administrator, transfer agent, custodian, and independent public accountant

# Evaluating Fund Performance

- Using ranking tools or portfolio evaluation tools (alpha, Sharp ratio, and Treynor measure)

- 20 categories in domestic equity mutual funds, 14 in international equity funds, 12 in fixed income and 17 in municipal bond funds

# Top 10 U.S. Domestic Funds Based on 3 Year Return

| Fund Name: Classification | 1 Mon. | YTD | 1 Year | 3 Year | 5 Year | 10 Year |
|---|---|---|---|---|---|---|
| Pacific Adv: Small Cp;A<br>**PASMX** Small-Cap Value | 16.8 | 16.8 | 27.8 | 49.2% | 19.3 | 12.1 |
| ProFunds: UltraSm-Cap;Inv<br>**UAPIX** Small-Cap Core | 17.7 | 17.7 | 29.3 | 49.2% | 6.4 | -- |
| Pacific Adv: Small Cp;C<br>**PGSCX** Small-Cap Value | 16.6 | 16.6 | 26.7 | 48.0% | 18.0 | -- |
| ProFunds: UltraSm-Cap;Svc<br>**UAPSX** Small-Cap Core | 17.6 | 17.6 | 28.0 | 47.7% | 5.4 | -- |
| Schneider Sm Cap Val<br>**SCMVX** Small-Cap Value | 5.1 | 5.1 | 22.4 | 46.8% | 22.3 | -- |
| ProFunds: UltraMidCap;Inv<br>**UMPIX** Mid-Cap Core | 11.6 | 11.6 | 39.7 | 45.6% | 7.6 | -- |
| Hodges Fund<br>**HDPMX** Multi-Cap Core | 9.8 | 9.8 | 33.3 | 45.0% | 14.5 | 13.6 |
| Fidelity Lvrgd Co Stk<br>**FLVCX** Mid-Cap Core | 6.9 | 6.9 | 26.1 | 44.4% | 22.4 | -- |
| ProFunds: UltraMidCap;Svc<br>**UMPSX** Mid-Cap Core | 11.5 | 11.5 | 38.2 | 44.1% | 6.6 | -- |
| Fidelity Adv Lev Co; Ins<br>**FLVIX** Mid-Cap Value | 6.7 | 6.7 | 25.4 | 43.3% | 22.6 | -- |

# Performance As of 31-Jan-06

Get **Performance** for: GO

| PERFORMANCE OVERVIEW | |
|---|---|
| Morningstar Return Rating: | Average |
| Year to Date Return: | 1.28% |
| 5-Year Average Return: | -0.07% |
| Number of Years Up: | 18 |
| Number of Years Down: | 3 |
| Best 1-Yr Total Return (1991): | 38.43% |
| Worst 1-Yr Total Return (2002): | -17.14% |
| Best 3-Yr Total Return (1995-97): | 30.36% |
| Worst 3-Yr Total Return (2000-2): | -9.03% |

| LOAD ADJUSTED RETURNS | |
|---|---|
| 1-Year: | No load |
| 3-Year: | No load |
| 5-Year: | No load |
| 10-Year: | No load |

ADVERTISEMENT

| TRAILING RETURNS (%) VS. BENCHMARKS | | | | | |
|---|---|---|---|---|---|
| Return | DGAGX | Category | Diff | Index* | Diff |
| Year To Date | 1.28 | 3.25 | -1.97 | 4.91 | -3.63 |
| 1-Month | 1.28 | 3.25 | -1.97 | 0.04 | 1.24 |
| 3-Month | 3.21 | 7.54 | -4.33 | 2.08 | 1.13 |
| 1-Year | 6.69 | 11.64 | -4.95 | 4.91 | 1.78 |
| 3-Year | 11.54 | 16.16 | -4.62 | 14.38 | -2.84 |
| 5-Year | -0.07 | 0.59 | -0.66 | 0.54 | -0.61 |
| Last Bull Market ( 28-Feb-03 to 31-Mar-04) | 26.16 | 33.26 | -7.1 | 33.61 | -7.45 |
| Last Bear Market ( 31-Mar-02 to 30-Apr-03) | -16.15 | -17.48 | 1.33 | -17.13 | 0.98 |

## ANNUAL TOTAL RETURN (%) HISTORY

| Year | DGAGX | Category | Diff |
|---|---|---|---|
| 2005 | 4.14 | 5.77 | -1.63 |
| 2004 | 5.57 | 10.10 | -4.53 |
| 2003 | 20.39 | 27.62 | -7.23 |
| 2002 | -17.14 | -21.78 | 4.64 |
| 2001 | -10.75 | -11.20 | 0.45 |
| 2000 | 1.80 | -3.51 | 5.31 |
| 1999 | 9.97 | 20.21 | -10.24 |
| 1998 | 30.85 | 21.39 | 9.46 |
| 1997 | 27.85 | 27.63 | 0.22 |
| 1996 | 25.67 | 21.47 | 4.20 |

## PAST QUARTERLY RETURNS (%) FOR DGAGX

| | Q1 | Q2 | Q3 | Q4 |
|---|---|---|---|---|
| 2005 | -0.06 | 0.72 | 3.36 | 0.08 |
| 2004 | 0.69 | 1.39 | -3.59 | 7.26 |
| 2003 | -4.28 | 12.96 | 0.71 | 10.55 |
| 2002 | 2.60 | -11.29 | -14.34 | 6.27 |
| 2001 | -10.83 | 3.79 | -8.74 | 5.67 |
| 2000 | 0.65 | 2.94 | -1.98 | 0.24 |
| 1999 | 3.12 | 3.64 | -6.65 | 10.22 |
| 1998 | 15.69 | 4.54 | -10.23 | 20.52 |
| 1997 | 3.52 | 16.35 | 4.45 | 1.63 |
| 1996 | 5.84 | 5.66 | 4.22 | 7.83 |

IRMT

| RANK IN CATEGORY (BY TOTAL RETURN) | | | |
|---|---|---|---|
| Period | Rank | Funds in Category | % Rank |
| Year To Date | 2087 | 2174 | 96.00 |
| 1-Month | 2043 | 2174 | 93.97 |
| 3-Month | 2106 | 2149 | 98.00 |
| 6-Month | 1777 | 1975 | 89.97 |
| 1-Year | 1424 | 1853 | 76.85 |
| 3-Year | 1232 | 1498 | 82.24 |
| 5-Year | 707 | 1153 | 61.32 |

# Exchange-Trade Funds (ETFs)

- Tradable shares in baskets of stocks that closely track broad market averages, market sectors, or major stock markets from around the world.
- Tradable shares in baskets of stocks that closely track broad market averages, market sectors, or major stock markets from around the world.
- Standard and Poor's Depository Receipts (SPY), "spiders": closely track S&P 500 Index
- Diamonds (DIA): track Dow Jones Industrial Average
- QQQQ: track Nasdaq 100 Index
- Select Sector SPDRs: unbundled S&P Index to give investors ownership in a particular market sector or group of industries.
- Barclays Global Investors: offer "iShares" – internationally indexed

# Closed-End Funds

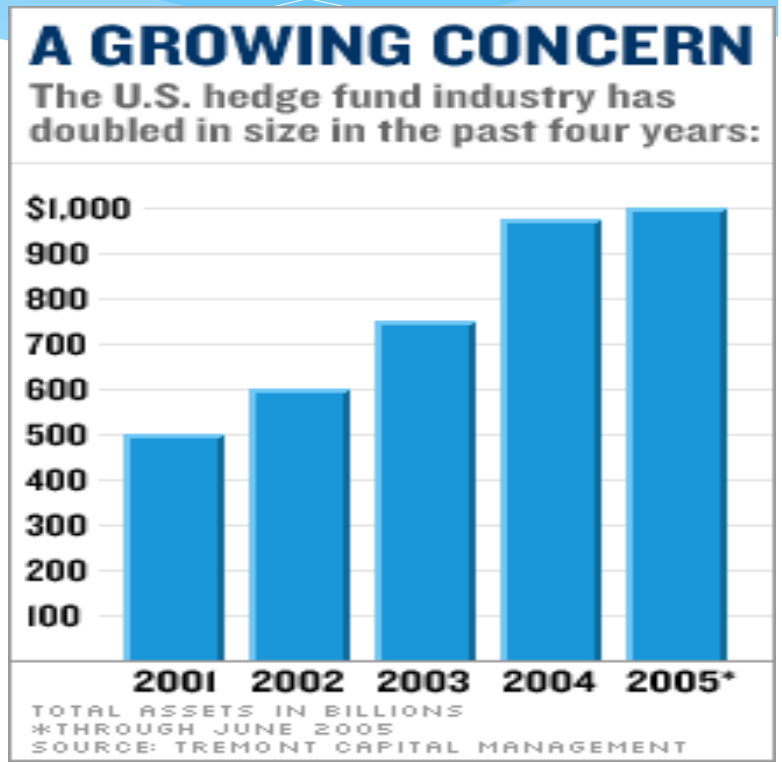
- Issues a fixed number of shares at a given point in time
- Collect money from investors through and IPO and use this money to invest in securities.
- # of securities are fixed at the time of IPO.
- When the market price exceeds its NAV, selling at a premium, otherwise, selling at a discount (closed-end funds typically sell at a discount)
- Suited to specialized investing in small or illiquid markets

| Statistic | Value |
|---|---|
| Total number of closed-end funds (U.S. exchanges only): | 693 |
| Total Assets*: | $214,736.69 |

** Assets are Net Assets, expressed in Millions, and exclude leveraged capital (preferred stock, debt, etc.).*

# Hedge Funds

- Like mutual funds, a means for groups of investors to pool financial resources
- Typically organized as partnership arrangement available only to the wealthiest investors
- Flexibility to use speculative investment strategies
- Subject to only limited oversight.



# Table 16.6 Hedge Funds Differ From Mutual Funds in a Number of Ways

| | Mutual Funds | Hedge Funds |
|---|---|---|
| Who Invests | 92 million Americans own mutual fund shares. The only qualification for investing is having the minimum investment to open an account with a fund company -- often $1,000 or less. | Only sophisticated, high net worth investors are eligible to invest. The typical investor is a wealthy individual or an institution such as an endowment or foundation. A minimum investment of $1 million or more is required. |
| Fees | Mutual fund shareholders pay, on average, an annual expense ratio of roughly 1.5% of assets. Load charges can increase this to 2.5% to 5% per year. Funds must disclose fees and expenses in detail. Sales charges and other distribution fees are subject to specific regulatory limits. | Hedge fund investors often pay a portfolio management fee of 1% to 2% of net assets, plus a performance-based fee that can run as high as 10% per year, depending upon performance. Fees are not subject to specific regulatory limits. |
| Investment Practices | Securities laws restrict a mutual fund's ability to leverage, or borrow against the value of securities in its portfolio. Funds that use options, futures, forward contracts, and short selling must "cover" their positions with cash reserves or other liquid securities. Investment policies must be fully disclosed to investors. | Leveraging strategies are hallmarks of hedge funds. Investment policies do not have to be disclosed, even to investors in the fund. |
| Pricing and Liquidity | Mutual funds must value their portfolio securities and compute their share daily. They generally must also allow shareholders to redeem shares on at least a daily basis. | There are no specific rules on valuation or pricing. As a result, hedge fund investors may be unable to determine the value of their investment at any given time. In addition, new investors typically must pledge to keep their money in a hedge fund for at least one year. |

# Taxes on Distributions

* Shareholders pay taxes due once income dividends and capital gains distributions are received.

* All income and capital gains distributions are generally subject to income taxes.
  * Municipal bond or US T-securities interest income exempt from federal taxes, but capital gains are taxable.

* Turnover rate: expressed as a percentage of the fund's average assets (average turnover rate for stock mutual fund: 79%)

I
R
M
T



irmT
The Institute of Risk Management Tanzania

# INSTITUTE OF RISK MANAGEMENT TANZANIA (IRMT)

# STUDENTS SUMMARY NOTES

## MODULE V
## INTEREST RATE RISK, VALUE AT RISK AND VOLATILITY

## CERTIFIED FINANICIAL SERVICES RISK MANAGEMENT PROFESSIONAL COURSE

## Certified Financial Services Risk Professional Examination (CFSRP)



irmT The Institute of Risk Management Tanzania

IRMT

# Interest Rate Risks

## Introduction

Interest rate risk is more difficult to manage than the risk arising from market variables such as equity prices, exchange rates, and commodity prices. One complication is that there are many different interest rates in any given currency (Treasury rates, interbank borrowing and lending rates, swap rates, mortgage rates, deposit rates, prime borrowing rates, and so on). Although these tend to move together, they are not perfectly correlated.

# Interest Rate Risks Cont…

Another complication is that we need more than a single number to describe the interest rate environment. We need a function describing the variation of the rate with maturity. This is known as the ***term structure of interest rates*** or **the *yield curve.***



IRMT

irmT The Institute of Risk Management Tanzania

# Bank Earnings

**Interest and fees on loans** is the major source of income for commercial banks. Interest paid on deposits is the largest expense item. Both of the above follow market rates of interest.

**Net interest income** represents the difference between gross interest income and gross interest expense.

The provision for loan losses is an expense item that adds to a bank's loan loss reserve (a contra-asset account).

# Bank Earnings Cont…

Banks increase their provision for loan losses in anticipation of credit quality problems in their loan portfolio. Loans are written off against the loan loss reserve

Noninterest income includes fees and service charges. This source of revenue has grown significantly in importance. Noninterest expense includes salary expenditures. These expenses have also grown in recent years.

# The Management of Net Interest Income

A key risk management activity for a bank is the management of **net interest income**.

* As explained prior **the Net Interest Income** is the excess of interest received over interest paid.
* It is the role of the asset-liability management function within the bank to ensure that the **Net Interest Margin,** which is net interest income divided by income-producing assets, remains roughly constant through time.

# The Management of Net Interest Income Cont…

How can fluctuations in net interest margin occur? Consider a simple situation where a bank offers consumers a one-year and a five-year deposit rate as well as a one-year and five-year mortgage rate.

Example of rates offered by a bank to its customers as shown in Table 1.1 below:

| Maturity (years) | Deposit Rate | Mortgage Rate |
|---|---|---|
| 1 | 3% | 6% |
| 5 | 3% | 6% |

# The Management of Net Interest Income Cont…

The simplifying assumption that the expected one-year interest rate for future time periods equals the one-year rate prevailing in the market today.

Generally speaking, this means that market participants consider interest rate increases to be just as likely as interest rate decreases. As a result, the rates in Table 1.1 are fair in that they reflect the market's expectations. Investing money for one year and reinvesting for four further one-year periods leads to an uncertain return. But, given our assumptions, the expected overall return is the same as a single five-year investment.

# The Management of Net Interest Income Cont…

Similarly, borrowing money for one year and refinancing each year for the next four years leads to the same expected financing costs as a single five-year loan. Suppose you have money to deposit and agree with the prevailing view that interest rate increases are just as likely as interest rate decreases. Would you choose to deposit your money for one year at 3% per annum or for five years at 3% per annum.

The chances are that you would choose one year because this gives you more financial flexibility.

# The Management of Net Interest Income Cont…

The net result of all banks behaving in the way we have just described is that long-term rates tend to be higher than those predicted by expected future short term rates. This phenomenon is referred to as ***liquidity preference theory***.

It leads to long-term rates being higher than short-term rates most of the time.

Even when the market expects a small decline in short-term rates, liquidity preference theory is likely to cause long-term rates to be higher than short-term rates. Only when a steep decline in interest rates is expected will long-term rates be less than short-term rates.

# Managing Interest Rate Risk

Gross interest income and gross interest expense have become more volatile in the last 30 years.

Consequently, interest rate risk has become a concern to both bank managers and bank regulators.

# Measuring Interest Rate Risk: Maturity GAP Analysis

* Assets and liabilities which can be re-priced (change the earnings/expense rate in a specified period of time) are identified as rate sensitive.
* A bank's GAP for a period of time is computed by subtracting rate sensitive liabilities (RSL) from rate sensitive assets (RSA).
* GAP = RSA – RSL
* Positive GAP = RSA > RSL
  - Net interest income will decline if interest rates fall in the GAP period.
  - More assets than liabilities will be re-priced downward if interest rates decline, thus reducing net interest income.
  - What happens if interest rates increase?

# GAP = RSA - RSL (concluded)

**Negative GAP** = RSA < RSL

Net interest income will decline if interest rates increase in the GAP period. More liabilities than assets will be re-priced upward if interest rates increase, thus reducing net interest income.

**Duration GAP Analysis**

Simple maturity matching, discussed above, may not produce the same cash flow or re-pricing timing in any period.

# GAP = RSA - RSL (concluded) Cont…

Duration GAP analysis matches cash flows and their re-pricing capabilities over a period of time.

The percentage change in the value of a portfolio, given a change in interest rates, is proportional to the duration of the portfolio multiplied by the change in interest rates.

# Duration GAP Analysis (concluded)

$$D_G = D_A - (MV_L / MV_A) \times D_L$$

$D_G$ = duration gap
$D_A$ = duration of assets
$D_L$ = duration of liabilities
$MV_A$ = market value of assets
$MV_L$ = market value of liabilities

Duration GAPs are opposite in sign from maturity GAPs for the same risk exposure



IRMT

irmT The Institute of Risk Management Tanzania

# Techniques for Hedging Interest Rate Risk

Adjustments by asset-sensitive institutions with positive maturity GAP, negative duration GAP--hurt by decreasing interest rates;

- Buy financial futures--falling rates would increase value of futures contract, offsetting negative impact of GAP situation
- Buy call options on financial futures
- Swap to increase their variable-rate cash outflows and increase their fixed-rate (long-term) cash flows
- Lengthen the repricing of assets; shorten the repricing capability of liabilities

# Techniques for Hedging Interest Rate Risk Cont…

Adjustments by liability-sensitive institutions with negative maturity GAPs or positive duration GAPs--hurt by increasing interest rates;

* Sell financial futures--increasing rates would increase value of futures contracts, offsetting the negative impact of GAP situation
* Buy put options on financial futures
* Swap long-term, fixed-rate payments for variable-rate payments
* Shorten the repricing of assets; lengthen the repricing capability of liabilities

# LIBOR and Swap Rates

LIBOR is short for ***London interbank offered rate***. It is an unsecured short-term borrowing rate between banks. LIBOR rates have traditionally been calculated each business day for 10 currencies and 15 borrowing periods.

The borrowing periods range from one day to one year. LIBOR rates are used as reference rates for hundreds of trillions of dollars of transactions throughout the world. One popular and important derivatives transaction that uses LIBOR as a reference interest rate is an **Interest Rate Swap**

# LIBOR and Swap Rates Cont…

The top quarter and bottom quarter of the quotes for each currency/borrowing-period combination are discarded and the remaining ones are averaged to determine the LIBOR fixings for a day.

# LIBOR vs Treasury Rates

Risk-free rates are important in the pricing of financial contracts. Treasury rates might be thought to be natural rates to use as risk-free rates, but in practice they are regarded as artificially low because:

* The amount of capital a bank is required to hold to support an investment in Treasury bills and bonds (typically zero) is substantially smaller than the capital required to support a similar investment in other very-low-risk instruments.
* In most of countries, Treasury instruments are given a favorable tax treatment compared with most other fixed-income investments because they are not taxed at the state level.

# LIBOR vs Treasury Rates Cont…

Prior to the credit crisis that started in 2007, financial institutions used **LIBOR and swap rates** as a proxies for risk-free rates. Since the crisis, they have switched to using **overnight indexed swap (OIS)** rates for this purpose.

An overnight indexed swap (OIS) is a swap where a fixed interest rate for a period (e.g., one month, three months, one year, or two years) is exchanged for the geometric average of overnight rates during the period. The term "geometric average of overnight rates" should be interpreted as "geometric average of one plus the overnight rates minus one."

# LIBOR vs Treasury Rates Cont…

The relevant overnight rates are the rates in the government-organized interbank market where banks with excess reserves lend to banks that need to borrow to meet their reserve requirements.

Central banks require commercial banks to keep a certain percentage of customer deposits as reserves that cannot be lent out. The reserves can take the form of cash or deposits with the central bank.

# LIBOR vs Treasury Rates Cont…

If during a certain period a bank borrows at the overnight rate (rolling the loan and interest forward each day), it pays the geometric average of the overnight interest rates for the period. Similarly, if it lends at the overnight rate every day, it receives the geometric average of the overnight rates for the period.

An OIS therefore allows overnight borrowing or lending to be swapped for borrowing or lending at a fixed rate for a period of time. The fixed rate is referred to as the OIS rate.

# LIBOR vs Treasury Rates Cont…

A key indicator of stress in the banking system is the LIBOR-OIS spread. This is the amount by which the three-month London Interbank Offered Rate (LIBOR) exceeds the three-month overnight indexed swap (OIS) rate.

# Interest Rate Swaps

**Introduction**

Today there exist an interest rate swap market where trillions of dollars (in notional principal) of swaps of fixed-rate loans for floating-rate loans occur each year.

The market primarily consist of financial institutions and corporations who use the swap market to hedge more efficiently their liabilities and assets.

Many institutions create synthetic fixed- or floating-rate assets or liabilities with better rates than the rates obtained on direct liabilities and assets.

# Interest Rate Swaps: Definition

**Definition**

A swap is an exchange of cash flows (CFs), It is a legal arrangement between two parties to exchange specific payments.

In other words **Swap**, two **counterparties** agree to a contractual arrangement wherein they agree to exchange cash flows at periodic intervals.



IRMT

irmT The Institute of Risk Management Tanzania

# Types of Swaps

There are basically four types of swaps these includes:

1. **Interest Rate Swaps:** Exchange of fixed-rate payments for floating-rate payments

2. **Currency Swaps:** Exchange of liabilities in different currencies

3. **Cross-Currency Swaps:** Combination of Interest rate and Currency swap

4. **Credit Default Swaps:** Exchange of premium payments for default protection

# Plain Vanilla Interest Rate Swaps

I
R
M
T

**Definition**

Plain Vanilla or Generic Interest Rate Swap involves the exchange of fixed-rate payments for floating-rate payments.

# Plain Vanilla Interest Rate Swaps: Terms

1. Parties to a swap are called ***counterparties***. There are two parties:
   - Fixed-Rate Payer
   - Floating-Rate Payer

2. ***Rates***:
   - Fixed rate is usually a T-note rate plus basis points.
   - Floating rate is a benchmark rate: LIBOR.

# Plain Vanilla Interest Rate Swaps: Terms Cont…

3. ***Reset Frequency***: Semiannual

4. ***Principal***: No exchange of principal

5. ***Notional Principal*** (NP): Interest is applied to a notional principal; the NP is used for calculating the swap payments.

# Plain Vanilla Interest Rate Swaps: Terms Cont…

6. ***Maturity*** ranges between 3 and 10 years.

7. ***Dates***: Payments are made in arrears on a semi-annual basis:
   - ***Effective Date*** is the date interest begins to accrue
   - ***Payment Date*** is the date interest payments are made

# Plain Vanilla Interest Rate Swaps: Terms-Cont…

8. ***Net Settlement Basis***: The counterparty owing the greater amount pays the difference between what is owed and what is received—*only the interest differential is paid*.

9. ***Documentation***: Most swaps use document forms suggested by the *International Swap Dealer Association* (ISDA) or the British Banker's Association. The ISDA publishes a book of definitions and terms to help standardize swap contracts.

# Swap Terminology

Note:

Fixed-rate payer can also be called the floating-rate receiver and is often referred to as having bought the swap or having a long position.

Floating-rate payer can also be referred to as the fixed-rate receiver and is referred to as having sold the swap and being short.

# Plain Vanilla Interest Rate Swap: Example

Example:

Fixed-rate payer pays 5.5% every six months

Floating-rate payer pays LIBOR every six months

Notional Principal = $10 million

Effective Dates are 3/1 and 9/1 for the next three years

# Plain Vanilla Interest Rate Swap: Example

| 1<br>Effective Dates | 2<br>LIBOR | 3<br>Floating-Rate Payer's Payment* | 4<br>Fixed-Rate Payer's Payment** | 5<br>Net Interest Received by Fixed-Rate Payer Column 3 - Column 4 | 6<br>Net Interest Received by Floating-Rate Payer Column 4 - Column 3 |
|---|---|---|---|---|---|
| 3/1/Y1 | 0.045 | | | | |
| 9/1/Y1 | 0.050 | $225,000 | $275,000 | -$50,000 | $50,000 |
| 3/1/Y2 | 0.055 | $250,000 | $275,000 | -$25,000 | $25,000 |
| 9/1/Y2 | 0.060 | $275,000 | $275,000 | $0 | $0 |
| 3/1/Y3 | 0.065 | $300,000 | $275,000 | $25,000 | -$25,000 |
| 9/1/Y3 | 0.070 | $325,000 | $275,000 | $50,000 | -$50,000 |
| 3/1/Y4 | | $350,000 | $275,000 | $75,000 | -$75,000 |

* (LIBOR/2)($10,000,000)

** (.055/2)($10,000,000)

# Interest Rate Swap: Cont…

Points:

If LIBOR > 5.5%, then fixed payer receives the interest differential.

If LIBOR < 5.5%, then floating payer receives the interest differential.



IRMT

irmT The Institute of Risk Management Tanzania

# Interest Rate Swaps' Fundamental Use

One of the important uses of swaps is in creating a synthetic fixed- or floating-rate liability or asset that yields a better rate than a conventional or direct one:

1. Synthetic fixed-rate loans and investments

2. Synthetic floating-rate loans and investments

A ***synthetic fixed-rate loan*** is formed by combining a floating-rate loan with a fixed-rate payer's position

| | |
|---|---|
| ➢ Conventional Floating-Rate Loan<br>➢ Swap: Fixed-Rate Payer Position<br>➢ Swap: Fixed-Rate Payer Position | ➢ Pay Floating Rate<br>➢ Pay Fixed Rate<br>➢ Receive Floating Rate |
| ➢ Synthetic Fixed Rate | ➢ Pay Fixed Rate |

# Synthetic Fixed-Rate Loan

**Example:**

A synthetic fixed-rate loan formed with 2-year, $10,000,000 floating-rate loan with rates set equal to the LIBOR on 3/1 and 9/1 combined with a fixed-rate payer's position on the swap just analyzed.

# Synthetic Fixed-Rate Loan

| 1<br>Effective Dates | 2<br>LIBOR | 3<br>Swap<br>Floating-Rate<br>Payer's Payment* | 4<br>Swap<br>Fixed-Rate<br>Payer's Payment** | 5<br>Swap<br>Net Interest Received<br>by Fixed-Rate Payer<br>Column 3 – Column 4 | 6<br>Loan<br>Interest Paid on<br>Floating-Rate Loan* | 7<br>Synthetic Loan<br>Payment on Swap<br>and Loan<br>Column 6 – Column 5 | 8<br>Synthetic Loan<br>Effective<br>Annualized Rate*** |
|---|---|---|---|---|---|---|---|
| 3/1/Y1 | 0.045 | | | | | | |
| 9/1/Y1 | 0.050 | $225,000 | $275,000 | -$50,000 | $225,000 | $275,000 | 0.055 |
| 3/1/Y2 | 0.055 | $250,000 | $275,000 | -$25,000 | $250,000 | $275,000 | 0.055 |
| 9/1/Y2 | 0.060 | $275,000 | $275,000 | $0 | $275,000 | $275,000 | 0.055 |
| 3/1/Y3 | 0.065 | $300,000 | $275,000 | $25,000 | $300,000 | $275,000 | 0.055 |
| 9/1/Y3 | 0.070 | $325,000 | $275,000 | $50,000 | $325,000 | $275,000 | 0.055 |
| 3/1/Y4 | | $350,000 | $275,000 | $75,000 | $350,000 | $275,000 | 0.055 |

* (LIBOR/2)($10,000,000)

** (.055/2)($10,000,000)

*** 2 (Payment on Swap and Loan)/$10,000,000

# A ***synthetic floating-rate loan*** is formed by combining a fixed-rate loan with a floating-rate payer's position.

| | |
|---|---|
| ➢ Conventional Fixed-Rate Loan<br>➢ Swap: Floating-Rate Payer Position<br>➢ Swap: Floating-Rate Payer Position | ➢ Pay Fixed Rate<br>➢ Pay Floating Rate<br>➢ Receive Fixed Rate |
| ➢ Synthetic Floating Rate | ➢ Pay Floating Rate |

# Synthetic Floating-Rate Loans

I R M T

**Example:**

A synthetic floating-rate loan formed with a 3-year, $10,000,000, 5% fixed-rate loan combined with the floating-rate payer's position on the swap just analyzed.

# Synthetic Floating-Rate Loans

| 1<br>Effective Dates | 2<br>LIBOR | 3<br>Swap<br>Floating-Rate<br>Payer's Payment* | 4<br>Swap<br>Fixed-Rate<br>Payer's Payment** | 5<br>Swap<br>Net Interest Received<br>by Floating-Rate Payer<br>Column 4 – Column 3 | 6<br>Loan<br>Interest Paid on<br>5% Fixed-Rate Loan | 7<br>Synthetic Loan<br>Payment on Swap<br>and Loan<br>Column 6 – Column 5 | 8<br>Synthetic Loan<br>Effective<br>Annualized Rate*** |
|---|---|---|---|---|---|---|---|
| 3/1/Y1 | 0.045 | | | | | | |
| 9/1/Y1 | 0.050 | $225,000 | $275,000 | $50,000 | $250,000 | $200,000 | 0.040 |
| 3/1/Y2 | 0.055 | $250,000 | $275,000 | $25,000 | $250,000 | $225,000 | 0.045 |
| 9/1/Y2 | 0.060 | $275,000 | $275,000 | $0 | $250,000 | $250,000 | 0.050 |
| 3/1/Y3 | 0.065 | $300,000 | $275,000 | -$25,000 | $250,000 | $275,000 | 0.055 |
| 9/1/Y3 | 0.070 | $325,000 | $275,000 | -$50,000 | $250,000 | $300,000 | 0.060 |
| 3/1/Y4 | | $350,000 | $275,000 | -$75,000 | $250,000 | $325,000 | 0.065 |

* (LIBOR/2)($10,000,000)
** (.055/2)($10,000,000)
*** 2 (Payment on Swap and Loan)/$10,000,000



IRMT
irmT The Institute of Risk Management Tanzania

# Swaps as Bond Positions

Swaps can be viewed as a combination of a fixed-rate bond and flexible-rate note (FRN). A fixed-rate payer position is equivalent to Buying a FRN paying the LIBOR and Shorting a fixed-rate bond at the swap's fixed rate.

From the previous example, the fixed-rate payer's swap's CFs can be replicated by: Selling at par a 3-year bond, paying a 5.5% fixed rate and a principal of $10,000,000 (semiannual payments) and Purchasing a 3-year, $10,000,000 FRN with the rate reset every six months at the LIBOR.

# Swaps as Bond Positions Cont…

A floating-rate payer position is equivalent to Shorting a FRN at the LIBOR and Buying a fixed-rate bond at the swap fixed rate.

From the previous example, the floating-rate payer's swap's CFs can be replicated by:

Selling a 3-year, $10,000,000 FRN paying the LIBOR and Purchasing 3-year, $10,000,000, 5.5% fixed-rate bond at par

# Swaps as Eurodollar Futures Positions

A swap can also be viewed as a series of Eurodollar futures contracts.

Consider a short position in a Eurodollar strip in which the short holder agrees to sell 10 Eurodollar deposits at the CME-index price of 94.5 (or discount yield of RD = 5.5%) with each of the contracts having a face value of $1,000,000 and maturity of 6 months.

The expirations on the strip being March 1st and September 1st for a period of two and half years.

# Swaps as Eurodollar Futures Positions - Cont…

- With the index at 94.5, the contract price on one Eurodollar futures contract is $972,500:

$$f_0 = \left[\frac{100-(5.5)(180/360)}{100}\right](\$1{,}000{,}000) = \$972{,}500$$

- The next slide shows the cash flows at the expiration dates from closing the 10 short Eurodollar contracts at the same assumed LIBOR used in the previous swap example, with the Eurodollar settlement index being 100 − LIBOR.

# Swaps as Eurodollar Futures Positions - Cont…

| 1 | 2 | 3 | 4 |
|---|---|---|---|
| Closing Dates | LIBOR % | $f_T$ | Cash Flow* $10[f_0 - f_T]$ |
| 9/1/Y1 | 5.00 | $975,000 | -$25,000 |
| 3/1/Y2 | 5.50 | $972,500 | $0 |
| 9/1/Y2 | 6.00 | $970,000 | $25,000 |
| 3/1/Y3 | 6.50 | $967,500 | $50,000 |
| 9/1/Y3 | 7.00 | $965,000 | $75,000 |

$*f_0 = 972{,}500$

$$f_T = \left[\frac{100 - (\text{LIBOR}\%)(180/360)}{100}\right](\$1{,}000{,}000)$$



IRMT

irmT The Institute of Risk Management Tanzania

# Swaps as Eurodollar Futures Positions - Cont…

I
R
M
T

Comparing the fixed-rate payer's net receipts shown in Column 5 of the first exhibit (Slide 196) with the cash flows from the short positions on the Eurodollar strip shown in Slide 209, one can see that the two positions yield the same numbers.

# Swaps as Eurodollar Futures Positions - Cont…

Note there are some differences between the Eurodollar strip and the swap:

1. A 6-month differential occurs between the swap payment and the futures payments. This time differential is a result of the interest payments on the swap being determined by the LIBOR at the beginning of the period, whereas the futures position's profit is based on the LIBOR at the end of its period.

2. The futures contract is on a Eurodollar deposit with a maturity of 6 months instead of the standard 3 months.

# Swaps as Eurodollar Futures Positions - Cont…

3. **Credit Risk:** On a futures contract, the parties transfer credit risk to the exchange. The exchange then manages the risk by requiring margin accounts. Swaps, on the other hand, are exposed to credit risk.

4. **Marketability:** Swaps are not traded on an exchange like futures and therefore are not as liquid as futures.

# Swaps as Eurodollar Futures Positions - Cont…

5. **Standardization:** Swaps are more flexible in design than futures that are standardized.

6. **Cash Flow Timing:** CFs on swaps are based on the LIBOR 6 months earlier; CFs on futures are based on the current LIBOR.

# Swap Market Structure

***Swap Banks***: The market for swaps is organized through a group of brokers and dealers collectively referred to as swap banks.

* As *brokers*, swap banks try to match counterparties.

* As *dealers*, swap banks take temporary positions as fixed or floating players; often hedging their positions with positions in Eurodollar futures contracts or with spot fixed-rate and floating-rate bond positions.

I
R
M
T

# DURATION AND CONVEXITY



irmT
The Institute of Risk Management Tanzania

# Duration

**Introduction**

measures the "average maturity" of a stream of bond payments, it is the weighted average time to full recovery of the principal and interest payments. Duration is a widely used measure of a portfolio's exposure to yield curve movements.

The duration of a bond is an approximation of the percent change in its price given a 100 basis point change in interest rates.

For example, a bond with a duration of 7 will gain about 7% in value if interest rates fall 100 bp.

# Duration Cont…

For zeroes, this measure is easy to define and compute with a formula.

For securities with fixed cash flows, we must make assumptions about how rates shift together.

To compute duration for other instruments requires further assumptions and numerical estimation.

# Dollar Duration of Zeroes

**Definition:** The dollar duration of a zero-coupon bond is a linear approximation of the dollar change in its price divided by the change in its discount rate. Because $dur is essentially the derivative of the bond price with respect to the interest rate, we often call it the bond's Delta.

$$\$dur \equiv \Delta \approx \frac{\text{Change in Price}}{\text{Change in rate}}, \text{ i.e.}$$

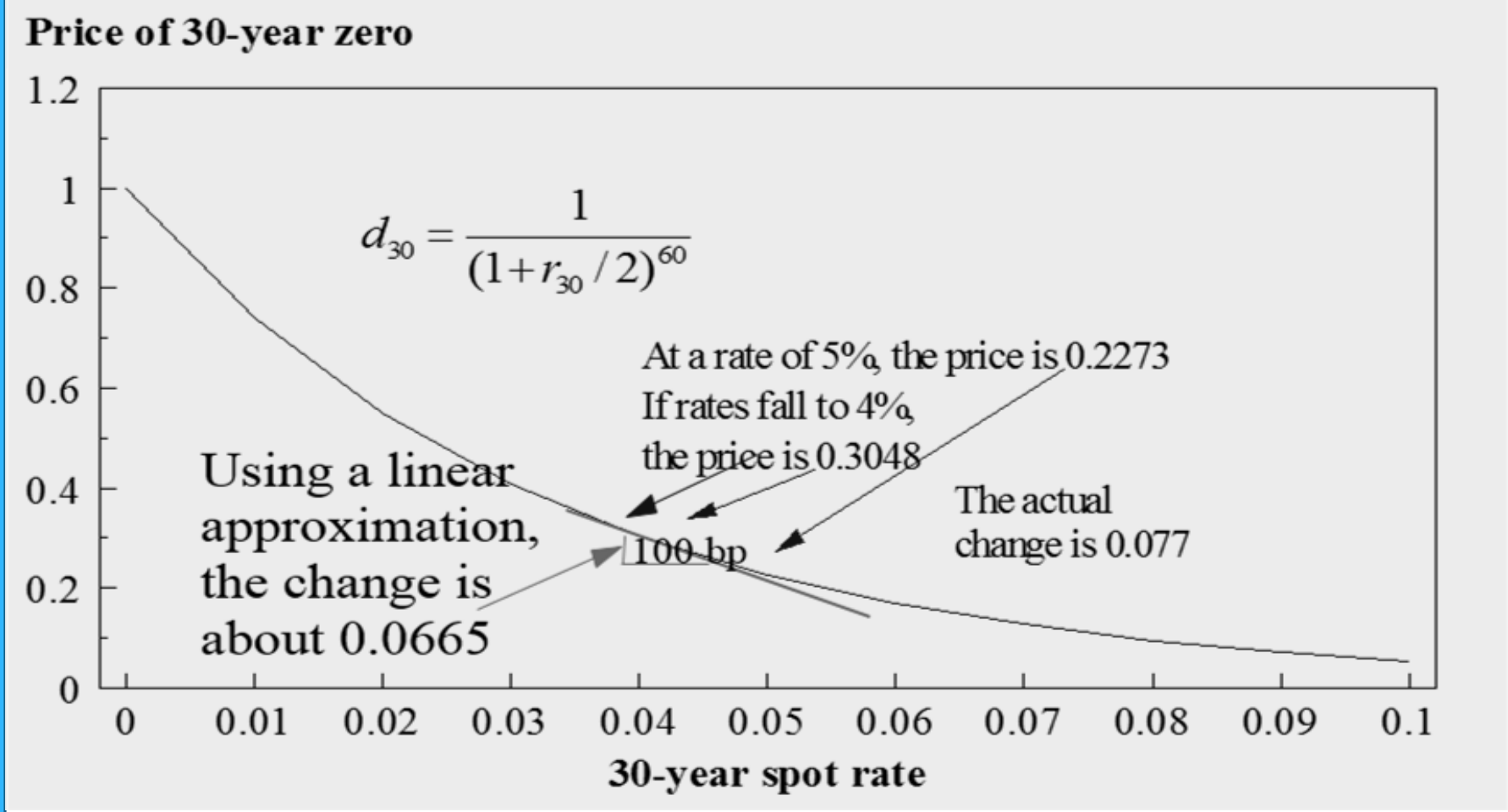
$$\Delta P \approx \$dur \times \Delta r$$



IRMT

irmT The Institute of Risk Management Tanzania

# Example


Price of 30-year zero
1.2
1
0.8
0.6
0.4
0.2
0
$d_{30} = \frac{1}{(1+r_{30}/2)^{60}}$
At a rate of 5%, the price is 0.2273
If rates fall to 4%,
the price is 0.3048
Using a linear
approximation,
the change is
about 0.0665
100 bp
The actual
change is 0.077
0
0.01
0.02
0.03
0.04
0.05
0.06
0.07
0.08
0.09
0.1
30-year spot rate

# Example: Dollar Duration

- The dollar duration of $1 par of a 30-year zero at an interest rate of 5% is 6.65, as illustrated in the last slide.
- -0.0665/(-0.01)=0.0665/0.01=6.65.
- The illustration shows that the dollar duration is related to the slope of the price-rate function.
- We can use calculus to get an explicit formula for the dollar duration of any zero.

# Dollar Duration: Formula

$$d_t(r_t) = \frac{1}{(1+r_t/2)^{2t}} = \frac{1}{(1+0.05/2)^{60}} = 0.2273$$

$$d_t'(r_t) = \frac{-t}{(1+r_t/2)^{2t+1}} = \frac{-30}{(1+0.05/2)^{61}} = -6.65$$

To avoid working with negative numbers, the dollar duration is quoted in positive terms, that is, 6.65

# Duration

Duration is a measure of the interest rate sensitivity of the bond that does not depend on scale or size. It is defined as the dollar duration scaled by the value of the bond:

For a t-year zero, we have

$$\text{Duration} = \frac{\dfrac{t}{(1+\frac{r_t}{2})^{2t+1}}}{\dfrac{1}{(1+\frac{r_t}{2})^{2t}}} = \frac{t}{(1+\frac{r_t}{2})}$$



IRMT

irmT The Institute of Risk Management Tanzania

# Duration: Example

- Duration approximates the percent change in price for a 100 basis point change in rates
- For example, at an interest rate of 5.47%, the duration of the 1.5-year zero is

$$\text{duration} = \frac{\text{dollar duration}}{\text{price}} = \frac{1.3465}{0.9222} = 1.46$$

$$\Leftrightarrow \text{duration} = \frac{t}{(1 + r_t / 2)} = \frac{1.5}{1 + 0.0547 / 2} = 1.46$$



IRMT

irmT The Institute of Risk Management Tanzania

# Duration: Example Continued…

At an interest rate of 5%, the duration of a 30-year zero in our example is

$$\text{duration} = \frac{\text{dollar duration}}{\text{price}} = \frac{6.65}{0.2273}$$

$$\Leftrightarrow \text{duration} = \frac{t}{(1 + r_t / 2)} = \frac{30}{1 + 0.05/2} = 29.26$$



IRMT

irmT The Institute of Risk Management Tanzania

# Characteristics of Duration

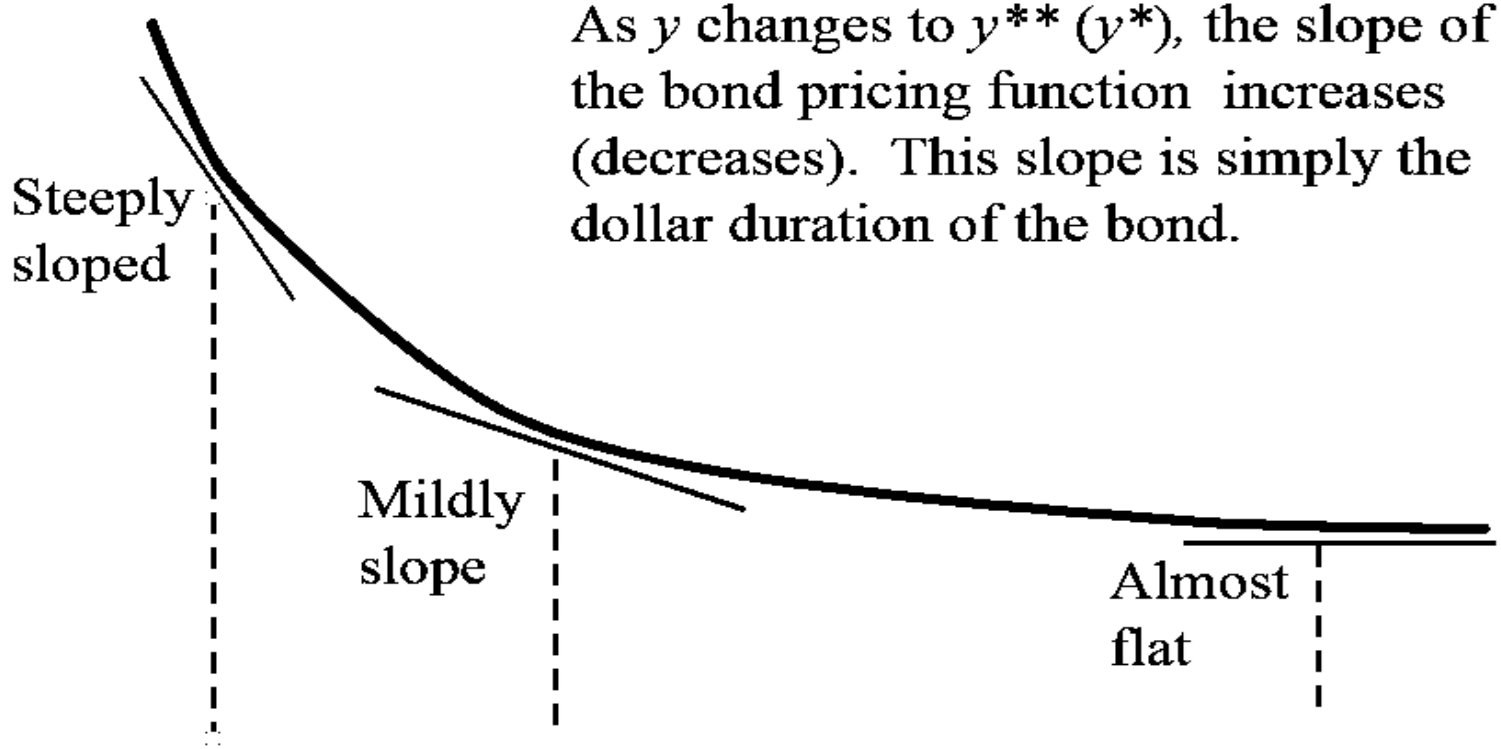
- Duration of a bond with coupons is always less than its term to maturity because duration gives weight to these interim payments:
  - **A zero-coupon bond's duration equals its maturity**
- There is an inverse relation between duration and coupon.
- There is a positive relation between term to maturity and duration, but duration increases at a decreasing rate with maturity.

# Convexity

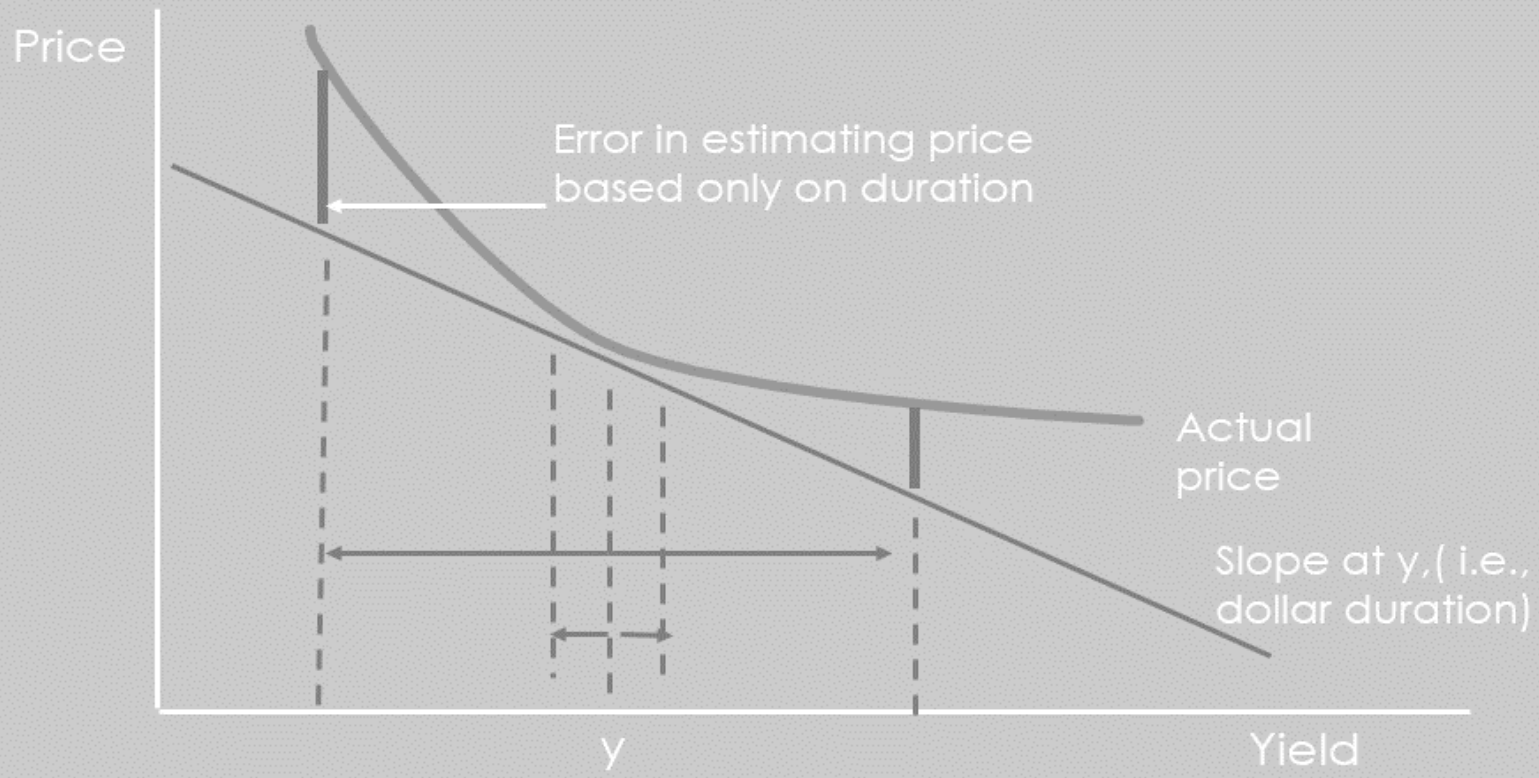
- Convexity is a measure of the curvature of the value of a security or portfolio as a function of interest rates. It tells you how the duration changes as interest rates change.
- As its name suggests, convexity is related to the second derivative if the price function. As such, it is often called a bond's Gamma.
- Using convexity together with duration gives a better approximation of the change in value given a change in interest rates than using duration alone.

# Illustration

As $y$ changes to $y^{**}$ ($y^{*}$), the slope of the bond pricing function increases (decreases). This slope is simply the dollar duration of the bond.



# Illustration



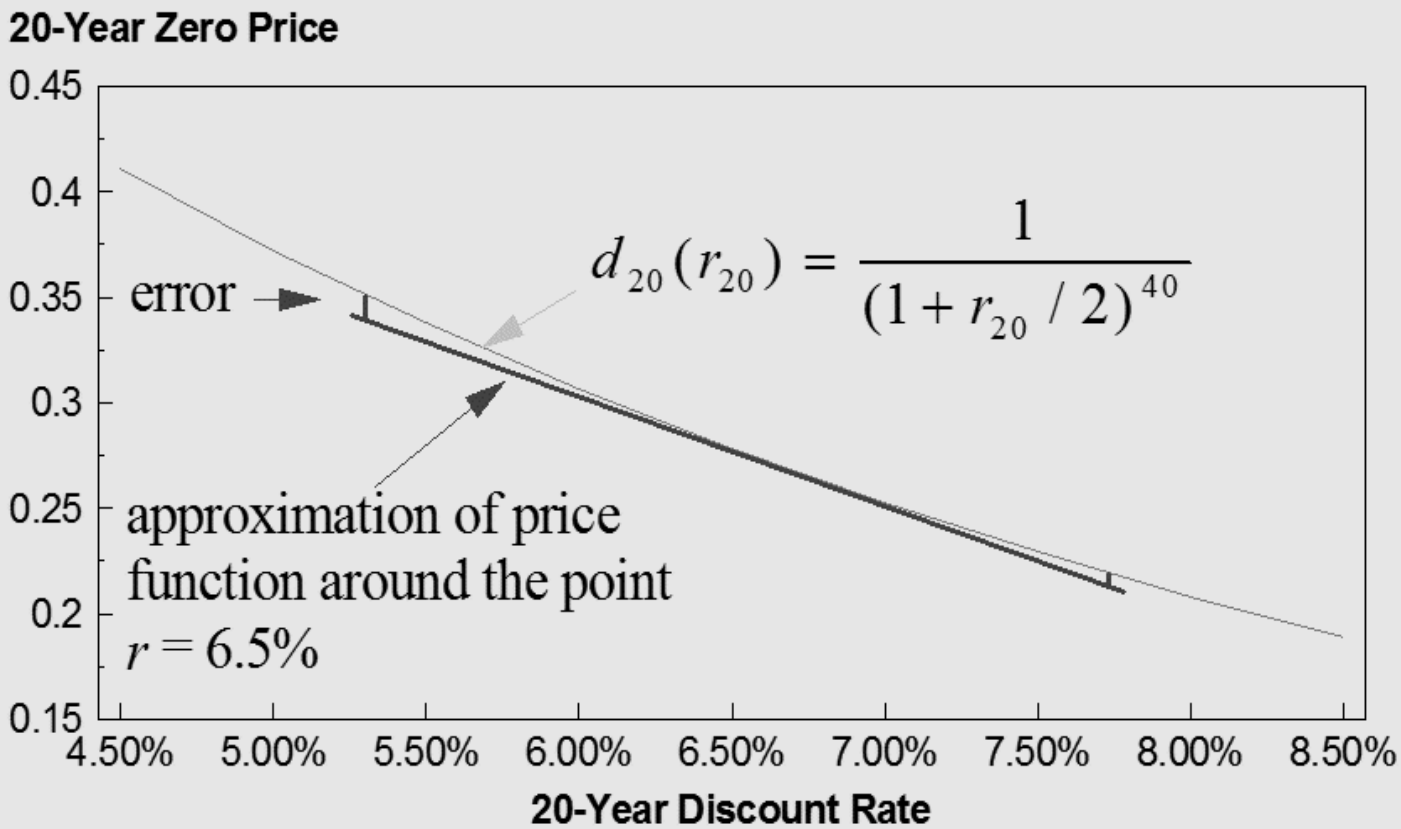




IRMT

irmT
The Institute of Risk
Management Tanzania

# Examples


20-Year Zero Price
0.45
0.4
0.35
0.3
0.25
0.2
0.15
4.50%
5.00%
5.50%
6.00%
6.50%
7.00%
7.50%
8.00%
8.50%
20-Year Discount Rate
error
$d_{20}(r_{20}) = \frac{1}{(1 + r_{20}/2)^{40}}$
approximation of price function around the point $r = 6.5\%$

# Correcting the Duration Error

- The price-rate function is not linear.
- Duration and dollar duration use a linear approximation to the price rate function to measure the change in price given a change in rates.
- The error in the approximation can be substantially reduced by making a convexity correction.

# INTEREST RATE DELTAS IN PRACTICE

# Delta (Δ)

- The delta of an option, Δ, is defined as the rate of change of the option price respected to the rate of change of underlying asset price:

$$\Delta = \frac{\partial \Pi}{\partial S}$$

- Where $\prod$ is the option price and S is underlying asset price. We next show the derivation of delta for various kinds of stock option.



IRMT

irmT The Institute of Risk Management Tanzania

# Application of Delta

- Figure 1.0 shows the relationship between the price of a call option and the price of its underlying asset.
- The delta of this call option is the slope of the line at the point of A corresponding to current price of the underlying asset.

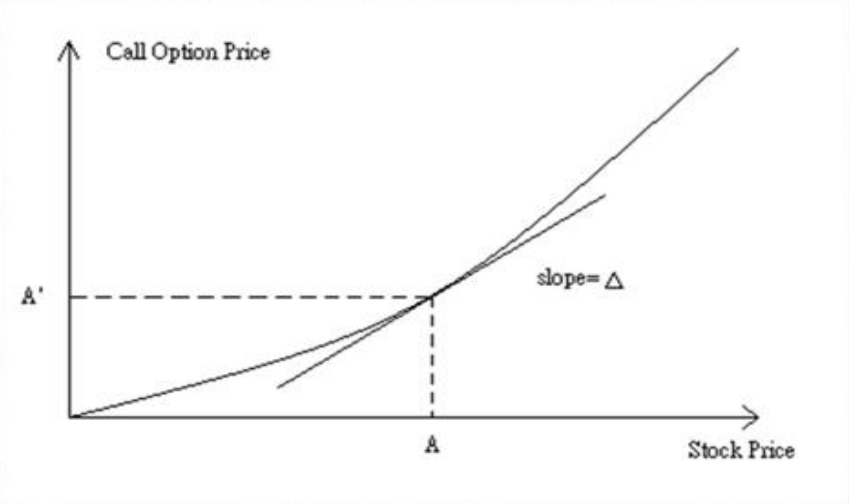



Figure 1.0 The Relationship between the Price of a Call Option and the Price of Its Underlying Asset

# Application of Delta Cont…

- By calculating delta ratio, a financial institution that sells option to a client can make a delta neutral position to hedge the risk of changes of the underlying asset price.
- Suppose that the current stock price is $100, the call option price on stock is $10, and the current delta of the call option is 0.4.
- A financial institution sold 10 call option to its client, so that the client has right to buy 1,000 shares at time to maturity.
- To construct a delta hedge position, the financial institution should buy 0.4 × 1,000 = 400 shares of stock.

# Application of Delta Cont…

- If the stock price goes up to $1, the option price will go up by $0.40. In this situation, the financial institution has a $400 ($1 × 400 shares) gain in its stock position and a $400 ($0.40 × 1,000 shares) loss in its option position.
- The total payoff of the financial institution is zero. On the other hand, if the stock price goes down by $1, the option price will go down by $0.40.
- The total payoff of the financial institution is also zero.

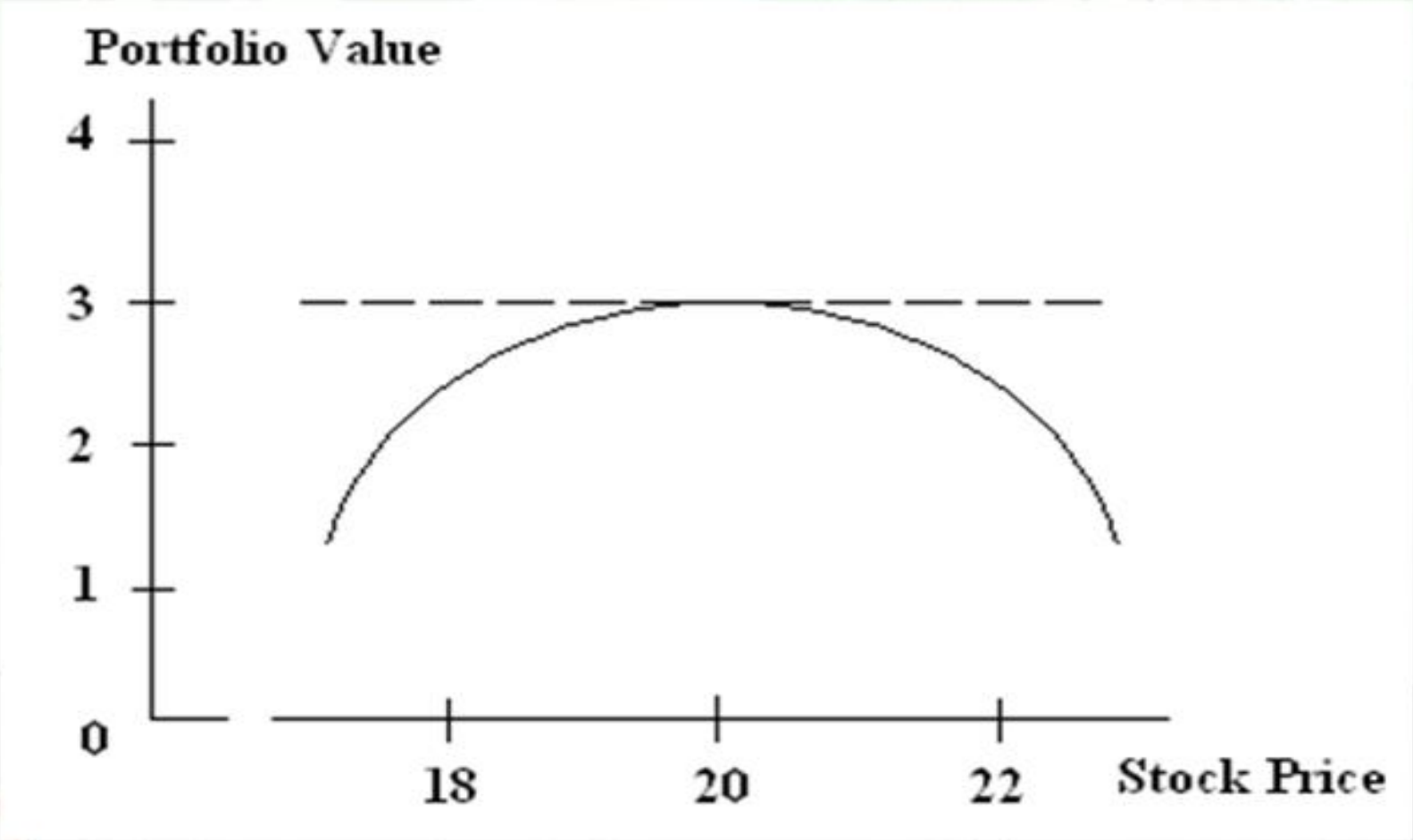
# Application of Delta Cont…

- However, the relationship between option price and stock price is not linear, so delta changes over different stock price.
- If an investor wants to remain his portfolio in delta neutral, he should adjust his hedged ratio periodically.
- The more frequent adjustments he does, the better delta-hedging he gets.
- Figure 2.0 exhibits the change in delta affecting the delta-hedges.

# Application of Delta Cont…

- If the underlying stock has a price equal to $20, then the investor who uses only delta as risk measure will consider that his or her portfolio has no risk.
- However, as the underlying stock prices changes, either up or down, the delta changes as well and thus he or she will have to use different delta hedging.
- Delta measure can be combined with other risk measures to yield better risk measurement. We will discuss it further in the following sections.

# Figure 2.0 Changes of Delta Hedge



# Interest Rate Deltas in Practice

The concept of delta risk on interest rate derivatives is a generalization of the traditional one of a single asset option.

However, contrary to single asset derivatives, fixed income derivatives are derivatives depending on a variety of instruments, used in the determination of the interest rate curve, rather than a single asset.

# Interest Rate Deltas in Practice Cont…

- In practice, a number of different approaches are used to calculate interest rate deltas.
- One approach is to define delta as the dollar duration. This is the sensitivity of the portfolio to a parallel shift in the zero-coupon yield curve. A measure related to this definition of delta is DV01. This is the impact of a one-basis-point increase in all rates.
- It is the dollar duration multiplied by 0.0001. Alternatively, it is the duration of the portfolio multiplied by the value of the portfolio multiplied by 0.0001.

# Interest Rate Deltas in Practice Cont…

- Analysts like to calculate several deltas to reflect their exposures to all the different ways in which the yield curve can move. There are a number of different ways this can be done. One approach corresponds to the partial duration approach that we outlined in the previous section. It involves computing the impact of a one-basis point change similar to the one illustrated in Figure 9.5 for points on the zero-coupon yield curve.

- This delta is the partial duration calculated in Table 9.5 multiplied by the value of the portfolio multiplied by 0.0001. The sum of the deltas for all the points on the yield curve equals the DV01. Suppose that the portfolio in Table 9.5 is worth $1 million. The deltas are shown in Table 9.6.

# Interest Rate Deltas in Practice Cont…

**TABLE 9.6** Deltas for Portfolio in Table 9.5

| Maturity (years) | 1 | 2 | 3 | 4 | 5 | 7 | 10 | Total |
|---|---|---|---|---|---|---|---|---|
| Delta | −20 | −60 | −90 | −160 | −200 | 210 | 300 | −20 |

Value of portfolio is $1 million. The dollar impact of a one-basis-point increase in points on the zero curve is shown.

# Calculating Deltas to Facilitate Hedging

- One of the problems with the delta measures that we have considered so far is that they are not designed to make hedging easy. Consider the deltas in Table 9.6. If we plan to hedge our portfolio with zero-coupon bonds, we can calculate the position in a one-year zero coupon bond to zero out the $200 per basis point exposure to the one-year rate, the position in a two-year zero-coupon bond to zero out the exposure to the two-year rate, and so on.

- But, if other instruments are used, a much more complicated analysis is necessary.

# Calculating Deltas to Facilitate Hedging Cont…

- In practice, traders tend to use positions in the instruments that have been used to construct the zero curve to hedge their exposure. For example, a government bond trader is likely to take positions in the actively traded government bonds that were used to construct the Treasury zero curve when hedging.

- A trader of instruments dependent on the LIBOR/swap yield curve is likely take a position in LIBOR deposits, Eurodollar futures, and swaps when hedging.

# DEFINITION OF VaR AND CALCULATION

# Value at Risk (VAR)

VAR is the maximum loss over a target horizon within a confidence interval (or, under normal market conditions).

In other words, if none of the "extreme events"(i.e., low-probability events) occurs, what is my maximum loss over a given time period?



IRMT

irmT The Institute of Risk Management Tanzania

# Another Definition of VAR

A forecast of a given percentile, usually in the lower tail, of the distribution of returns on a portfolio over some period; similar in principle to an estimate of the expected return on a portfolio, which is a forecast of the 50th percentile.

Ex: 95% one-tail normal distribution is 1.645 sigma ($Pr(x<=X)=0.05$, $X=-1.645$) while 99% normal distribution is 2.326 sigma

# VAR: Example

Consider a $100 million portfolio of medium-term bonds. Suppose my confidence interval is 95% (i.e., 95% of possible market events is defined as "normal".) Then, what is the maximum monthly loss under normal markets over any month?

To answer this question, let's look at the monthly medium-term bond returns from 1953 to 1995:

Lowest: -6.5% vs. Highest: 12%



IRMT

irmT The Institute of Risk Management Tanzania

# Calculating VAR at 95% Confidence

At the 95% confidence interval, the lowest monthly return is -1.7%. (I.e., there is a 5% chance that the monthly medium bond return is lower than -1.7%)

That is, there are 26 months out of the 516 for which the monthly returns were lower than -1.7%.

VAR = 100 million X 1.7% = $1.7 million (95% of the time, the portfolio's loss will be no more than $1.7 million!)

# Issues to Ponder

- What horizon is appropriate?

  * *A day, a month, or a year?*

  The holding period should correspond to the longest period needed for an orderly portfolio liquidation.

- What confidence level to consider?

  * *Are you risk averse?*

  The more risk averse => (1) the higher confidence level necessary & (2) the lower VAR desired.

# How to Convert VaR Parameters

If Assuming normal distribution and since returns are uncorrelated day-to-day:

* *VAR(T days) = VAR(1 day) x SQRT(T)*

And 95% one-tail VaR corresponds to 1.645 of sigma while 99% VaR corresponds to 2.326 sigma:

* *VAR(95%) = VAR(99%) x 1.645 / 2.326*



IRMT

irmT The Institute of Risk Management Tanzania

# VaR Computation

Parametric: Delta-Normal

Portfolio return is normally distributed as it is the linear combination of risky assets, therefore need:

1. Predicted variances and correlations of each asset (going back 5 years), no need for returns data.

2. Position on each asset (risk factor).



IRMT

irmT The Institute of Risk Management Tanzania

# VaR Computation Cont…

**Historical simulation**

Going back in time, e.g. over the last 5 years, and applying current weights to a time-series of historical asset returns. This return does not represent an actual portfolio but rather reconstructs the history of a hypothetical portfolio using the current position;

(1) For each risk factor, a time-series of actual movements, and

(2) Positions on risk factors.

# VaR Computation - Cont…

**Monte Carlo Simulation**

Two steps:

Specifies a stochastic process for financial variables as well as process parameters; the choice of distributions and parameters such as risk and correlations can be derived from historical data.

Fictitious price paths are simulated for all variables of interest. At each horizon considered, one day to many months ahead, the portfolio is marked-to-market using full valuation. Each of these ``pseudo'' realizations is then used to compile a distribution of returns, from which a VAR figure can be measured.

# VaR Computation - Cont…

Required:

for each risk factor, specification of a stochastic process (i.e., distribution and parameters), valuation models for all assets in the portfolio, and positions on various securities.



IRMT

irmT The Institute of Risk Management Tanzania

# Duration and VAR

- Value-at-Risk is directly linked to the concept of duration in situations where a portfolio is exposed to one risk factor only, the interest rate.
- Duration, average maturity of all bond payments, measures the sensitivity of the bond price to changes in yield:

  *Bond Return = - Duration x 1/(1+y) x Yield Change*

  So as duration increases, the interest rate risk is higher.

# Duration and VaR continued

- The example before: at the 95% level over one month, the portfolio VAR was found to be $1.7 million. The typical duration for a 5-year note is 4.5 years.
- Assume now that the current yield *y* is 5%. From historical data, we find that the worst increase in yields over a month at the 95% is 0.40%. The worst loss, or VAR, is then given by:

*Worst Dollar Loss = Duration x 1/(1+y) x Portfolio Value x Worst Yield Increase*

*VAR = 4.5 Years x (1/1.05) x $100m x 0.4% =1.7mil*



IRMT

irmT The Institute of Risk Management Tanzania

# Weaknesses

- VaR does not measure "event" (e.g., market crash) risk. That is why portfolio stress tests are recommended to supplement VaR.
- VaR does not readily capture liquidity differences among instruments. That is why limits on both tenors and option greeks are still useful.
- VaR doesn't readily capture model risks, which is why model reserves are also necessary.

# VALUE AT RISK: DEFINITION

# VaR and Capital

The value at risk (VAR) of a portfolio is the loss in value in the portfolio that can be expected over a given period of time (e.g., 1-Day) with a probability not exceeding a given number (e.g., 5%).

Probability (Portfolio Loss < - VAR) = K

K = Given Probability

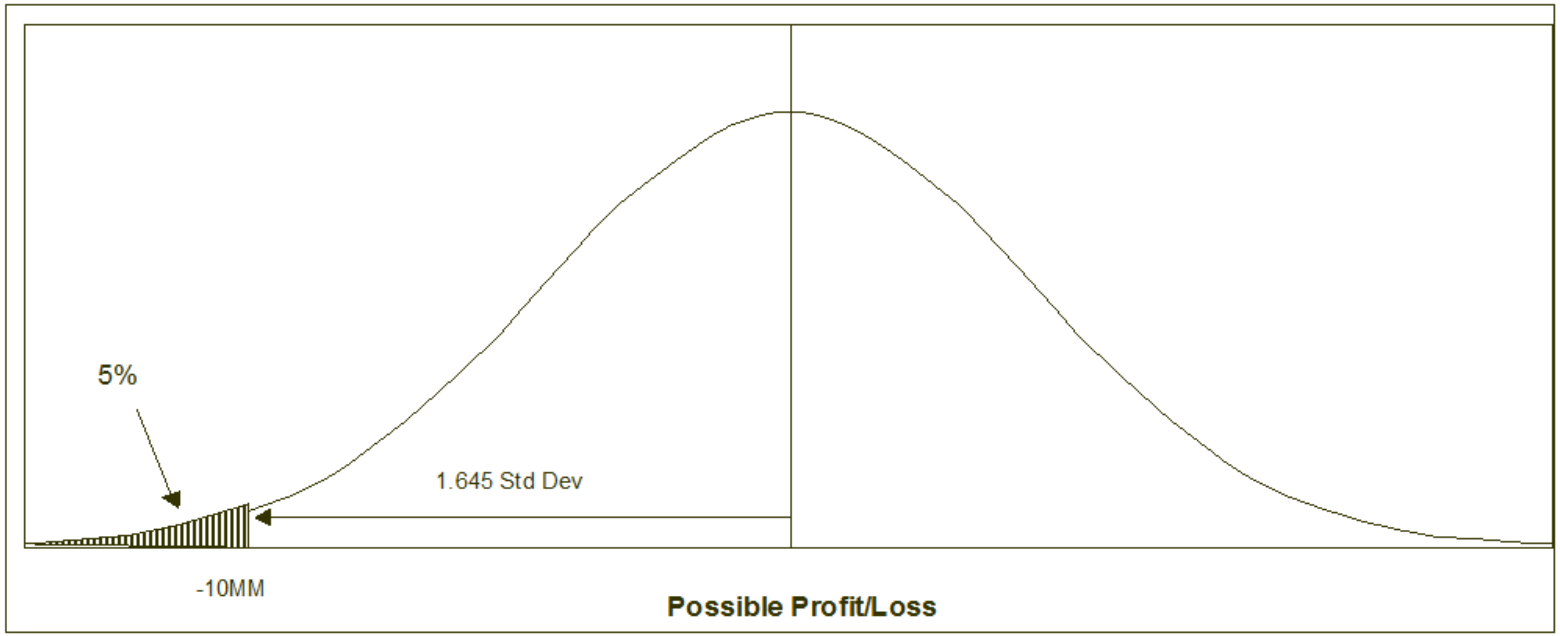


IRMT

irmT The Institute of Risk Management Tanzania

# Visualizing VAR: An Example

A one day VAR of $10mm using a probability of 5% means that there is a 5% chance that the portfolio could lose more than $10mm in the next trading day



# VAR and Capital Requirements For Banks

Regulatory Capital = Market Risk Capital + Specific Risk Capital + Counterparty Risk Capital

Market Risk Capital = Max [Ave. of 10-Day 99% VAR x Multiplier, yesterday's 10-Day 99% VAR]

- Regulators base the capital they require banks to keep on VaR
- The market-risk capital is $k$ times the 10-day 99% VaR where $k$ is at least 3.0

# VAR and Capital Requirements For Banks Cont…

- VaR is the loss level that will not be exceeded with a specified probability.
- C-VaR (or expected shortfall) is the expected loss given that the loss is greater than the VaR level.
- Although C-VaR is theoretically more appealing, it is not widely used.

# Coherent Risk Measures

**Introduction**

With the latest market turmoil stemming from US sub-prime mortgage crises it is clear that there is a need for an approach that comes to terms with problems posed by extreme event estimation.

VaR is not a "coherent" risk measure because it does not necessarily satisfy the sub-additivity condition.

(Sub-additivity = a portfolio will risk an amount, which is at most the sum of the separate amounts risked by its subportfolios).

# Coherent Risk Measures Cont…

An alternative measure that is coherent and quantifies the losses that might be encountered in the tail is the expected tail loss (ETL).

Since the introduction by Artzner (1999) of coherent risk measures and the new dawn of measuring extreme losses it seems as if the academic community is willing to sacrifice all the advances made in the field of measuring VaR.

# Coherent Risk Measures

- A coherent risk measure $\rho$ assigns to each loss $X$ a risk measure $\rho(X)$ such that the following conditions are satisfied:

$\rho(tX) = t\rho(X)$ (homogeneity)

$\rho(X) \geq \rho(Y)$, if $X \leq Y$ (monotonicity)

$\rho(X + n) = \rho(X) - n$ (risk-free condition)

$\rho(X) + \rho(Y) \leq \rho(X + Y)$ (sub-additivity)

These conditions guarantee that the risk function is convex, which in turn corresponds to risk aversion:

$$\rho(tX + (1 - t)Y) \leq t\rho(X) + (1 - t)\rho(Y)$$



IRMT

irmT The Institute of Risk Management Tanzania

# Coherent Risk Measures Cont…

- VaR is not a coherent risk measure because it does not necessarily satisfy the sub-additivity condition. VaR can only be made sub-additive if a usually implausible assumption is imposed on returns being normally distributed.

- For a sub-additive measure, which ETL is, portfolio diversification always leads to risk reduction, while for VaR, diversification may produce an increase in its value even when partial risks are triggered by mutually exclusive events.

# Coherent Risk Measures Cont…

Sub-additivity matters because:

- Adding risks together would give an overestimate of combined risk - a sum of risks can be used as a conservative estimate of combined risk.
- If regulators use non-sub-additive risk measures to set capital requirements, a bank might be tempted to break itself up to reduce its regulatory capital requirements.
- Non-sub-additive risk measures can inspire traders to break up their accounts, with separate accounts for separate risks, in order to reduce their margin requirements.

I
R
M
T

# MARGINAL VaR, INCREMENTAL VaR AND COMPONENT VaR

# Marginal VaR

How risk sensitive is my portfolio to increase in size of each position?

- calculate VaR for the entire portfolio VaRP=X
- increase position A by one unit (say 1% of the portfolio)
- calculate VaR of the new portfolio: VaRPa= Y
- incremental risk contribution to the portfolio by A: Z = X-Y

i.e. Marginal VaR of A is Z = X-Y

Marginal VaR can be Negative; what does this mean…?

# Marginal VaR Cont…

$$\frac{\partial \sigma_p^2}{\partial w_i} = 2w_i\sigma_i^2 + 2\sum_{j=1,\, j\neq i}^{N} w_j\sigma_{ij}$$

$$= 2\,\mathrm{cov}\left(R_i, w_iR_i + \sum_{j\neq i}^{N} w_jR_j\right) = 2\,\mathrm{cov}(R_i, R_p)$$

$$\frac{\partial \sigma_p}{\partial w_i} = \frac{\mathrm{cov}(R_i, R_p)}{\sigma_p}$$

$$\Delta\mathrm{VAR}_i = \frac{\partial \mathrm{VAR}}{\partial w_i W} = \alpha\frac{\partial \sigma_p}{\partial w_i} = \alpha\frac{\mathrm{cov}(R_i, R_p)}{\sigma_p}$$



IRMT

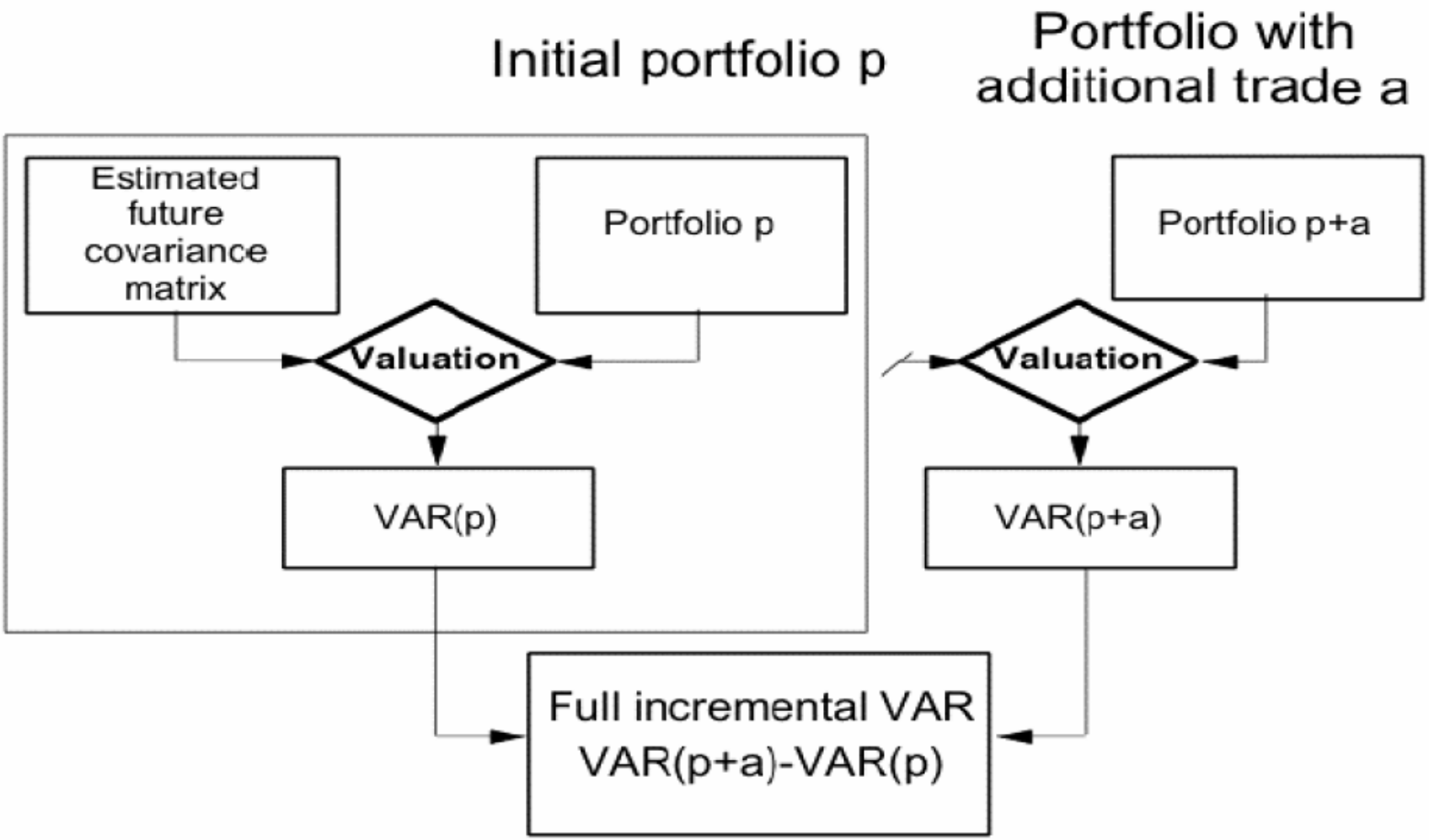
irmT The Institute of Risk Management Tanzania

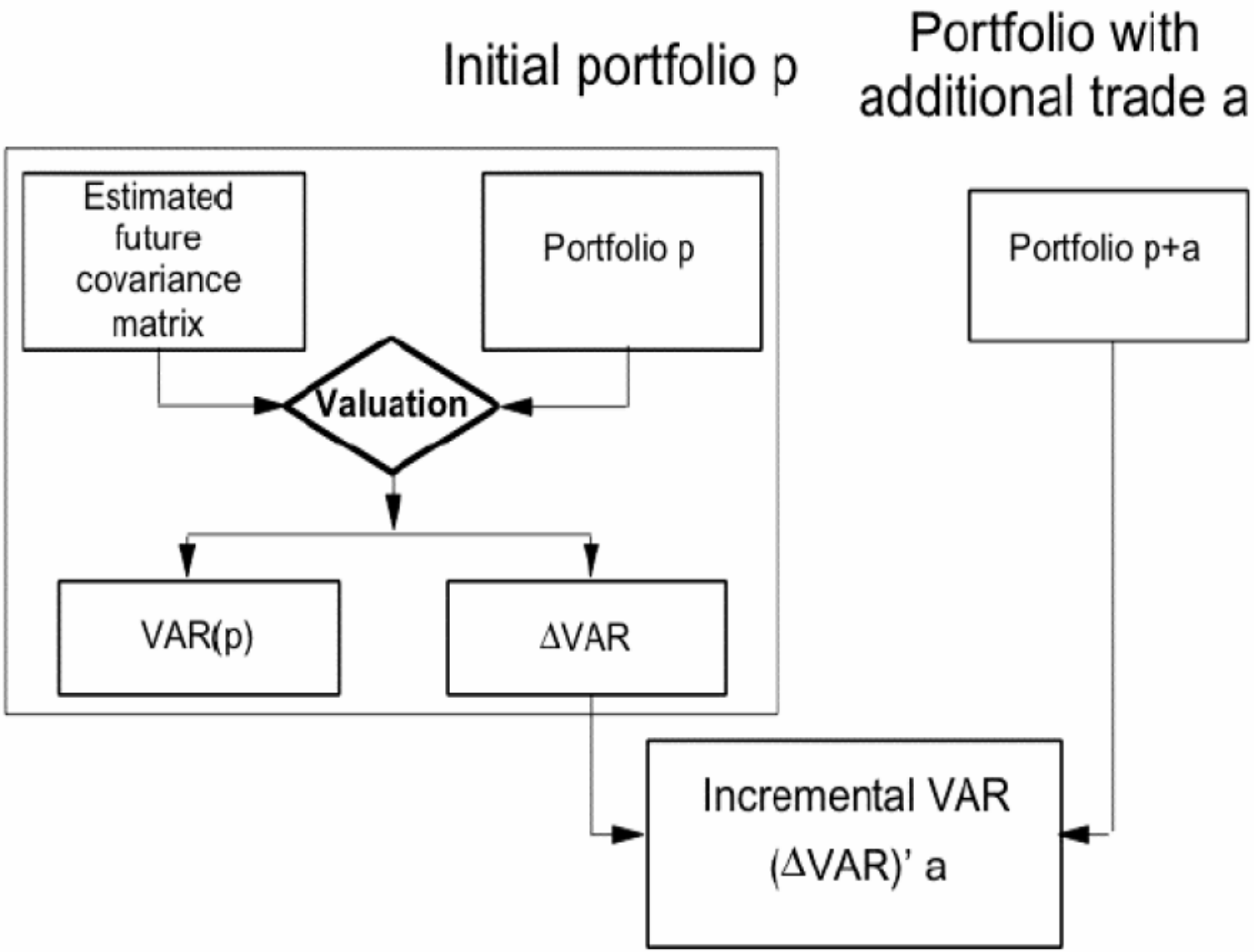
# Incremental VaR

**Risk contribution of each position in my portfolio:**

- Calculate VaR for the entire portfolio VaRP= X
- Remove A from the portfolio
- Calculate VaR of the portfolio without A: VaRP-A= Y
- Risk contribution to the portfolio by A: Z = X-Y
- i.e. Incremental VaR of A is Z = X-Y
- Incremental VaR can be Negative; what does this mean…?

# The impact of a proposed trade with full revaluation.




Initial portfolio p
Portfolio with additional trade a
Estimated future covariance matrix
Portfolio p
Portfolio p+a
Valuation
VAR(p)
ΔVAR
Incremental VAR
(ΔVAR)' a

# Component VAR

Objective: to get a risk decomposition of the portfolio taking individual VAR is not useful since it ignore diversification. Rather, the component VAR defined as:

$$\text{Component VAR} = (\Delta VARi)\ x\ wi\ W = VAR\beta_i\ wi$$

Indicates how the portfolio would change (approximately) if the component is deleted from the portfolio

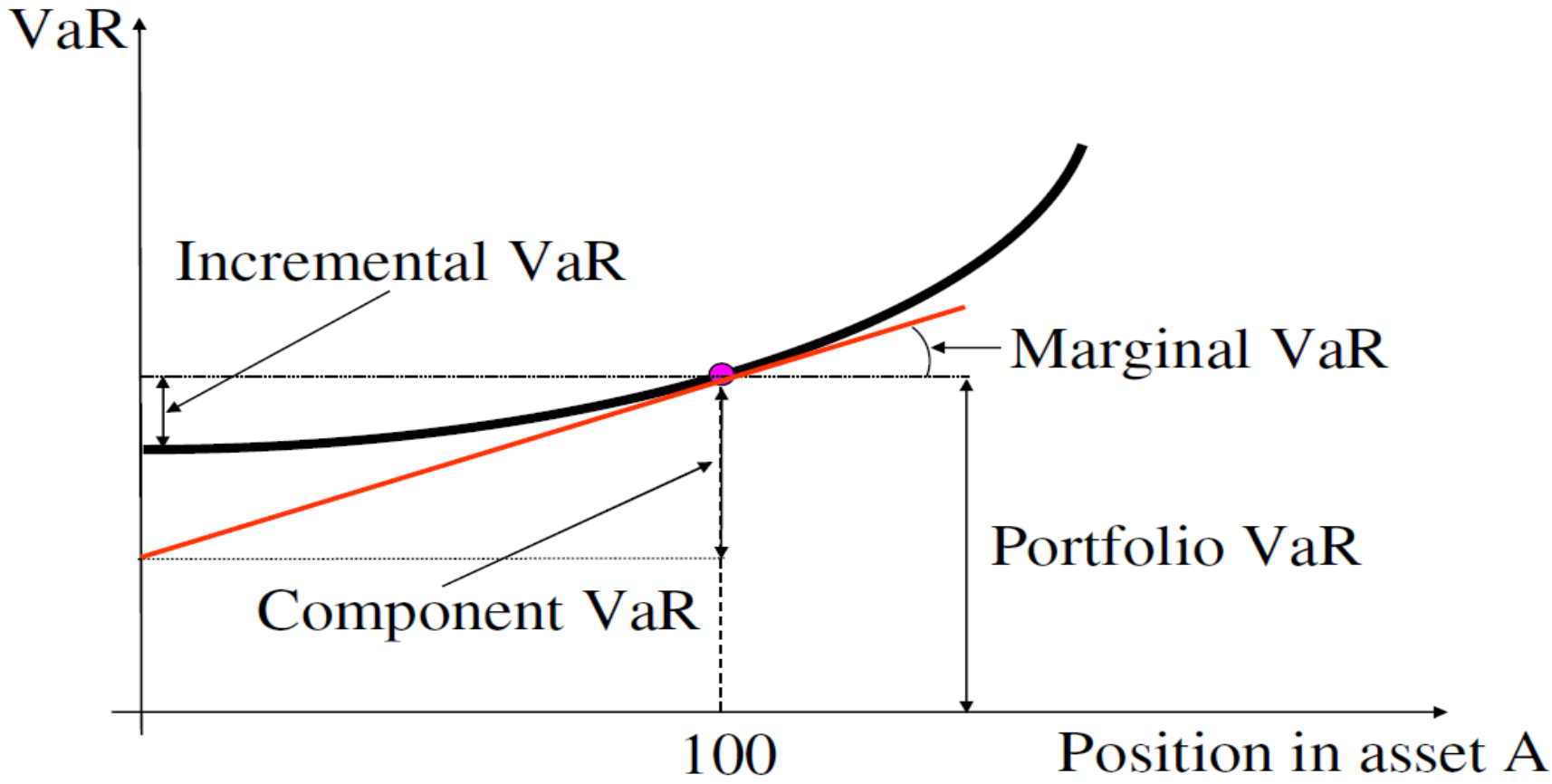
$$\text{CVAR}_1 + \text{CVAR}_2 + \cdots + \text{CVAR}_N = \text{VAR}\left(\sum_{i=1}^{N} w_i\beta_i\right) = \text{VAR}$$



I R M T

irmT The Institute of Risk Management Tanzania

# VaR Decomposition






IRMT

irmT
The Institute of Risk Management Tanzania

# Example of VaR Decomposition

| Currency | Position | Individual VaR | Marginal VaR | Component VaR | Contribution to VaR in % |
|---|---|---|---|---|---|
| CAD | $2M | $165,000 | 0.0528 | $105,630 | 41% |
| EUR | $1M | $198,000 | 0.1521 | $152,108 | 59% |
| Total | $3M | | | | |
| Undiversified | | $363K | | | |
| Diversified | | | | $257,738 | 100% |

# Summary

The marginal VAR is the change in VAR due to an addition of $1 in EUR, or 0.1521; this represents the slope of the straight line that is tangent to the VAR curve at the current value.

The incremental VAR is the change in VAR due to the deletion of the euro position, which is $92,738 and is measured along the curve. This is approximated by the component VAR, which is simply the marginal VAR times the current position of $1 million, or $152,108. The latter is measured along the straight line that is tangent to the VAR curve. The graph illustrates that the component VAR is only an approximation to the incremental VAR. These component VAR measures add up to the total portfolio VAR, which gives a quick decomposition of the total risk.

# Implied Volatilities

**Volatility** is a measure for variation of price of a financial instrument over time.

**Historical volatility** is a direct measure of the movement of the underlying price (realized volatility) over recent history (e.g. a trailing 21-day period).

**An implied volatility** is derived from the market price of a market traded derivative (in particular an option)

# Implied Volatilities Cont…

For instance, the IBM call option, struck at $100 and expiring in 6 months, may have an implied volatility of 18%, While the put option struck at $105 and expiring in 1 month may have an implied volatility of 21%.

At the same time, the historical volatility for IBM for the previous 21 day period might be 17% (all volatilities are expressed in annualized percentage moves).

# Implied Volatilities Cont…

Implied volatilities often exceed their historic counterparts prior to a major announcement (such as an earnings announcement or a merger), and tend to the mean afterwards.

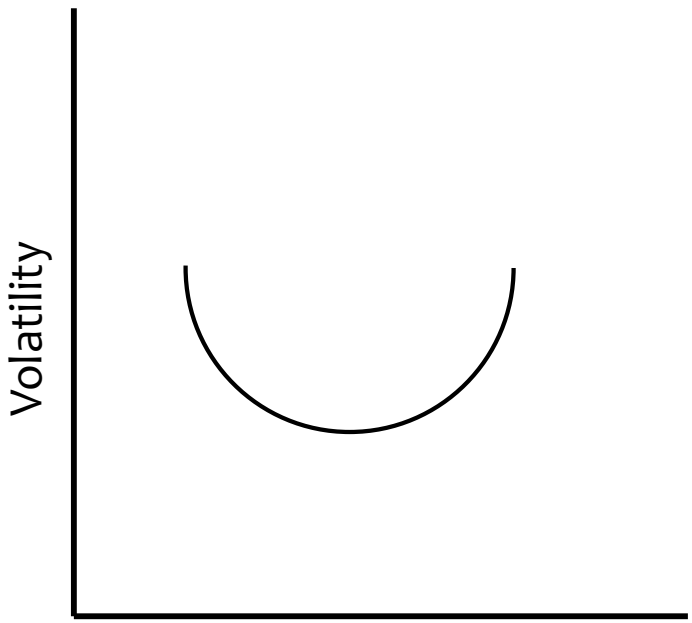
For example, if the market is enthusiastic about a specific stock (perhaps due to a great earnings report), then a call option will be expensive. Accordingly, a covered call is a good strategy.

# Implied Volatility as Measure of Relative Value

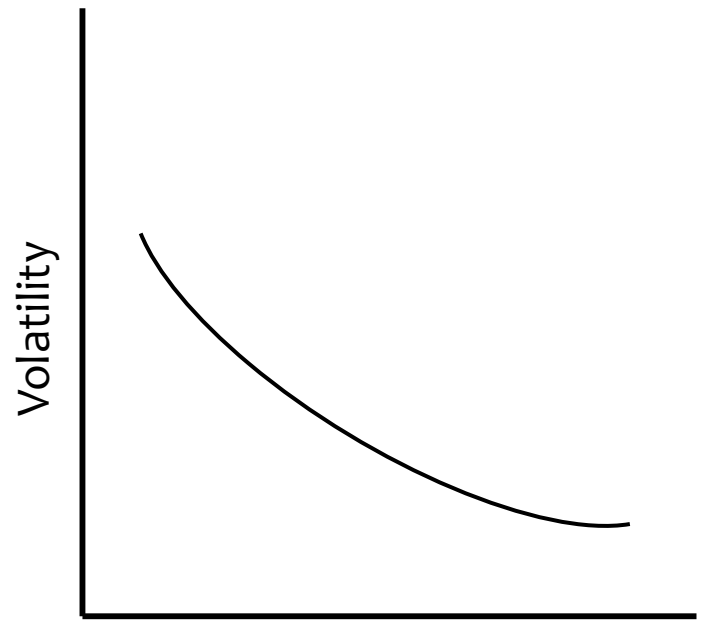
EX: A call option is trading at $1.50 with the underlying trading at $42.05. The implied volatility of the option is determined to be 18.0%.

A short time later, the option is trading at $2.10 with the underlying at $43.34, yielding an implied volatility of 17.2%.

# Volatility Smile

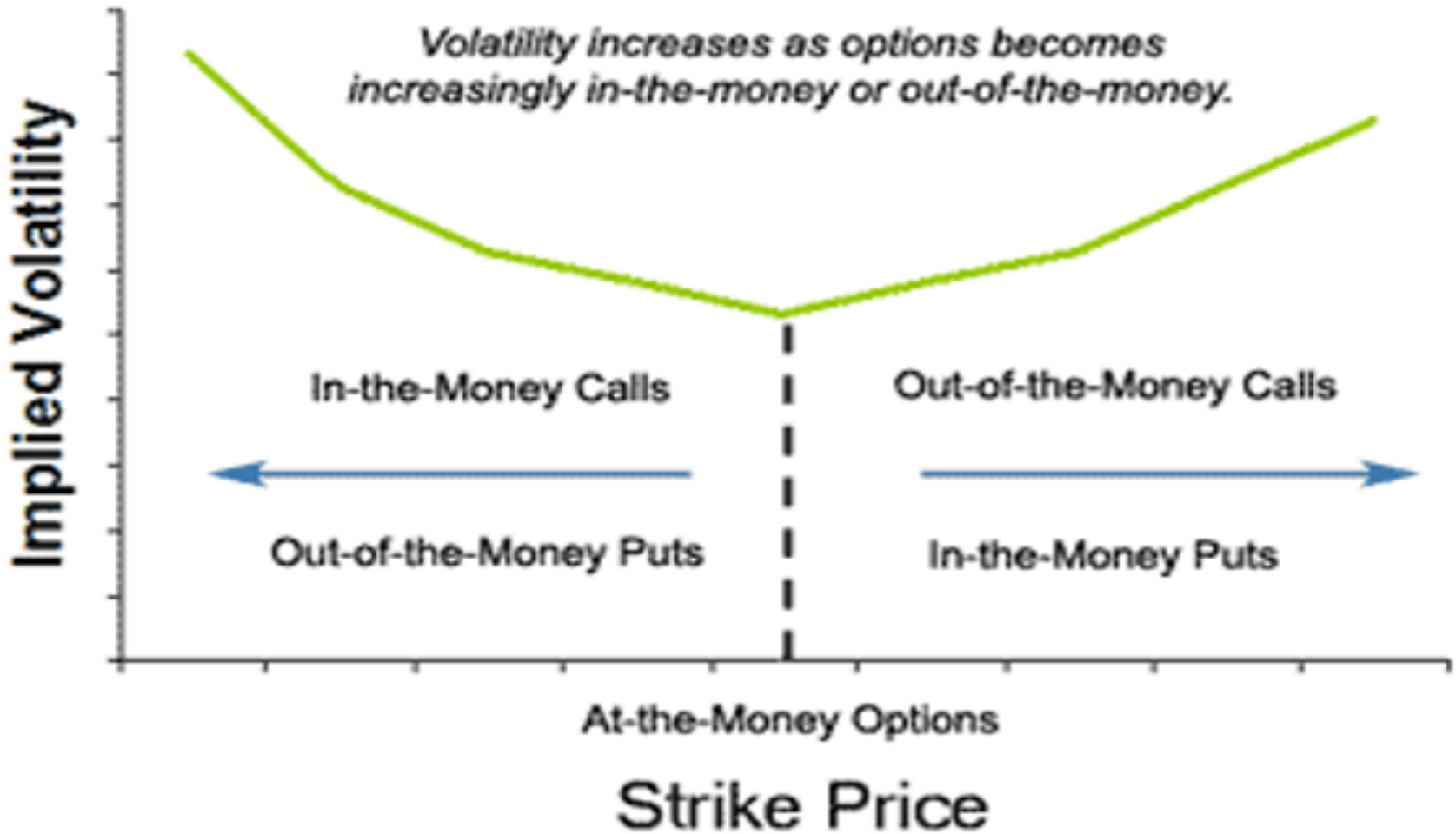



Strike Price
**"SMILE"**

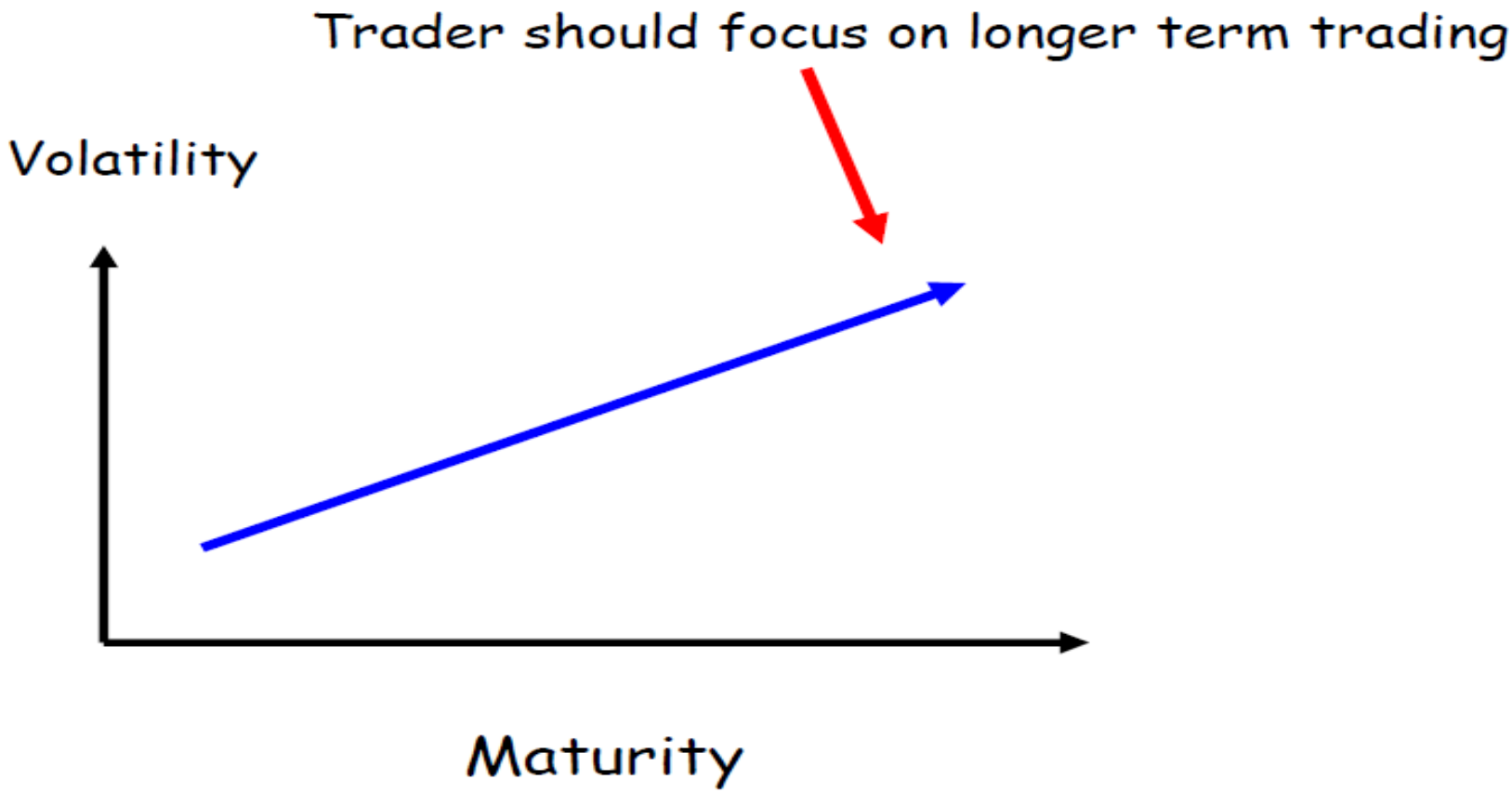



Strike Price
**"SKEW"**

# Volatility Smile



# Term Structure of Volatility





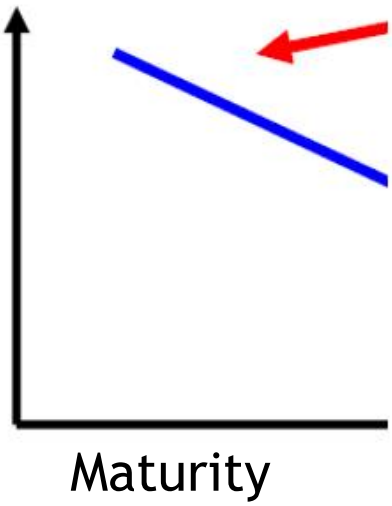

IRMT

irmT
The Institute of Risk Management Tanzania

# Term Structure of Volatility Cont…

Volatility

Trader should focus on Shorter term trading




Implied Volatility Surface

- A three-dimensional curved surface.
- Delta as a function of M and DTM.
- Z-axis(Delta),X-axis(DTM),Y-axis(M).



IRMT

irmT The Institute of Risk Management Tanzania

# Power Law

The power law provides an alternative to assuming normal distributions. The law asserts that, for many variables that are encountered in practice, it is approximately true that the value of the variable, *v*, has the property that when *x* is large.

$$\text{Prob}\,(v > x) = Kx^{-\alpha} \quad \ldots\ldots\ldots\ldots(1)$$

Where K and α are constants. The equation has been found to be approximately true for variables v as diverse as the income of an individual, the size of a city, and the number of visits to a website in a day.

# Power Law Cont…

EXAMPLE 10.4

Suppose that we know from experience that $\alpha = 3$ for a particular financial variable and we observe that the probability that $v > 10$ is 0.05.

Equation (1) gives $0.05 = K \times 10^{-3}$ so that $K = 50$. The probability that $v > 20$ can now be calculated as $50 \times 20^{-3} = 0.00625$

The probability that $v > 30$ is $50 \times 30^{-3} = 0.0019$



IRMT

irmT The Institute of Risk Management Tanzania

# Power Law Cont…

- Two quantities x and y are related by a *power law* if y is proportional to $x^{(-c)}$ for a constant c

$$y = \alpha . x^{(-c)}$$

- If x and y are related by a power law, then the graph of log(y) versus log(x) is a straight line

$$\log(y) = -c.\log(x) + \log(\alpha)$$

- The slope of the log-log plot is the *power exponent* c



IRMT

irmT The Institute of Risk Management Tanzania

# Power Law Distributions

- A random variable X has a *power law distribution* if Pr[X=k] is proportional to $k^{(-c)}$ for a constant c
- The cumulative distribution, Pr[X>k], of a power law distribution is proportional to $k^{(-c+1)}$, and is called the *Pareto law*
- Similar to a power law, the *Zipf law* relates the rank r of X to its size: the r'th largest instance of X is proportional to $r^{(-c')}$



IRMT

irmT The Institute of Risk Management Tanzania

# Power Law Distributions Cont…

- The power law is a way of modeling the tail of a distribution from empirical data. The theoretical basis for this approach is extreme value theory.

- Therefore, if all we are interested in is calculating the extreme tail of the total operational risk loss distribution, it may only be necessary to consider one or two business line/risk type combinations.

# Example: City Populations

| | | |
|---|---|---|
| 1. | New York | 7,322,564 |
| 2. | Los Angeles | 3,485,398 |
| 3. | Chicago | 2,783,726 |
| 4. | Houston | 1,630,553 |
| 5. | Philadelphia | 1,585,577 |
| 6. | San Diego | 1,110,549 |
| 7. | Detroit | 1,027,974 |
| 8. | Dallas | 1,006,877 |
| 9. | Phoenix | 983,403 |
| 10. | San Antonio | 935,933 |

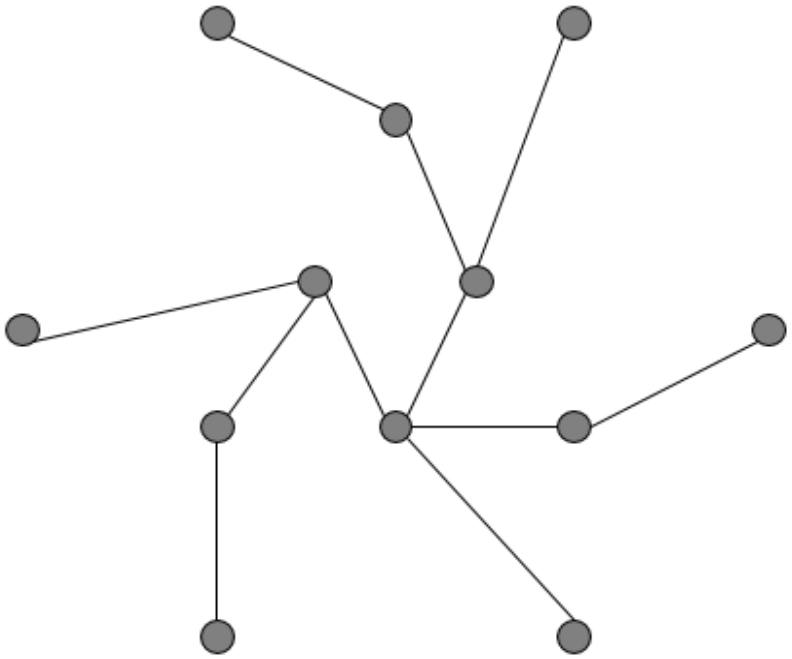
# Example: City Populations Cont…

| | | |
|---|---|---|
| 1. | New York | 7,322,564 |
| 2. | Los Angeles | 3,485,398 |
| 3. | Chicago | 2,783,726 |
| | ⋮ | |
| 21. | Seattle | 516,259 |
| | ⋮ | |
| 94. | Spokane, WA | 177,196 |
| 95. | Tacoma, WA | 176,664 |
| 96. | Little Rock, AR | 175,795 |
| 97. | Bakersfield, CA | 174,820 |
| 98. | Fremont, CA | 173,339 |
| 99. | Fort Wayne, IN | 173,072 |
| 100. | Arlington, VA | 170,936 |

# Power Laws in Networks

- Degree distribution often satisfies a power law: fraction of nodes $f_d$ of degree $d$ is proportional to $d^{-c}$

| Degree $d$ | Fraction $f_d = 1/(2d)$ |
|---|---|
| 1 | 1/2 |
| 2 | 1/4 |
| 3 | 1/6 |
| 4 | ~1/8 |





IRMT

irmT The Institute of Risk Management Tanzania

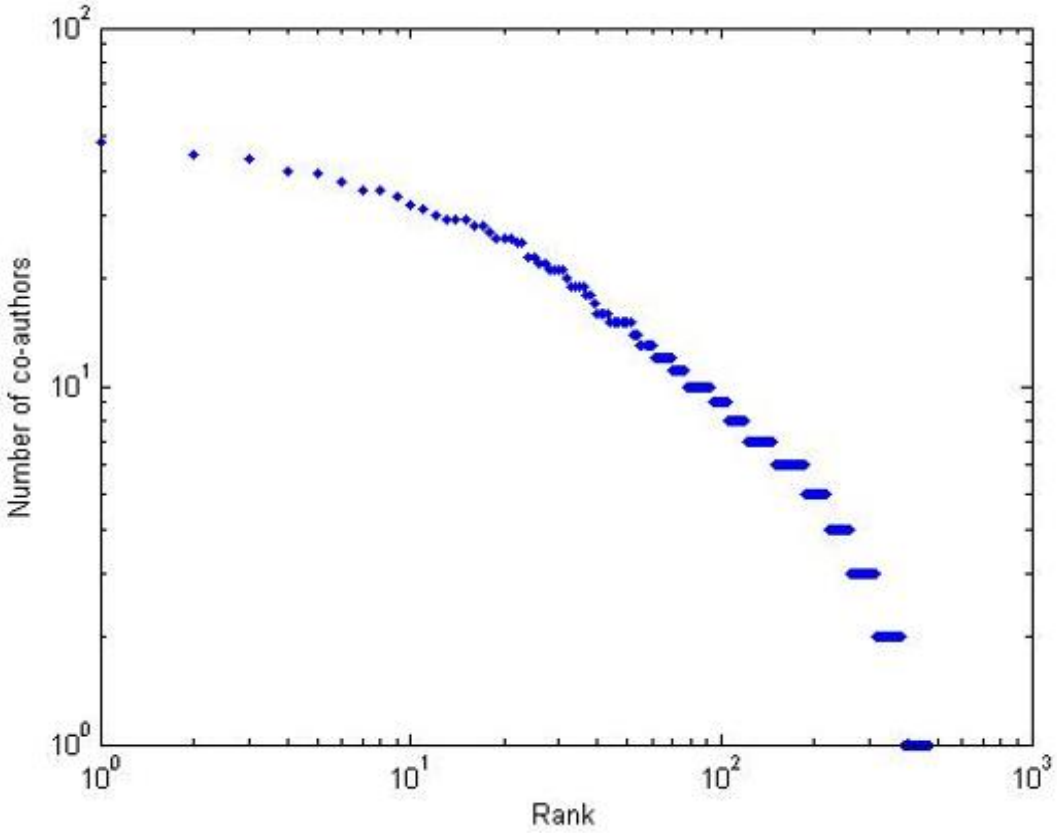
# Example: Collaboration Graph

- Power law exp:

  c = 2.97

- With exponential decay factor,

  c = 2.46





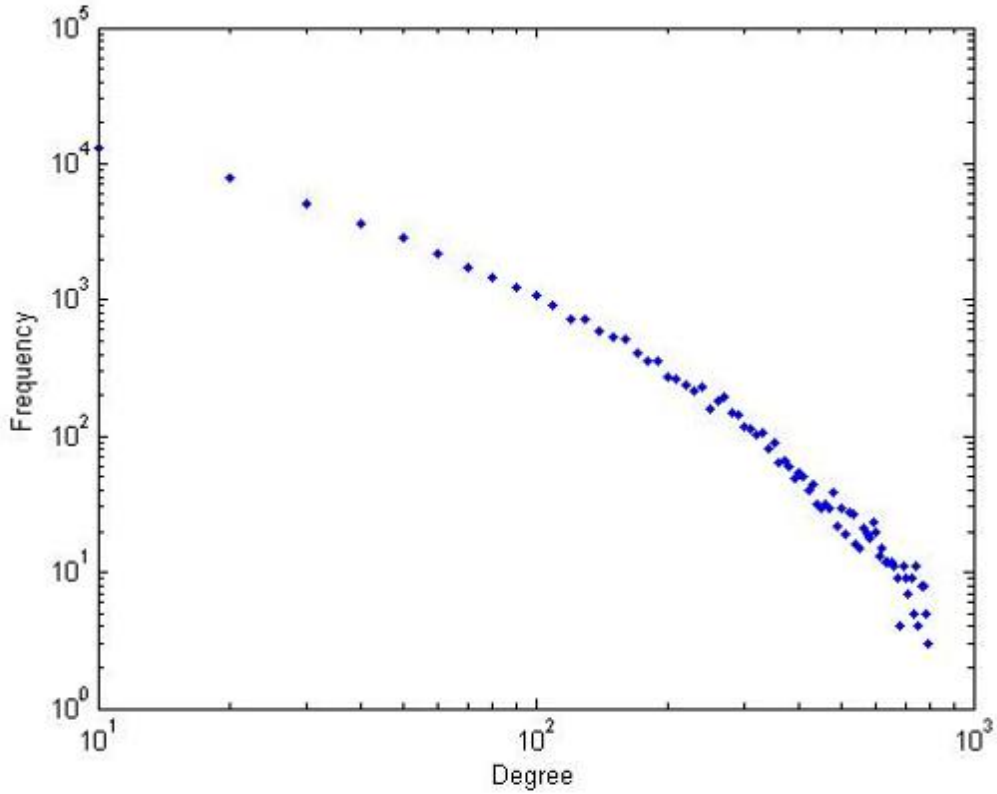


IRMT

irmT The Institute of Risk Management Tanzania

# Example: Cross-Post Graph

- Power law exponent: c = 1.3



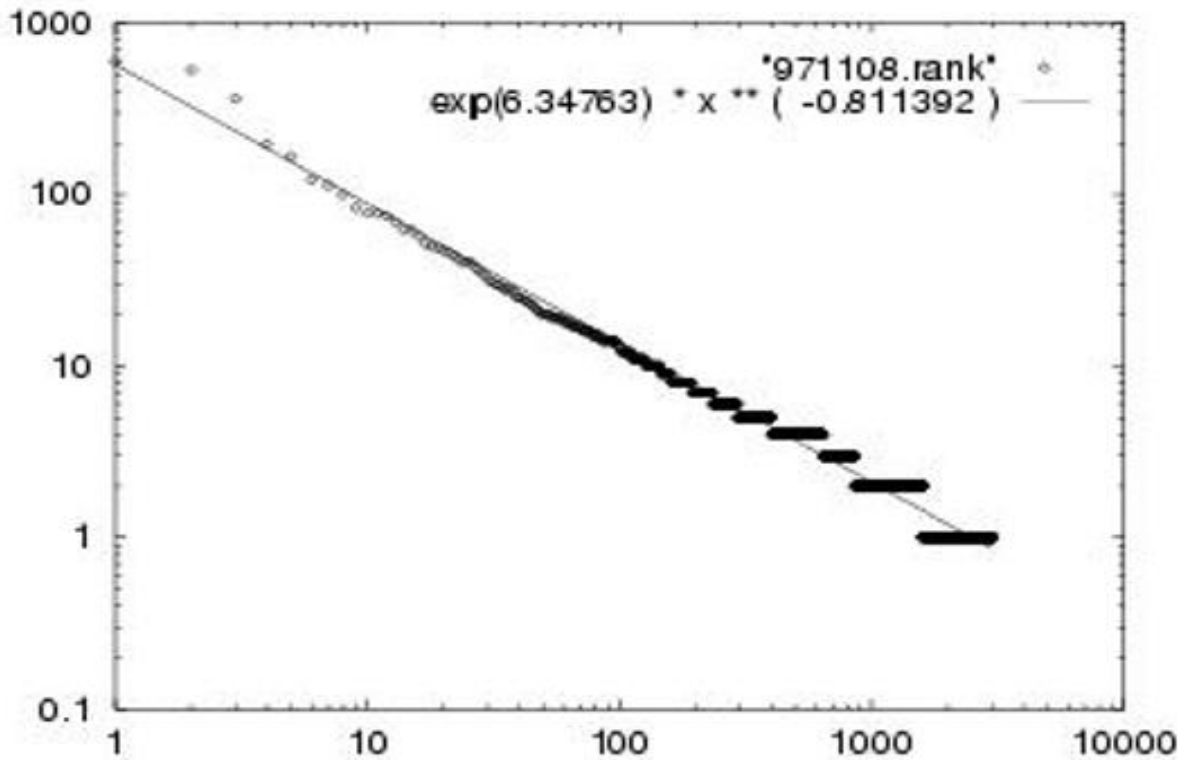



IRMT

irmT
The Institute of Risk Management Tanzania

# Example: Inter-Domain Internet

- Power law exponent: 2.15 < c < 2.2





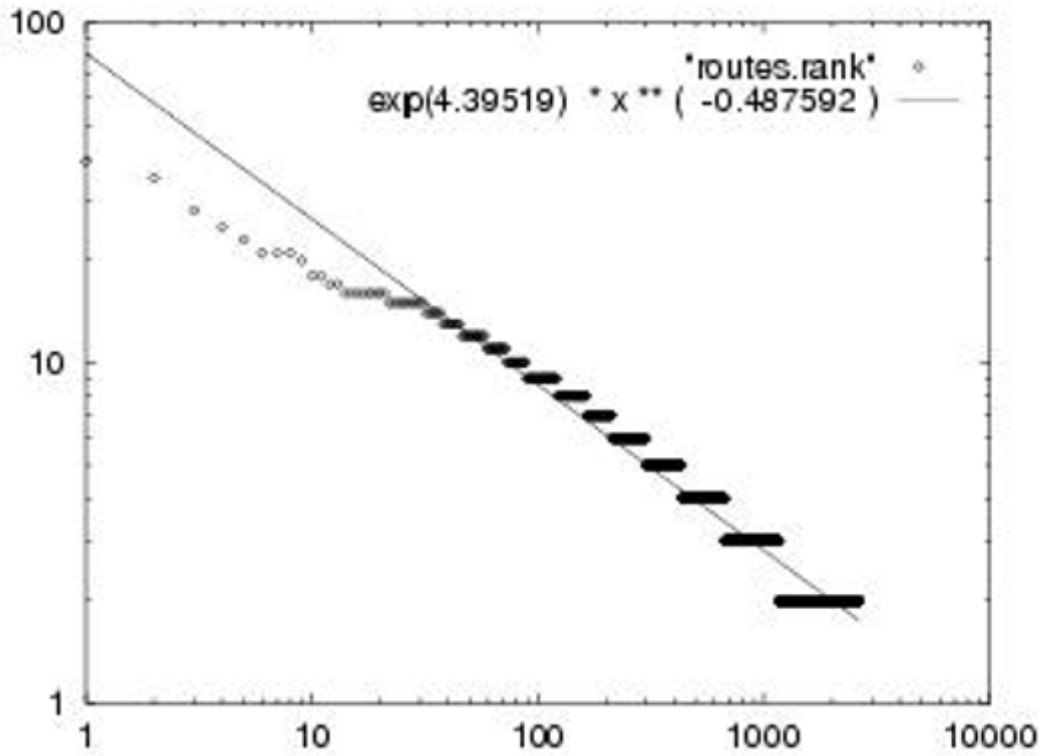


IRMT

irmT The Institute of Risk Management Tanzania

# Example: Intra-Domain Internet

- Power law exponent: c = 2.48



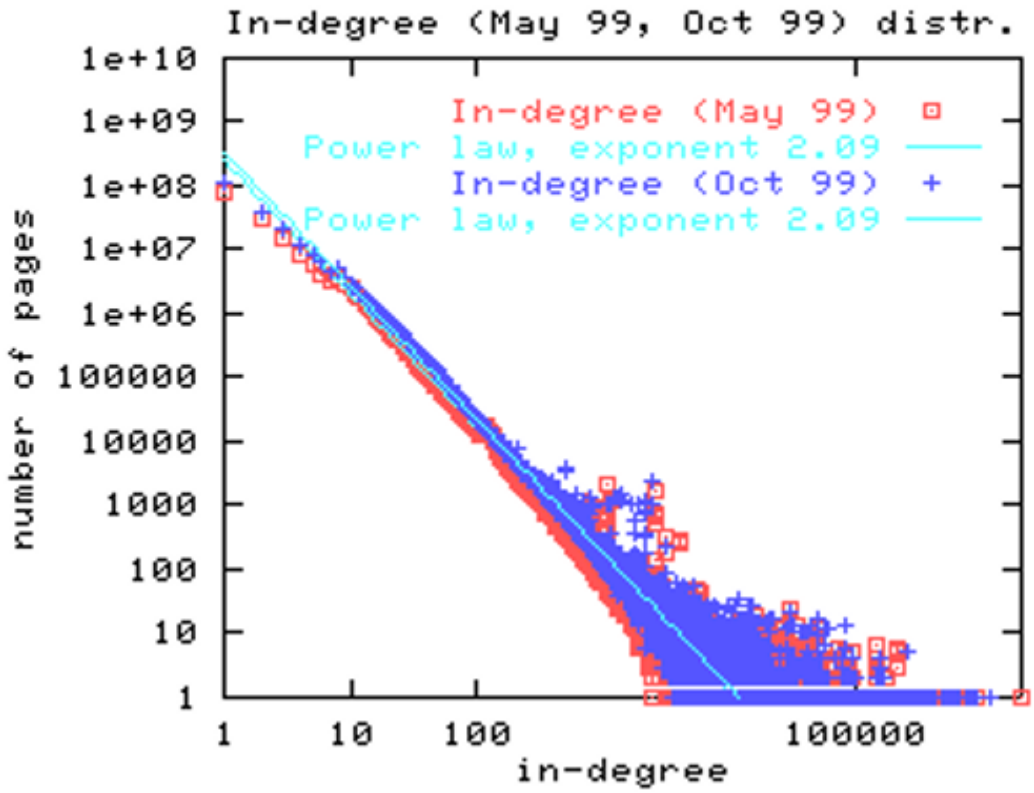



IRMT

irmT
The Institute of Risk Management Tanzania

# Example: Web Graph In-Degree

- Power law exponent: c = 2.09





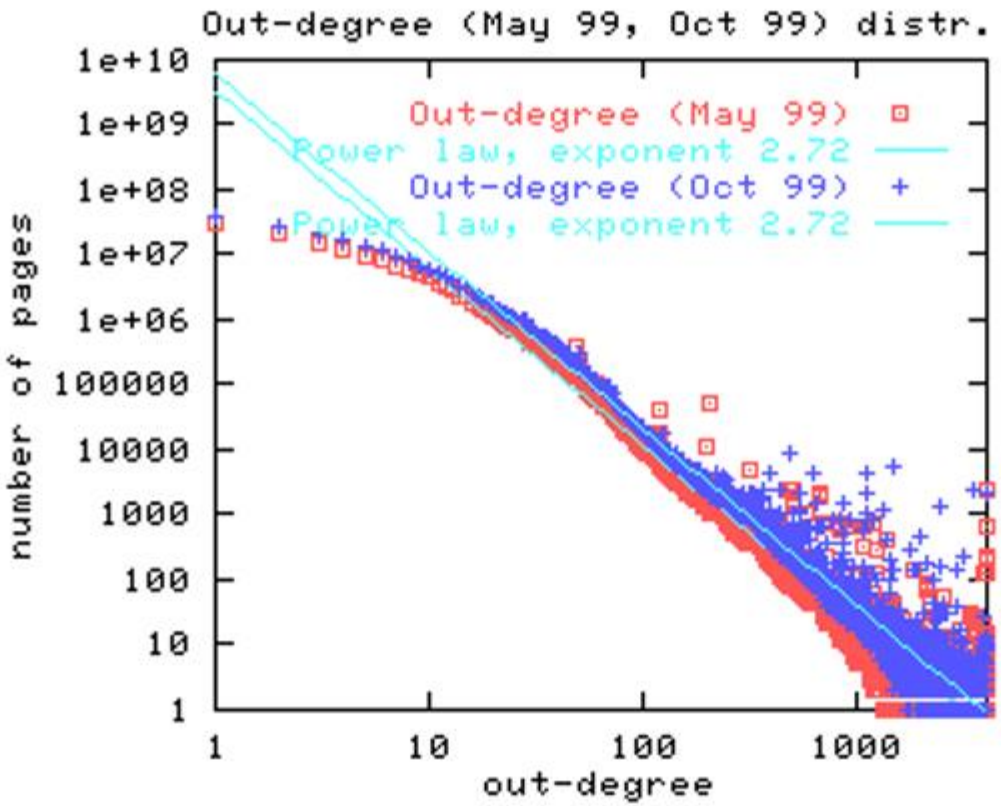


IRMT

irmT The Institute of Risk Management Tanzania

# Example: Web Graph Out-Degree

- Power law exponent: c = 2.72







IRMT

irmT The Institute of Risk Management Tanzania

# Conclusions

- It's really hard to show something is a power law.
- With high noise or few points, it's hard to show something isn't a power law.

# Exponentially Weighted Moving Average Modal

- The exponentially weighted moving average (EWMA) model is a particular case of the model in equation (10.5) where the weights, $\alpha i$, decrease exponentially as we move back through time.

- Specifically, $\alpha i+1 = \lambda \alpha i$ where $\lambda$ is a constant between zero and one. It turns out that this weighting scheme leads to a particularly simple formula for updating volatility estimates. The formula is $\sigma_n^2 = \lambda \sigma_{n-1}^2 + (1-\lambda) u_{n-1}^2$



IRMT

irmT The Institute of Risk Management Tanzania

# Exponentially Weighted Moving Average Modal

The estimate, $\sigma_n$, of the volatility for day $n$ (made at the end of day $n-1$) is calculated from $\sigma_{n-1}$ (the estimate that was made at the end of day $n-2$ of the volatility for day $n-1$) and $u_{n-1}$ (the most recent daily percentage change).

To understand why equation (10.8) corresponds to weights that decrease exponentially, we substitute for $\sigma_{n-1}^2$ to get

$$\sigma_n^2 = \lambda[\lambda\sigma_{n-2}^2 + (1-\lambda)u_{n-2}^2] + (1-\lambda)u_{n-1}^2$$

or

$$\sigma_n^2 = (1-\lambda)(u_{n-1}^2 + \lambda u_{n-2}^2) + \lambda^2\sigma_{n-2}^2$$

Substituting in a similar way for $\sigma_{n-2}^2$ gives

$$\sigma_n^2 = (1-\lambda)(u_{n-1}^2 + \lambda u_{n-2}^2 + \lambda^2 u_{n-3}^2) + \lambda^3\sigma_{n-3}^2$$

# Exponentially Weighted Moving Average Modal Cont…

Continuing in this way, we see that

$$\sigma_n^2 = (1-\lambda)\sum_{i=1}^{m}\lambda^{i-1}u_{n-i}^2 + \lambda^m\sigma_{n-m}^2$$

For a large $m$, the term $\lambda^m\sigma_{n-m}^2$ is sufficiently small to be ignored so that equation (10.8) is the same as equation (10.5) with $\alpha_i = (1-\lambda)\lambda^{i-1}$. The weights for the $u_i$ decline at rate $\lambda$ as we move back through time. Each weight is $\lambda$ times the previous weight.



IRMT

irmT The Institute of Risk Management Tanzania

# Example

Suppose that $\lambda$ is 0.90, the volatility estimated for a market variable for day $n-1$ is 1% per day, and during day $n-1$ the market variable increased by 2%. This means that $\sigma_{n-1}^2 = 0.01^2 = 0.0001$ and $u_{n-1}^2 = 0.02^2 = 0.0004$. Equation (10.8) gives

$$\sigma_n^2 = 0.9 \times 0.0001 + 0.1 \times 0.0004 = 0.00013$$

The estimate of the volatility for day $n$, $\sigma_n$, is, therefore, $\sqrt{0.00013}$ or 1.14% per day. Note that the expected value of $u_{n-1}^2$ is $\sigma_{n-1}^2$ or 0.0001. In this example, the realized value of $u_{n-1}^2$ is greater than the expected value, and as a result our volatility estimate increases. If the realized value of $u_{n-1}^2$ had been less than its expected value, our estimate of the volatility would have decreased.

# Example Cont…

The EWMA approach has the attractive feature that the data storage requirements are modest.

At any given time, we need to remember only the current estimate of the variance rate and the most recent observation on the value of the market variable.



IRMT

irmT The Institute of Risk Management Tanzania

I
R
M
T

# INSTITUTE OF RISK MANAGEMENT TANZANIA (IRMT)

## STUDENTS SUMMARY NOTES

# MODULE VI

## Basel I, Basel II, Basel II.5 Basel III and Dodd Frank Act

## CERTIFIED FINANCIAL SERVICES RISK MANAGEMENT PROFESSIONAL COURSE

### Certified Financial Services Risk Professional Examination (CFSRP)

IRMT

# MODULE VI

# Basel I, Basel II, Basel II.5 Basel III and Dodd Frank Act



IRMT

irmT The Institute of Risk Management Tanzania

# The Bank Regulatory Environment

* Outline
  * Why banks are regulated?
  * Why do banks fail?



IRMT

irmT The Institute of Risk Management Tanzania

I
R
M
T

# REGULATION: A THEORETICAL FRAMEWORK



irmT
The Institute of Risk Management Tanzania

# Objectives

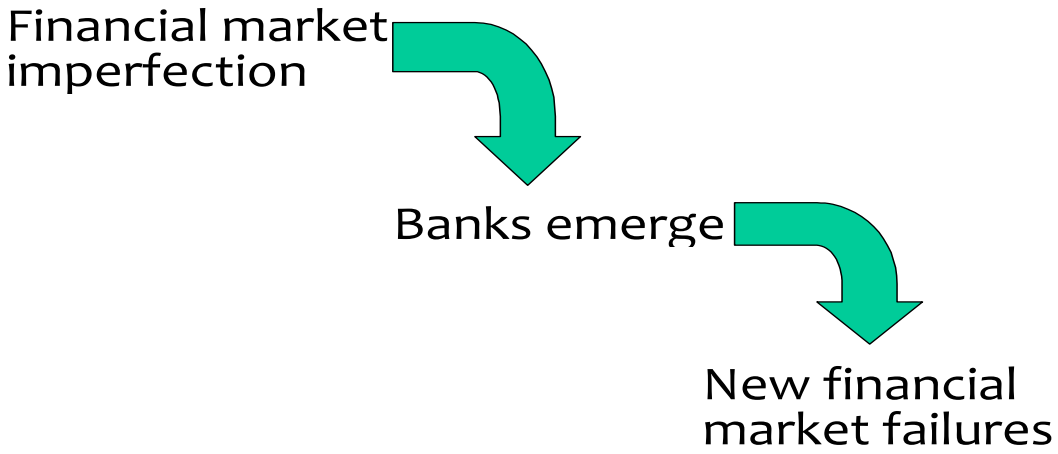
- Justify the existence of banking regulation
- Consider banking regulation within the theory of regulation
- Consider the effects adverse selection and moral hazard have on regulation

# Why Regulation?

- Regulation is the response to market failure
- The failure of financial institutions creates important externalities because
  - Affect small uninformed depositors
  - Bank failures may trigger contagion through
    - expectations
    - Connectivity (Interbank market, Payment system, OTC derivatives)

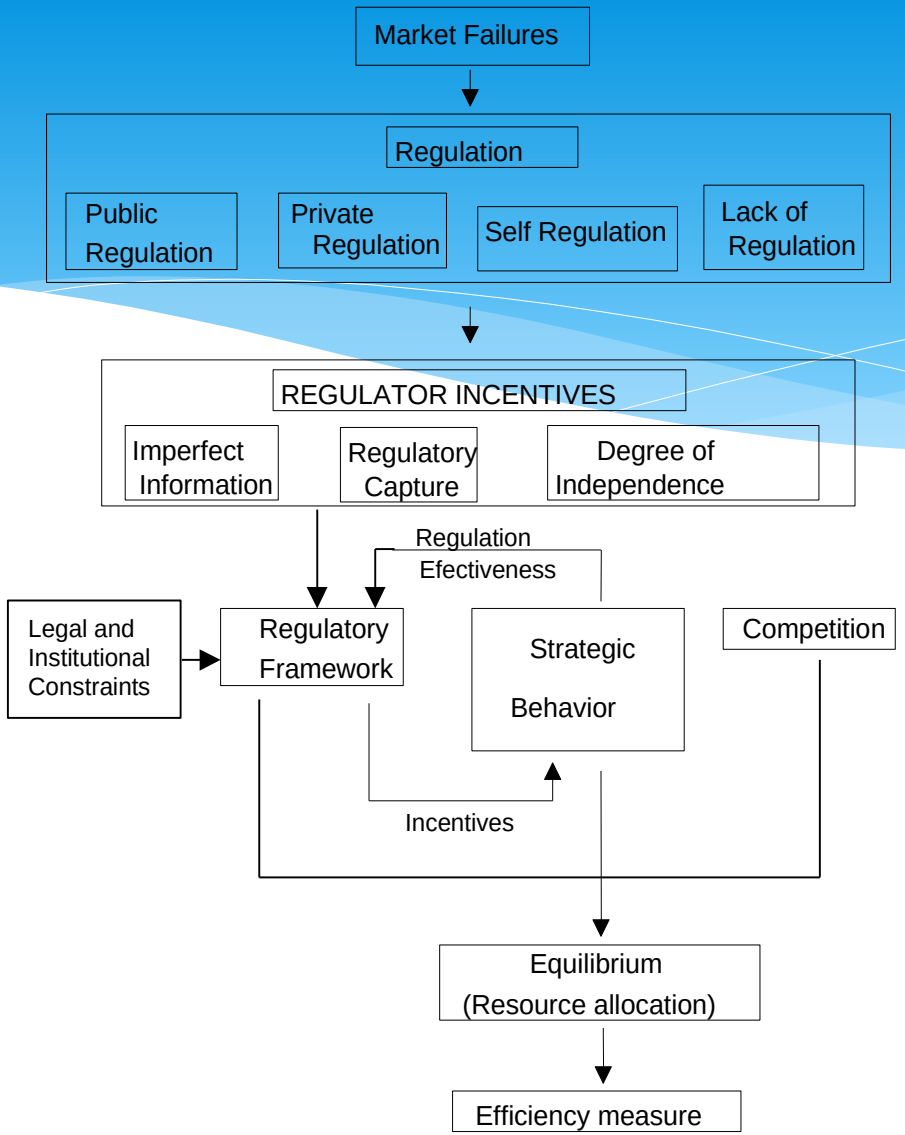
# Market Failure in the Banking Industry

* Financial intermediation and banking regulation



# Market Failures in the Banking Industry

- Monetary liquidity costs
- Social vs. Private costs of bankruptcy
- Financial stability as a public good
- The production of information
- The government distorting hand






irmT The Institute of Risk Management Tanzania

# Goals of Bank Regulation

* The risk of the whole system, or 'systemic risk', leading to preemptive actions against bank failures by the regulators, all inspired by the most important capital adequacy to risk principle.
* Promoting a level playing field, without distortions in terms of unfair competitive advantages.
* Promoting sound practices, contributing to the financial system safety.
* The regulators face several dilemmas when attempting to control risks.
* Regulation and competition conflict, since many regulations restrict the operations of banks.
* New rules may create unpredictable behaviour to turn around the associated constraints. For this reason, regulators avoid making brutal changes in the environment that would generate other uncertainties.

# Need for Regulation

- Risk taking is a normal behaviour of financial institutions, given that risk and expected return are so tightly interrelated.
- Because of the protection of bank depositors that exists in most countries, banks also benefit from 'quasi-free' insurance, since depositors cannot impose a real market discipline on banks.
- The banking system is subject to 'moral hazard': enjoying risk protection is an incentive for taking more risks because of the absence of penalties.
- Sometimes, adverse conditions are incentives to maximize risks. When banks face serious difficulties, the barriers that limit risks disappear.
- In such situations, and in the absence of aggressive behaviour, failure becomes almost unavoidable.
- By taking additional risks, banks maximize the chances of survival. The higher the risk, the wider the range of possible outcomes, including favorable ones.
- At the same time, the losses of shareholders and managers do not increase because of limited liability. In the absence of real downside risk, it becomes rational to increase risk. This is the classical attitude of a call option holder.
- He gets the upside of the bet with a limited downside. The potential for upside gain without the downside risk encourages risk taking because it maximizes the expected gains.

# Dilemmas of Regulator

- A number of factors helped stabilize the banking environment in the seventies.
- Strong and constraining regulations weighed heavily on the banks' management.
- Commercial banking meant essentially collecting resources and lending. Limited competition facilitated a fair and stable profitability.
- Concerns for the safety of the industry and the control of its money creation power were the main priorities for regulators.
- The rules limited the scope of the operations of the various credit institutions, and limited their risks as well. There were low incentives for change and competition.
- The regulators faced a safety – competition trade-off in addition to the negative side effects of risk insurance.
- In the period preceding deregulation, too many regulations segmented the banking industry, restraining competition.
- Deregulation increased competition between players unprepared by their past experiences, thereby resulting in increasing risks for the system. Reregulation aimed at setting up a regulatory framework reconciling risk control and fair competition.

# Regulation and Competition

- Regulations limit the scope of operations of the various types of financial institutions, thereby interfering directly with free competition.
- Examples of inconsistency between competition and regulations have grown more and more numerous.
- A well-known example, in the United States in the early eighties, was the unfair competition between commercial banks, subject to regulation Q, imposing a ceiling on the interest paid on deposits, and investment bankers offering money market funds through interest- earning products.
- Similar difficulties appear whenever rules enforce the segmentation of industry between those who operate in financial markets and others, savings and banking institutions, etc.
- The unfair competition stimulated the disappearance of such rules and the barriers to competition were progressively lifted.
- This old dilemma led to the deregulation of the banking industry. The seventies and the eighties were the periods of the first drastic waves of change in the industry.

# Regulation and Competition

- The disappearance of old rules created a vacancy.
- Regulators could not rely any longer on rules that segmented the industry as barriers to risk-taking behaviour.
- They started redefining new rules that could ensure the safety of the banking industry.
- BIS (Bank for International Settlements) in Basel defined these new regulations, and national regulators relayed them for implementation within the national environments.
- Deregulation drastically widened the range of products and services offered by banks. Most credit institutions diversified their operations out of their original businesses.
- More- over, the pace of creation of new products remained constantly high, especially for those acting in the financial markets, such as derivatives or futures. The active research for new market opportunities and products stimulated the growth of fields other than intermediation.

# Regulation and Competition

- Those waves of change generated risks.
- Risks increased because of new competition, product innovations, a shift from commercial banking to capital markets, increased market volatility and the disappearance of old barriers.
- This was a radical change in the banking industry.
- Lifting existing constraints stimulates new competition and increases risks and failures for those players who are less ready to enter new businesses.
- Deregulation implies that players can freely enter new markets.
- The process necessitates an orderly and gradual progress to avoid bank management disruption.
- Value-added services, such as advisory, structured transactions, asset acquisition, Leveraged Buy-Out (LBO), project finance, securitization of mortgages and credit card debts, derivatives and off-balance sheet operations, developed at a rapid pace.
- The banks entered new business fields and faced new risks. The market share of bank lending decreased with the development of capital markets and the competition within existing market shares rose abruptly.

# Regulation and Competition

- Risk control is pre-emptive, while insurance is passive, after the fact.
- The regulatory framework aims at making it an obligation to have a capital level matching risks.
- This is a pre-emptive policy.
- However, after the fact, there is still a need to limit the consequences of failures. Losses of depositors are the old consequences of bank failures.
- The consequences of bank failures are that they potentially trigger systemic risk, because of banks' interdependencies, such as the recent LTCM collapse.
- This is still an ongoing process, notably in the United States and Japan, where the Glass – Steagall Act and the Article 65 enforced a separation between commercial banking and the capital markets.
- For those countries where universal banking exists, the transition is less drastic, but leads to a significant restructuring of the industry. It is not surprising that risk management has emerged with such strong force at the time of these waves of transformations

# Regulation and Competition

- Any rule that limits the adverse consequences of risk-taking behaviour is an incentive for risk taking rather than risk reduction.
- Regulators need to minimize adverse effects of failures for the whole system without at the same time encouraging the risk-taking behaviour.
- The ideal solution would be to control the risks without insuring them.
- In practice, there is no such ideal solution.
- The deposit insurance scheme protects depositors against bank failures.
- Nevertheless, it does generate the adverse side effect of encour aging risk taking.
- Hence, there is a need for after- the-fact regulatory action.
- If such actions rely on an insurance-like scheme, such as the insurance deposit scheme, it can foster risk-taking behaviour.
- Until reregulation through capital changes came into force, old regulations created insurance-based incentives for taking risks.

# Regulation and Competition

- Theoretically, depositors should monitor the bank behaviour, just as any lender does. In practice, if depositors' money were at risk, the functioning of the banking system would greatly deteriorate.
- Any sign of increased risks would trigger withdrawals of funds that would maximize the difficulties, possibly leading to failures. Such an adverse effect alone is a good reason to insure depositors, at least largely, against bank failure.
- The new regulation focuses on pre-emptive (ex ante) actions, while still enforcing after-the-fact (ex post) corrective actions.

# The Three Pillars of Basel II

- Capital
- Supervision
- Market Discipline

# The Safety Net

- Deposit insurance
- Capital requirements
- Lender of last resort
- Bail-out policy and bank closure

# Deposit Insurance

- Deposit insurance as a put option (Merton)
  - Option pricing and risk related premia
  - Are insurance premia fairly priced?
  - What effect of bank closure policy: callable put option

# Deposit Insurance (II)

- The adverse selection issue
- The moral hazard issue
  - Flat deposit premia
  - Unobservable risk
- Unobservable risk and mechanism design



IRMT

irmT The Institute of Risk Management Tanzania

# Solvency Regulation: CAPM

- Consider the CAPM approach to banks optimal portfolio strategy.
- Mean - Variance set up
- Risk averse bankers
- Banks are price takers and chose the proportion of their wealth to be invested on assets (if positive) and on liabilities (if negative)

# Solvency Regulation: Application

- Application to regulation: Impact of Capital requirements
- Kim and Santomero (1988) showed that if the coefficients on each asset are not proportional to its risk (beta), the bank will choose an inefficient portfolio. In an example they show the probability of failure could increase!

# The Incomplete Contract Approach to bank closure

- Dewatripont - Tirole (1993)
- At date *t=0* the contract is signed and the manager chooses her level of effort.
- Her incentives depend upon how effort affect her probability of continuing running the bank.
- At date *t=1* a first repayment v(1) is obtained and a signal *u* is observed about the banks value at time 2, v(2)
- At date 2 the liquidation value v(2) is observed.
- The regulator has to choose either to close down the bank or to allow continuation.
- For a given level of effort, signals v(1) and u are independent. Still higher effort will increase the probability of reaching a higher value for both v(1) and v(2).

# Optimal Decision in a Full Information Set Up:

* close the bank down if :

$$u < \underline{u}$$



IRMT

irmT The Institute of Risk Management Tanzania

# Second Best Decision

- The regulation has to provide incentives to exert a high level of effort.
- Since a higher level of effort affects both v(1) and *u* the optimal decision will depend on both.
- Notice: commitment is crucial



IRMT

irmT The Institute of Risk Management Tanzania

# Bank Monitoring and Closure Policy

- Who should be in charge of closing down banks?
  - Deposit Insurance Company?(private or public?)
  - Central Bank?
- The credibility issue (Maliath and Mester)

# Market Discipline1: Free banking

* The Scottish and US experience
* Could the Modigliani-Miller theorem justify free banking? (Fama 1980)
* What's different about banks?
  * Their creditors are their customers (discipline)
  * Their securities are used in the payment system (transaction costs)

# Market Discipline II

- The subordinate debt proposal
- Defining market discipline
  - Ex ante effects
  - Interim effects
    - Chari and Jagganathan(1987)
    - Calomiris and Kahn(1991)
- Empirical evidence
  - Does the market price of subordinated debt react to an increase in risk?
  - Do debt spreads contain relevant information?
  - Does subordinated debt implement market discipline (interim effects)

# Some Standard Regulatory Instruments

- Deposit rate regulation (obsolete)
- Entry, branching, network and merger restrictions (network and merger restrictions can be justified)
- Portfolio restrictions (Glass-Steagall)

# Introduction to Basel Accord

- The Bank for International Settlements (BIS) was created in 1929-30 to act as a global entity to foster world-wide financial and monetary collaboration, and to act as banker to central banks
- But by the end of the Second World War, institutions like the World Bank and the International Monetary Fund were established under the Brenton Wood system of July 1944, and the BIS was deemed to be irrelevant
- Though the Brenton Wood system failed, The Bank for International Settlements (BIS) still exists today)
- During the late 1960s and early 1970s the Brenton Wood system (based on fixed exchange rates) started unraveling.

# Introduction to Basel Accord

- The June 1974 suspension of the banking license of Bankhaus Herstatt (German bank), and the October 1974 closing of Franklin National Bank of New York due to massive foreign exchange losses, was a wake-up call for G-10 nations to take a fresh look at disruptions to international financial markets.

- In January of 1975, G-10 central bank governors met in Basel, Switzerland, and established a Committee on Banking Regulations and Supervisory Practices to enhance cooperation on banking supervisory challenges, and to exchange know-how on improved banking supervision globally

# Introduction to Basel Accord

- The Committee aims to meet its mission by:
  - setting minimum supervisory standards
  - improving the effectiveness of techniques for supervising international banking business; and
  - exchanging information on national supervisory arrangements.

- The group was later renamed to "Basel Committee on Banking Supervision" or BCBS in recognition of the town where it was first conceived, and is comprised of nearly 27 regulatory bodies from countries around the globe.

# Introduction to Basel Accord

- The Basel Committee has two main reasons for proposing its Basel framework:
  - to strengthen international banking by boosting their capital requirements
  - to remove inter-country competitive inequalities amongst G-10 banking institutions
  - When Basel I was effected back in 1988, the world was a rather simple place to conduct financial transactions.

- And though Basel I was a simplistic effort to regulate the financial marketplace, it did bear fruit.
  - Banks, which were previously undercapitalized, responded by improving their capital ratios in order to comply with Basel I.

# Introduction to Basel Accord

- In 1988, the average ratio of capital to risk-weighted assets of key banks in the G-10 stood at 9.3%. By 1996, this rate had gone up to 11.2%.
- More importantly though, Basel I introduced a standardized definition of capital adequacy globally, and heightened awareness of prudent capital management across the financial industry.
- Financial experts were quick to see through the loopholes and deficiencies in Basel I

# Introduction to Basel Accord

- Critics felt that something more than just Capital Ratios was needed to assess the true risk potential of a bank.
  - Basel I focused on key financial risk metrics, it completely ignored the need for a robust risk management process.
    - Enter Basel 2 (II).
  - Basel II, initially, as well as subsequently through enhancements under Basel 2.5, took a much broader view of risks in the financial industry such as:
    - Its scope was applicable to international banking on a consolidated basis (as opposed to a limited country or regional view)
    - It excluded insurance activity from the purview of "financial activity"
- It set aside a banks' investments in other commercial entities while calculating risk thresholds

# Basel II- 3 Pillars

* Basel II broadened the focus of risk assessment and management by enforcing a 3-pillar approach in the capital accord, these included:
  * **Pillar 1: Minimum Capital Requirements.** Banks were required to maintain a designated acceptable capital level. It also enhanced its approach to assessing both Credit and Operational Risks.
  * **Pillar 2: Supervisory Review Process.** Banks were required to assess their solvency in light of their risk profile. Additional supervisory oversight was introduced on how banks calculated their capital requirements, and regulators are now able to intervene well before those capital levels start to deteriorate.
  * **Pillar 3: Market Discipline.** This pillar enforces enhanced levels of disclosures by the bank, especially around their risk profiles, their capital structures, their risk management and measurement practices, and their capital adequacy.

# Basel II.5

The 4 major enhancements to Basel II, as delivered in Basel II.5, include:

* a deviation from a Value At Risk (VaR) -based capital requirement of Basel II, into a **Stressed Value At Risk (SVaR) model** through Basel II.5
* an attempt at capturing credit margin and default risks by introducing the **Incremental Risk Charge (IRC)**
* a set of new charges for securitization/re-securitization of banks' positions
* introduction of a new measure to correlate trading positions, known as the **Comprehensive Risk Measure (CRM)**, which assesses the underlying exposures for default and migration risks

# Basel II.5

In general, these new enhancements in Basel 2.5 only enhanced the measures already enforced via Basel II.

According to Standards & Poor's research:
*"The new regulatory measures are already significantly Increasing capital charges on traded risks, particularly for large international banks"*
This should further help de-risk existing capital markets by discouraging risky behavior.

* Subsequently, Basel II was further fortified, albeit as a temporary measure until a more robust (Basel 3) accord was reached. With the introduction of the Basel 2.5 enhancements to Basel 2, several shortcomings in the Basel 2 framework were addressed.
* However, the fundamental guiding principles of the 3 pillars remain largely intact.
  * Basel 2.5 does, however, introduced tougher regulations that mandated banks to hold larger amounts of capital against the market risks they ran in their trading operations.

# Basel II.5 and 2008/09 Meltdown

- Basel 2, and its associated Basel 2.5 enhancements, were harshly criticized for not doing enough to stave off the financial crisis of 2008.
- It was felt that the average levels of capital requirements enforced were inadequate, and that the assessment of credit risks was improperly delegated to inappropriate (non-banking) institutions.
- Furthermore, Basel II and Basel II.5 were criticized for making assumptions that the internal models used by banks, to measure risk exposure, were superior to those which external (supervisory) agencies could have implemented.
- The framework was also seen as providing an incentive to banking intermediaries to "hide" (deconsolidate) risky exposures from the banks' balance sheets.

# Basel III

- In wake of the 2008 financial meltdown, despite implementation of Basel II and Basel II.5, the Basel Committee decided that more needed to be done to foster transparency and accountability within international banking.

- The Committee felt that, to fend off another similar crisis, amongst other steps, more supervision and control was needed over how banks reported "Tier 1" capital.

# Basel III

- Basel 3 set itself three major aims:
  - to make participating banks strong enough to withstand future financial shocks (similar to the 2008/09 crises) without causing contagion to other economies/sectors
  - to enforce greater risk management within all aspects (including operational) of the financial industry
  - to strengthen the financial industries' transparency, governance, and disclosure practices
- Under Basel 3, banks would be mandated to maintain healthier amounts of "true" capital.
- The way that the Committee did this was to have banks exclude the use of Preferred Equity and other hybrid capital instruments from the calculation of "Tier 1" capital reserves.

# Basel III

- Basel III focused on:
  - stress testing
  - practices governing "fair value" assessment
  - executive compensation/remuneration practices
  - stronger corporate governance
  - scrutiny over "large exposures"
  - increased oversight of "concentration risk"
  - While some of these protocols existed in previous Basel accords, they have been updated and strengthened in Basel III.

Others, like stress testing requirements, are not new and are in direct response to the 2008 crisis.

# Challenges of Basel III

* When the initial Basel III guidelines were published in 2010, the world (especially regulators, investors, and consumers of financial products and services) waited in great anticipation for its January 2013 implementation.
* However, industry lobby groups and other parties-at-interest (and at "disinterest") continued to make representations to the Basel Committee for updates and changes to the accord.
* US banking lobbyists pushed back hard to have the liquidity restrictions on its members relaxed.
* They contended that in the three years since the initial draft was published, most US banks had already done a lot to improve their liquidity (Tier 1 capital) ratios – even before Basel III implementation kicked in.

# Challenges of Basel III

- However, observers were quick to point out that was not the case. They pointed out that:
  - *"American banks were only able to raise their holdings of liquid assets by $700bn, less than half the $1.5trn identified as target at the end of 2010."*
  - When January 2013 finally rolled around, the Basel Committee released a newly-updated accord, which observers felt had "*…watered-down some of its most important requirements…*"
- To the disappointment of many a financial watchdog, the implementation timelines of Basel III, as envisioned in the original draft, were also significantly relaxed in the final version of the proposal.
  - Critics of Basel III believe that this third kick at the can is doomed to fail, just as the previous two-and-a-half kicks have failed.

# Challenges of Basel III

- And one key reason why this could happen is because of how Basel III deals with the calculation of risk. In the words of one critic:
  - *"The most serious failure in Basel III is that it doesn't address the principal contribution of Basel II to the last financial crisis, namely, the calculation of risk-weights.*

- Because it doesn't really change the risk-weighting, Basel III doesn't force banks to increase the amount of capital they must hold against some of the higher-risk assets they do hold. In that sense, Basel III simply reinforces Basel II – under whose watch the 2008 crises took place.

# Challenges of Basel III

* Overall however, both Basel 2.5 and Basel 3 have:
  * made it costlier for banks to indulge in riskier behavior
  * made it more difficult (due to new oversight and stringent restrictions) for financial institutions to take unwanted risks
  * provided a more robust early-warning system to detect and prevent many financial disasters from happening

# Future of Basel III

- The full implementation of Basel III is not likely to be finalized (globally) until 2019, subject to local (country-specific) phase-in requirements

- For instance, based on a report from the Congressional Research Service, the implementation of key Basel III framework proposals in the US were harmonized to work in tandem with other U.S legislation, specifically the Dodd-Frank Act

# Future of Basel III

## Basel III Phase- in Arrangements

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|---|---|
| Leverage ratio | Supervisory monitoring | | Parallel run 1 Jan 2013 – 1 Jan 2017. Disclosure from 1.1.2015 | | | | | To Pillar 1 | |
| Min. common equity ratio | | | 3.5% | 4.0% | 4.5% | 4.5% | 4.5% | 4.5% | 4.5% |
| Capital conservation buffer | | | | | | 0.625 | 1.25 | 1.875 | 2.50 |
| Min. common equity plus capital conservation buffer | | | 3.5 | 4.0 | 4.5 | 5.125 | 5.75 | 6.375 | 7.0 |
| Phase-in of deduction from CET1 | | | | 20 | 40 | 60 | 80 | 100 | 100 |
| Minimum Tier 1 Capital | | | 4.5 | 5.5 | 6.0 | 6.0 | 6.0 | 6.0 | 6.0 |
| Minimum Total Capital | | | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 | 8.0 |
| Minimum total capital plus conservation buffer | | | 8.0 | 8.0 | 8.0 | 8.625 | 9.25 | 9.875 | 10.5 |
| Liquidity coverage ratio | A | | | | B | | | | |
| Net stable funding ratio | | A | | | | | | B | |
| *A -> Observation period begins* | | | | | | | | | |
| *B -> Introduce minimum standard* | | | | | | | | | |

Source: Leonard Chumo - Strathmore University GARP Chapter Meeting, 14thJanuary 2011

I R M T

irmT The Institute of Risk Management Tanzania

# Future of Basel III

* Given how interconnected today's global financial institutions are, and how quickly "contagion" from one country can spread to another's financial system, a lot could happen between now and 2019.
* As the milestone dates for implementing key Basel III proposals tick by, the Basel Committee will continue to monitor its implementation, through its Regulatory Consistency Assessment Program (RCAP), as will other member, central bankers.
* It is very conceivable that, in the event of yet another financial crisis of major proportion, the world could very well see a Basel III.5 come forth from the Basel Committee.

IRMT

irmT
The Institute of Risk Management Tanzania

# Summary of Basel Accord

- Basel I was a rather simplistic, first significant attempt, in a post-World War era, of reigning in the potential of large banking/financial institutions from causing chaos to global economies. Basel II, which was released in 2004, used a 3-pillar approach to enhance risk measurement and assess operational risks of those financial institutions.
- With Basel II.5 enhancements in 2009, came even greater measurements of risks with respect to securitization, as well as more oversight on a bank's trading book exposures.
- The most recent Basel accord (III), agreed in December 2010, sets about introducing a new global liquidity framework.

# Summary of Basel Accord

- Basel 3 was altered in November 2011, January 2013, and January 2014, to address several concerns that member states and business representation bodies raised.
- While Basel 3 has already started to be implemented, various aspects of the new accord will be subject to "transitional and phase-in arrangements."
- As the Basel accord currently stands, full implementation is not scheduled to occur until January 2019.

# Dodd Frank Act

- During the fall of 2008, the so-called "best of times" started catching up with those that lived it.
  - America faced a financial crisis of epic proportion that resulted in millions of lost jobs, and trillions of dollars in lost personal and corporate wealth.
- The cause was a financial environment that:
  - was antiquated and fragmented
  - faced a broken regulatory system
  - had little or no oversight
  - relied excessively on fine print and hidden fees

# Dodd Frank Act Cont…

- The immediate result of living the "best of times" to their fullest, totally unchecked and barely regulated, was a slew of failed corporations and financial institutions.
- There was a liquidity crisis that was so severe that financial institutions refused to lend to each other, lest the borrowing institution defaulted on their obligations.
- Corporate creditors and ordinary borrowers found it extremely difficult to secure financing and lines of credit from banks and mortgage companies.
- To immediately halt a ripple effect from destabilizing the country's entire economy, Congress passed the Emergency Economic Stabilization Act of 2008 (EESA) which, through the Troubled Asset Relief Program (TARP) enacted on Oct. 3, 2008, empowered the Treasury to acquire up to $700 billion of mortgage-backed securities and a variety of other assets from a number of "troubled" institutions.

# Dodd Frank Act Cont…

- This was a time when, amongst other high-profile activities:
  - Lehman Brothers went bust, and had to seek Chapter 11 bankruptcy protection
  - JP Morgan Chase took over control of the failing Bear Sterns
  - American International Group (AIG) lending division was "bailed out" using Federal funding
  - AIG's credit default swap division received bailout funding
  - Companies such as General Motors and Citigroup needed use of TARP funds for bail out
  - The Federal government engineered the takeover of troubled mortgage lenders Freddie Mac and Fannie Mae
  - The primary objective of TARP was to prevent contagion of the crisis by injecting funds to restore liquidity into the financial markets.
  - Unless something like TARP was implemented quickly, confidence (domestic and international) in America's financial institutions could wane, ultimately leading to even deeper, unresolved issues.

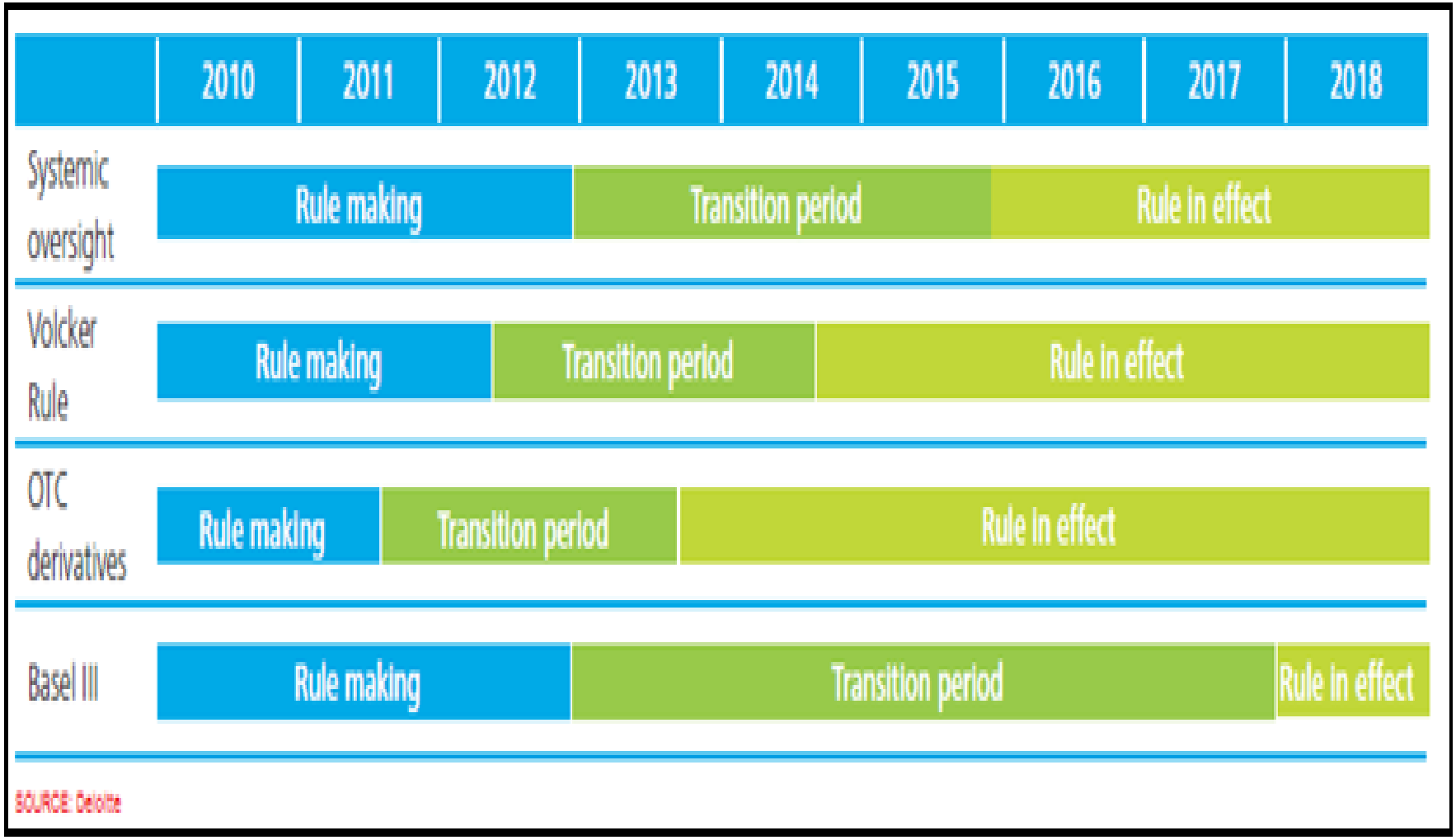
# Dodd Frank Act Cont…

- While the 2008 initiatives, such as the Emergency Economic Stabilization Act and TARP, were reactive responses to deal with an ever-deepening financial crisis, they were by no means considered comprehensive enough to prevent the same situation from repeating itself.
- A more systemic review of the crisis revealed that far deeper reform of the entire financial system was needed to address the underlying causes of the 2008 crisis.
- On March 15, 2010, Senator Christopher J. Dodd (D-CT) introduced a bill in the Senate, which was passed approximately two months later, on May 2010. U.S. Representative Barney Frank (D-MA) revised the bill, which then received House approval on June 30, 2010.
- In tribute to the efforts of these two lawmakers to reform the ailing financial industry, the bill was named the Dodd-Frank Wall Street Reform Act.
- The Act became law on July 21, 2010, when President Obama signed and made it the law of the land.

# SUMMARY DODD-FRANK SUMMARY-2319 pgs "The Dodd-Frank Act has been dubbed the "Wall Street Reform Act."

* Introduces greater supervision and oversight of financial institutions
* provides a formal framework for dealing with financial companies that may be "too big to fail"
* introduces stricter regulations around capital requirements for banks and other lending agencies
* enforces stringent regulation of over the counter (OTC) derivatives
* creates a new agency tasked with governing consumer finance and protecting retail customers of financial institutions (banks, insurance companies, mortgage brokers, credit card companies)
* regulates credit rating agencies (such as Standard & Poors, Moody's and Fitch)
* introduces tighter control and transparency over corporate governance, specifically with respect to executive compensation
* bars banking institutions from involvement in specific investment activities, while limiting their relationship with hedge funds
* mandates certain private fund advisory companies to provide additional disclosures about their relationships with clients, while also requiring them to register with the government

# Dodd Frank Act Implementation Timeline




I R M T

irmT
The Institute of Risk Management Tanzania

# Dodd Frank Act Implementation Timeline

- While it is estimated that full implementation will not happen until 2018, some experts believe that even that timeline is far too ambitious, and here's why:
  - The Act was conceived and approved in 2010, which is a "long time ago" when speaking in financial industry terms.
  - Parts of the Act will come (and some have already come) on-stream in installments. As the intended targets (banks, hedge funds, credit rating agencies) of those provisions feel the full impact of those laws, they will likely modify their "behavior."
  - The impact of those modified behaviors could potentially trigger a review of parts of Dodd-Frank that have already been implemented, as well as those yet to be implemented.
  - Such reviews inevitably result in legislative provisions either needing to be dropped, updated, or re-written altogether.
  - If that happens, the 2018 target date might be pushed out further.

# Dodd-Frank Titles

- The Act has been set out over 16 Titles, each dealing with specific aspects of the financial industry that need regulatory overhaul following the 2008 financial crisis.
- Dodd Frank Titles
  - Title I - Financial Stability—Systemic Risk Regulation and Oversight
  - Title II—Orderly Liquidation Authority for Systemic Risk Companies
  - Title III—Transfer of OTS Authority to OCC, FDIC, Federal Reserve
  - Title IV—Regulation of Advisors to Hedge Funds and Others
  - Title V—Insurance
  - Title VI—Improvements to Regulation of Bank and Savings Association
  - Title VII—Swaps and Derivatives Regulation (Wall Street Transparency and Accountability)
  - Title VIII—Payment, Clearing, and Settlement Supervision

# Dodd-Frank Titles Cont…

* Title IX—Investor Protections and Improvements to the Regulation of Securities
* Title X—Bureau of Consumer Financial Protection
* Title XI—Federal Reserve System Provisions (Lending Authority, Reserve Bank Governance)
* Title XII—Improving Access to Mainstream Financial Institutions
* Title XIII—Pay It Back Act
* Title XIV—Mortgage Reform and Anti-Predatory Lending Act
* Title XV—Miscellaneous Provisions
* Title XVI —Section 1256 Contracts

# Solvency II

- There are no international standards for the regulation of insurance companies
- In US, insurance companies are regulated at the state level with some from Federal Insurance office and National Association of Insurance Commissioners
- In Europe, the regulation of insurance companies is handles by the European Union
- The long standing regulatory framework in EU, known as Solvency is in the process of being replaced by Solvency II
- The quantitative impact studies shows that Solvency II will be implemented in all EU countries including UK in 2016
- Solvency I calculates capital only for underwriting risk, Solvency II will consider investment risk and operational risks as well

# Solvency II

- Solvency II has similarities to Basel II
- There are three pillars
  - Pillar I is concerned with calculation of capital requirements and the types of capital that are eligible
  - Pillar II is concerned with the supervisory review process
  - Pillar III is concerned with the disclosure risk management information to the market
- The three pillars are therefore analogous to the three pillars of Basel II

# Solvency II

- Pillar 1 of Solvency II specifies a *minimum capital requirement* (MCR) and a *solvency capital requirement* (SCR)
- If its capital falls below the SCR level, an insurance company should, at minimum, deliver to the supervisor a plan to restore capital to above the SCR level
- The supervisor might require the insurance company to take particular measures to correct the situation
- The MCR is regarded as an absolute minimum level of capital. If capital drops below the MCR level, supervisors may prevent the insurance company from taking new business
- It might force the insurance company into liquidation, transferring its policies to another company. The MCR will typically be between 25% and 45% of the SCR

# Solvency II

- There are two ways to calculate the SCR:
  - the standardized approach and
  - the internal models approach.
  - The internal models approach involves a VaR calculation with a one-year time horizon and a 99.5% confidence limit. (The confidence level is therefore less than the 99.9% confidence level used in Pillar 1 of Basel II.) Longer time horizons with lower confidence levels are also allowed when the protection provided is considered equivalent. The SCR involves a capital charge for investment risk, underwriting risk, and operational risk.
- Investment risk is subdivided into
  - market risk and
  - credit risk.
- Underwriting risk is subdivided into
  - risk arising from life insurance,
  - non-life insurance (i.e., property and casualty), and health insurance.
- Capital should be adequate to deal with large adverse events.

I
R
M
T

# Basel I to Basel III
# A Journey of Risk Management



irmT
The Institute of Risk Management Tanzania

# Basel I to Basel III
# A journey of Risk Management

I
R
M
T

* This part starts by reviewing the evolution of bank regulation between the 1980s and 2000. It explains the 1988 Basel Accord (now known as Basel I), netting provisions, and the 1996 Amendment. It then moves on to discuss Basel II, which is a major overhaul of the regulations and was implemented by many banks throughout the world in about 2007.

* Finally, it reviews Solvency II, a new regulatory framework for insurance companies, which is broadly similar to Basel II and is expected to be implemented by the European Union in 2016

irmT
The Institute of Risk Management Tanzania

# Basel I to Basel III
# A Journey of Risk Management

IRMT

* This part starts by reviewing the evolution of bank regulation between the 1980s and 2000. It explains the 1988 Basel Accord (now known as Basel I), netting provisions, and the 1996 Amendment. It then moves on to discuss Basel II, which is a major overhaul of the regulations and was implemented by many banks throughout the world in about 2007.

* Finally, it reviews Solvency II, a new regulatory framework for insurance companies, which is broadly similar to Basel II and is expected to be implemented by the European Union in 2016

# Reasons for Regulating Banks

* The main purpose of bank regulation is to ensure that a bank keeps enough capital for the risks it takes.
* It is not possible to eliminate altogether the possibility of a bank failing, but governments want to make the probability of default for any given bank very small.
* By doing this, they hope to create a stable economic environment where private individuals and businesses have confidence in the banking system

# Food for Thought

"Bank regulation is unnecessary. Even if there were no regulations, banks would manage their risks prudently and would strive to keep a level of capital that is commensurate with the risks they are taking."

*Discuss in context of historical changes*

# Reasons for Regulating Banks

* Governments provide deposit insurance programs to protect depositors. Without deposit insurance, banks that took excessive risks relative to their capital base would find it difficult to attract deposits.
* However, the impact of deposit insurance is to create an environment where depositors are less discriminating.
* A bank can take large risks without losing its deposit

# Systematic Risk

## Systemic Risk

Systemic risk is the risk that a default by one financial institution will create a "ripple effect" that leads to defaults by other financial institutions and threatens the stability of the financial system. There are huge numbers of over-the-counter transactions between banks. If Bank A fails, Bank B may take a huge loss on the transactions it has with Bank A. This in turn could lead to Bank B failing. Bank C that has many outstanding transactions with both Bank A and Bank B might then take a large loss and experience severe financial difficulties; and so on.

The financial system has survived defaults such as Drexel in 1990, Barings in 1995, and Lehman Brothers in 2008 very well, but regulators continue to be concerned. During the market turmoil of 2007 and 2008, many large financial institutions were bailed out, rather than being allowed to fail, because governments were concerned about systemic risk.

# Systemic Risk

* A major concern of governments is what is known as *systemic risk*.
* This is the risk that a failure by a large bank will lead to failures by other large banks and a collapse of the financial system
* When a bank or other large financial institution does get into financial difficulties, governments have a difficult decision to make. If they allow the financial institution to fail, they are putting the financial system at risk. If they bail out the financial institution, they are sending the wrong signals to the market
* There is a danger that large financial institutions will be less vigilant in controlling risks if they know that they are "too big to fail" and the government will always bail them out.

IRMT

irmT
The Institute of Risk Management Tanzania

# Should Government Bail Out?

* During the market turmoil of 2007 and 2008, the decision was taken to bail out many large financial institutions in the United States and Europe.
* However, Lehman Brothers was allowed to fail in September, 2008. Possibly, the United States government wanted to make it clear to the market that bailouts for large financial institutions were not automatic.
* However, the decision to let Lehman Brothers fail has been criticized because arguably it made the credit crisis worse.

# Bank Regulation History

- Prior to 1988, bank regulators within a country tended to regulate bank capital by setting minimum levels for the ratio of capital to total assets.
- However, definitions of capital and the ratios considered acceptable varied from country to country.
  - Countries with weak capital regulations considered as competitive edge
  - Huge exposures created loans for major international banks to less developed countries such as Mexico, Brazil and Argentina
  - Lead to accounting games in the exposures leading to questions on adequacy of capital levels
  - The over-the-counter derivatives market for products such as interest rate swaps, currency swaps, and foreign exchange options was growing fast
- It became apparent to regulators that the value of total assets was no longer a good indicator of the total risks being taken.
- A more sophisticated approach than that of setting minimum levels for the ratio of capital to total balance-sheet assets was needed.

IRMT

irmT
The Institute of Risk Management Tanzania

# Basel Committee

- The Basel Committee was formed in 1974
- The committee consisted of representatives from Belgium, Canada, France, Germany, Italy, Japan, Luxembourg, the Netherlands, Sweden, Switzerland, the United Kingdom, and the United States
- It met regularly in Basel, Switzerland, under the patronage of the Bank for International Settlements
- The first major result of these meetings was a document entitled "International Convergence of Capital Measurement and Capital Standards."
- This was referred to as "The 1988 BIS Accord" or just "The Accord." Later it became known as Basel I.

IRMT

irmT
The Institute of Risk Management Tanzania

# BIS Accord

- The 1988 BIS Accord was the first attempt to set international risk-based standards for capital adequacy
- It has been subject to much criticism as being too simple and somewhat arbitrary
- The key innovation in the 1988 Accord was the Cooke ratio *(The ratio is named after Peter Cooke from the Bank of England)*
- The Cooke ratio considers credit risk exposures that are both on-balance-sheet and off-balance-sheet. It is based on what is known as the bank's total *risk-weighted assets* (also sometimes referred to as the *risk-weighted amount*)
- This is a measure of the bank's total credit exposure

IRMT

irmT
The Institute of Risk Management Tanzania

# BIS Accord

**TABLE 15.1** Risk Weights for On-Balance-Sheet Items

| Risk Weight (%) | Asset Category |
|---|---|
| 0 | Cash, gold bullion, claims on OECD governments such as Treasury bonds or insured residential mortgages |
| 20 | Claims on OECD banks and OECD public sector entities such as securities issued by U.S. government agencies or claims on municipalities |
| 50 | Uninsured residential mortgage loans |
| 100 | All other claims such as corporate bonds and less-developed country debt, claims on non-OECD banks |

Credit risk exposures can be divided into three categories:

1. Those arising from on-balance sheet assets (excluding derivatives)
2. Those arising for off-balance sheet items (excluding derivatives)
3. Those arising from over-the-counter derivatives

# Example

Consider the first category. Each on-balance-sheet asset is assigned a risk weight reflecting its credit risk. A sample of the risk weights specified in the Accord is shown in Table 15.1. Cash and securities issued by governments of OECD countries (members of the Organisation of Economic Co-operation and Development) are considered to have virtually zero risk and have a risk weight of zero. Loans to corporations have a risk weight of 100%. Loans to banks and government agencies in OECD countries have a risk weight of 20%. Uninsured residential mortgages have a risk weight of 50%. The total of the risk-weighted assets for $N$ on-balance-sheet items equals

$$\sum_{i=1}^{N} w_i L_i$$

where $L_i$ is the principal amount of the $i$th item and $w_i$ is its risk weight.

# Example

The assets of a bank consist of $100 million of corporate loans, $10 million of OECD government bonds, and $50 million of residential mortgages. The total of the risk-weighted assets is

$$1.0 \times 100 + 0.0 \times 10 + 0.5 \times 50 = 125$$

or $125 million.



IRMT

irmT The Institute of Risk Management Tanzania

# BIS Accord

- **Capital Requirement**
  - The Accord required banks to keep capital equal to at least 8% of the risk-weighted assets.
  - **The capital had two components:**
    - *Tier 1 Capital*. This consists of items such as equity and noncumulative perpetual preferred stock. (Goodwill is Subtracted from equity)
    - *Tier 2 Capital*. This is sometimes referred to as Supplementary Capital. It includes instruments such as cumulative perpetual preferred stock,4 certain types of 99-year debenture issues, and subordinated debt (i.e., debt subordinated to depositors) with an original life of more than five years.

# BIS Accord

* The Accord required at least 50% of the required capital (that is, 4% of the risk-weighted assets) to be in Tier 1.
* Furthermore, the Accord required 2% of risk weighted assets to be common equity. (Note that the Basel committee has updated its definition of instruments that are eligible for Tier 1 capital and its definition of common equity in Basel III.)
* The bank supervisors in some countries require banks to hold more capital than the minimum specified by the Basel Committee and some banks themselves have a target for the capital they will hold that is higher than that specified by their bank supervisors

# G-30 Policy Recommendations

* In 1993, a working group consisting of end-users, dealers, academics, accountants, and lawyers involved in derivatives published a report that contained 20 risk management recommendations for dealers and end-users of derivatives and four recommendations for legislators, regulators, and supervisors

* A company's policies on risk management should be clearly defined and approved by senior management, ideally at the board of directors level. Managers at all levels should enforce the policies.

# G30 Policy Recommendations Cont…

1. Derivatives positions should be marked to market (i.e., revalued using a model that is consistent with market prices) at least once a day.
2. Derivatives dealers should measure market risk using a consistent measure such as value at risk. Limits to the market risks that are taken should be set.
3. Derivatives dealers should carry out stress tests to determine potential losses under extreme market conditions.
4. The risk management function should be set up so that it is independent of the trading operation.
5. Credit exposures arising from derivatives trading should be assessed based on the current replacement value of existing positions and potential future replacement costs.
6. Credit exposures to a counterparty should be aggregated in a way that reflects enforceable netting agreements. (We talk about netting in the next section).
7. The individuals responsible for setting credit limits should be independent of those involved in trading.

# G30 Policy Recommendations

9. Dealers and end-users should assess carefully both the costs and benefits of credit risk mitigation techniques such as collateralization and downgrade triggers. In particular, they should assess their own capacity and that of their counterparties to meet the cash flow requirement of downgrade triggers.
10. Only individuals with the appropriate skills and experience should be allowed to have responsibility for trading derivatives, supervising the trading, carrying out back office functions in relation to the trading, and so on.
11. There should be adequate systems in place for data capture, processing, settlement, and management reporting.
12. Dealers and end-users should account for the derivatives transactions used to manage risks so as to achieve a consistency of income recognition treatment between those instruments and the risks being managed.

# 1996 Basel Amendments

- In 1995, the Basel Committee issued a consultative proposal to amend the 1988 Accord to be "1996 Amendment", "BIS 98"
- *Marking to market* is the practice of revaluing assets and liabilities daily using a model that is calibrated to current market prices. It is also known as *fair value accounting*.
- Banks are required to use fair value accounting for all assets and liabilities that are held for trading purposes. This includes most derivatives, marketable equity securities, foreign currencies, and commodities.
- These items constitute what is referred to as the bank's *trading book*.
- Banks are not required to use fair value accounting for assets that are expected to be held for the whole of their life for investment purposes

# 1996 Amendment

I
R
M
T

# From Basel I-III Journey

- In the beginning, the international Basel Committee on Bank Supervision (BCBS) created Basel I, a series of regulatory guidelines for the banking sector that outlined specific measures that aimed to reduce institutional credit risk.

- The Basel I Capital Accord of 1988 set forth minimum capital requirements for major financial institutions.

# From Basel I-III Journey

* Newer financial institutions came into existence. More innovative products and services were introduced
* The nature of financial risks started changing
* The international Basel Committee on Bank Supervision saw this as a signal for Basel I to evolve as well, and in 2004 it came up with Basel II – a series of rules to address the post-1988 financial climate.
* Basel II was adopted by the EU in January 2008, while its implementation was delayed until January 2009 in the US
* Subsequently, there were even more glacial changes in the global financial environment, which lead to the Great Financial Crisis of 2008-09
* The international Basel Committee on Bank Supervision and other sovereign regulators recognized how much risk, to individual countries and world financial markets, a single bank's operations could get

# From Basel I-III Journey

**Time line for agreement of the Basel 2.5 and Basel III proposals**

| July 2009 | December 2009 | July 16, 2010 | July 26, 2010 | August 18, 2010 | September 12, 2010 |
|---|---|---|---|---|---|
| • Enhancements to the Basel II framework<br>• Revisions to the market risk framework<br>• Guidelines for computing capital for incremental risk in the trading book | • Strengthening the resilience of the banking sector (capital proposals)<br>• International framework for liquidity risk measurement standards and monitoring (liquidity proposals) | • Counter-cyclical capital proposal | • Capital and liquidity agreements with amendments | • Proposal to ensure the loss absorbency of regulatory capital at the point of non-viability | • Endorsement of the July 26 agreement "Group of governors and heads of supervision announces higher global minimum capital standards" |

Source: KPMG analysis of BCBS, date.

# From Basel I-III Journey

* Ultimately, they realized that a more comprehensive overhaul of the Basel II protocols was needed
* However in the interim, until more complex negotiations for a major update were scheduled, BCBS released Basel 2.5 in July 2009 to address the growing concern over banks' capital requirements, particularly with respect to riskier credit-related products.
* After a series of protracted negotiations, the international financial community agreed to tighter monetary and fiscal reforms for the financial sector. These regulations, which were agreed to in July 2010, were finally endorsed as "Basel III" in September 2010, addressing Basel II shortcomings as related to Regulatory Capital and Additional Risk

I
R
M
T

# INSTITUTE OF RISK MANAGEMENT TANZANIA (IRMT)

# STUDENTS SUMMARY NOTES

## MODULE VII

## MARKET RISK

## CERTIFIED FINANICIAL SERVICES RISK MANAGEMENT PROFESSIONAL COURSE

## Certified Financial Services Risk Professional Examination (CFSRP)

I R M T



irmT The Institute of Risk Management Tanzania

I
R
M
T

# MODULE VII
# Market Risk



irmT
The Institute of Risk Management Tanzania

# Introduction

- Market risk is the risk of adverse deviations of the mark-to-market value of the trading portfolio, due to market movements, during the period required to liquidate the transactions.

- The period of liquidation is critical to assess such adverse deviations. If it gets longer, so do the deviations from the current market value.

# Introduction

- Market risk is the risk of adverse deviations of the mark-to-market value of the trading portfolio, due to market movements, during the period required to liquidate the trans- actions.

- The period of liquidation is critical to assess such adverse deviations. If it gets longer, so do the deviations from the current market value.

# Introduction

- Liquidation involves asset and market liquidity risks. Price volatility is not the same in high-liquidity and poor-liquidity situations.
- When liquidity is high, the adverse deviations of prices are much lower than in a poor-liquidity environment, within a given horizon.
- 'Pure' market risk, generated by changes of market parameters (interest rates, equity indexes, exchange rates), differs from market liquidity risk.
- This interaction raises important issues. What is the 'normal' volatility of market parameters under fair liquidity situations? What could it become under poorer liquidity situations? How sensitive are the prices to liquidity crises? The liquidity issue becomes critical in emerging markets. Prices in emerging markets often diverge considerably from a theoretical 'fair value'.

# Introduction

- Market risk does not refer to market losses due to causes other than market movements, loosely defined as inclusive of liquidity risk.
- Any deficiency in the monitoring of the market portfolio might result in market values deviating by any magnitude until liquidation finally occurs.
- In the meantime, the potential deviations can exceed by far any deviation that could occur within a short liquidation period. This risk is an operational risk, not a market risk (Example, the failure of Baring Brothers, due to deficiencies in control of the risk position)

# Market Risk and Value at Risk

- In order to define the potential adverse deviation, a methodology is required to identify what could be a 'maximum' adverse deviation of the portfolio market value.
- This is the VaR methodology.
- The market risk VaR technique aims at capturing downside deviations of prices during a preset period for liquidating assets, considering the changes in the market parameters.
- Controlling market risk means keeping the variations of the value of a given portfolio within given boundary values through actions on limits, which are upper bounds imposed on risks, and hedging for isolating the portfolio from the uncontrollable market movements.

# Market Risk and Model Risk

- Model risk is significant in the market universe, which traditionally makes relatively intensive usage of models for pricing purposes.
- Model risk is growing more important, with the extension of modeling techniques to other risks, notably credit risk, where scarcity of data remains a major obstacle for testing the reliability of inputs and models.
- This part details many modeling approaches, making model risk self-explanatory.

# Market Risk and Model Risk

- Model risk materializes, for instance, as gaps between predicted values of variables, such as the VaR, and actual values observed from experience.
- Pricing models used for market instruments predict prices, which are readily comparable to observed prices.
- Often, modeled prices do not track actual prices accurately.
- When P&L calculations for the trading portfolio rely on 'pricers', there are 'P&L leaks' due to models.
- Such 'P&L leaks' represent the dollar value of model risk for 'pricers'. Unfortunately, it is much easier to track gaps between predicted prices and actual prices than between modeled worst-case losses and actual large losses.

# Market Risk and Model Risk

- The difficulty is even greater for credit risk, since major credit risk events remain too scarce
- The sources of model risk, however, relate to common sense. Models are subject to misspecifications, because they ignore some parameters for practical reasons.
- Model implementation suffers from errors of statistical techniques, lack of observable data for obtaining reliable fits (credit risk) and judgmental choices on dealing with 'outliers', those observations that models fail to capture with reasonable accuracy.

# Market Risk and Model Risk

- Credit risk models of interdependencies between individual defaults of borrowers rely on inferring such relations from 'modeled' events rather than observable events, because default data remains scarce.
- Consequently, measuring errors is not yet feasible until credit risk data becomes more reliable than it is currently.
- This is an objective of the New Basel Accord, from January 2001 making the data gathering process a key element in implementing the advanced techniques for measuring credit risk capital.

# Historical Simulation Approach

- Historical Simulation Approach (HAS) consist of two popular approach for calculating value at risk (VaR) and expected shortfall (ES) for market risk
- It involves using the day to day changes in values of market variables that have been observed in the past in a direct way to estimate the probability distribution of the change in the value of the current portfolio between today and tomorrow
- However the HAS has number of deficiencies to be communicated later

# Historical Simulation Approach Methodology

- Historical Simulation approach involves using past data as guide to what will happened in the future
- Assume we want o calculate the VaR for a portfolio using one day time horizon, a 99% confidence level, and 501 days of data
- The time horizon and confidence level are those typically used in a market risk VaR Calculations; we use 501 days of data because, it leads to 500 scenarios being created

# Introduction

- VaR is is a good measure of risk
  - it combines information on the sensitivity of the value to changes in market-risk factors with information on the probable amount of change in those factors.
  - VaR tries to answer the question: how much could we lose today given our current position and the possible changes in the market?
  - VaR formalizes that question into the calculation of the level of loss that is so bad that there is only a 1 in 100 chance of there being a loss worse than the calculated VaR.
  - VaR estimates this level by knowing the current value of the portfolio and calculating the probability distribution of changes in the value over the next trading day.
  - From the probability distribution we can read the confidence level for the 99-percentile loss.

# Introduction

- To estimate the value's probability distribution, we use two sets of information. the current position, or holdings, in the bank's trading portfolio, and an estimate of the probability distribution of the price changes over the next day.
- The estimate of the probability distribution of the price changes is based on the distribution of price changes over the last few weeks or months.
- The goal of this chapter is to explain how to calculate VaR using the three methods that are in common use:
  - Parametric VaR
  - Historical Simulation
  - Monte Carlo Simulation.

# Parametric Var

- Parametric VaR is also known as Linear VaR, Variance-Covariance VaR
- The approach is parametric in that it assumes that the probability distribution is Normal and then requires calculation of the variance and covariance parameters.
- The approach is linear in that changes in instrument values are assumed to be linear with respect to changes in risk factors.
- For example, for bonds the sensitivity is described by duration, and for options it is described by the Greeks

# Parametric VaR

- The overall Parametric VaR approach is as follows:
  - Define the set of risk factors that will be sufficient to calculate the value of the bank's portfolio
  - Find the sensitivity of each instrument in the portfolio to each risk factor
  - Get historical data on the risk factors to calculate the standard deviation of the changes and the correlations between them
  - Estimate the standard deviation of the value of the portfolio by multiplying the sensitivities by the standard deviations, taking into account all correlations
  - Finally, assume that the loss distribution is Normally distributed, and therefore approximate the 99% VaR as 2.32 times the standard deviation of the value of the portfolio

# Parametric VaR

* Parametric VaR has two advantages:
  * It is typically 100 to 1000 times faster to calculate Parametric VaR compared with Monte Carlo or Historical Simulation.
  * Parametric VaR allows the calculation of VaR contribution, as explained in the next chapter.

# Parametric VaR

- Parametric VaR also has significant limitations:
  - It gives a poor description of nonlinear risks
  - It gives a poor description of extreme tail events, such as crises, because it assumes that the risk factors have a Normal distribution. In reality, as we found in the statistics chapter, the risk-factor distributions have a high kurtosis with more extreme events than would be predicted by the Normal distribution.
  - Parametric VaR uses a covariance matrix, and this implicitly assumes that the correlations between risk factors is stable and constant over time

# Parametric VaR

- To give an intuitive understanding of Parametric VaR, we have provided three worked-out examples.
- The examples are fundamentally quite simple, but they intro-duce the method of calculating Parametric VaR.
- There are a lot of equations, but the underlying math is mostly algebra rather than complex statistics or calculus
- Three different notations are used in this chapter
  - Algebraic
  - Summation
  - matrix.

# Parametric VaR

- If we have a portfolio of two instruments, the loss on the portfolio (*Lp*) will be the sum of the losses on each instrument:

$$L_p = L_1 + L_2$$

- The standard deviation of loss on the portfolio ($\sigma_p$) will be as follows:

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



IRMT

irmT The Institute of Risk Management Tanzania

# Parametric VaR

Algebraic Notation

Summation Notation

$$\sigma_P^2 = \sigma_1^2 + \sigma_2^2 + 2\rho_{1,2}\sigma_1\sigma_2$$

$$\sigma_P^2 = \sum_{i=1}^{2}\sum_{j=1}^{2}\rho_{i,j}\sigma_i\sigma_j$$

$$\sigma_P^2 = \sum_{i=1}^{2}\left(\rho_{i,1}\sigma_i\sigma_1 + \rho_{i,2}\sigma_i\sigma_2\right)$$

$$= \rho_{1,1}\sigma_1\sigma_1 + \rho_{1,2}\sigma_1\sigma_2 + \rho_{2,1}\sigma_2\sigma_1 + \rho_{2,2}\sigma_2\sigma_2$$

$$= \sigma_1^2 + \sigma_2^2 + 2\rho_{1,2}\sigma_1\sigma_2$$

# Parametric VaR

$$\sigma_p^2 = SRS^T$$

$$S = [\sigma_1 \quad \sigma_1]$$

$$R = \begin{bmatrix} 1 & \rho_{1,2} \\ \rho_{1,2} & 1 \end{bmatrix}$$

$$S^T = \begin{bmatrix} \sigma_1 \\ \sigma_2 \end{bmatrix}$$

Matrix Notation



IRMT

irmT The Institute of Risk Management Tanzania

# Parametric VaR

$$RS^T = \begin{bmatrix} \sigma_1 + \rho_{1,2}\sigma_2 \\ \rho_{1,2}\sigma_1 + \sigma_2 \end{bmatrix}$$

$$SRS^T = \left[\sigma_1\sigma_1 + \rho_{1,2}\sigma_2\sigma_1 + \rho_{1,2}\sigma_1\sigma_2 + \sigma_2\sigma_2\right]$$

$$= \sigma_1^2 + \sigma_2^2 + 2\rho_{1,2}\sigma_1\sigma_2$$



IRMT

irmT The Institute of Risk Management Tanzania

# Example One

- The first example calculates the stand-alone VaR for a bank holding a long position in an equity. The stand-alone VaR is the VaR for the position on its own without considering correlation and diversification effects from other positions.
- The present value of the position is simply the number of shares (N) times the value per share, (Vs)
- PV$ = N x Vs



IRMT

irmT The Institute of Risk Management Tanzania

# Example One

* The change in the value of the position is simply the number of shares multiplied by the change in the value of each share:

$$\Delta PV\$ = N \times \Delta Vs$$

* The standard deviation of the value is the number of shares multiplied by the standard deviation of the value of each share

$$\sigma_v = N \times \sigma_s$$

* we have assumed that the value changes are Normally distributed, there will be a 1chance that the loss is more than 2.32 standard deviations; therefore, we can calculate the 99 VaR as follows

$$VaR = 2.32 \times N \times \sigma_s$$

# Example Two

- As a slightly more complex example, consider a government bond held by a U.K. bank denominated in British pounds with a single payment.

- The present value in pounds (*PVp*) is simply the value of the cash flow in pounds (*Cp*) at time t discounted according to sterling interest rates for that maturity, $r_p$:



IRMT

irmT The Institute of Risk Management Tanzania

# Example Two

present value

$$PV_p = \frac{C_p}{(1 + r_p)^t}$$

$$\Delta PV_p = d_r \times \Delta r_p$$

$$\frac{\partial PV_p}{\partial r_p} = \left[\frac{-tC_p}{(1 + r_p)^{t+1}}\right]$$

$$VaR = 2.32 \times d_r \times \sigma_{r_p}$$

The derivative of *PVp* with respect to $r_p$

$$d_r = \left[\frac{-tC_p}{(1 + r_p)^{t+1}}\right]$$



IRMT

irmT The Institute of Risk Management Tanzania

# Example Two

- To make this example more concrete, consider a bond paying 100 pounds ($Cp$) in 5 years' time ($t$), with the 5-year discount rate at 6% ($r_p$), and a standard deviation in the rate of 0.5% ($\sigma_r$).

- The present value is then 74 pounds, the sensitivity $d_r$ is -352 pounds per 100% increase in rates, and the VaR is 4.1 pounds



IRMT

irmT The Institute of Risk Management Tanzania

# Example Two

$$PV_p = \frac{100}{(1.06)^5} = 74$$

$$d_r = \frac{-5 \times 100}{(1.06)^6} = -352$$

$$VaR = \left| 2.32 \times \frac{-5 \times 100}{(1.06)^6} \times 0.5\% \right| = 4.1$$



IRMT

irmT The Institute of Risk Management Tanzania

# Example Three

- The two examples above were simple because they had only one risk factor
- Now let us consider a multidimensional case: the same simple bond as before, but now held by a U.S. bank.
- The U.S. bank is exposed to two risks: changes due to sterling interest rates and changes due to the pound-dollar exchange rate.
- The value of the bond in dollars is the value in pounds multiplied by the FX rate

# Example Three

$$PV_{\$} = FX \times PV_p$$

$$= FX \frac{C_p}{(1+r_p)^t}$$

$$\frac{\partial PV_{\$}}{\partial FX} = \frac{C_p}{(1+r_p)^t}$$

$$\Delta PV_{\$} = \Delta FX \frac{C_p}{(1+r_p)^t}$$

$$\frac{\partial PV_{\$}}{\partial r_p} = FX \frac{-tC_p}{(1+r_p)^{t+1}}$$

$$\Delta PV_{\$} = FX \frac{-tC_p}{(1+r_p)^{t+1}} \Delta r_p$$



IRMT

irmT The Institute of Risk Management Tanzania

# Example Three

$$\Delta PV_{\$} = \frac{C_p}{(1+r_p)^t}\Delta FX + FX\frac{-tC_p}{(1+r_p)^{t+1}}\Delta r_p$$

$$d_{FX} = \frac{C_p}{(1+r_p)^t}$$

$$d_{r_p} = FX\frac{-tC_p}{(1+r_p)^{t+1}}$$

$$\Delta PV_{\$} = d_{FX}\Delta FX + d_{r_p}\Delta r_p$$

# Example Three

$$L_P = L_1 + L_2$$

$$\sigma_P^2 = \sigma_1^2 + \sigma_2^2 + 2\rho_{1,2}\sigma_1\sigma_2$$

$$L_1 = d_{FX}\Delta FX$$

$$L_2 = d_{r_p}\Delta r_p$$

$$L_P = \Delta PV_{\$}$$



IRMT

irmT The Institute of Risk Management Tanzania

# Example Three

$$\Delta FX_t = FX_t - FX_{t-1} \qquad \Delta r_{p,t} = r_{p,t} - r_{p,t-1}$$

$$\sigma_{FX}^2 = \frac{1}{N-1}\sum_{t=1}^{N}(\Delta FX_t)^2 \qquad \sigma_{r_p}^2 = \frac{1}{N-1}\sum_{t=1}^{N}\left(\Delta r_{p,t}\right)^2$$

$$\rho_{FX,r_p} = \frac{1}{N-1}\left(\frac{\sum_{t=1}^{N}\Delta r_{p,t}\Delta FX_t}{\sigma_{r_p}\sigma_{FX}}\right)$$



IRMT

irmT The Institute of Risk Management Tanzania

Microsoft Excel - Book2

檔案(F) 編輯(E) 檢視(V) 插入(I) 格式(O) 工具(T) 資料(D) 視窗

C4 fx =(B4-B3)/B3

| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | T-Bill rate | | | | |
| 2 | Date | r (%) | △r% | △r (%) | |
| 3 | 2006/3/6 | 4.46 | | | |
| 4 | 2006/3/7 | 4.49 | 0.006726 | 0.030269 | |
| 5 | 2006/3/8 | 4.47 | -0.004454 | -0.020045 | |
| 6 | 2006/3/9 | 4.48 | 0.002237 | 0.010067 | |
| 7 | 2006/3/10 | 4.5 | 0.004464 | 0.020089 | |
| 8 | 2006/3/13 | 4.5 | 0.000000 | 0.000000 | |
| 9 | 2006/3/14 | 4.48 | -0.004444 | -0.020000 | |
| 10 | 2006/3/15 | 4.51 | 0.006696 | 0.030134 | |
| 11 | 2006/3/16 | 4.5 | -0.002217 | -0.009978 | |

Microsoft Excel - Book2

檔案(F) 編輯(E) 檢視(V) 插入(I) 格式(O) 工具(T) 資料(D) 視窗(W) 說明(H)

C4 =(B4-B3)/B3

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 1 | Exchange rate: USD:NTD | | | | | |
| 2 | Date | FX | △FX% | △FX | | |
| 3 | 2006/3/6 | 32.501 | | | | |
| 4 | 2006/3/7 | 32.557 | 0.001723 | 0.055929 | | |
| 5 | 2006/3/8 | 32.578 | 0.000645 | 0.020937 | | |
| 6 | 2006/3/9 | 32.669 | 0.002793 | 0.090670 | | |
| 7 | 2006/3/10 | 32.570 | -0.003030 | -0.098367 | | |
| 8 | 2006/3/13 | 32.577 | 0.000215 | 0.006976 | | |
| 9 | 2006/3/14 | 32.598 | 0.000645 | 0.020925 | | |
| 10 | 2006/3/15 | 32.537 | -0.001871 | -0.060742 | | |
| 11 | 2006/3/16 | 32.460 | -0.002367 | -0.076818 | | |

# Example Three

$$\sigma_1 = d_{FX}\sigma_{FX}$$

$$\sigma_2 = d_{r_p}\sigma_{r_p}$$

$$\rho_{1,2} = \rho_{FX,r_p}$$

$$VaR = 2.32\,\sigma_p$$

$$= 2.32\sqrt{(d_{FX}\sigma_{FX})^2 + 2\rho_{FX,r_p}(d_{FX}\sigma_{FX})\left(d_{r_p}\sigma_{r_p}\right) + \left(d_{r_p}\sigma_{r_p}\right)^2}$$



IRMT

irmT The Institute of Risk Management Tanzania

# Example Three

**TABLE 6-1**

Parameter Values for the Example of a Sterling Bond

| Parameter | Value |
|---|---|
| Cashflow ($C_p$) | 100 pounds |
| Maturity ($t$) | 5 years |
| Interest rate ($r_p$) | 6% |
| Interest-rate standard deviation ($\sigma_{r_p}$) | 0.5% |
| Exchange rate ($FX$) | 1.6 dollars/pound |
| Exchange-rate standard deviation ($\sigma_{FX}$) | 0.02 dollars/pound |
| Correlation ($\rho_{FX,r_p}$) | −0.6 |

Parameter values needed to calculate the VaR for a foreign-currency bond.

# Example Three

$$PV_{\$} = \$119$$

$$d_{FX} = 74.7$$

$$d_r = -564.0$$

$$VaR = \$9.05$$



IRMT

irmT The Institute of Risk Management Tanzania

# Example Three

$$VaR = 2.32\sqrt{(d_1\sigma_1)^2 + 2\rho_{1,2}(d_1\sigma_1)(d_2\sigma_2) + (d_2\sigma_2)^2 + \cdots + 2\rho_{N-1,N}(d_{N-1}\sigma_{N-1})(d_N\sigma_N) + (d_N\sigma_N)}$$

$$d_N = \frac{\partial V}{\partial f_N}$$

$$VaR = 2.32\sqrt{\sum_{i=1}^{N}\sum_{j=1}^{N}\left[\rho_{i,j}(d_i\sigma_i)\left(d_j\sigma_j\right)\right]}$$



IRMT

irmT The Institute of Risk Management Tanzania

# Example Three

$$D = \begin{bmatrix} d_{FX} & d_{r_p} \end{bmatrix}$$

$$C = \begin{bmatrix} \sigma_{FX}^2 & \sigma_{FX}\sigma_{r_p}\rho_{FX,r_p} \\ \sigma_{FX}\sigma_{r_p}\rho_{FX,r_p} & \sigma_{r_p}^2 \end{bmatrix}$$

$$\sigma_{PV}^2 = DCD^T$$

$$VaR = 2.32\sqrt{DCD^T}$$



IRMT

irmT The Institute of Risk Management Tanzania

# Example Three

$$D = [74.7 \quad -563]$$

$$C = \begin{bmatrix} 0.0004 & -0.00006 \\ -0.00006 & 0.000025 \end{bmatrix}$$

$$D^T = \begin{bmatrix} 74.7 \\ -563 \end{bmatrix}$$

$$VaR = 2.32\sqrt{DCD^T}$$

$$= \$9.05$$



IRMT

irmT The Institute of Risk Management Tanzania

# Example Three

$$D = [d_1, d_2, \ldots, d_N]$$

$$C = \begin{bmatrix} \sigma_1\sigma_1 & \rho_{1,2}\sigma_1\sigma_2 & & \rho_{1,N}\sigma_1\sigma_N \\ \rho_{2,1}\sigma_2\sigma_1 & \sigma_2\sigma_2 & & \rho_{2,N}\sigma_2\sigma_N \\ & & \ddots & \\ \rho_{N,1}\sigma_N\sigma_1 & \rho_{N,2}\sigma_N\sigma_2 & & \sigma_N\sigma_N \end{bmatrix}$$



IRMT

irmT The Institute of Risk Management Tanzania

# Group work

- Now let us consider a U.S. bond, but now held by a Taiwan's bank.
- Other conditions are consistent with the precious case.
- Consider this bond paying 100 U.S. dollars ($C_{USD}$) in 5 years' time ($t$)
- Two risks
  - Changes due to U.S. interest rates ($r_{US}$)
  - changes due to the NTD-USD exchange rate (FX)
- Find the current 5-year interest rate ($r_{US}$) and the current NTD-USD exchange rate (FX)
- Find the standard deviation in the interest rate and the exchange rate
- Find the correlation coefficient between $r_{US}$ and FX

# Using Parametric VaR to Calculate Risk Sensitivity for Several Positions

- In the example above, we had one security that was sensitive to two different risk factors.
- If the portfolio is made up of several securities, each of which is affected by the same risk factor, then the sensitivity of the portfolio to the risk factor is simply the sum of these sensitivities for the individual positions.
- For example, consider a portfolio holding our example 100-pound five-year bond and 100 pounds of cash

# Using Parametric VaR to Calculate Risk Sensitivity for Several Positions

$$Value_{Bond} = FX \frac{100}{(1+6\%)^5}$$

$$Value_{Cash} = FX \times 100$$

$$PV_P = FX \frac{100}{(1+6\%)^5} + FX \times 100$$



IRMT

irmT The Institute of Risk Management Tanzania

# Using Parametric VaR to Calculate Risk Sensitivity for Several Positions

$$d_{FX} = \frac{100}{(1 + 6\%)^5} + 100$$



IRMT

irmT The Institute of Risk Management Tanzania

# Using Parametric VaR to Calculate Risk Sensitivity for Several Positions

$$D_{Bond} = [74.7 \quad -563]$$

$$D_{Cash} = [100 \quad 0]$$

$$D_{Position} = D_{Bond} + D_{Cash}$$

$$= [174.7 \quad -563]$$



IRMT

irmT The Institute of Risk Management Tanzania

# Using Parametric VaR to Calculate Risk Sensitivity for Several Positions

$$D_A = [d_{A,1}, d_{A,2}, d_{A,3}, \cdots d_{A,N}]$$

$$D_B = [d_{B,1}, d_{B,2}, d_{B,3}, \cdots d_{B,N}]$$

$$\vdots$$

$$D_Z = [d_{Z,1}, d_{Z,2}, d_{Z,3}, \cdots, d_{Z,N}]$$

$$D_{Portfolio} = D_A + D_B + \cdots + D_Z$$

$$D_{Portfolio} = [(d_{A.1} + d_{B.1} + \cdots + d_{Z.1}), \cdots, (d_{A.N} + d_{B,N} + \cdots + d_{Z,N})]$$

$$VaR_{Portfolio} = 2.32\sqrt{D_{Portfolio} C \; D_{Portfolio}^{T}}$$



IRMT

irmT The Institute of Risk Management Tanzania

# Discussions

- Now let us consider a bond portfolio with a U.S. bond and a U.K. bond,
- The bond portfolio is held by a Taiwan's bank.
- Other conditions are consistent with the precious case.
- Consider the US and UK bonds paying 100 US dollars ($C_{USD}$) and 100 British pound ($C_{BP}$), respectively, in 5 years' time ($t$)
- Four risk factors
  - Changes due to U.S. interest rates ($r_{US}$)
  - changes due to the NTD-USD exchange rate ($FX_{USD}$)
  - Changes due to U.K. interest rates ($r_{UK}$)
  - changes due to the NTD-BP exchange rate ($FX_{BP}$)

# Historical-Simulation VaR

- Conceptually, historical simulation is the most simple VaR technique, but it takes significantly more time to run than parametric VaR.
- The historical-simulation approach takes the market data for the last 250 days and calculates the percent change for each risk factor on each day
- Each percentage change is then multiplied by today's market values to present 250 scenarios for tomorrow's values.
- For each of these scenarios, the portfolio is valued using full, nonlinear pricing models. The third-worst day is the selected as being the 99% VaR.

# Historical-Simulation VaR

- As an example, let's consider calculating the VaR for a five-year, zero-coupon bond paying $100
- We start by looking back at the previous trading days and noting the five year rate on each day.
- We then calculate the proportion by which the rate changed from one day to the next

# Historical-Simulation VaR

$$r_{Scenario,k} = r_{Today}(1 + \Delta_t)$$

The change rate of interest rate for one day

$$Value_{Scenario,k} = \frac{100}{(1 + r_{Scenario,k})^5}$$

$$\Delta V_k = Value_{Scenario,k} - Value_{Today}$$



IRMT

irmT The Institute of Risk Management Tanzania

# Historical-Simulation VaR

**TABLE 6-2**

Example of Historical VaR Calculation

| Data | Rate (%) | Proportional change | Scenario rate | Bond Value ($) | Change in Value ($) |
|---|---|---|---|---|---|
| 9-Jul | 5.02 | 0.6% | 5.03 | 78.25 | −0.10 |
| 10-Jul | 5.05 | −0.9% | 4.96 | 78.52 | 0.17 |
| 11-Jul | 5.01 | 1.9% | 5.09 | 78.00 | −0.35 |
| 12-Jul | 5.10 | 0.2% | 5.01 | 78.32 | −0.03 |
| 13-Jul | 5.11 | −0.8% | 4.96 | 78.50 | 0.14 |
| 16-Jul | 5.07 | 2.1% | 5.11 | 77.96 | −0.39 |
| 17-Jul | 5.18 | 1.0% | 5.05 | 78.17 | −0.19 |
| 18-Jul | 5.23 | −0.2% | 4.99 | 78.40 | 0.05 |
| 19-Jul | 5.22 | −0.2% | 4.99 | 78.39 | 0.04 |
| 20-Jul | 5.21 | −4.0% | 4.80 | 79.10 | 0.75 |
| 23-Jul | 5.00 | | | 78.35 | |

# Discussion

- Consider a Taiwan bond held by a Taiwan's bank.
- Other conditions are consistent with the precious case.
- Consider this bond paying 100 NT dollars ($C_{NTD}$) in 5 years' time ($t$)
- One risk factor
  - Changes due to Taiwan interest rates ($r_{TAIWAN}$)
- Use the historical simulation approach to calculate the VaR
- Use one-year historical data at least



IRMT

irmT The Institute of Risk Management Tanzania

# Historical-Simulation VaR

- There are two main advantages of using historical simulation:
  - It is easy to communicate the results throughout the organization because the concepts are easily explained
  - There is no need to assume that the changes in the risk factors have a structured parametric probability distribution
  - no need to assume they are Joint-Normal with stable correlation

# Historical-Simulation VaR

- The disadvantages are due to using the historical data in such a raw form:
  - The result is often dominated by a single, recent, specific crisis, and it is very difficult to test other assumptions. The effect of this is that Historical VaR is strongly backward-looking, meaning the bank is, in effect, protecting itself from the last crisis, but not necessarily preparing itself for the next

# Historical-Simulation VaR

* There can also be an unpleasant "window effect." When 250 days have passed since the crisis, the crisis observation drops out of our window for historical data and the reported VaR suddenly drops from one day to the next. This often causes traders to mistrust the VaR because they know there has been no significant change in the risk of the trading operation, and yet the quantification of risk has changed dramatically

# Monte Carlo Simulation VaR

- Monte Carlo simulation is also known as Monte Carlo evaluation (MCE). It estimates VaR by randomly creating many scenarios for future rates

- using nonlinear pricing models to estimate the change in value for each scenario, and then calculating VaR according to the worst losses



IRMT

irmT The Institute of Risk Management Tanzania

# Monte Carlo Simulation VaR

- Monte Carlo simulation has two significant advantages:
  - Unlike Parametric VaR, it uses full pricing models and can therefore capture the effects of nonlinearities
  - Unlike Historical VaR, it can generate an infinite number of scenarios and therefore test many possible future outcomes

# Monte Carlo Simulation VaR

- Monte Carlo has two important disadvantages:
  - The calculation of Monte Carlo VaR can take 1000 times longer than Parametric VaR because the potential price of the portfolio has to be calculated thousands of times
  - Unlike Historical VaR, it typically requires the assumption that the risk factors have a Normal or Log-Normal distribution.

# Monte Carlo Simulation VaR

- The Monte Carlo approach assumes that there is a known probability distribution for the risk factors.
- The usual implementation of Monte Carlo assumes a stable, Joint-Normal distribution for the risk factors.
- This is the same assumption used for Parametric VaR.
- The analysis calculates the covariance matrix for the risk factors in the same way as Parametric VaR

# Monte Carlo Simulation VaR

- But unlike Parametric VaR
  - Decomposes the covariance matrix and ensures that the risk factors are correlated in each scenario
  - The scenarios start from today's market condition and go one day forward to give possible values at the end of the day
  - Full, nonlinear pricing models are then used to value the portfolio under each of the end-of-day scenarios.
  - For bonds, nonlinear pricing means using the bond-pricing formula rather than duration
  - for options, it means using a pricing formula such as Black-Scholes rather than just using the Greeks.

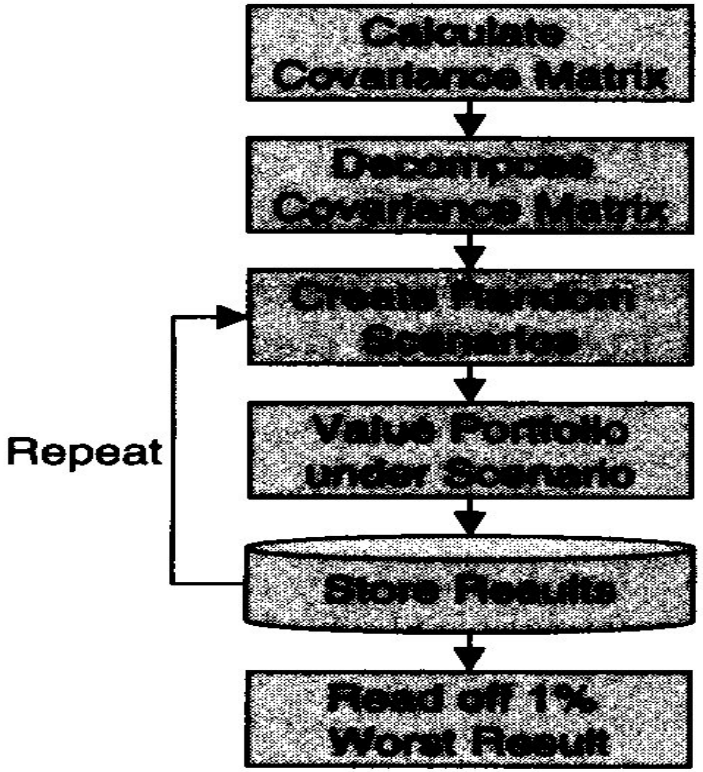
# Monte Carlo Simulation VaR

- From the scenarios, VaR is selected to be the 1-percentile worst loss
- For example, if1000 scenarios were created, the 99% VaR would be the tenth-worst result
- Figure 6-4summarizes the Monte Carlo approach
- Most of the Monte Carlo approach is conceptually simple. The one mathematically difficult step is to decompose the covariance matrix in such a way as to allow us to create random scenarios with the same correlation as the historical market data

# Monte Carlo Simulation VaR

**FIGURE 6-4**

Illustration of the Process for Monte Carlo VaR







IRMT

irmT The Institute of Risk Management Tanzania

# Monte Carlo Simulation VaR

- For example, in the previous example of a Sterling bond held by a U.S. bank, we assumed a correlation of -0.6 between the interest rate and exchange rate
- In other words, when the interest rate increases, we would expect that the exchange rate would tend to decrease.
- One way to think of this is that 60% of the change in the exchange rate is driven by changes in the interest rate. The other 40% is driven by independent, random factors.

# Monte Carlo Simulation VaR

- The trick is to create random scenarios that properly capture such relationships

- If we just have two factors, we can easily create correlated random numbers in a simple way



IRMT

irmT
The Institute of Risk Management Tanzania

# Issues

From the scenarios, VaR is selected to be the 1-percentile worst loss. For example, if 1000 scenarios were created, the 99% VaR would be the tenth-worst result. Figure 6-4 summarizes the Monte Carlo approach:

Most of the Monte Carlo approach is conceptually simple. The one mathematically difficult step is to decompose the covariance matrix in such a way as to allow us to create random scenarios with the same correlation as the historical market data. For example, in the previous example of a Sterling bond held by a U.S. bank, we assumed a correlation of −0.6 between the interest rate and exchange rate. In other words, when the interest rate increases, we would expect that the exchange rate would tend to decrease. One way to think of this is that 60% of the change in the exchange rate is driven by changes in the interest rate. The other 40% is driven by independent, random factors. The trick is to create random scenarios that properly capture such relationships.

If we just have two factors, we can easily create correlated random numbers in the following way:

# Issues

- Draw a random number, $z_1$, from a Standard Normal distribution.
- Multiply $z_1$ by the standard deviation of the first risk factor ($\sigma_A$) to create the first risk factor for that scenario, $f_A$:

$$f_A = \sigma_A z_1, \quad z_1 \sim N(0,1)$$

- Multiply $z_1$ by the correlation, $\rho_{A,B}$.
- Draw a second independent random number, $z_2$.
- Multiply $z_2$ by the root of one minus the correlation squared $\left(\sqrt{1-\rho_{A,B}^2}\right)$.
- Add the two results together to create a random number ($y$) that has a standard deviation of one and correlation $\rho_{A,B}$ with $f_A$:

$$y = z_1\rho_{A,B} + z_2\sqrt{1-\rho_{A,B}^2}, \quad z_2 \sim N(0,1)$$

# Issues

- Multiply $y$ by the standard deviation of the second risk factor, $\sigma_B$, to create the second risk factor for that scenario, $f_B$:

$$f_B = \sigma_B y$$

This process can be summarized in the following equations:

$$f_A = \sigma_A z_1, \quad z_1 \sim N(0,1)$$

$$f_B = \sigma_B \left( z_1 \rho_{A,B} + z_2 \sqrt{1 - \rho_{A,B}^2} \right), \quad z_2 \sim N(0,1)$$



IRMT

irmT The Institute of Risk Management Tanzania

# Issues

For the previous bond example, we would create changes in the risk factors $r_p$ and $FX$ by using the following equations:

$$\sigma_{r_p} = 0.5\%$$

$$\sigma_{FX} = 0.02$$

$$\rho_{FX,r_p} = -0.6$$

$$\delta FX = 0.02 \times z_1, \qquad z_1 \sim N(0,1)$$

$$\delta r_p = 0.005\left(-0.6\, z_1 + z_2\sqrt{1-0.36}\right), \qquad z_2 \sim N(0,1)$$

Unfortunately, this simple approach does not work if there are more than two risk factors. If there are many risk factors, we need to create the correlation by decomposing the covariance matrix using either Cholesky decomposition or Eigen-value decomposition. We will give an overview of each approach.



IRMT

irmT The Institute of Risk Management Tanzania

# Monte Carlo Simulation VaR

$$f_A = \sigma_A z_1, \quad z_1 \sim N(0,1)$$

$$y = z_1 \rho_{A,B} + z_2 \sqrt{1 - \rho_{A,B}^2}, \quad z_2 \sim N(0,1)$$

$$f_B = \sigma_B y$$

$$f_A = \sigma_A z_1, \quad z_1 \sim N(0,1)$$

$$f_B = \sigma_B \left( z_1 \rho_{A,B} + z_2 \sqrt{1 - \rho_{A,B}^2} \right), \quad z_2 \sim N(0,1)$$



IRMT

irmT The Institute of Risk Management Tanzania

# Example Three

**TABLE 6-1**

Parameter Values for the Example of a Sterling Bond

| Parameter | Value |
|---|---|
| Cashflow ($C_p$) | 100 pounds |
| Maturity ($t$) | 5 years |
| Interest rate ($r_p$) | 6% |
| Interest-rate standard deviation ($\sigma_{r_p}$) | 0.5% |
| Exchange rate ($FX$) | 1.6 dollars/pound |
| Exchange-rate standard deviation ($\sigma_{FX}$) | 0.02 dollars/pound |
| Correlation ($\rho_{FX,r_p}$) | −0.6 |

Parameter values needed to calculate the VaR for a foreign-currency bond.

# Example Three

$$PV_{\$} = \$119$$

$$d_{FX} = 74.7$$

$$d_r = -564.0$$

$$VaR = \$9.05$$



IRMT

irmT The Institute of Risk Management Tanzania

# Monte Carlo Simulation VaR

* For the previous bond example, we would create changes in the risk factors $r_p$ and FX by using the following equations: EXCEL

$$\sigma_{r_p} = 0.5\%$$

$$\sigma_{FX} = 0.02$$

$$\rho_{FX,r_p} = -0.6$$

$$\delta FX = 0.02 \times z_1, \qquad z_1 \sim N(0,1)$$

$$\delta r_p = 0.005\left(-0.6\, z_1 + z_2\sqrt{1-0.36}\right), \qquad z_2 \sim N(0,1)$$



IRMT

irmT The Institute of Risk Management Tanzania

# Discussions

- Find the realized data to redo the sample example in the previous homework
- Three approaches are asked to apply
  - Parametric VaR
  - Historical VaR
  - Monte Carlo VaR
- Compare the differences among them

# Discussions

- Now let us consider a U.S. bond, but now held by a Taiwan's bank.
- Other conditions are consistent with the precious case.
- Consider this bond paying 100 U.S. dollars ($C_{USD}$) in 5 years' time ($t$)
- Two risk factors
  - Changes due to U.S. interest rates ($r_{US}$)
  - changes due to the NTD-USD exchange rate (FX)



IRMT

irmT The Institute of Risk Management Tanzania

# Quick Quiz

- Four popular limitations for VaR ?
  - Calculation speed
  - Non-normality
  - Nonlinearity
  - Too heavily dependent on historical data
- Three common approaches for VaR
  - The main advantage/disadvantage for each of them?

# Limitations Shared By All Three Methods

**FIGURE 6-1**

Summary of VaR Techniques

| | Parametric VaR | Monte Carlo Simulation | Historical Simulation |
|---|---|---|---|
| Speed of computation | ● | ○ | ◔ |
| Ability to capture nonlinearity | ○ | ● | ● |
| Ability to capture nonnormality | ○ | ◔ | ● |
| Independence from historical data | ◑ | ◑ | ○ |

The relative strengths of the VaR calculation methods are shown by the extent of the shading.

# Limitations Shared By All Three Methods

- It is important to note that while the three calculation methods differ, they do share common attributes and limitations.
- Each approach uses market-risk factors
  - Risk factors are fundamental market rates that can be derived from the prices of securities being traded
  - Typically, the main risk factors used are interest rates, foreign exchange rates, equity indices, commodity prices, forward prices, and implied volatilities
  - By observing this small number of risk factors, we are able to calculate the price of all the thousands of different securities held by the bank
  - This risk-factor approach uses less data than would be required if we tried to collect historical price information for every security.

# Limitations Shared By All Three Methods

- Each approach uses the distribution of historical price changes to estimate the probability distributions.
  - This requires a choice of historical horizon for the market data
  - how far back should we go in using historical data to calculate standard deviations?
  - This is a trade-off between having large amounts of information or fresh information

IRMT

irmT
The Institute of Risk Management Tanzania

# Limitations Shared By All Three Methods

- Because VaR attempts to predict the future probability distribution, it should use the latest market data with the latest market structure and sentiment
  - However, with a limited amount of data, the estimates become less accurate
  - There is less chance of having data that contains those extreme, rare market movements which are the ones that cause the greatest losses

IRMT

irmT
The Institute of Risk Management Tanzania

# Limitations Shared By All Three Methods

- Each approach has the disadvantage of assuming that past relationships between the risk factors will be repeated
  - it assumes that factors that have tended to move together in the past will move together in the future

IRMT

irmT
The Institute of Risk Management Tanzania

# Limitations Shared By All Three Methods

- Each approach has strengths and weaknesses when compared to the others, as summarized in Figure 6-1
  - The degree to which the circles are shaded corresponds to the strength of the approach
  - The factors evaluated in the table are
    - the speed of computation
    - the ability to capture nonlinearity
      - Nonlinearity refers, to the price change not being at linear function of the change in the risk factors. This is especially important for options
    - the ability to capture non-Normality
      - non-Normality refers to the ability to calculate the potential changes in risk factors without assuming that they have a Normal distribution
    - the independence from historical data

IRMT

irmT
The Institute of Risk Management Tanzania

I
R
M
T

# INSTITUTE OF RISK MANAGEMENT TANZANIA (IRMT)

# STUDENTS SUMMARY NOTES

I R M T

## MODULE VIII

## CREDIT RISK AND ESTIMATING DEFAULT PROBABILITIES

## CERTIFIED FINANICIAL SERVICES RISK MANAGEMENT PROFESSIONAL COURSE

## Certified Financial Services Risk Professional Examination (CFSRP)

# Credit Ratings and Historical Default Probabilities

**Credit Risk**

Arise from the probability that borrowers and counterparties in derivatives transactions may default.

In other words; Credit risk is the risk that a financial institution will incur losses because the financial position of a borrower has deteriorated to the point that the value of an asset (including off-balance-sheet assets) is reduced or extinguished.

# Credit Ratings and Historical Default Probabilities

Among credit risks, the risk that the financial institution will incur losses because of political or economic conditions in the country of a foreign borrower is referred to as "country risk."

Inspectors will verify and inspect the credit risk management systems of financial institutions using the Risk Management Systems Checklists (Common Items) and this checklist.

# Credit Ratings

Credit ratings provide information that is widely used by financial market participants for the management of credit risks.

**A credit rating** is a measure of the credit quality of a debt instrument such as a bond. However, the rating of a corporate or sovereign bond is often assumed to be an attribute of the bond issuer rather than of the bond itself.

Thus, if the bonds issued by a company have a rating of AAA, the company is often referred to as having a rating of AAA.

# The Three Major Credit Rating Agencies

The major credit rating agencies are **Moody's, S&P, and Fitch**.
The best rating assigned by Moody's is Aaa. Bonds with this rating are considered to have almost no chance of defaulting.
The next best rating is Aa. Following that come A,

- Baa, Ba, B, Caa, Ca, and C. The S&P ratings corresponding to Moody's Aaa, Aa,
- A, Baa, Ba, B, Caa, Ca, and C are AAA, AA, A, BBB, BB, B, CCC, CC, and C, respectively.
- To create finer rating measures Moody's divides the Aa rating category into Aa1, Aa2, and Aa3; it divides A into A1, A2 and A3; and so on. Similarly S&P divides its AA rating category into AA+, AA, and AA–; it divides its A rating category into A+, A, and A–; and so on.

# The Three Major Credit Rating Agencies

There is usually assumed to be an equivalence between the meanings of the ratings assigned by the different agencies. For example, a BBB+ rating from S&P is considered equivalent to a Baa1 rating from Moody's. Instruments with ratings of BBB– (Baa3) or above are considered to be investment grade.

Those with ratings below BBB– (Baa3) are termed **noninvestment grade or speculative grade or junk** bonds.

(In August 2012, S&P created a stir by downgrading the debt of the U.S. government from AAA to AA+.)

# The Three Major Credit Rating Agencies

- S&P
  - AAA , AA, A, BBB, BB, B, CCC, CC, C
- Moody
  - Aaa, Aa, A, Baa, Ba, B, Caa, Ca, C

best ⟷ worst

- Investment grade
  - Bonds with ratings of BBB (or Baa) and above



IRMT
irmT The Institute of Risk Management Tanzania

# Assigning Ratings and Default Probabilities: Judgmental versus Analytical

* Ratings rank the credit risk of debt issues. When assigning ratings, there are various dimensions of the risk of a loan to capture. The first is the risk of the borrower. This is a counterparty risk, rather than a facility risk. The facility risk depends on collateral, third-party guarantees and informal support of a holding company.
* The most common way to assign default probabilities to facilities is through the internal rating system of the bank.
* This is the 'Internal Ratings-Based' (IRB) approach of the New Basel Accord.

# Assigning Ratings and Default Probabilities: Judgmental versus Analytical

The forthcoming regulations on credit risk require these internal ratings to better capture risk differentiation than the former Cooke ratio.

First from internal ratings to external ratings of rating agencies, and second from these to the historical default frequencies, as recorded historically by agencies for the portfolio of rated entities.

# Historical Default Probabilities

Historical data provided by rating agencies are also used to estimate the probability of default

- The table 22.1 shows the probability of default for companies starting with a particular credit rating
- A company with an initial credit rating of Baa has a probability of 0.181% of defaulting by the end of the first year, 0.506% by the end of the second year, and so on
- For a company that starts with a good credit rating default probabilities tend to increase with time
- For a company that starts with a poor credit rating default probabilities tend to decrease with time

# Historical Data

**Table 22.1** Average cumulative default rates (%), 1970–2006. *Source*: Moody's.

| *Term (years)*: | *1* | *2* | *3* | *4* | *5* | *7* | *10* | *15* | *20* |
|---|---|---|---|---|---|---|---|---|---|
| Aaa | 0.000 | 0.000 | 0.000 | 0.026 | 0.099 | 0.251 | 0.521 | 0.992 | 1.191 |
| Aa | 0.008 | 0.019 | 0.042 | 0.106 | 0.177 | 0.343 | 0.522 | 1.111 | 1.929 |
| A | 0.021 | 0.095 | 0.220 | 0.344 | 0.472 | 0.759 | 1.287 | 2.364 | 4.238 |
| Baa | 0.181 | 0.506 | 0.930 | 1.434 | 1.938 | 2.959 | 4.637 | 8.244 | 11.362 |
| Ba | 1.205 | 3.219 | 5.568 | 7.958 | 10.215 | 14.005 | 19.118 | 28.380 | 35.093 |
| B | 5.236 | 11.296 | 17.043 | 22.054 | 26.794 | 34.771 | 43.343 | 52.175 | 54.421 |
| Caa–C | 19.476 | 30.494 | 39.717 | 46.904 | 52.622 | 59.938 | 69.178 | 70.870 | 70.870 |

# Default Intensity

- The unconditional default probability
  - the probability of default for a certain time period as seen at time zero

39.717 - 30.494 = 9.223%

- The default intensity (hazard rate)
  - the probability of default for a certain time period conditional on no earlier default

100 – 30.494 = 69.506%

0.09223 / 0.69506 = 13.27%

| *Term (years):* | *1* | *2* | *3* |
|---|---|---|---|
| Caa–C | 19.476 | 30.494 | 39.717 |

$\lambda(t)$ : the default intensities at time $t$

$V(t)$ : the cumulative probability of the company surviving to time $t$

$\lambda(t)\Delta t$ : the probability of default between time $t$ and $t+\Delta t$ condtional on no earlier default

$$[V(t)-V(t+\Delta t)]\div V(t)=\lambda(t)\Delta t$$

$$V(t+\Delta t)-V(t)=-\lambda(t)V(t)\Delta t$$

$$\frac{V(t+\Delta t)-V(t)}{\Delta t}=\frac{-\lambda(t)V(t)\Delta t}{\Delta t}$$

$$\frac{dV(t)}{dt}=-\lambda(t)V(t)$$

$$V(t)=e^{-\int_0^t \lambda(\tau)d\tau}$$



IRMT

irmT The Institute of Risk Management Tanzania

# CONTD….

- Q(t) : the probability of default by time t

$$Q(t) = 1 - V(t)$$

$$= 1 - e^{-\int_0^t \lambda(\tau)\,d\tau}$$

$$= 1 - e^{-\bar{\lambda}(t)t} \qquad (22.1)$$

where $\bar{\lambda}(t)$ is the average default intensity (hazard rate) between time 0 and time $t$.



IRMT

irmT The Institute of Risk Management Tanzania

# Recovery Rates and Credit Default Swaps

**Recovery Rate**

Defined as the price of the bond immediately after default as a percent of its face value.

Moody found the following relationship fitting the data:

Recovery rate = 59.1% – 8.356 x Default rate

Significantly negatively correlated with default rates



IRMT

irmT The Institute of Risk Management Tanzania

# Recovery Rates-Cont…

When a company goes bankrupt, those that are owed money by the company file claims against the company.4 Sometimes there is a reorganization in which these creditors agree to a partial payment of their claims.

In other cases, the assets are sold by the liquidator and the proceeds are used to meet the claims as far as possible. Some claims typically have priorities over other claims and are met more fully. The *recovery rate* for a bond is normally defined as the price at which it trades about 30 days after default as a percent of its face value.

# Credit Default Swap

Credit default swaps refers to a financial contract whereby a buyer of corporate or sovereign debt in the form of bonds attempts to eliminate possible loss arising from default by the issuer of the bonds.

This is achieved by the issuer of the bonds insuring the buyer's potential losses as part of the agreement.

In a standard ***credit default swap*** (CDS), a counterparty buys protection against default by a particular company or economic entity from a counterparty (seller).

# Credit Default Swap Cont…

The company  or entity is known as the ***reference entity*** and a default by that entity is known as a ***credit event***.

The ***buyer*** of the CDS makes periodic payments or a ***premium*** to the ***seller*** until the end of the life of the CDS or until the credit event occurs.



IRMT

irmT The Institute of Risk Management Tanzania

# Credit Default Swap Cont…

A derivative that has become very important in credit markets is a *credit default swap* (CDS). The simplest type of CDS is an instrument that provides insurance against the risk of a default by a particular company. The company is known as the *reference entity* and a default by the company is known as a ***credit event.***

The buyer of the insurance obtains the right to sell bonds issued by the company for their face value when a credit event occurs and the seller of the insurance agrees to buy the bonds for their face value when a credit event occurs.

# Credit Default Swap Cont…

The total face value of the bonds that can be sold is known as the **credit default swap's *notional principal*.**

The buyer of a CDS makes periodic payments to the seller until the end of the life of the CDS or until a credit event occurs. These payments are usually made in arrears every quarter.

# Credit Default Swap Cont…

**Example:**

Suppose two parties enter into a 5-year CDS with a NP of $200,000,000.

The buyer agrees to pay 95 bp annually for protection against default by the reference entity. If the reference entity does not default, the buyer does not receive a payoff and ends up paying $1,900,000 each year for 5 years.

If a credit event does occur, the buyer will receive the default payment and pay a final accrual payment on the unpaid premium.

# Credit Default Swap Cont…

## A Common Credit Default Swap Transaction

**Protection Seller**

Does not usually own underlying credit asset

Selling Credit Protection

Long Credit Exposure

Payment Only if Credit Event Occurs

Credit Default Swap Premium Paid Periodically

**Protection Buyer**

Tends to own underlying credit asset

Purchasing Credit Protection

Short Credit Exposure

# Estimating Default Probabilities

**Assumption**

The only reason that a corporate bond sells for less than a similar risk-free bond is the possibility of default

In practice the price of a corporate bond is affected by its liquidity.



IRMT

irmT The Institute of Risk Management Tanzania

# Credit Spreads

A Credit spread refers to the difference in interest rates between a corporate bond and a comparable Government bonds.

In the event of a default, the payoff from the CDS is equal to the face value of the bond (or NP) minus the value of the bond just after the default.

The value of the bond just after the default expressed as a proportion of the bond's face value is known as the recovery rate (RR). If that value on the $200,000,000 CDS were $30 per $100 face value, then the recovery rate would be 30% and the payoff to the CDS buyer would be $140,000,000 minus any accrued payment.

# Credit Spreads Cont…

Payoff = (1 –.30)$200,000,000) – Accrued Payment

Payoff = $140,000,000 – Accrued Payment.

The payments on a CDS are quoted as an annual percentage of the NP. The payment is referred to as the ***CDS spread***

# The Equilibrium CDS Spread

In equilibrium, the payment or spread on a CDS should be approximately equal to the credit spread on the CDS's underlying bond or credit.

***Example:***

If the only risk on a 5-year BBB corporate bond yielding 8% were credit risk and the risk-free rate on 5-year investment were 6%, then the bond would be trading in the market with a 2% credit spread.

# The Equilibrium CDS Spread Cont…

***Example:***

If the spread on 5-year CDS on a BBB quality bond were 2%, then an investor could obtain a 5-year risk-free investment yielding 6% by either Buying a 5-year Treasury

or

Buying the 5-year BBB corporate yielding 8% and purchasing the CDS on the underlying credit at a 2% spread

# Comparison of Default Probabilities Estimates

The default probabilities estimated from historical data are much less than those derived from bond prices

**Table 22.4** Seven-year average default intensities (% per annum).

| *Rating* | *Historical default intensity* | *Default intensity from bonds* | *Ratio* | *Difference* |
|---|---|---|---|---|
| Aaa | 0.04 | 0.60 | 16.7 | 0.56 |
| Aa | 0.05 | 0.74 | 14.6 | 0.68 |
| A | 0.11 | 1.16 | 10.5 | 1.04 |
| Baa | 0.43 | 2.13 | 5.0 | 1.71 |
| Ba | 2.16 | 4.67 | 2.2 | 2.54 |
| B | 6.10 | 7.97 | 1.3 | 1.98 |
| Caa and lower | 13.07 | 18.16 | 1.4 | 5.50 |

# Comparison of Default Probabilities Estimates Cont…

**TABLE 19.4** Cumulative Default Probabilities Compared with Credit Spreads

| Rating | Cumulative 7-Year Default Probabilities (%), 1970–2013 | 7-Year Credit Spread (bp) 1996–2007 |
|---|---|---|
| Aaa | 0.241 | 35.74 |
| Aa | 0.682 | 43.67 |
| A | 1.615 | 68.68 |
| Baa | 2.872 | 127.53 |
| Ba | 13.911 | 280.28 |
| B | 31.774 | 481.04 |
| Caa | 56.878 | 1,103.70 |

# Comparison of Default Probabilities Estimates Cont…

We now compare the default probability estimates calculated from historical data with those calculated from credit spreads. Table 19.4 shows:

* The seven-year average cumulative probability of default for companies with different credit ratings The average credit spread for bonds with different credit ratings between December 1996 and June 2007. This is taken from data on bond yields published by Merrill Lynch and an assumption that the risk-free rate is 10 basis points less than the seven-year swap rate.

# Comparison of Default Probabilities Estimates Cont…

* The bonds had an average maturity of about seven years. The table considers data on bond yields only up to the start of the credit crisis.
* During the credit crisis, credit spreads soared. If that unusual period had been included, the results we present, which show that hazard rates calculated from credit spreads are higher than those calculated from historical default probabilities, would become much more pronounced

# Using Equity Prices to Estimate Default Probabilities

**Table 22.1** Average cumulative default rates (%), 1970–2006. *Source*: Moody's.

| *Term (years)*: | *1* | *2* | *3* | *4* | *5* | *7* | *10* | *15* | *20* |
|---|---|---|---|---|---|---|---|---|---|
| Aaa | 0.000 | 0.000 | 0.000 | 0.026 | 0.099 | 0.251 | 0.521 | 0.992 | 1.191 |
| Aa | 0.008 | 0.019 | 0.042 | 0.106 | 0.177 | 0.343 | 0.522 | 1.111 | 1.929 |
| A | 0.021 | 0.095 | 0.220 | 0.344 | 0.472 | 0.759 | 1.287 | 2.364 | 4.238 |
| Baa | 0.181 | 0.506 | 0.930 | 1.434 | 1.938 | 2.959 | 4.637 | 8.244 | 11.362 |
| Ba | 1.205 | 3.219 | 5.568 | 7.958 | 10.215 | 14.005 | 19.118 | 28.380 | 35.093 |
| B | 5.236 | 11.296 | 17.043 | 22.054 | 26.794 | 34.771 | 43.343 | 52.175 | 54.421 |
| Caa–C | 19.476 | 30.494 | 39.717 | 46.904 | 52.622 | 59.938 | 69.178 | 70.870 | 70.870 |

# Using Equity Prices to Estimate Default Probabilities Cont…

Unfortunately , credit ratings are revised relatively infrequently. The equity prices can provide more up-to-date information.

This has led some analysts to argue that equity prices can provide more up-to-date information for estimating default probabilities.

I
R
M
T

# CREDIT RISK IN DERIVATIVES

# What are Derivatives?

A financial contract that has its price derived from, and depending upon, the price of an underlying asset. The underlying assets might be traded.

Types of Derivatives include:

- ✓ Swaps,
- ✓ Options and
- ✓ Futures for example.

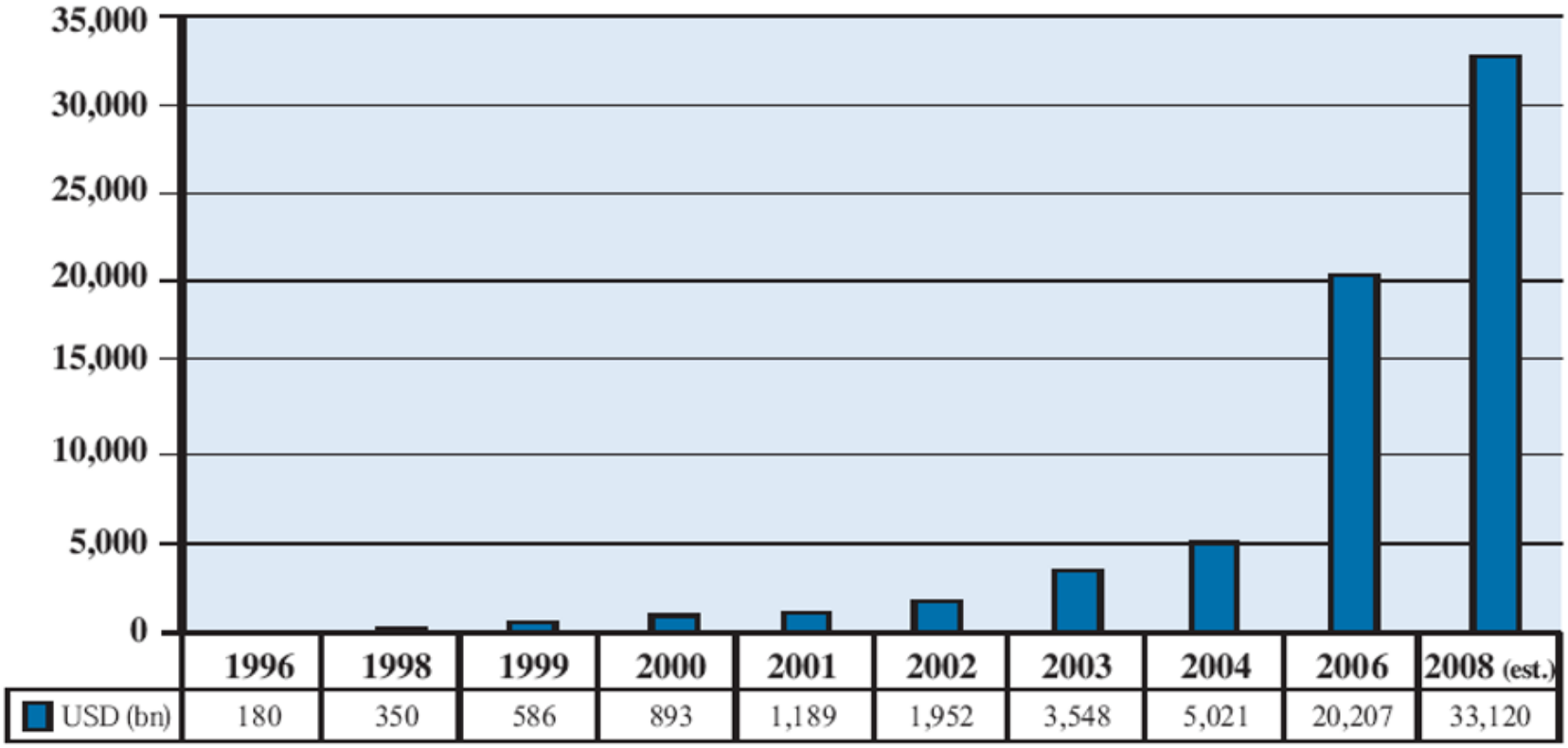
# What is Credit Derivatives?

Credit Risk refers to the risk that a counterparty to a financial transaction will fail to fulfill their obligation.

Credit derivatives these refers to derivative instruments that seek to trade in credit risks.

# Growth in Credit Derivatives

**Source: BBA Credit Derivatives Report 2006**




| | 1996 | 1998 | 1999 | 2000 | 2001 | 2002 | 2003 | 2004 | 2006 | 2008 (est.) |
|---|---|---|---|---|---|---|---|---|---|---|
| USD (bn) | 180 | 350 | 586 | 893 | 1,189 | 1,952 | 3,548 | 5,021 | 20,207 | 33,120 |

**Global Credit Derivatives Market $bn**

# Types of Credit Derivatives

Credit derivatives includes the following three basics:

- ✓ Credit default swap
- ✓ Credit spread option
- ✓ Credit linked note



IRMT
irmT The Institute of Risk Management Tanzania

# What is Credit Default Swap?

Credit default swaps allow one party to "buy" protection from another party for losses that might be incurred as a result of default by a specified reference credit (or credits).

The "buyer" of protection pays a premium for the protection, and the "seller" of protection agrees to make a payment to compensate the buyer for losses incurred upon the occurrence of any one of several specified "credit events."

# Example

Suppose Bank A buys a bond which issued by a Steel Company.

To hedge the default of Steel Company:

Bank A buys a credit default swap from Insurance Company C.

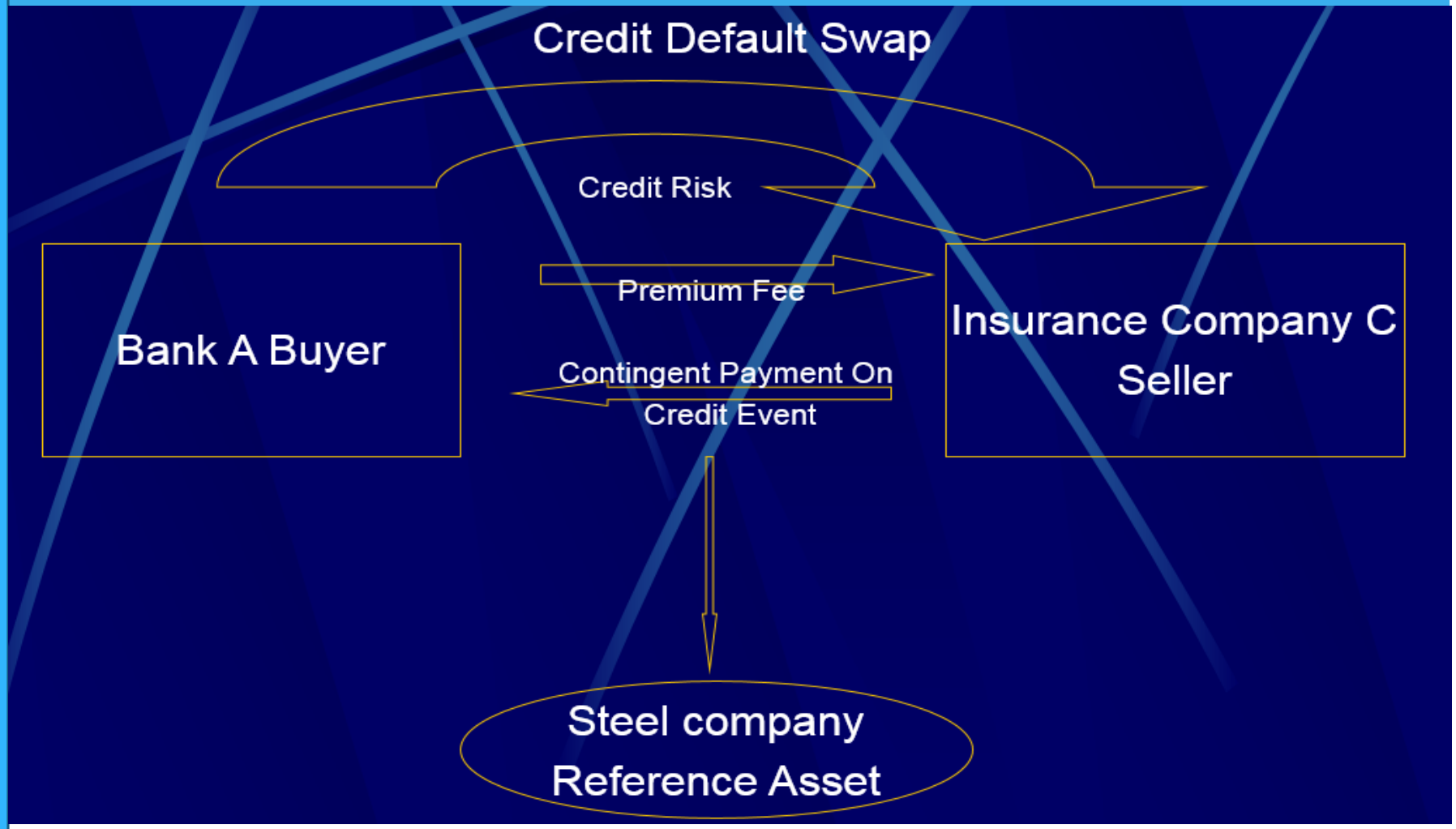
Bank A pays a fixed periodic payments to C, in exchange for default protection.



IRMT

irmT The Institute of Risk Management Tanzania

# Exhibit






IRMT

irmT
The Institute of Risk
Management Tanzania

# What is Credit Spread Option?

A credit spread option grants the buyer the right, but not the obligation, to purchase a bond during a specified future "exercise" period at the contemporaneous market price and to receive an amount equal to the price implied by a "strike spread" stated in the contract.

The different between the yield on the borrower's debt (loan or bond) and the yield on the referenced benchmark such as U. S. Treasury debt of the same maturity.

# Example

An investor may purchase from an insurer an option to sell a bond at a particular spread above LIBOR Credit spread.

If the spread is higher on the exercise date, then the option will be exercised. Otherwise it will lapse.

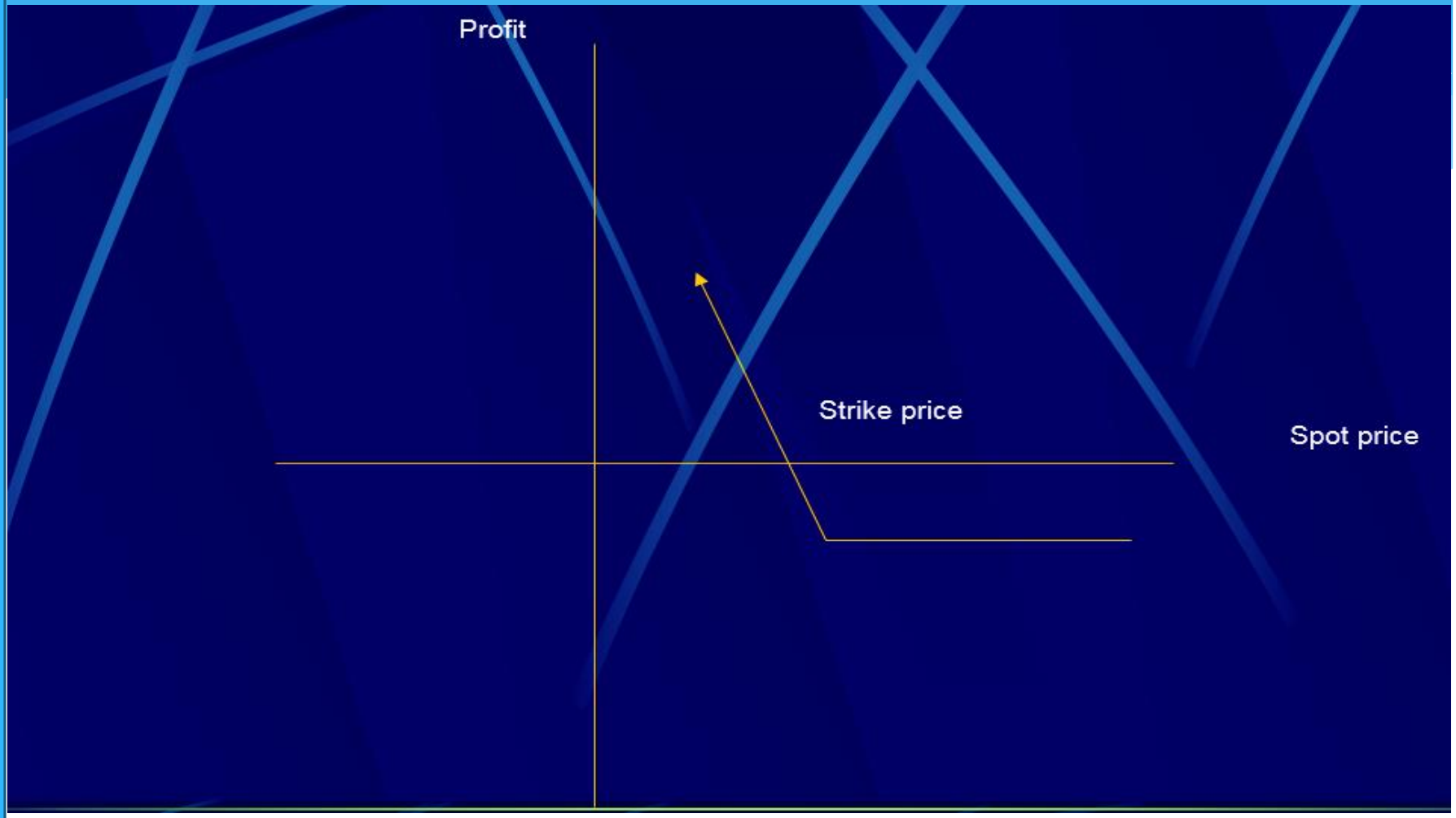


www.irmtz.org

IRMT

irmT The Institute of Risk Management Tanzania

# Exhibit



# Credit-linked Notes

A credit-linked note (CLN) is essentially a funded CDS, which transfers credit risk from the note issuer to the investor.

The issuer receives the issue price for each CLN from the investor and invests this in low-risk collateral.

If a credit event is declared, the issuer sells the collateral and keeps the difference between the face value and market value of the reference entity's debt.

# Example

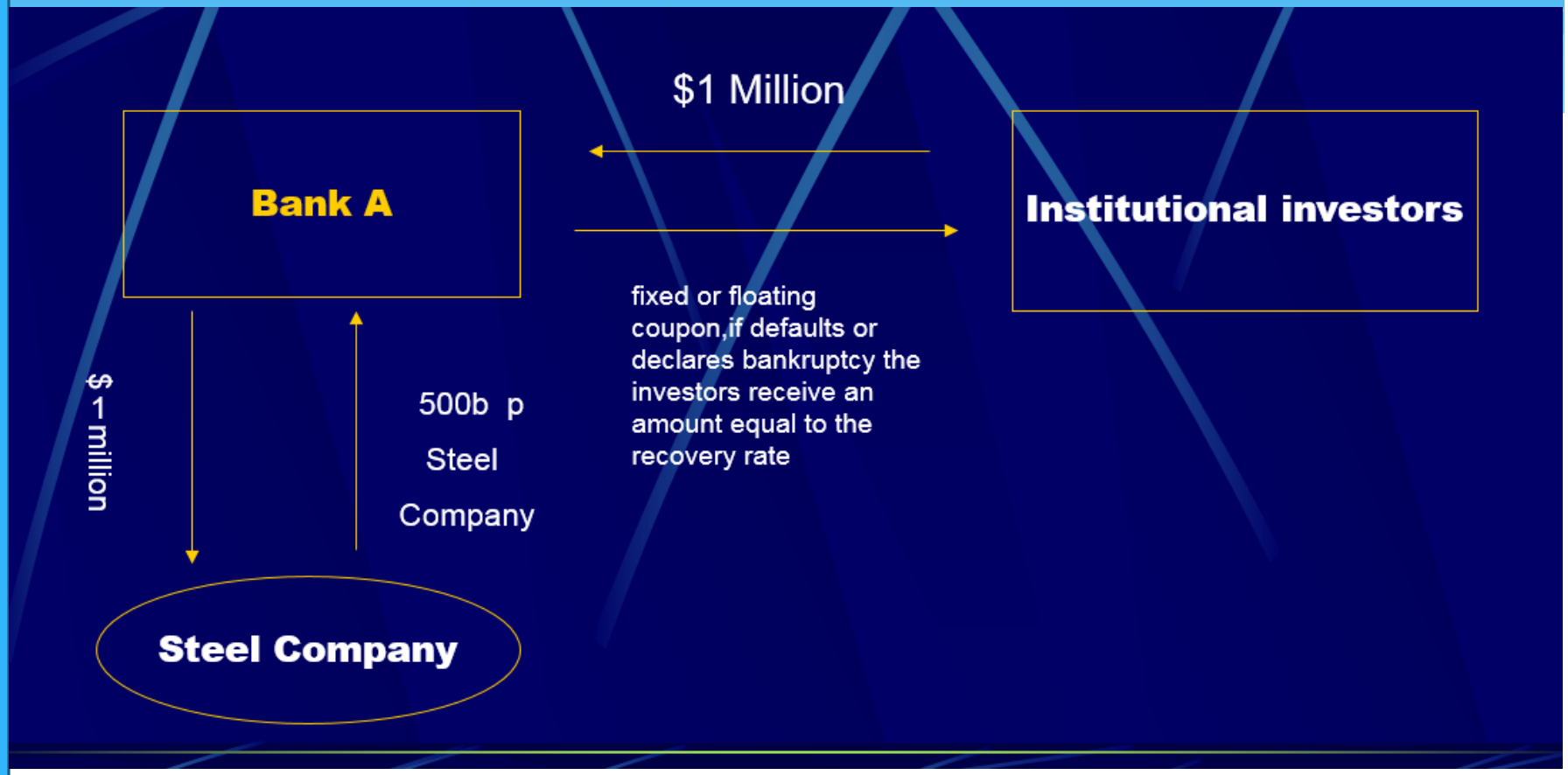
Refer to the Steel company case again.

Bank A would extend a $1 million loan to the Steel Company.

At same time Bank A issues to institutional investors an equal principal amount of a credit-linked note, whose value is tied to the value of the loan.

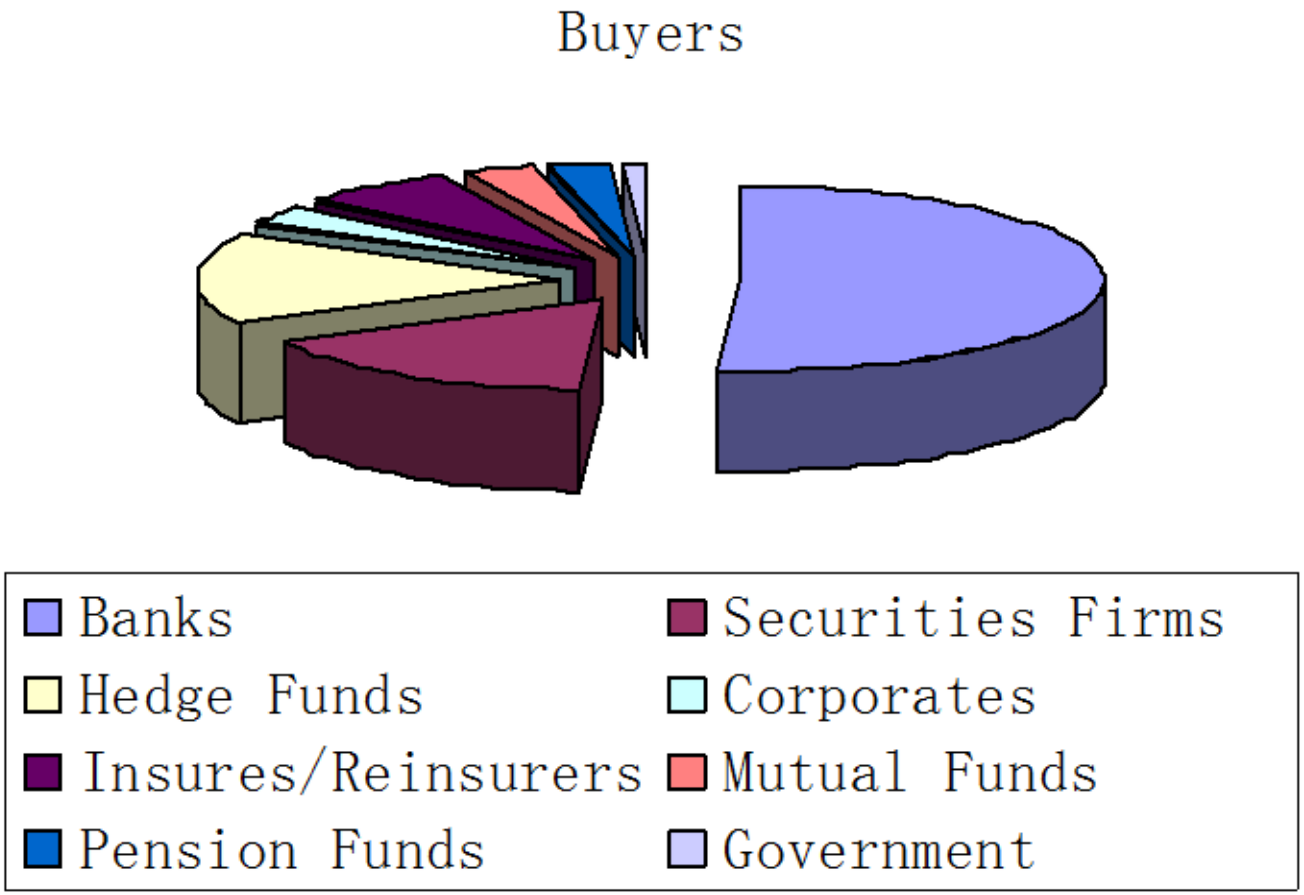
If a credit event occurs, Bank A's repayment obligation on the note will decrease by just enough to offset its loss on the loan.

# Exhibit


$1 Million
Bank A
Institutional investors
fixed or floating coupon,if defaults or declares bankruptcy the investors receive an amount equal to the recovery rate
$1 million
500b p
Steel
Company
Steel Company

# Credit Derivatives Market Participants

Source: British Bankers Association (BBA) 2003/2004 – Credit Derivatives Report



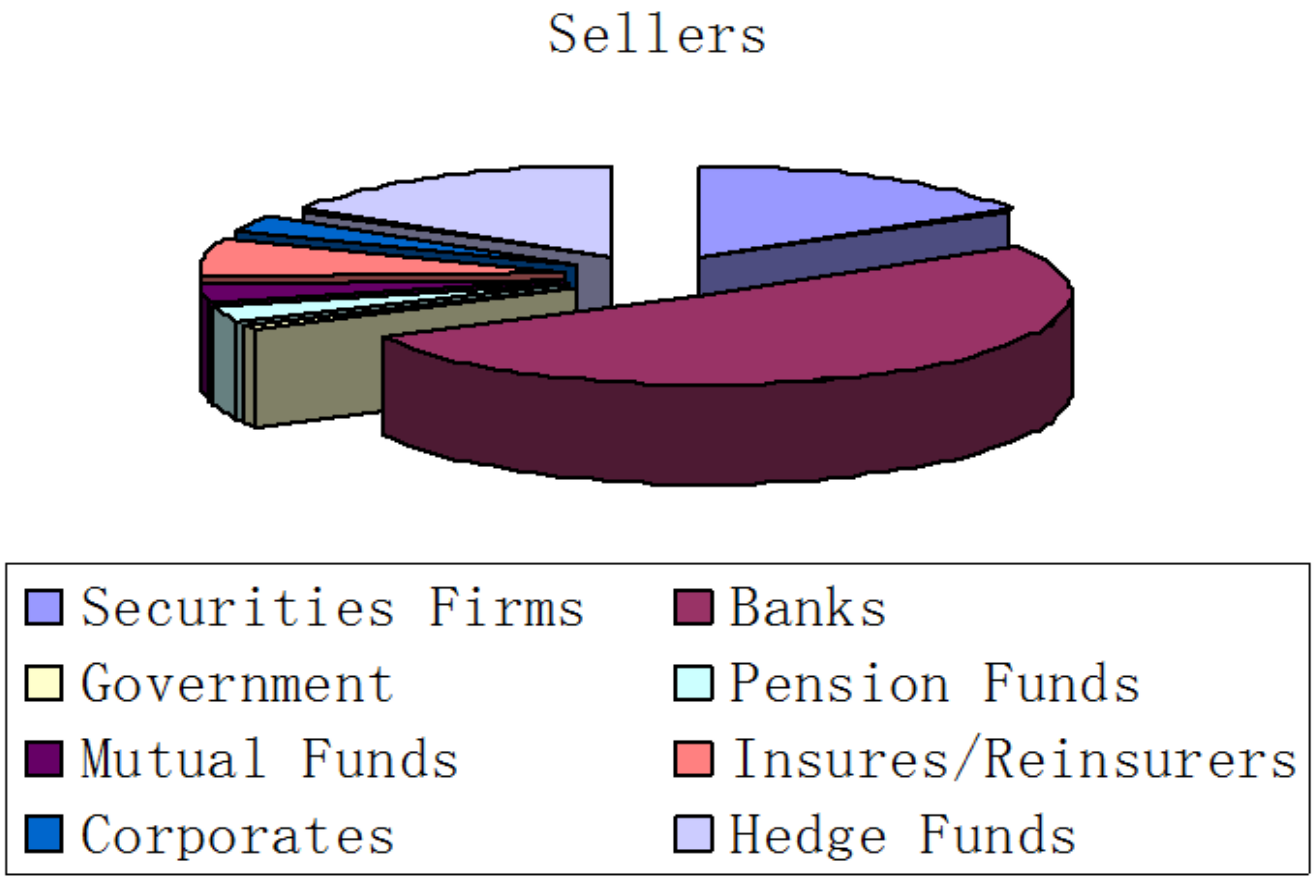
# Credit Derivatives Market Participants Cont…

For the protection buyer (the risk seller)

- To transfer credit risk on an entity without transferring the underlying instrument
- Regulatory benefit
- Reduction of specific concentrations portfolio management
- To go short credit risk

# Credit Derivatives Market Participants

Source: British Bankers Association (BBA)



# Credit Value at Risk

Credit VaR asks a question such as: What credit loss are we 99% certain will not be exceeded in 1 year?

**Basing Credit VaR on Defaults Only (CSFP Approach)**

When the expected number of defaults is m, the probability of n defaults is:

$$\frac{e^{-\mu}\mu^{n}}{n!}$$



IRMT

irmT The Institute of Risk Management Tanzania

# Credit Value at Risk Cont…

This can be combined with a probability distribution for the size of the losses on a single default to obtain a probability distribution for default losses.

The value at risk measure is central to the determination of regulatory capital for credit risk and to much of the credit risk management carried out internally by both financial and nonfinancial corporations.

This chapter covers alternative approaches for calculating credit risk VaR.

# Credit Value at Risk Cont…

Credit risk VaR is defined similarly to market risk VaR. It is the credit risk loss over a certain time period that will not be exceeded with a certain confidence level.

Some credit risk VaR models consider only losses from defaults; others consider losses from downgrades or credit spread changes as well as from defaults.

Banks calculate credit risk VaR to determine both regulatory capital and economic capital.

# Lesson Learned from Credit Crisis 2007-2012

Starting in 2007, the United States experienced the worst financial crisis since the 1930s. The crisis spread rapidly from the United States to other countries and from financial markets to the real economy.

Some financial institutions failed. Many more had to be bailed out by national governments. The first decade of the twenty first century was disastrous for the financial sector, and the risk management practices of financial institutions have been subjected to a great deal of criticism.

# What Went Wrong?

Many factors contributed to the crisis that started in 2007. Mortgage originators used lax lending standards. Products were developed to enable mortgage originators to profitably transfer credit risk to investors.

Rating agencies moved from their traditional business of rating bonds, where they had a great deal of experience, to rating structured products, which were relatively new and for which there were relatively little historical data. The products bought by investors were complex and in many instances investors and rating agencies had inaccurate or incomplete information about the quality of the underlying assets.

# What Went Wrong? Cont…

Investors in the structured products that were created thought they had found a money machine and chose to rely on rating agencies rather than forming their own opinions about the underlying risks.

The return promised on the structured products rated AAA was high compared with the returns promised on bonds rated AAA.

# Lessons From the Crisis

Some of the lessons for risk managers from the crisis are as follows:

a) Risk managers should be watching for situations where there is irrational exuberance and make sure that senior management recognize that the good times will not last forever.

b) Correlations always increase in stressed markets. In considering how bad things might get, risk managers should not use correlations that are estimated from data collected during normal market conditions.

c) Transparency is important in financial markets. If there is a lack of transparency markets are liable to dry up when there is negative news.

# Lessons From the Crisis Cont…

d) Recovery rates decline when default rates increase. This is true for almost all debt instruments, not just mortgages. In considering how bad things might get, risk managers should not use recovery rates that are estimated from data collected during normal market conditions.

e) Investors should not rely on ratings. They should understand the assumptions made by rating agencies and carry out their own analyses.

# Lessons From the Crisis Cont…

f) If a deal seems too good to be true, it probably is. AAA-rated tranches of structured products promised returns that were higher than the returns promised on AAA bonds by 100 basis points, or more. A sensible conclusion from this for an investor would be that further analysis is needed because there are likely to be risks in the tranches that are not considered by rating agencies.

I
R
M
T

# INSTITUTE OF RISK MANAGEMENT TANZANIA (IRMT)

# STUDENTS SUMMARY NOTES

## MODULE IX

## OPERATIONAL RISK IN FINANCIAL SERVICES

## CERTIFIED FINANICIAL SERVICES RISK MANAGEMENT PROFESSIONAL COURSE

## Certified Financial Services Risk Professional Examination (CFSRP)

IRMT



irmT The Institute of Risk Management Tanzania

# Operational Risk Management

*With programme A we know that 200 lives will be saved, whereas with programme B there is a one-third chance of saving all 600 lives and a two-thirds chance of saving none..*

*With programme C we know that 400 lives will be lost, whereas with programme D there is a one-third chance that none will die and a two-thirds chance that all 600 people will die.*

# The training is Designed to Help the Participants to Understand

- Background to operational risk
- Define operational risk
- Enablers of operational risk management
- Operational Risk Management Principles and Basel II
- Measuring of operational risk
- Developments in operational risk

# Background

- Operational Risk is the type of risk that will disrupt normal everyday activities
- It is closely related to infrastructure risk described in the FIRM risk scorecard classification system
- Operational risk are usually hazard risk, and this has been an area of strong application of risk transfer by way of insurance
- It has now a more extensive application and more specific definition, particularly financial institutions
- However, operational risks in financial institutions is differentiated by the fact that there is a need to quantify these risks in terms of potential financial loss

# Background to Operational Risk

- Financial institutions are required to have sufficient capital reserves available to meet the actual and potential financial losses and obligations faced by the organizations
  - It is a key regulatory framework set out for banks in the BASEL II Accord and under emerging regulation for European insurance companies through the Solvency II European Directive
- The financial institutions need to measure the level of operational risk they face

# Background to Operational Risk

- A major contributing factor for global financial crisis was that banks adopted high-risk strategies that resulted in the banks having insufficient capital when the risks materialized
- Basel II adequacy regulations require that banks take their operational risk exposure into account in determining capital requirements
- Operational Risk Management Framework should include identification, measurement and monitoring, reporting, control and mitigation frameworks for operational risk

# Background to Operational Risk

- The assessment of capital requirements is often called **economic capital**
- Regulations requires that banks must follow one of the three specific quantitative methods to provide another measure of capital requirement, called **regulatory capital**
- The two methods above are based on the incomes of the financial institution and the last one requires assessment of all material operational risk exposure to high degree of statistical quality

# Background to Operational Risk

- Under the Solvency II European Directive, insurance companies in the EU have to adopt a similar approach
- Basel II is the second of the Basel Accord that set out recommendations on banking laws and regulations, as issued by the Basel Committee on Banking Supervision.
- The purpose of Basel II (2004) is to create an international standard that the banking regulators can use when creating regulations about how much capital banks need to put aside to guard against the types of financial and operational risk they face

# Definition of Operational Risk

- Operational risk faced by banks and other financial institutions represents essentially the same types of disruptive hazard risks that are faced by other organizations, although the definition may be broader.
- However, in financial institutions the level of operational risk need to be quantified, because the level of risk has to be covered by available capital within institution
- Therefore banks must reduce the operational risks to the lowest level that is cost-effective

# Definition of Operational Risk

- Banks have long been concerned with market risks and credit risks
  - Insurance companies with underwriting risk
- Advent of Basel II and Solvency II requires financial institutions to consider broader operational risk exposure
- Operational risk was initially defined as being any form of risk that was not market risk or credit risk

# Definition of Operational Risk

- The best definition was defined by Basel II
  - Operational risk is the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events.
  - Basel II definition includes legal risk, but excludes strategic and reputational risk
- The following risks are associated with Basel II definitions
  - Internal fraud, include misappropriation of assets, tax evasion and bribery;

# Definition of Operational Risk

- External fraud including theft, hacking and forgery
- Employment practices and workplace safety
- Clients, projects and business practices
- Damage to physical assets
- Business interruption and system failures
- Execution, delivery and process management

# Definition of Operational Risk

- Operational risk has also variety of meanings and certain financial institutions use a different term or broader definition.
- Basel II definition identifies four types of risk categories:
  - People
  - Process
  - System
  - External risks

# Definition of Operational Risk

- People risks include failure to comply with procedures and lack of segregation of duties.
- Process risks include process failures and inadequate controls
- System risks include failure of application systems to meet the user requirements and the absence of built-in control measures
- External risks include
  - action by regulators (change of regulations, but excluding enforcement or disciplinary action)

# Definition of Operational Risk

- Unsatisfactory performance by service providers and fraud both internal and external
- External risks also include legal action by customers of financial institutions in relation to negligence or fraud committed by staff.

# Other Risks

- Market risks is the risk that the value of investments may decline over a period, simply because of economic changes or other events that impact large portions of the market
- Credit risks is the risk that there will be a failure by a customer/ or client to repay the principal and/or interest on a loan or other outstanding debt in timely manner, or at all.
- Underwriting risks is also important for insurance companies; it is the exposure the risks of the client through insurance policies

# Failure of Operational Risk Management

- There are numerous approaches that have been developed across different industries, but many institutions are struggling to make these fully effective by really embedding them into the day-to-day management of their business
- To overcome this, it is essential to define clearly the relationship between operational risk processes and the overall control environment
- Effectiveness of operational risk management has been impeded by common failure to truly embed operational risk into overall management of risk and control

# Failure of Operational Risk Management

- Group risk function must demonstrate to business-unit staff the full potential of using operational risk processes, developed under the group framework to manage the actual risks into the business
- Therefore the governance of operational risks involves more than just calculating the yearly operational risk capital. As economies and financial condition change over time, so does the operational risk exposure
- Thus, a number of specific operational risk events may become even more likely, which in times of crises require the attention of top management

# Failure of Operational Risk Management

- Failure to manage operational risks can be very substantial
- Losses suffered by rogue-traders are sometimes attributed to market risks
  - the argument for this is that the losses occurred because market conditions changed in an unexpected way and significant loss materialized
  - However, the above **analysis is incorrect**
  - More correctly is to say that the losses occurred because of a failure to control activities of traders
    - if the operations has been controlled by adequate operational risk controls then the traders would not have been in position ot have put substantial assets of the bank at risk.

# Operational Risks for a Bank

| Event Category | Definition | Description | Examples |
|---|---|---|---|
| Internal fraud | Losses due to fraud, misappropriation or circumvention of regulations by internal party | Unauthorized activity, theft and fraud | Unreported transactions, unauthorized transactions, theft and frau. Tax non-compliance and insider trading |
| External fraud | Losses due to fraud, misappropriation or circumvention of the regulations by third party | Systems security, theft and fraud | Theft, robbery, forgery, hacking/theft of information |
| Employees | Losses arising form injury or non-compliance with the employment legislation | in a safe environment, damaged employee relations and discrimination | Compensation claim, discrimination allegation |

# Operational Risks for a Bank

| Event Category | Definition | Description | Examples |
|---|---|---|---|
| Clients | Losses arising from failure to meet professional obligations to clients | Disclosure and fiduciary | Fiduciary breaches, disclosure violations, misuse of confidential information |
| Physical assets | Losses arising from loss or damage to physical assets | Disasters and other events | Natural disaster losses . Terrorism/vandalism |
| Systems | Losses arising from disruption of business or system failure | Systems | Hardware or software failure. Telecommunications and utility disruption |

# Operational Risk in Financial and Industrial Organizations

| Financial | Industrial |
|---|---|
| • Errors mostly arise when people reach their mental limits.<br>• Systems are highly complex and widely distributed and the environment is only partly manageable.<br>• Loss prevention is concerned with security of value and assets.<br>• Loss prevention is aimed at avoiding financial loss.<br>• The main incentive for committing mistakes is personal financial gain or self-interest.<br>• Risk management is a key skill in financial services and has central importance to the organization. | • Errors are mostly due to people reaching their physical limits.<br>• People are working in relatively simple relationships and the environment is highly manageable.<br>• Loss prevention is mainly concerned with physical safety, equipment protection and avoiding accidents.<br>• Loss prevention is aimed at avoiding physical harm to people or equipment and/or the manufacture of faulty goods (scrap).<br>• The main incentive for making deliberate mistakes is reducing effort or (possibly) sabotage.<br>• Risk management is not central to operations, although the aim is to avoid disruption to manufacturing processes. |

# Sample Risk Register /Risk Analysis

| No. | Rank | Risk | Description | Category | Root Cause | Triggers | Potential Responses | Risk Owner | Probability | Impact | Severity | Status |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| R44 | 1 | | | | | | | | | | | |
| R21 | 2 | | | | | | | | | | | |
| R7 | 3 | | | | | | | | | | | |

- Project severity = expectation (1-10) * impact (1-10)
- When should risk analysis be formed?
- Is not a time activity
- Periodic update and reviewed

# Calculating Severity

| Problem | Expectation | Impact | Severity |
|---|---|---|---|
| Staff | 6 | 5 | 30 |
| Late delivery of hardware | 5 | 8 | 40 |
| Communication and Networks problem | 5 | 5 | 25 |
| | | | |
| | | | |
| | | | |

Project severity = expectation (1-10) * impact (1-10)

# Qualitative Risk Analysis

- Assess the likelihood and impact of identified risks to determine their magnitude and priority.
- Risk quantification tools and techniques include:
  - Probability/impact matrixes
  - The Top Ten Risk Item Tracking
  - Expert judgment

# Probability/Impact Matrix

- A **probability/impact matrix** or **chart** lists the relative probability of a risk occurring on one side of a matrix or axis on a chart and the relative impact of the risk occurring on the other.
- List the risks and then label each one as high, medium, or low in terms of its probability of occurrence and its impact if it did occur.
- Can also calculate **risk factors**:
  - Numbers that represent the overall risk of specific events based on their probability of occurring and the consequences to the project if they do occur.

# Figure 11-4. Sample Probability/ Impact Matrix

| Probability | Low | Medium | High |
|---|---|---|---|
| High | risk 6 | risk 9 | risk 1<br>risk 4 |
| Medium | risk 3<br>risk 7 | risk 2<br>risk 5<br>risk 11 | |
| Low | | risk 8<br>risk 10 | risk 12 |

Impact



IRMT

irmT The Institute of Risk Management Tanzania

# Table 11-6. Sample Probability/Impact Matrix for Qualitative Risk Assessment

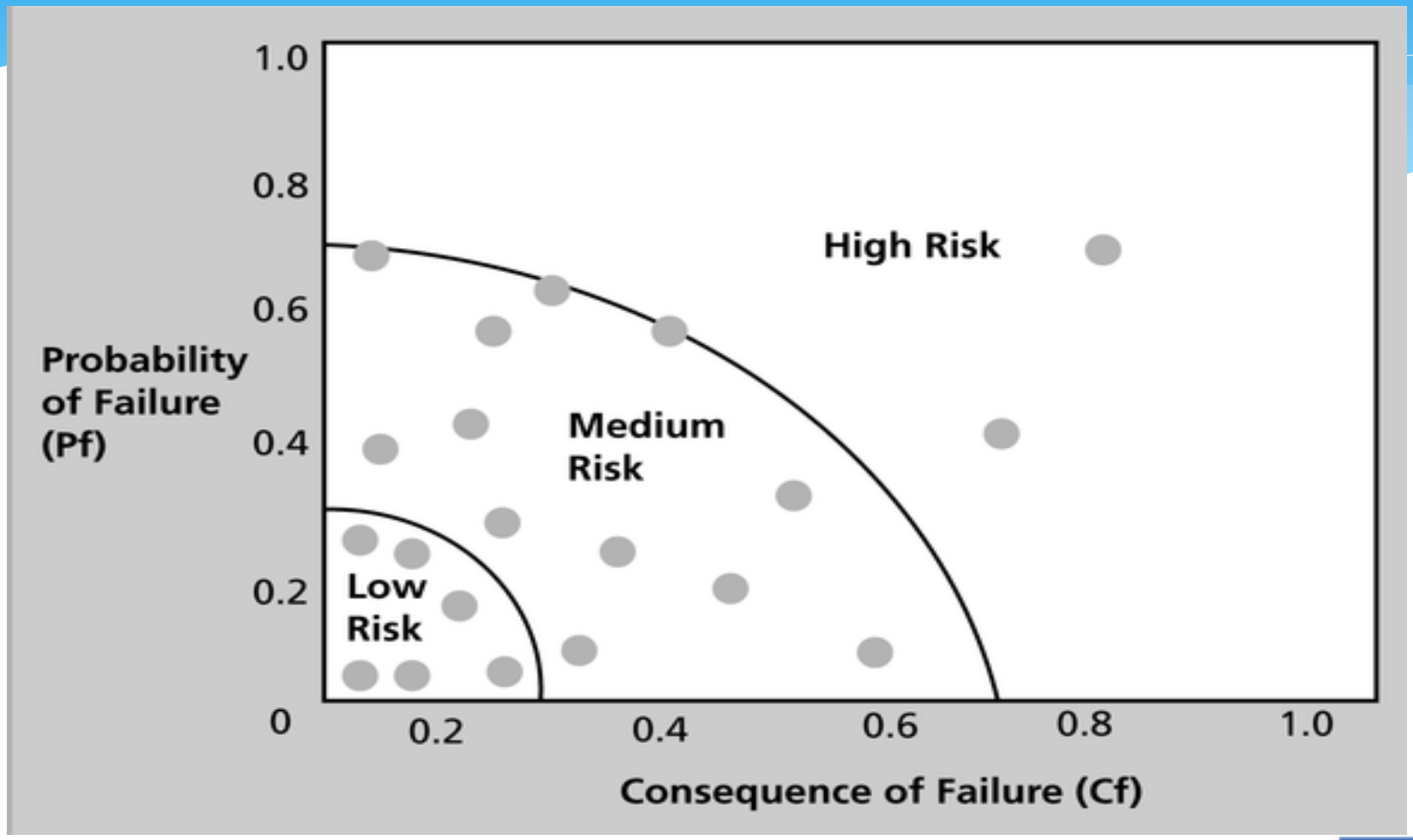
**PROBABILITY OF FAILURE ($P_F$) ATTRIBUTES OF SUGGESTED TECHNOLOGY**

| Value | Maturity Hardware/Software | Complexity Hardware/Software | Support Base |
|---|---|---|---|
| 0.1 | Existing | Simple Design | Multiple Programs And Services |
| 0.3 | Minor Redesign | Somewhat Complex | Multiple Programs |
| 0.5 | Major Change Feasible | Fairly Complex | Several Parallel Programs |
| 0.7 | Complex HW Design/ New SW Similar to Existing | Very Complex | At Least One Other Program |
| 0.9 | Some Research Completed/ Never Done Before | Extremely Complex | No Additional Programs |

**CONSEQUENCE OF FAILURE ($C_F$) ATTRIBUTES OF SUGGESTED TECHNOLOGY**

| Value | Fallback Solutions | Life Cycle Cost (LCC) Factor | Schedule Factor (Initial Operational Capability = IOC) | Downtime (DT) Factor |
|---|---|---|---|---|
| 0.1 | Several Acceptable Alternatives | Highly Confident Will Reduce LCC | 90—100% Confident Will Meet IOC Significantly | Highly Confident Will Reduce DT |
| 0.3 | A Few Known Alternatives | Fairly Confident Will Reduce LCC | 75—90% Confident Will Meet IOC | Fairly Confident Will Reduce DT Significantly |
| 0.5 | Single Acceptable Alternative | LCC Will Not Change Much | 50—75% Confident Will Meet IOC | Highly Confident Will Reduce DT Somewhat |
| 0.7 | Some Possible Alternatives | Fairly Confident Will Increase LCC | 25—50% Confident Will Meet IOC | Fairly Confident Will Reduce DT Somewhat |
| 0.9 | No Acceptable Alternatives | Highly Confident Will Increase LCC | 0—25% Confident Will Meet IOC | DT May Not Be Reduced Much |

# Chart Showing High-, Medium-, and Low-Risk Technologies



# Top Ten Risk Item Tracking

- **Top Ten Risk Item Tracking** is a qualitative risk analysis tool that helps to identify risks and maintain an awareness of risks throughout the life of a project.
- Establish a periodic review of the top ten project risk items.
- List the current ranking, previous ranking, number of times the risk appears on the list over a period of time, and a summary of progress made in resolving the risk item.

# Example of Top Ten Risk Item Tracking

| | Monthly Ranking | | | |
|---|---|---|---|---|
| **Risk Item** | **This Month** | **Last Month** | **Number of Months** | **Risk Resolution Progress** |
| Inadequate planning | 1 | 2 | 4 | Working on revising the entire project plan |
| Poor definition of scope | 2 | 3 | 3 | Holding meetings with project customer and sponsor to clarify scope |
| Absence of leadership | 3 | 1 | 2 | Just assigned a new project manager to lead the project after old one quit |
| Poor cost estimates | 4 | 4 | 3 | Revising cost estimates |
| Poor time estimates | 5 | 5 | 3 | Revising schedule estimates |

I
R
M
T



irmT
The Institute of Risk Management Tanzania

I
R
M
T

# A Regulatory Perspective on Operational Risk



irmT
The Institute of Risk Management Tanzania

# Outline

- How to define operational risk for banks
- Why banks and supervisors are pursuing quantification of operational risk
- A detailed look at the Advanced Measurement Approach for banks
- Implications for emerging markets

IRMT

irmT
The Institute of Risk Management Tanzania

# Basle Operational Risk Definition/ Framework

- "The risk of loss resulting from inadequate or failed internal processes, people and systems or from external events"
  - This definition includes legal risk
  - Strategic and reputational risk are excluded

IRMT

irmT
The Institute of Risk Management Tanzania

# Basle Operational Risk Definition/ Framework continued...

- Operational Risk is <u>not:</u>
  - All risk other than credit and market
  - Only systems & IT related
  - New

| | | Loss Event Types | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Internal Fraud | External Fraud | Employment Practices & Workplace Safety | Clients, Products & Business Practices | Damage to Physical Assets | Business Disruption & System Failures | Execution, Delivery & Process Management |
| Business Lines | Corporate Finance | | | | | | | |
| | Trading & Sales | | | | | | | |
| | Retail Banking | | | | | | | |
| | Payment & Settlement | | | | | | | |
| | Agency Services | | | | | | | |
| | Commercial Banking | | | | | | | |
| | Asset Management | | | | | | | |
| | Retail Brokerage | | | | | | | |

IRMT

irmT The Institute of Risk Management Tanzania

# Examples of Operational Loss Events in Banking

- *Internal Fraud*: Allied Irish Bank, Barings, and Daiwa Bank Ltd - $691 million, $1 billion, and $1.4 billion, respectively - fraudulent trading. Remember Stanbic Scandal

- *External Fraud*: Republic New York Corp. - $611 million - fraud committed by custodial client.

IRMT

irmT
The Institute of Risk Management Tanzania

# Examples of Operational Loss Events in Banking Cont…

- *Employment Practices and Workplace Safety*: Merrill Lynch - $250 million - legal settlement regarding gender discrimination.

- *Clients, Products & Business Practices*: Household International - $484 million- improper lending practices; Providian Financial Corp. - $405 million- improper sales and billing practices.

IRMT

irmT
The Institute of Risk Management Tanzania

# Examples of Operational Loss Events

- *Damage to Physical Assets:* Bank of New York - $140 million - damage to facilities related to September 11, 2001.

- *Business Disruption and System Failures:* Solomon Brothers - $303 million - change in computer technology resulted in "unreconciled balances".

IRMT

irmT
The Institute of Risk Management Tanzania

# Examples of Operational Loss Events Cont…

* *Execution, Delivery & Process Management*: Bank of America and Wells Fargo Bank - $ 225 million and $150 million, respectively - systems integration failures/failed transaction processing.

I R M T

irmT
The Institute of Risk Management Tanzania

# Bank's Recognize the Significance of Operational Risk

- More than 100 losses exceeding $100 Million over the last decade

- Large banks recognize the importance/ magnitude of op risk:
  - Based on recent Basle survey, on average they hold 15% of their capital for Op Risk.
  - Per their Annual Reports, Deutsche Bank and JPM are holding €2.5B and $5.8B for operational risk.

IRMT

irmT
The Institute of Risk Management Tanzania

# Rationale Banks Cite for Quantifying Op Risk

- Operational failures negatively impact profitability
  - Banks that measure and manage operational risk can reduce earnings volatility
  - Banks that measure and manage operational risk can reduce likelihood of an operational event becoming a "capital event"
- Businesses are more complex, changing rapidly, operationally intensive, and technology reliant
  - Banks that measure and manage operational risk are likely to be less susceptible to systemic problems

IRMT

irmT The Institute of Risk Management Tanzania

# Rationale Banks Cite for Quantifying Op Risk Cont…

- Customers and shareholders demand operational sophistication, speed, and flawless execution
- Risk modeling that omits (or arbitrarily sets) capital for operational risk can distort decision making and performance evaluation

IRMT

irmT
The Institute of Risk Management Tanzania

# Rationale Banks Cite for Quantifying Op Risk Cont…

- Allows banks to identify source of operational losses
  - Perhaps surprising, many banks do not routinely track such losses
  - "Causal" factor analysis helps manage these risks
- Allows banks to identify operational loss outcomes that they have exposure to, but have yet to experience.
  - example: bad cluster of high frequency, low impact events

IRMT

irmT
The Institute of Risk Management Tanzania

# Rationale Banks Cite for Quantifying Op Risk Cont…

- Provides a framework for modeling extreme events.
  - "Scenario Analyses" of low frequency, high impact events
  - example: business interruption
- Help incorporate the quantification of "risk reduction" into the decision making process
  - examples: technology, growth, insurance products

IRMT



irmT The Institute of Risk Management Tanzania

# Goals of Bank Supervisors

- Revise international capital accord to incorporate greater risk sensitivity and capture significant risks, including op risk
- Allocate capital according to a risk-focused approach to the quantification of operational risk

# Goals of Bank Supervisors Cont…

- Provide incentives for banks to measure and manage operational risks
  - Promote sound internal policies/controls/ procedures
  - Motivate investment in operational risk infrastructure to reduce operational risk
- Ensure appropriate consideration of stress testing/systemic risk
  - Consideration of systemic implications of operational risk decisions made by individual firms

IRMT

irmT
The Institute of Risk Management Tanzania

# Basle II Operational Risk Framework

- Minimum Regulatory Capital (Pillar 1)
  - Framework for calculating op risk capital charge
  - Utilizes spectrum of approaches of increasing complexity
- Sound Practices (Pillar 2)
  - Basle issued Sound Practices Paper February 2003
- Disclosure (Pillar 3)
  - Market Discipline
  - Expected to be strong motivator

IRMT

irmT
The Institute of Risk Management Tanzania

# Basle II: Current Op Risk Proposal

- Alternative approaches provided to accommodate different levels of bank sophistication:

| Basic Indicator Approach | Standardized Approach | Advanced Measurement Approaches (AMA) |
|---|---|---|
| Supervisor Specified Parameters | Supervisor Specified Parameters | Bank Defined Parameters |
| Bank-wide Measure | Business Line Based | Supervisor Set Qualitative / Quantitative Stds |
| Exposure Indicator * Alpha | Exposure Indicator * Beta | Significant Flexibility |
| Exposure Indicator = Gross Income | Exposure Indicator = Gross Income | Examples: |
| Alpha = 15% | Betas = 12 - 18% | Loss Distribution Approach<br>Scorecard Approach |

**Increasing Complexity Increasing Risk Sensitivity**



IRMT
irmT The Institute of Risk Management Tanzania

# Key Elements of a Basle II AMA

1. Internal Data
2. External Data
3. Scenario Analysis
4. Internal Control and Business Environment Factors
5. Insurance/Mitigation Techniques

* Flexible, framework that builds on banks' internal methodologies and allows for evolution of practice over time

# Key Elements of a Basle II AMA Cont…

- Qualitative and quantitative supervisory criteria
  - Similar approach as Basle Market Risk Amendment
- Key elements can be combined in different ways to quantify the bank's Op Risk exposure
- Rely on supervisory validation and benchmarking across institutions

# Operational Loss Data

- Data collection differs across banks:
  - The more detail the better, but detail comes at a $ cost
  - What kind of tracking system is needed? Manual? Automated? Training?
  - Definition? Date information? Insurance payoffs? Other recoveries?
  - What is the appropriate $ threshold to capture in database? Near misses?
  - How should operational events "across business lines" be handled?

IRMT

irmT
The Institute of Risk Management Tanzania

# Operational Loss Data Cont…

- How should internal data be supplemented with external data?

| [1] | [2] | [3] | [4] | [5] | [6] | [7] | [8] | [9] | [10] |
|---|---|---|---|---|---|---|---|---|---|
| Event # | Event Code (1) | Event Code (1) | Date | Cost Center | Business Line | Loss | Recoveries | Insurance | Event Description |
| 1 | IF | 12 | 960116 | 10003 | RB | 19057.25 | 0.00 | 19057.25 | |
| 2 | EF | 31 | 960116 | 20003 | RB | 40905.04 | 0.00 | 40905.04 | |
| 3 | SY | 22 | 960116 | 33890 | CF | 10194.55 | 3433.00 | 10194.55 | |
| 4 | SY | 11 | 960119 | 45359 | CF | 52831.68 | 0.00 | 52831.68 | |
| 5 | PD | 11 | 960120 | 11101 | CB | 36558.11 | 0.00 | 36558.11 | |
| 6 | IF | 32 | 960120 | 10003 | PS | 620537.37 | 0.00 | 620537.37 | |
| 7 | IF | 22 | 960122 | 20203 | AS | 10181.69 | 0.00 | 10181.69 | |
| 8 | EF | 31 | 960122 | 19767 | AS | 24783.17 | 13556.00 | 24783.17 | |
| 9 | EE | 17 | 960122 | 19332 | TS | 11963.49 | 0.00 | 11963.49 | |
| 10 | EE | 27 | 960122 | 18897 | AS | 20086.56 | 0.00 | 20086.56 | |
| . | . | . | . | . | . | . | | . | . |
| . | . | . | . | . | . | . | | . | . |
| . | . | . | . | . | . | . | | . | . |
| . | . | . | . | . | . | . | | . | . |
| . | . | . | . | . | . | . | | . | . |
| 2701 | UA | 8 | 960146 | 10003 | RB | 14451.49 | 0.00 | 14451.49 | |
| 2702 | UA | 3 | 960148 | 10003 | RB | 11010.46 | 0.00 | 11010.46 | |
| 2703 | WS | 17 | 960150 | 33890 | CF | 24681.18 | 0.00 | 24681.18 | |
| 2704 | SF | 26 | 960152 | 23223 | AM | 17963.66 | 16963.66 | 17963.66 | |

# Quantification Methodologies

- Alternative techniques are available
  - Chosen technique must include key elements of AMA: internal data, external data, scenario analysis, and internal control and business environment factors
  - Example 1: Loss Distribution Approach
    - Models frequency distribution and severity distribution to formulate an operational loss distribution
    - Challenge to understand appropriate modeling of the "tail" of the severity distribution

IRMT

irmT
The Institute of Risk Management Tanzania

# Quantification Methodologies Cont…

- Example 2: Scorecard Approach
  - Models required capital at the corporate level
  - Allocates capital pool to business lines based on scorecard
- Other credible methodologies will be acceptable
  - AMA does NOT preclude alternatives

# Quantification Methodologies - LDA

- The Loss Distribution Approach:
  - Standard statistical techniques are available
    - which techniques are most appropriate?
    - what are appropriate for modeling the "tail" of the distribution?
- Data Quality is Important
  - Incorporating high-severity events
    - External data?
    - Scenario analysis?

IRMT

irmT
The Institute of Risk Management Tanzania

# Quantification Methodologies – LDA Cont…

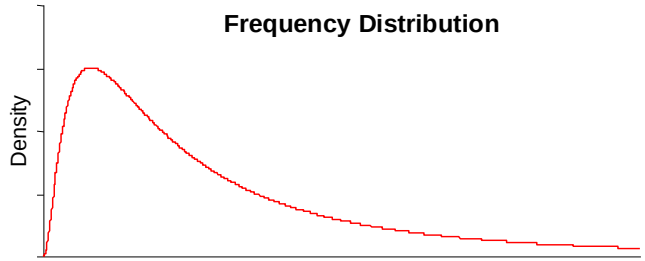
- Incorporating Risk Mitigation
  - Insurance coverage can be incorporated into methodology
    - uses information about deductibles/limits on "event policies"
    - still have to assess translation into credit/legal risk
  - Provides framework to assess appropriateness of coverage

# Overview of LDA

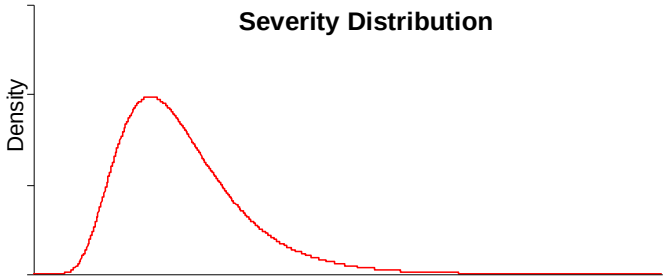
Generally, estimation of an operational loss distribution involves 3 steps:

1. Estimating a frequency distribution
2. Estimating a severity distribution
3. Running a statistical simulation to produce a loss distribution

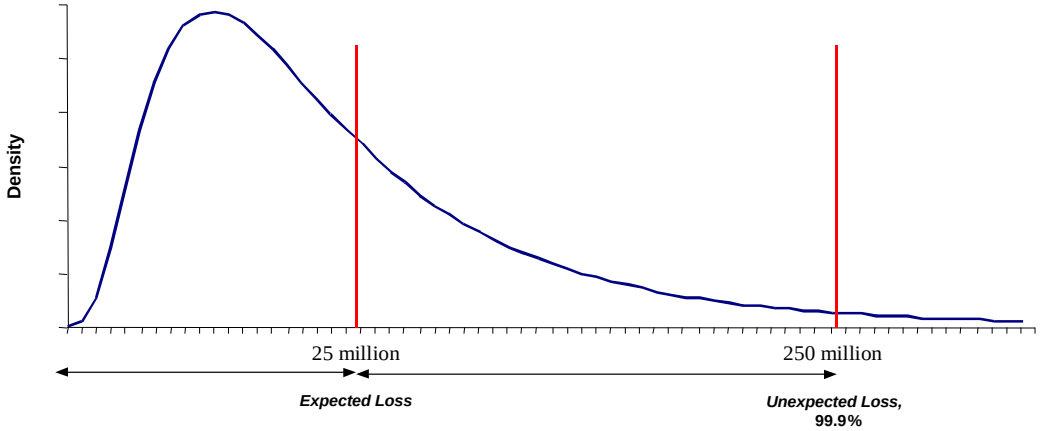
# Overview of LDA




Number of Loss Events per Year




$ Value of a Loss Events




**Total Operational Loss over a 1 year time horizon**

# Internal Control and Business Environment Factors
## *Qualitative Risk Assessments*

- Developing qualitative operational risk assessments
  - Tailored to business line, and are designed to be "real time" and/or "forward-looking"
  - "Scorecard"
    - business unit asked to answer series of questions regarding OpRisk

IRMT

irmT
The Institute of Risk Management Tanzania

# Internal Control and Business Environment Factors

## *Qualitative Risk Assessments Cont…*

IRMT

* Examples:
  * What is the number of sensitive positions filled by temps?
  * What is the ratio of supervisors to staff?
  * Does your business unit have confidential client information?

* However, are these scorecards correlated with true OpRisk exposure?



irmT
The Institute of Risk Management Tanzania

# Internal Control and Business Environment Factors

## *Key Risk Indicators*

- Developing systems that track risk indicators
  - "Real Time" indicators
  - Usually tailored to business line
  - examples:
    - employee turnover
    - number of open employee positions
    - transaction volume
    - average transaction size

# Internal Control and Business Environment Factors

## *Key Risk Indicators Cont…*

- However, are these indicators correlated with OpRisk exposure?
- Quantitative Analysis can help assess relevancy of KRIs
  - which are drivers
  - what are important thresholds

# AMA Should Be Consistent with the Scope of Application

- Applies to internationally active banks as well as to the entire banking group
- Home and host supervisors must be satisfied that capital reflects the operational risk profile

# Each Bank Must be Adequately Capitalized on a Stand-Alone Basis

- Capital is generally not freely transferable within a banking group
- Banking groups are allowed to recognize benefits of group-wide diversification at the group level
- Group-wide diversification benefits cannot be applied to significant banking subsidiaries
- Non-significant bank subsidiaries may be limited by host supervisor in applying diversification benefits

IRMT

irmT
The Institute of Risk Management Tanzania

# Supervisors Should Strive to Minimize the Cost of AMA Cross-Border Implementation

- Institutions can leverage group resources at the subsidiary level
- Subsidiaries can rely on data, parameters and experts at the parent company – with consideration of specific circumstances of the legal entity

# How Should Supervisors Coordinate?

- Home supervisor will lead the coordination effort
- Host supervisors will need to be comfortable with the bank capital in host country
  - Coordination between home/host countries will be critical
  - Allocations will need to be mutually acceptable

IRMT

irmT
The Institute of Risk Management Tanzania

# Implications for Emerging Markets

- To manage a risk you need to be able to measure it
- Operational loss data has been an effective place to start – patterns in data usually lead to better mitigation
- Most effective use tends to be by firms that use economic capital to manage
- Home/Host issues need to be resolved
- Largest global banks are moving rapidly to be ready for implementation

IRMT

irmT
The Institute of Risk Management Tanzania

# Questions?

more information on OpRisk issues

* **http://www.bos.frb.org/bankinfo/oprisk**

I
R
M
T

irmT
The Institute of Risk Management Tanzania

# Basel II

- The intention of Basel II is to help protect the international financial system fro the types of problems that might arise should a major bank or a series of bank collapse
- It attempts to protect internal financial system by setting up rigorous risk and capital management requirements designed to ensure that a bank holds capital reserves appropriate to the risk the bank exposes itself to through its lending and investment practices
- Principle 5 requires processes necessary for assessing operational risk to be established
- Currently Basel II has been reviewed and Basel III come into force

IRMT

irmT
The Institute of Risk Management Tanzania

# Basel II -Ten Commandments Operational Risk Management Principles

1. The Board is responsible for establishing the operational risk strategy
2. Senior management is responsible for implementing the operational risk strategy
3. Information, communication and escalation flows must be established
4. Operational risk inherent activities, processes, systems and products should be identified
5. Processes necessary for assessing operational risk should be established

IRMT

irmT
The Institute of Risk Management Tanzania

# Basel II -Ten Commandments Operational Risk Management Principles

6. Systems should be implemented to monitor operational risk exposure and loss events
7. Policies, processes and procedures to control or mitigate operational risks should be in place
8. Supervisors should require banks to have an effective system to identify, measure, monitor and control operational risk
9. Supervisors should conduct regular independent evaluations of these principles
10. Sufficient public disclosures should be made to allow stakeholders to assess the operational risk exposure and the quality of operational risk management

# Basel II

- The 10 rules mean that the greater risk to which the bank is exposed, the greater the amount of capital it needs to hold to safeguard its solvency and overall economic stability
- It aim to ensure that capital allocation is more risk sensitive, that operational risk is separated from credit risk (both of which should be quantified) and that a global regulatory regime is in place
- Basel II describes a comprehensive minimum standard for capital adequacy that the national supervisory authorities are working to implement.

I R M T

irmT
The Institute of Risk Management Tanzania

# Basel II

- It is also intended to promote a more forward-looking approach to capital supervision that encourages banks to identify the risks they face and improve their ability to manage those risks
- is intended to be more flexible and better able to evolve with advances in markets and risk management practices
- The effectiveness of Basel II accord (2004( was questioned in 2008 following failure of banking system in 2008
  - The failure in the global financial crisis has been a topic of much detailed evaluation

# Measuring Operational Risk

- Measuring operational risk is a specific issue in financial institution
  - Basel II requires them to measure/quantify the level of operational risk they face
- Measurement can involve a number of methods and are normally based on
  - Historical information
  - Simulated information or combination of these
- Basel II offers three alternatives for measuring operational risks for regulatory capital purposes
  - Basic indicator approach
  - Standardized approach
  - Advanced approach

IRMT

irmT
The Institute of Risk Management Tanzania

# Measuring Operational Risks

- **Basic indicator approach:** calculates the value of operational risk capital using a single indicator for overall risk exposure
- **Standardized approach:** calculates the value of operational risk, using a broad financial indicator, multiplied by operational loss experience
- **Advanced approach:** this uses the internal loss data and a combination of qualitative and quantitative methods to calculate the operational risk capital
- In order to measure operational risk, the financial institution needs to adopt a structured approach. Even after identification of risks, quantification is only possible if the amount of damage and risk probabilities are determined

I R M T

irmT
The Institute of Risk Management Tanzania

# Measuring Operational Risks

- Operational risks are hard to quantify since loss histories are usually available and some risks cannot be quantified
- Many banks have undertaken detailed evaluation and quantification of their operational risks.
- In general, it has been discovered that the size of the bank (measured in terms of number of employees) influences the size of losses that will be suffered.
- This appears to indicate that larger banks tend to have larger clients
- The other general trend being identified is that the number of losses is strongly correlated to the number of customers that used the bank

IRMT

irmT
The Institute of Risk Management Tanzania

# Challenges of Operational Risk Measurement

* The challenges of quantifying operational risk have been considerable.
* Expected levels of loss can only be estimated, even if the probability of loss is fairly accurately known.
* Although statistical approaches have been adopted and developed, a universally accepted approach is still not available.

IRMT

irmT
The Institute of Risk Management Tanzania

# Challenges of Operational Risk Measurement

- The expected losses can have a direct and indirect cost.
  - Indirect costs are often larger, and include the loss of a customer. This loss can be represented by the present value of that customer and all future gains from that relationship.
  - Actions that should be taken will include internal control measures as well as evaluation by internal audit.
  - Internal audit within a financial institution has the familiar, but vitally important, responsibility of checking whether procedures are followed in practice and whether the procedures themselves are likely to be effective in reducing the level of operational risk.

# Challenges of Measuring Operational Risk

- Operational risk quantification is possible for non-financial institutions
- A transport company could investigate the operational risks association with its activities
  - Risks associated with the operations include the price of fuel, tax obligations and the financial consequences of delivery mistakes
  - Operational risk can arise from road traffic accidents and other delivery delays and changes by the customers that have been correctly incorporated into the delivery schedule

IRMT

irmT
The Institute of Risk Management Tanzania

# Challenges of Measuring Operational Risk

- Operational risks can arise from road traffic accidents or other delivery delays and changes by the customers that have not been correctly incorporate into the delivery schedule
- Most important operational risks faced by a transport company would be incorrect customer deliveries and road traffic accidents
- The quantification of risk exposure associate with the various categories of operational risk will help a transport company routine operations – and then take the appropriate control actions to reduce the operational risk exposures

IRMT

irmT
The Institute of Risk Management Tanzania

# Operational Risk Practice

- Operational risk should be an integral to the management of a financial institution
- It is important to embed risk management practice for all employees from the time they join an entity to the time they assume management roles
- Measurement of operational risk in financial institutions is still proving to be a challenge, especially during the global financial crisis when the risk exposure was greater than most of banks believes.

IRMT

irmT
The Institute of Risk Management Tanzania

# Operational Risk Practice

- There are number of financial institutions which are seeking to adopt risk management standards such as
  - IRM standard
  - COSO framework

- Basel II does not prescribe or require any particular framework for use with operational risk management, except that the adopted framework is conceptually sound and pays high regard to integrity issues

IRMT

irmT
The Institute of Risk Management Tanzania

# Operational Risk Practice

* In many cases, the quantification of operational risk is seen as a compliance requirement rather than a business opportunity
* Given the quantification of operational risk can be quite technical, there may be a tendency for management within an organization to feel that it is the role of the operational risk manager to take responsibility for this work
* The responsibility for the management of risk and the implementation of controls usually rests with the line managers.
* If this responsibility is not accepted, there is a danger that operational risk management will not be fully integrated into management of the financial institution, with disastrous consequences.

IRMT

irmT
The Institute of Risk Management Tanzania

# Operational Risk Practice

- Calculation of operational risk exposure is a requirement of Basel II and financial institutions, therefore, have to undertake this work.
- Financial institutions are driven by increasing regulatory demands and other corporate governance pressures.
- Raising the level of operational risk awareness by quantifying the level of risk and explaining the full significance of risk management to relevant members of staff should be to the benefit of the organization.
- This increased awareness will enable the organization to identify the sources of operational risk and take appropriate cost-effective actions to optimize the level of operational risk exposure

# Why Global Financial Crisis ?

* Risk and Insurance Managers Society (RIMS) has undertaken an evaluation of the causes of global financial crisis
* The evaluation considered the contribution that could have made by enterprise risk management and the reasons for the failure in the application of Enterprise Risk Management tools and techniques
* There are many ways to implement an ERM program. The degree of success will be indicated by the competence of the risk management practices in the organization and the degree to which risk management behaviors are embedded into culture and decision making

IRMT

irmT
The Institute of Risk Management Tanzania

# Why Global Financial Crisis ?

- The global financial crisis is not a failure of ERM; it was caused by the following failures based on RIMS study:
  - There was an over-reliance on the use of financial models, with the mistaken assumption that the 'risk quantifications' (used as predictions) based solely on financial modeling were both reliable and sufficient tools to justify decisions to take risk in the pursuit of profit.
  - There was an over-reliance on compliance and controls to protect assets, with the mistaken assumption that historic controls and monitoring a few key metrics are enough to change human behavior.

# Why Global Financial Crisis ?

The global financial crisis is not a failure of ERM; it was caused by the following failures based on RIMS study:

* There was a failure to properly understand, define, articulate, communicate and monitor risk tolerances, with the mistaken assumption that everyone understands how much risk the organization is willing to take.
* There was a failure to embed enterprise risk management best practices from the top all the way down to the trading floor, with the mistaken assumption that there is only one way to view a particular risk

IRMT

irmT
The Institute of Risk Management Tanzania

I
R
M
T

# Supply Chain Risk Management

irmT
The Institute of Risk Management Tanzania

# Introduction

- Scope of the supply chain can extend to strategic partnerships, joint ventures, support services and outsourcing of facilities' management activities.
- Many organizations also choose to outsource the transportation component of their business.
- It is not unusual for chains of retail stores to outsource warehousing arrangements and the delivery of goods to the individual shops

IRMT

irmT
The Institute of Risk Management Tanzania

# Introduction

- Because of the increased use of outsourcing, there is an increasing interest in the risks associated with reliance on third parties.
- Outsourcing of operations is normally undertaken because it is assumed that costs can be reduced and risks transferred.
- A careful evaluation of the balance between risk and reward should be undertaken before any supply chain outsourcing decisions are taken.
- The organization should be aware of the fact that outsourcing means that the organization will not only have to focus on its own risks but should also look at the risks associated with other links in the supply chain.

IRMT

irmT
The Institute of Risk Management Tanzania

# Introduction

* Supply chain management and risk management are interrelated. Supply chain considerations are becoming more common, as well as much more complex.
* Outsourcing of the various components of the infrastructure of an organization is only part of supply chain management.
* Successful management of the supply chain will rely on strategic partnerships and may also extend to joint-venture arrangements.
* Supply chain issues also extend to simple outsourcing decisions, such as the appointment of cleaners and caterers. There was a strong trend in the 1980s to the outsourcing of many types of facilities management within buildings.

IRMT

irmT
The Institute of Risk Management Tanzania

# Part III

At the end of this part you will understand:

- Supply chain risk and vulnerability
- The impact of global sourcing
- Supply chain risk management
- Agility holds the key to resilience
- Creating the resilient supply chain

# Why Are Today's Supply Chains So Vulnerable?

- Widespread adoption of 'lean' practices
- The move to off-shore manufacturing and sourcing
- Out-sourcing and reduction in the supplier base
- Global consolidation of suppliers
- Centralised production and distribution

All of which combine to make supply chains vulnerable to disruption

# Nike Supply Chain

Nike has said that it has been facing a lot of problems with manufacturing in China with suppliers giving falsified documents, underage workers and unpaid wages topping the list. The sneakers and sportswear manufacturer, in what is believed to be its first country-specific supply chain report, has said that the company has been trying to get the Chinese suppliers to follow its code of conduct and Chinese law.

It is reported that the company's difficulties are a reflection of the depth of some of the problems faced by manufacturing businesses in China, which reportedly is Nike's largest single sourcing country, with around 180 manufacturers and about 210,000 employees, at a time when prices are rising and the legal environment is stiffening.

I R M T

irmT
The Institute of Risk Management Tanzania

# Nike Supply Chain Cont…

* The report, which was posted on Nike's website, said: 'As China continues to develop we see progress and best practices emerging. But like our partners in any other country, the factories we contract with in China continue to face challenges as well.' According to the report, the company faced several labour-related problems, which included falsification of payroll records (entry of age in particular), hiring practices and the absence of a proper grievance system for workers.

# Supply Chain Risk (i)

"The entire Japanese vehicle industry ground to a halt following an earthquake that stopped production of piston rings for engines provided by Riken, the industry leader in the domestic market.

Toyota, in particular, was forced to stop operations at all 12 of its domestic plants."

*Financial Times*, 24 July 2007

I R M T

irmT
The Institute of Risk Management Tanzania

# Supply Chain Risk (ii)

"A fire at a key Philips semiconductor factory in 2000 caused a worldwide shortage of the radio frequency chips used by both Nokia and Ericsson. Nokia immediately lined up another source and redesigned other chips so they could be produced elsewhere. However, Ericsson responded more slowly and lost an estimated $400 million in mobile phone handsets.

*MIT Sloan Management Review*

Summer 2006

IRMT

irmT
The Institute of Risk Management Tanzania

# Supply Chain Risk (iii)

"Yesterday it emerged that ice-cream supplies may run short because Unilever's only UK factory, based in flood-stricken Gloucester, has been closed for the past ten days.

The company usually manufacturers five million ice-creams and lollipops a day at the plant. It has stocks in freezers but it could be days before normal production resumes. Industry insiders predict that there will now be an ice-cream war as rival brands attempt to exploit Unilever's predicament and gain market share."

*The Times*, 31 July 2007



IRMT

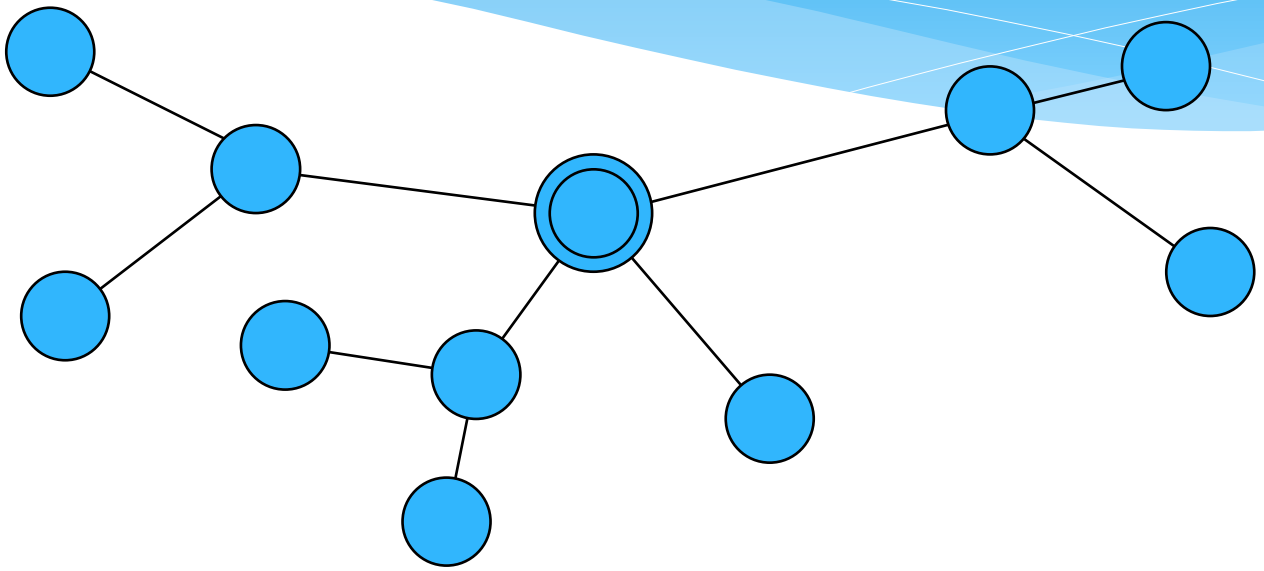
irmT The Institute of Risk Management Tanzania

# Supply Chain Risk is Systemic

- The biggest risk to business continuity may lie outside the company in the wider supply chain
- The complexity and inter-connectedness of modern supply chains increases their vulnerability to disruption
- Environmental risks are outside our control, but systemic risk is created through our own decisions

# There are Two Generic Categories of Supply Chain Risk

- Supply chains comprise nodes and links



- Nodes – organisational risk
- Links – network risk



IRMT

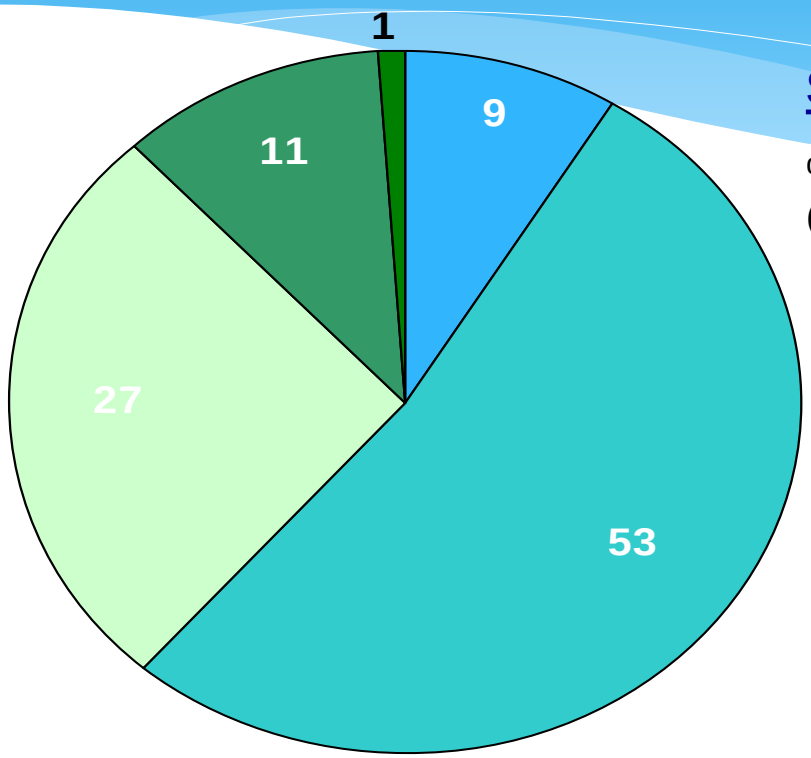
irmT The Institute of Risk Management Tanzania

# Supply Chain Risk Management

- "The identification and management of risks within the supply chain and risks external to it through a coordinated approach amongst supply chain members to reduce supply chain vulnerability as a whole".

- "Avoiding the loss of customer confidence and the erosion of shareholder value resulting from supply chain disruption."

# How would you assess the capability of your company to mitigate the key supply chain risks it faces right now?




**Somewhat Capable**

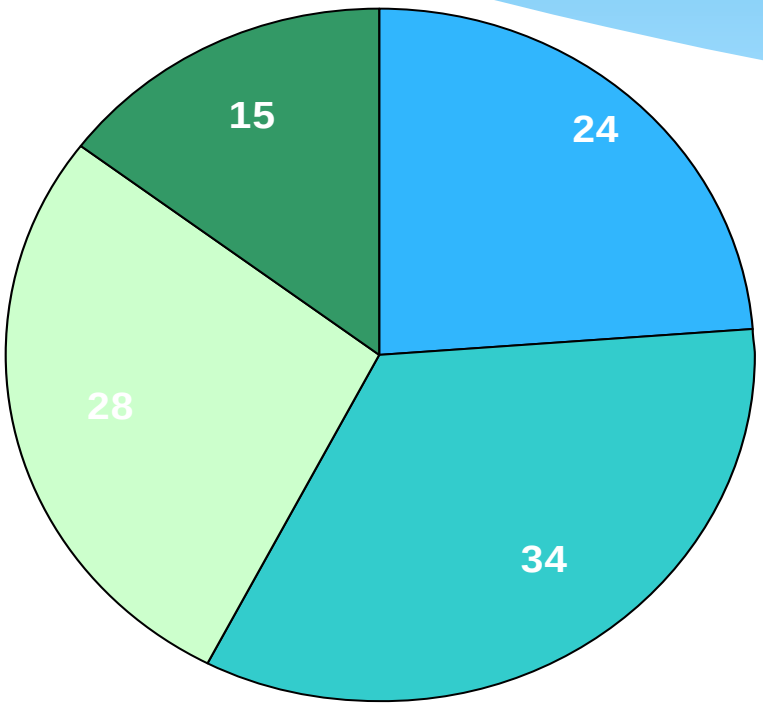
% of respondents[1]
(n=3,079)

- Extremely Capable
- Somewhat Capable
- Slightly Capable
- Not Very Capable
- Not at all Capable

[1] All data weighted by GDP of constituent countries; figures do not sum to 100%, because of rounding; excludes respondents who answered "don't know."

Source: September 2006
McKinsey Quarterly
Global Survey of Business Executives

# How does your Organisation Assess the Risks to its Supply Chain?




**On a wing and a prayer**

% of respondents[1]
(n=2,924)

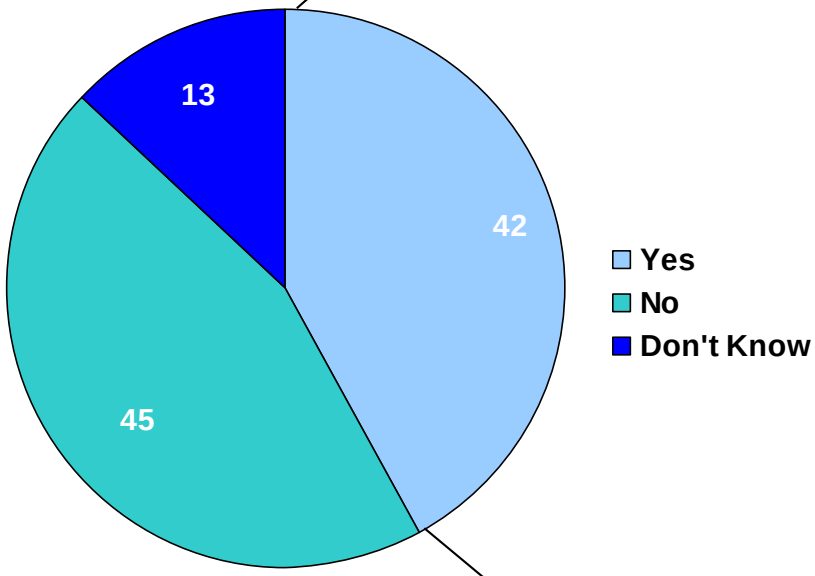
- **There is no Formal Assessment**
- **Qualitatively/Intuitively**
- **With rough Quantative Estimates**
- **With Detailed Models of Cash Flow at Risk**

[1] All data weighted by GDP of constituent countries; figures do not sum to 100%, because of rounding; excludes respondents who answered "don't know."

Source: September 2006
McKinsey Quarterly
Global Survey of Business Executives

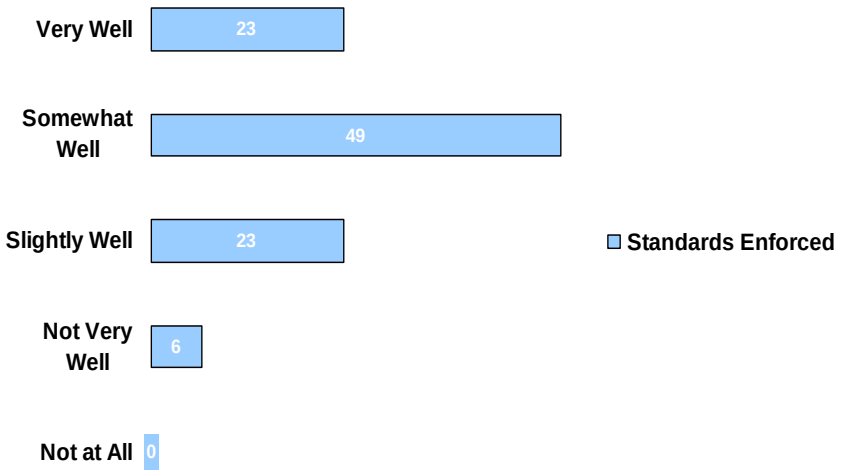
# Does your company have in place corporate standards and practices for overseeing the mitigation of supply chain risk?

% of respondents[1]
(n=3,172)




**How strictly enforced are those standards and practices?**

(n=1,301)[2]




[1] All data weighted by GDP of constituent countries;
[2] Figures do not sum to 100%, because of rounding; excludes respondents who answered "don't know."

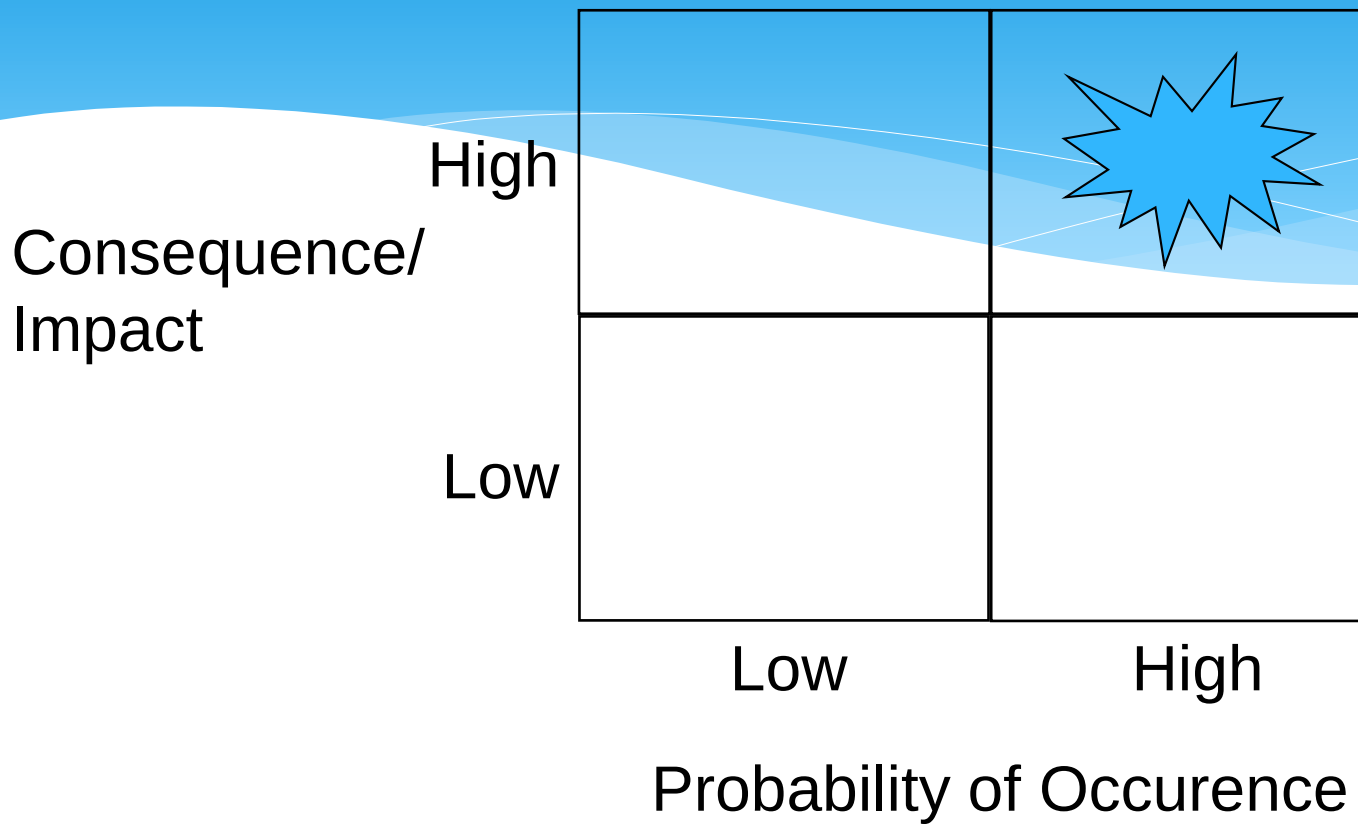
Source: September 2006 McKinsey Quarterly Global Survey of Business Executives

# What is Risk?

I
R
M
T

**Risk = probability of occurrence x consequences**

# The Risk Management Challenge




- Where can we reduce the probability?
- How can we reduce the consequence?



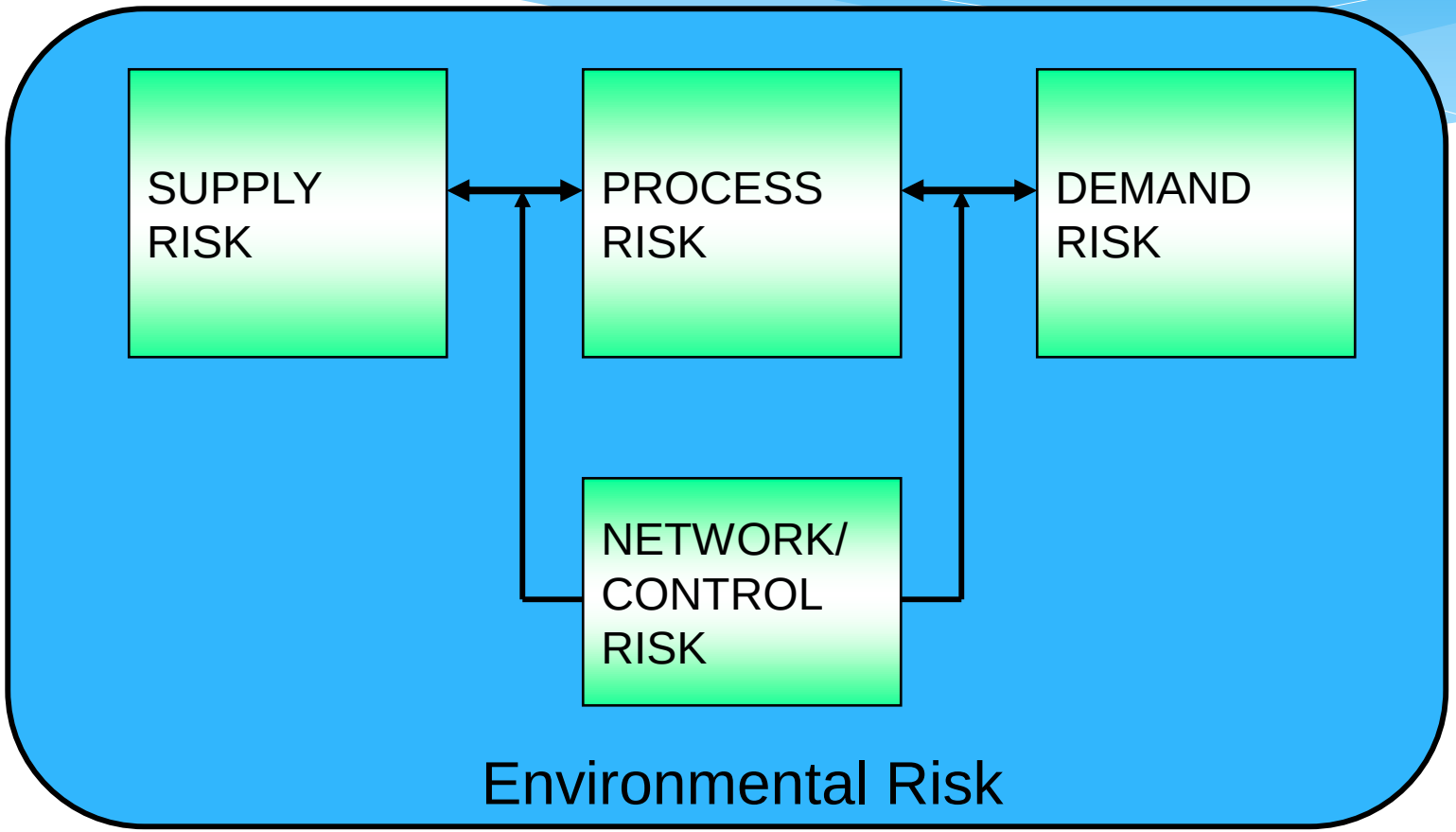
I R M T

irmT
The Institute of Risk Management Tanzania

# The Five Sources of Risk

- Supply risk
- Demand risk
- Process risk
- Control risk
- Environmental risk

# Location of Risk in the Supply Chain



# The Five Sources of Supply Chain Risk

IRMT

## Demand Risk

- Loss of major accounts
- Volatility of demand
- Concentration of customer base
- Short life cycles
- Innovative competitors

## Supply Risk

- Dependency on key suppliers
- Consolidation in supply markets
- Quality and management issues arising from off-shore sourcing
- Potential disruption at 2nd tier level
- Length and variability of replenishment lead-times

## Process Risk

- Manufacturing yield variability
- Lengthy set-up times and inflexible processes
- Equipment reliability
- Limited capacity/bottlenecks
- Outsourcing key business processes

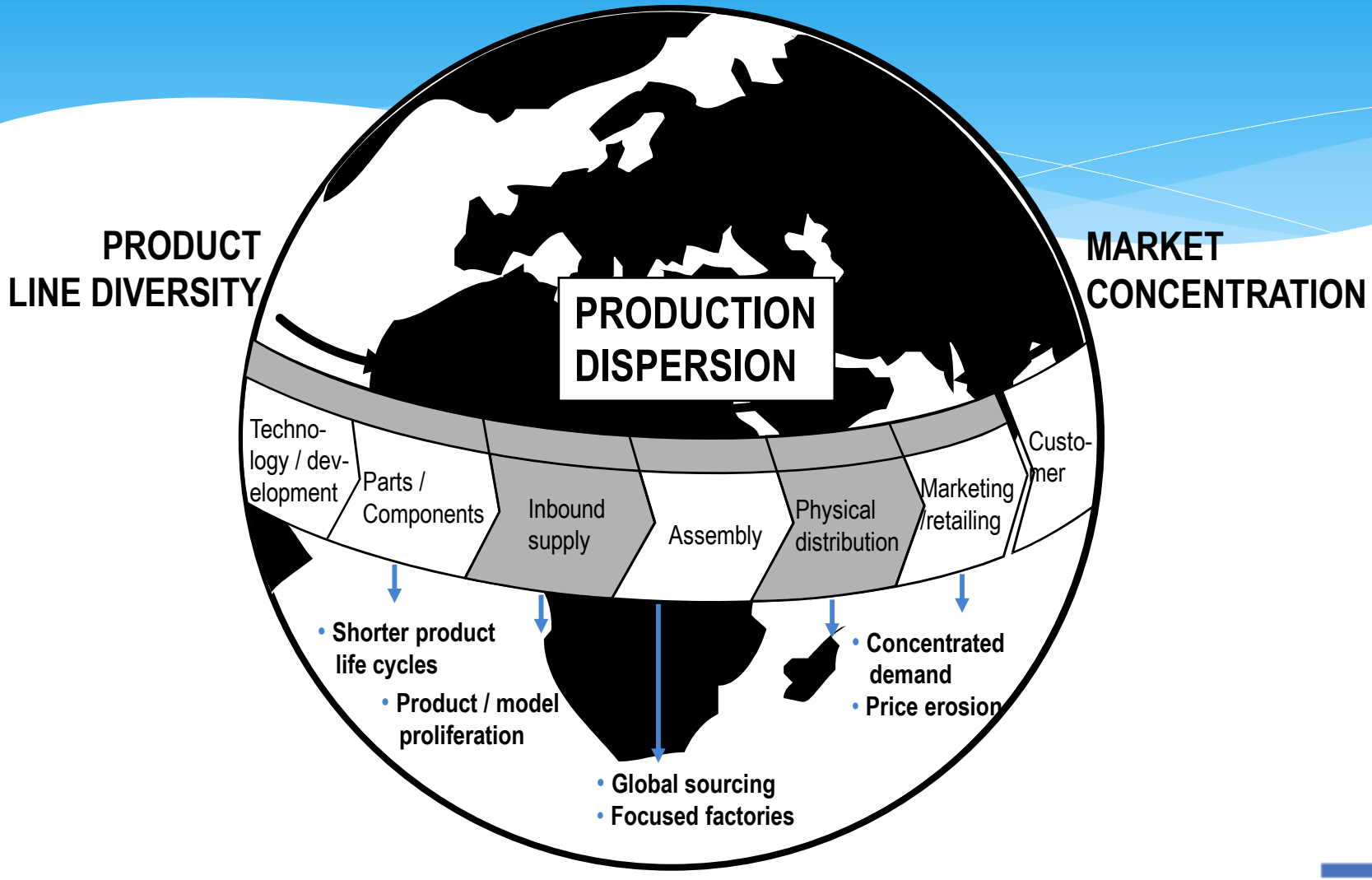
## Network/Control Risk

- Asymmetric power relationships
- Poor visibility along the pipeline
- Inappropriate rules that distort demand
- Lack of collaborative planning and forecasts
- Bullwhip effects due to multiple echelons

## Environment Risk

- Natural disasters
- Terrorism and war
- Regulatory changes
- Tax, duties and quotas
- Strikes

# The Challenge of Global Logistics






irmT
The Institute of Risk
Management Tanzania

# Global Business : Singer Sewing Machines

- Body shells from USA
- Motors from Brazil
- Drive Shafts from Italy
- Assembled in Taiwan
- Sold around the world

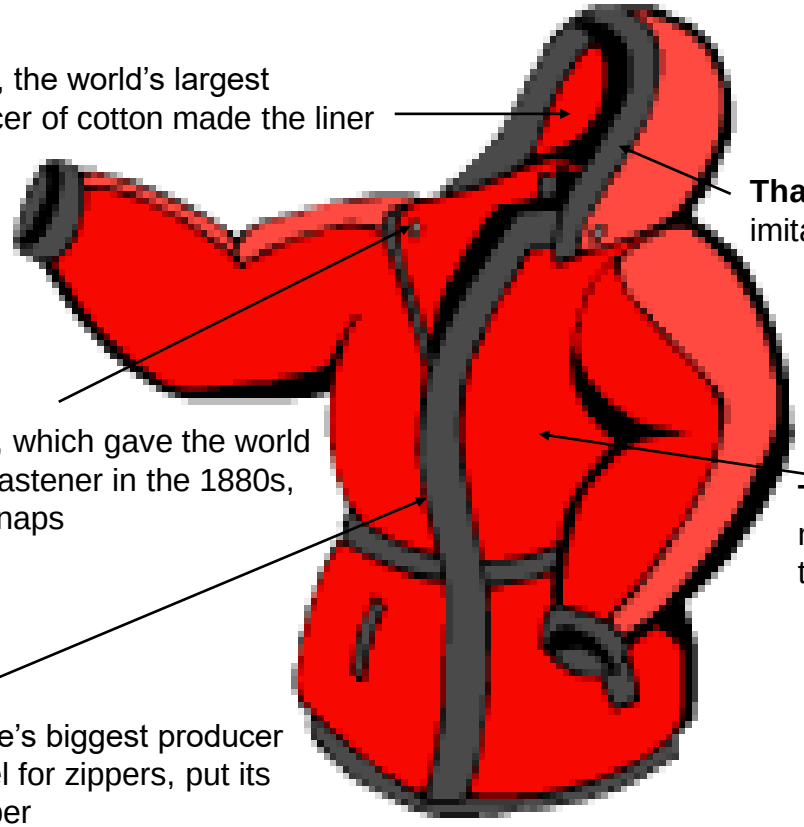


IRMT

irmT The Institute of Risk Management Tanzania

# How Many Countries Does it Take to Make a Coat

To make this jacket for the UK market, Hong Kong garment producer Li & Fung ordered materials from factories in five Countries and had them delivered to Thailand, where the jacket was stitched together. Using a network of web-sites, Li & Fung stays in touch with its worldwide suppliers and can compress the time it takes to get items into stores.



**China**, the world's largest producer of cotton made the liner

**Thailand**, a leading exporter of imitation fur, ringed the hood

**Germany**, which gave the world the snap fastener in the 1880s, sent the snaps

**Taiwan**, which specialises in making material for outdoor clothing, produced the shell and fleece

**Japan**, the globe's biggest producer of stainless steel for zippers, put its teeth in this zipper

# The Challenge of Globalisation

**Continued trends to off-shore sourcing and focused factories bring reduced costs to purchase/manufacture but ……**

**…… have the potential to increase total supply chain costs and to reduce agility.**



I R M T

irmT The Institute of Risk Management Tanzania

# Risks Associated with outsourcing

| Scope of arrangement | Default arrangements and termination |
|---|---|
| Duration of the agreement | Dispute resolution arrangements |
| Services to be supplied | Liability and indemnity |
| Pricing and fee structure | Restrictions on sub contracting |
| Service levels and performance requirements | Insurance requirements |
| Transfer/implementation arrangement | Confidentiality, privacy and security of information |
| Audit and monitoring procedures | |
| Business continuity management | |

# Understanding the Total Costs of Ownership

Not just the purchase price, but …..

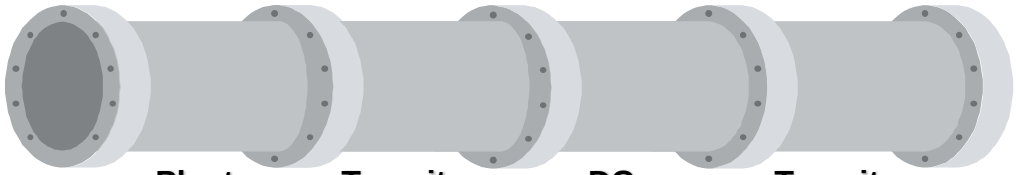
- Increased transport costs
- Increased inventory financing costs
- Increased uncertainty of supply
- Longer lead-times
- Less visibility and increased likelihood of "bullwhip" effect
- Loss of control in quality
- Longer development cycles for new products
- Increased exposure to security risks…. etc

# Pipeline Inventories

- Due to the length and increased uncertainty of global product pipelines, both planned and unplanned inventories may be higher than optimal

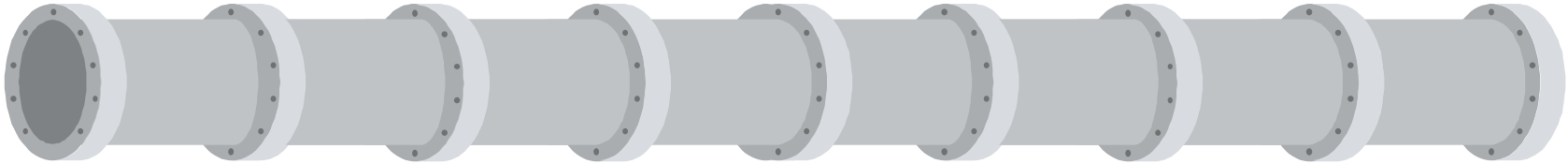
***Illustrative inventory comparison: domestic vs. global product pipelines each with customer demand of 10 per week***

**Domestic Pipeline = 70 units inventory**



**Plant 20** | **Transit 20** | **DC 20** | **Transit 10**

**Global Pipeline = 170 units inventory**



**Plant 30** | **Transit 20** | **Origin Forwarder 20** | **Ocean Transit 20** | **Destination Forwarder 20** | **Transit 20** | **DC 30** | **Transit 10**

# Managing Supply Chain Risk

- Map the supply chain
- Identify the critical paths
- Utilise cause and effect analysis (TQM tools)
- Implement supply chain event management
- Adopt agile practices
- Formalise supply chain risk management

# Identify the Critical Path(s)

Critical paths are characterised by:-

- long lead-times
- no short-term alternative source of supply
- bottlenecks
- high levels of identifiable risk (i.e. supply, demand, process, control and environmental risk)

# Use Cause and Effect Analysis

e.g.

- pareto analysis
- asking ‘why?’ five times
- fishbone charts
- failure mode and effects analysis



IRMT

irmT The Institute of Risk Management Tanzania

# Pareto Analysis

* 80% of disruptions will share 20% of the causes

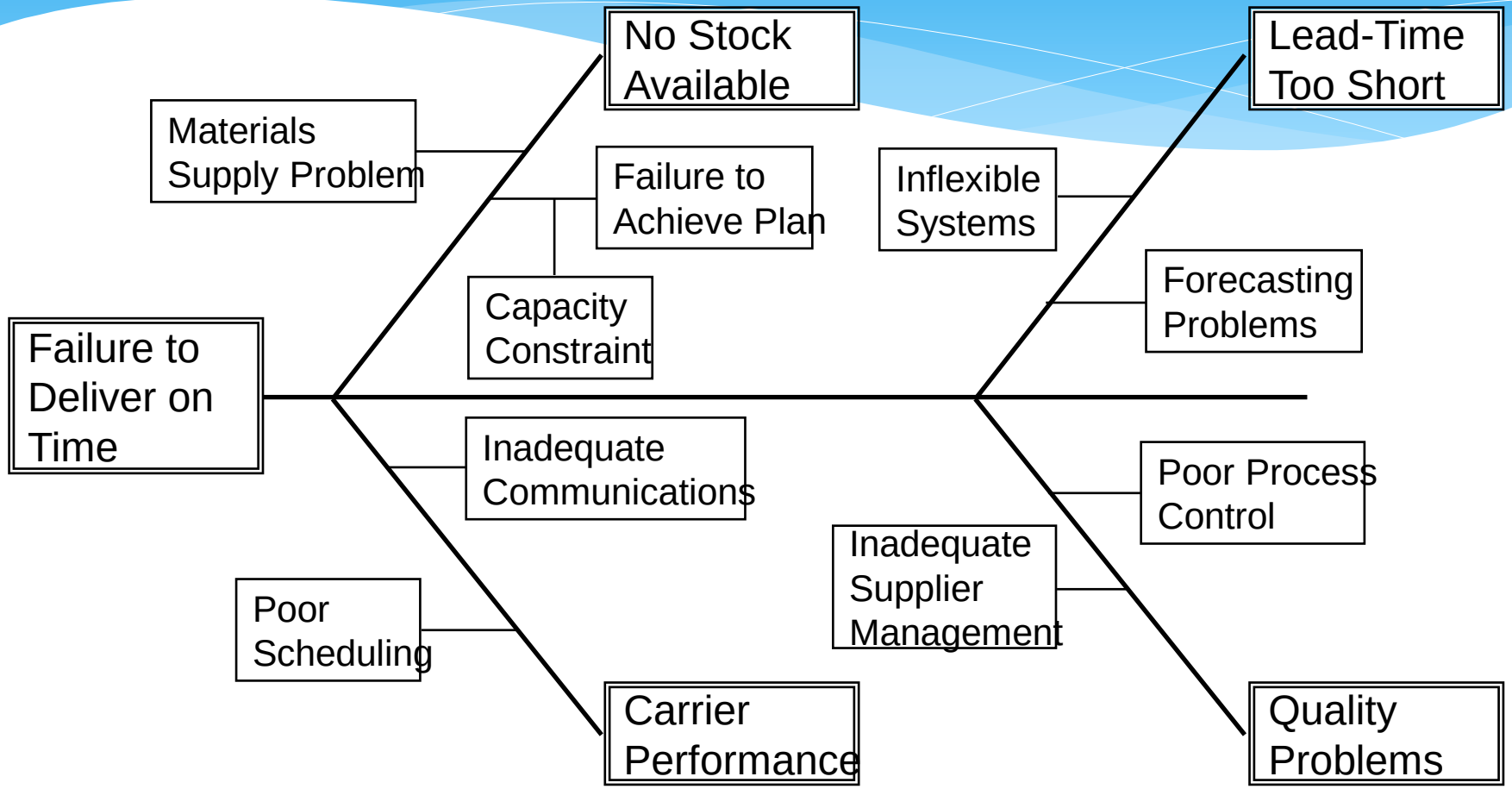
# Asking "Why?" Five Times

1. Q. Why did the machine stop?
   A. There was an overload and the fuse blew.
2. Q. Why was there an overload?
   A. The bearing was not sufficiently lubricated.
3. Q. Why was it not sufficiently lubricated?
   A. The lubrication pump was not pumping sufficiently.
4. Q. Why was it not pumping sufficiently?
   A. The shaft of the pump was worn and rattling.
5. Q. Why was the shaft worn?
   A. There was no strainer and metal scrap got in.

Repeating why five times like this can help uncover the root problem and correct it. If this procedure were not carried through, one might simply replace the fuse or the pump shaft. In that case the problem would reoccur in a few months.

* Taiichi Ohno
* Toyota Production System

# Cause and Effect Analysis



# Failure Mode and Effects Analysis (FMEA)

- Asks three questions:
  - What could go wrong?
  - What effect would this failure have?
  - What are the key causes of this failure?

- Provides an assessment of risk for each possible failure:

  S = severity of effect
  O = likelihood of occurrence
  D = likelihood of detection

# Risk Analysis Scoring System

| | |
|---|---|
| S = Severity | 1. no direct effect on operating service level<br>2. minor deterioration in operating service level<br>3. definite reduction in operating service level<br>4. serious deterioration in operating service level<br>5. operating service level approaches zero |
| O = Likelihood of occurrence | 1. probability of once in many years<br>2. probability of once in many operating months<br>3. probability of once in some operating weeks<br>4. probability of weekly occurrence<br>5. probability of daily occurrence |
| D = Likelihood of detection | 1. detectability is very high<br>2. considerable warning of failure before occurrence<br>3. some warning of failure before occurrence<br>4. little warning of failure before occurrence<br>5. detectability is effectively zero |

# Agility Holds the Key

Agile supply chains are designed to respond rapidly to unpredictable change. They are based upon a number of principles:-

- Very close connection to final marketplace
- Visibility of real demand
- High levels of synchronicity upstream and downstream
- Organisational focus on processes rather than functions
- Advanced level of collaborative planning with supply chain partners
- Continuous search for time compression opportunities

# What Does it Take to Become More Agile? Zara and M&S's Approach

- Changed structure of network to working directly with more raw material suppliers that have the capability to produce the garments, hence considerably reducing manufacturing time and the risk of miss-communicating design briefs
- Advance technical improvements in raw material supply base and garment manufacturers in QR to meet market demands
- Direct sourcing means that companies have become more agile because the procurement process is much quicker and cost effective
- Sourcing a mixture of suppliers with various skills & with close proximity to market for QR and to enable late configuration of products
- Manage SC risk by avoiding a narrow supply base & enables them to switch product to avoid supply chain disruption caused by political or economic events, or natural disasters

# Zara & M&S: Design-Led Supply Chains

- Both fashion retailers have integrated design into their supply chains in recognition that this mitigates risk and enhances supply chain agility
  - Starting design procurement process as close to each selling season
  - Avoid costs of storing finished products
  - Make last minute changes (late customisation) as receive trend information & utilise sales information from the current season – hence reducing time-to-market
  - Design-led procurement prevents the build up inventory & enables companies to be more responsive
  - Designers are linked to the buying process and in control of design decisions
- By aligning design with the supply chain in this way, the companies have reduced their exposure to supply chain failure & ensured that suppliers are able to produce exactly what they require

# Achieving Agility in The SC Through Design

- There are a number of critical principles underpinning design-led supply chains

The Supply chain 'begins on the drawing board'

* Design is the start of the supply chain, not the end
* Design must be integrative rather than functional orientation (silo)
* Supplier integrated approach - (share product knowledge)
* Multi-functional teams
* Postponement & Planning
* De-Coupling
* Flexible

*Design management is a holistic process which is not only concerned with the aesthetics of the product but rather the impact this product will have on the entire supply chain*

# The Importance of Supply Chain Event Management

- Supply chain visibility to enable potentially disruptive events to be identified as they happen – or even before they happen.
- Work as a supply chain community to define the business rules and exceptions that need to be monitored.
- Use shared information across the extended supply chain in as close to real time as possible to create supply chain intelligence.

# Robust or Resilient?

- A robust process can be defined as "a process able to deal with reasonable variability"

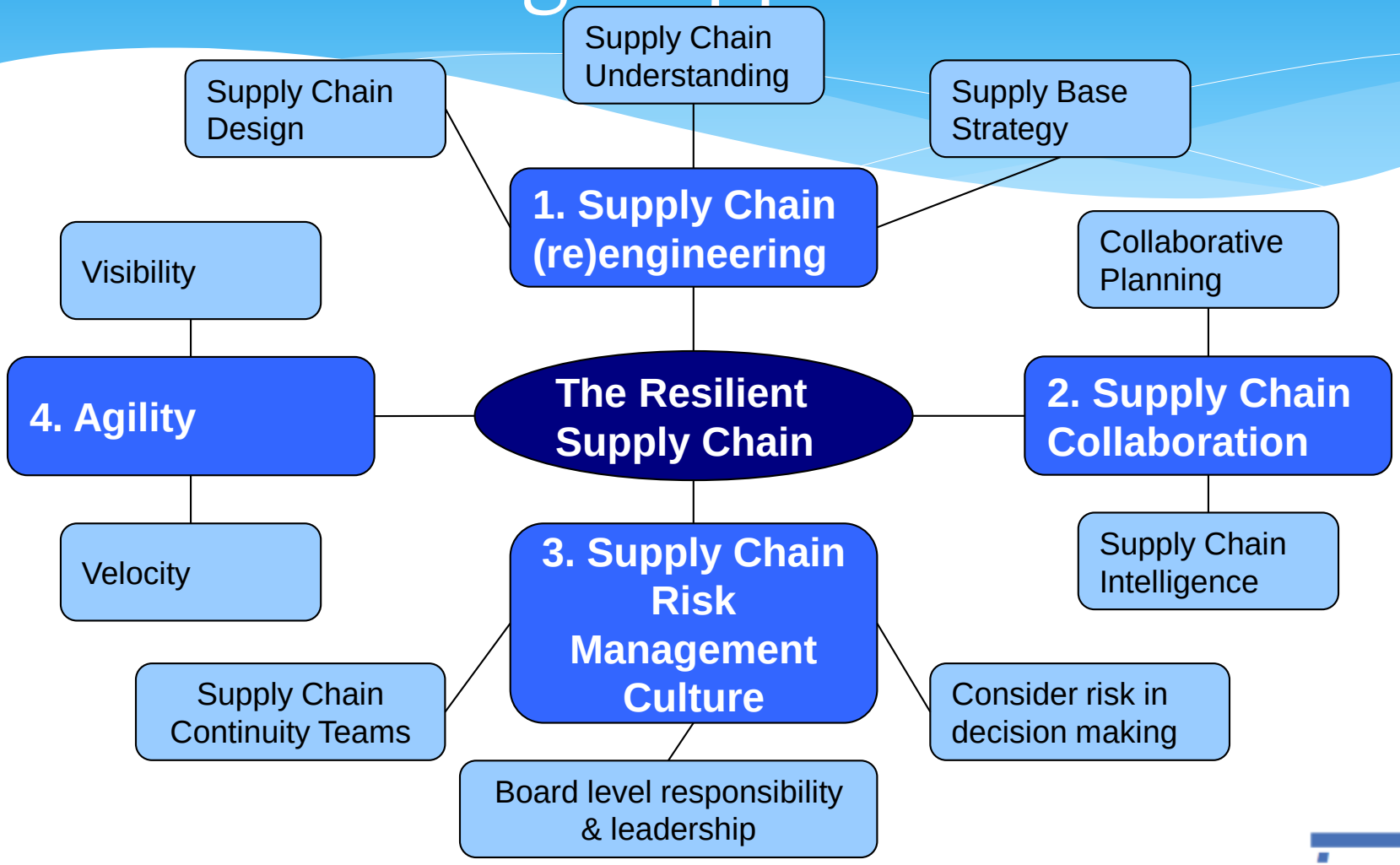
- A resilient supply chain can be defined as "a supply chain with the ability to recover quickly from unexpected events impacting supply chain performance"

- A robust process can deal with reasonable variability in input whilst maintaining good control over output variability. It has some resilience but is it capable of recovery from an event that causes exceptionally high levels of variability in input or output requirement?

# Characteristics of Robust and Resilient Supply Chains

| Robust | Resilient |
|---|---|
| 'Lean thinking' central to supply chain management | Risk mitigation central to supply chain management |
| Lean → | Agile |
| Strong → | Elastic |
| Internal quality control | Internal and external risk management |
| Responsive to reasonable variation in input | Capable of responding to sudden and significant variation in input |
| Low inventory levels throughout | Built in spare capacity and buffers at critical nodes |
| Supply chain Velocity | Supply chain Velocity & Acceleration |
| A culture of quality awareness (i.e. Six Sigma) | A culture of risk and quality awareness |
| Processes are stable and under control | |
| Non-value adding activities and processes removed | |

# Creating a Resilient Supply Chain: Strategic Approaches



# Case study

## Hercules Incorporated – outsourcing logistics

Odyssey Logistics & Technology Corporation, a provider of outsourced logistics management services to process manufacturers, today announced that Hercules Incorporated, a $1.7 billion chemical manufacturer and marketer, has signed a five-year, multimillion-dollar contract to outsource its North American import and export transportation and logistics operations to Odyssey.

As Hercules' contract transportation arm, Odyssey will provide all necessary services to ship product from Hercules' manufacturing plants and other shipping facilities to its global customers. Hercules' four divisions are focused on providing chemicals and other materials for industrial manufacturers in markets such as pulp and paper, personal care products, paints, carpets and adhesives.

In 2002, Hercules forged a renewed focus on its core business units and decided to outsource its transportation functions for three compelling business reasons: to achieve more insight into its global supply chain costs; to reduce its transportation costs by gaining increased leverage in negotiating rates with its multimodal carrier network; and to deploy its own expertise in the business of manufacturing chemical products and meeting its clients' needs.

Prior to outsourcing to Odyssey, Hercules worked with a variety of third-party logistics providers who were focused on one or two modes of transportation. Unlike Odyssey, they were not connected to one another and could not provide Hercules with a holistic view of its multimillion dollar transportation spend.

Odyssey's transportation management solution interfaces directly with Hercules' enterprise resource planning application, incorporating the order management system directly into its freight planning solution. The technology integration provides the critical link to allow Hercules senior executives to have one view of the transportation supply chain.

Odyssey is a full-service third-party logistics provider with capabilities in all transportation modes – truck, rail, ocean and air. The company has significant experience supporting the requirements of the chemical industry where the movement of liquids and dry bulk are often an important part of the product mix.

Odyssey Logistics & Technology Corporation 2008

# Food for Thought

*"It is not the strongest of the species that survive nor the most intelligent, but the one most responsive to change".*

Charles Darwin



IRMT

irmT The Institute of Risk Management Tanzania

I
R
M
T

# Project Risk Management

# Introduction

- Project risk management should be seen as an extension of conventional project planning.
- The main requirements for any project are that it is delivered on time, within budget and to specification or performance.
- Risk is often defined in terms of uncertainty or deviation from expected/required outcomes.
- It is in relation to project risk management that the definition of risk being represented by uncertainty is most relevant.
- Within project management, variability of outcomes is very undesirable.

# Introduction Cont…

- Therefore, the focus of risk management is often on the reduction in the variability of outcomes and the management of control risks
- There will be uncertainties within any project related to events, conditions and circumstances.
- The requirements of project risk management are to identify the events that could give rise to uncertainty and respond to the event appropriately.
- The style of risk management most relevant to project risk management is control management.

# Introduction

- Consider a project of building a new road where one of the bridges can be completed well ahead of schedule because of favorable ground conditions.

- There may be an opportunity to build the benefit of this early completion into the future project plan, so that this gain is not lost in the overall timescale for delivery of the final completed project.

# Introduction

- Project risk management is a type of control management. Projects relate to the delivery of a finite, specific or tactical product such as new:
  - Construction;
  - products;
  - IT systems;
  - technology;
  - markets.

# Introduction to Project Risk Management

- Projects and enhancements are fundamentally important to organizations.
- Most projects are undertaken either to keep ahead of competitors or to catch up with them.
- In the context of risk management, the project itself may be considered to be a risk reduction exercise that is designed to achieve specific management objectives.
- The only purpose in spending money on business enhancement projects is to achieve a business or value-for-money advantage.

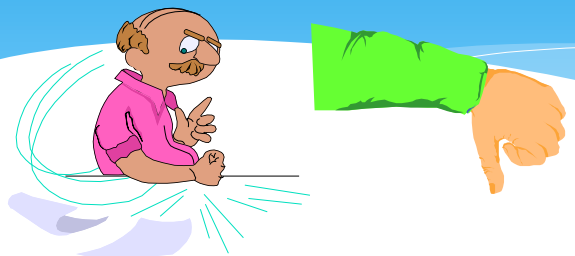
# Managing Project Risk

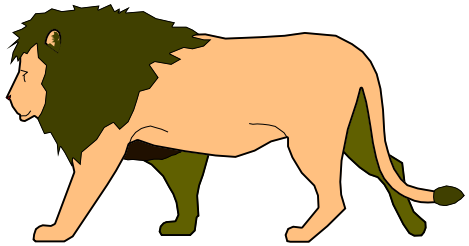
* Project risk management is the art and science of ***identifying***, ***assigning***, and ***responding*** to risk throughout the life of a project and in the best interests of meeting project objectives
* Risk management is often overlooked, but it can help improve project success by helping select good projects, determining project scope, and developing realistic estimates

# What is Risk?

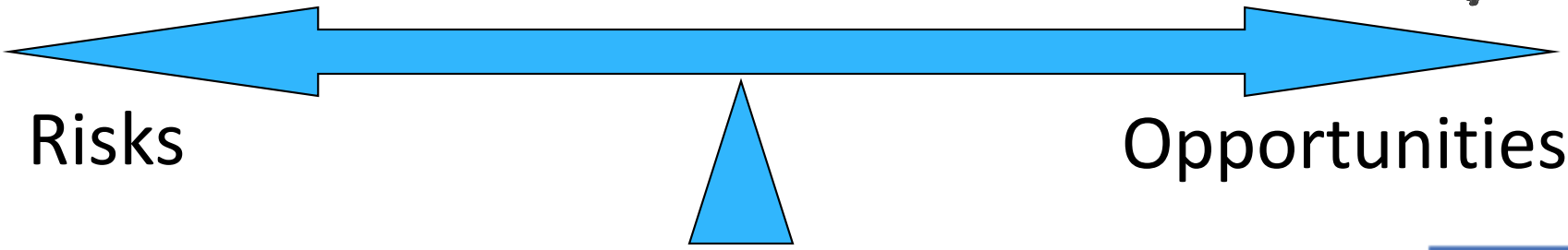
- A dictionary definition of risk is "the possibility of loss or injury"
- Project risk involves understanding potential problems that might occur on the project and how they might impede project success
- Risk management is like a form of insurance; it is an investment.

# Why Take Risks?





Try to balance risks and opportunities





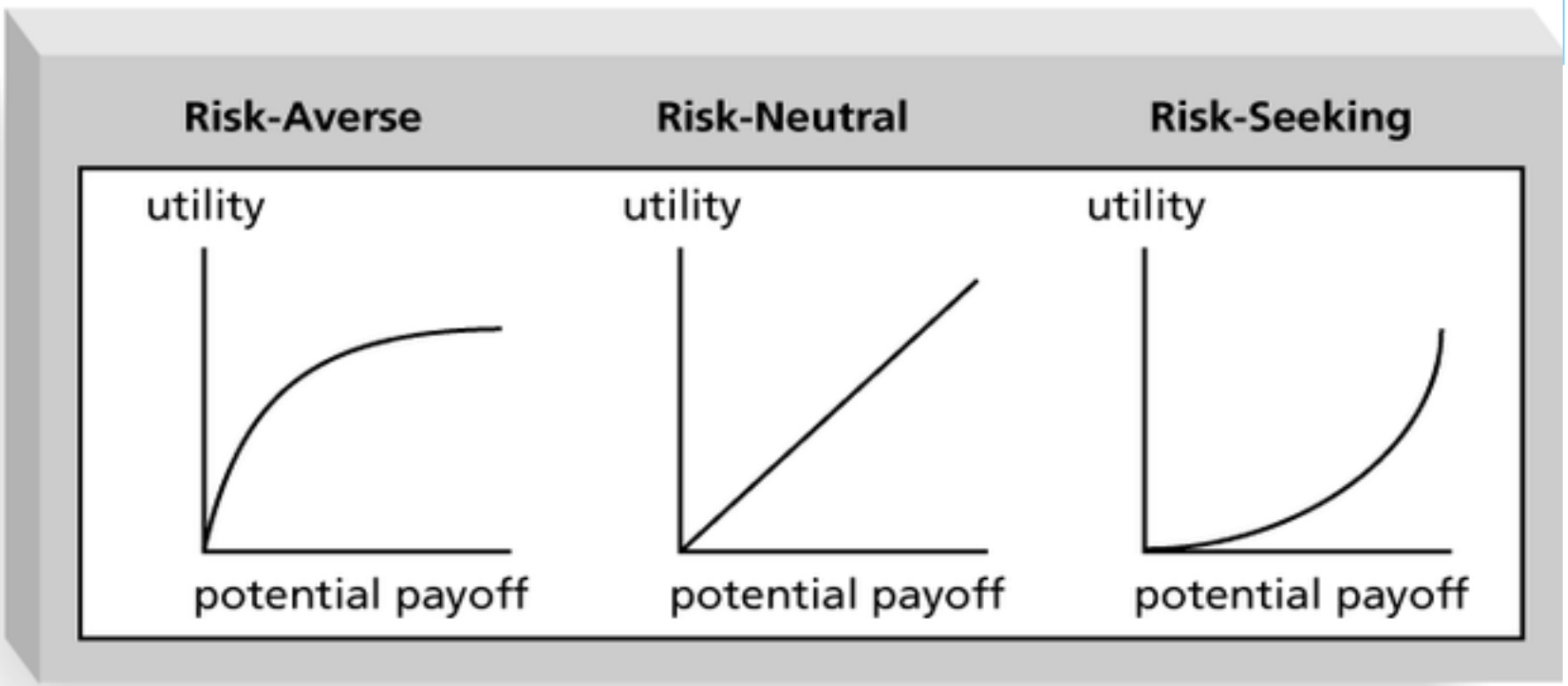

IRMT

irmT
The Institute of Risk Management Tanzania

# Risk Utility

- Risk utility or risk tolerance is the amount of satisfaction or pleasure received from a potential payoff
  - Utility rises at a decreasing rate for a person who is risk-averse
  - Those who are risk-seeking have a higher tolerance for risk and their satisfaction increases when more payoff is at stake
  - The risk neutral approach achieves a balance between risk and payoff

# Risk Utility Function



# Common Source of Risks For IT Projects

- Several studies show that IT projects share some common sources of risk
- The Standish Group developed an IT success potential scoring sheet based on potential risks
- McFarlan developed a risk questionnaire to help assess risk
- Other broad categories of risk help identify potential risks

# McFarlan's Risk Questionnaire

1. What is the project estimate in calendar (elapsed) time?
   (a ) 12 months or less — Low = 1 point
   (b ) 13 months to 24 months — Medium = 2 points
   (c ) Over 24 months — High = 3 points
2. What is the estimated number of person days for the system?
   (a) 12 to 375 — Low = 1 point
   (b ) 375 to 1875 — Medium = 2 points
   (c) 1875 to 3750 — Medium = 3 points
   (d) Over 3750 — High = 4 points
3. Number of departments involved (excluding IT)
   (a ) One — Low = 1 point
   (b) Two — Medium = 2 points
   (c ) Three or more — High = 3 points
4. Is additional hardware required for the project?
   (a) None — Low = 0 points
   (b ) Central processor type change — Low = 1 point
   (c ) Peripheral/storage device changes — Low = 1
   (d ) Terminals — Med = 2
   (e ) Change of platform, for example — High = 3
5. PCs replacing mainframes

# Risk types

- Market risk: Will the new product be useful to the organization or marketable to others? Will users accept and use the product or service?
- Financial risk: Can the organization afford to undertake the project? Is this project the best way to use the company's financial resources?
- Technology risk: Is the project technically feasible? Could the technology be obsolete before a useful product can be produced?

# Technology risk

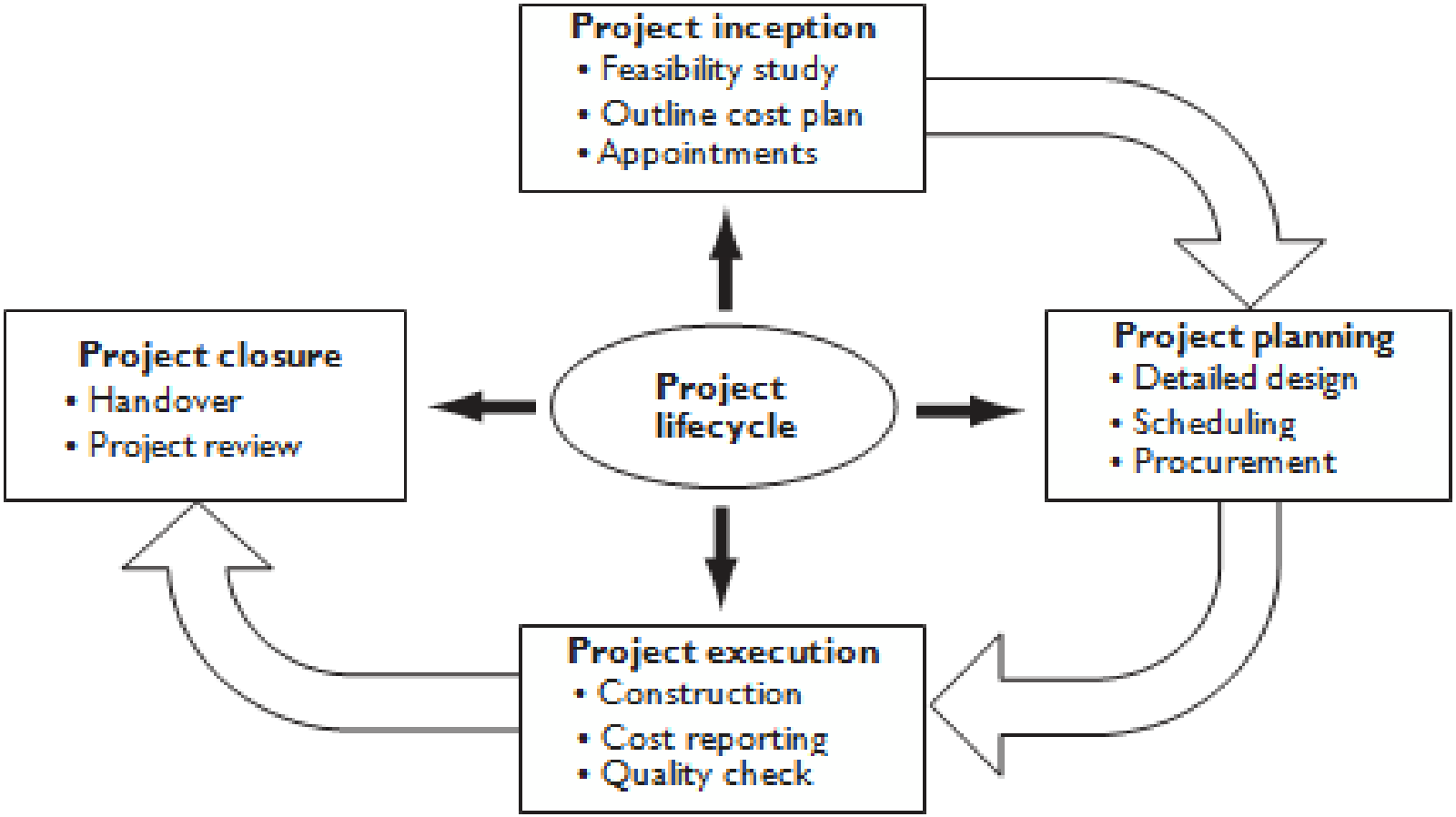
David Anderson, a project manager for Kaman Sciences Corp., shared his lessons learned from a project failure in an article for CIO Enterprise Magazine. After spending two years and several hundred thousand dollars on a project to provide new client-server based financial and human resources information systems for their company, Anderson and his team finally admitted they had a failure on their hands. Anderson admitted that he was too enamored by using cutting edge technology and took a high-risk approach on the project. He "ramrodded through" what the project team was going to do, and he admitted that he was wrong. The company finally decided to switch to a more stable technology to meet the business needs of the company.

Hildebrand, Carol. "If At First You Don't Succeed," CIO Enterprise Magazine, April 15, 1998

# Project risk Management

- Risk Management process as applied to project management is similar to the standard risk management process.
- However, the framework that support the risk management process in each case may be quite different, because the dynamic nature of the projects
- Each stage of the project cycle will have significant risk and uncertainty issues embedded within it

# Project Life Cycle



# Project Risk Management

- Each stage of the project life cycle will have significant risk and uncertainty issues embedded within it
- The uncertainty embedded in each stage of the project will include such issues as defining the project precisely, agreeing the timescale and budget and confirming the performance/specification.
- There will also need to be arrangements for changes and developments within the project specification, as well as arrangements for any deviation from expected circumstances.

# Example – Refurbishing a Block of Flat

- There will be large number of interested parties, including architects and principal contractor.
- External agencies will need to be involved, including planning, building regulations requirements, health and safety, environmental protection and utilities

# Example – Refurbishing a Block of Flat

- Successful management of this project will require the following:

| | |
|---|---|
| **1. Make risk management part of the project** | **6. Priotize risks** |
| 2. Identify risks early in the project | 7. Analyze |
| 3. Communicate about risks | 8. Plan and implement risk responses |
| 4. Consider both threats and opportunities | 9. Plan and implement risk responses |
| 5. Clarify ownership issues | 10. Track risks and associated task |

# What is project risk?

- The goal of project risk management is to minimize potential risks while maximizing potential opportunities. Major processes include
  - **Risk identification:** determining which risks are likely to affect a project
  - **Risk quantification:** evaluating risks to assess the range of possible project outcomes
  - **Risk response development:** taking steps to enhance opportunities and developing responses to threats
  - **Risk response control:** responding to risks over the course of the project

# Uncertainty in Projects

* In order to manage uncertainty in projects, organizations have a range of possible actions they can take. An organization can decide to adopt one of the following:
  * Accept the risk or uncertainty.
  * Adapt processes and procedures.
  * Adopt contingency plans and responses.
  * Avoid the risk or uncertainty.

***4As of control*** *or project risk management Versus 4T of hazard risk management*



IRMT

irmT The Institute of Risk Management Tanzania

# Identifying risk

* Risk identification is the process of understanding what potential unsatisfactory outcomes are associated with a particular project

* Several risk identification tools include checklists, flowcharts, and interviews



IRMT

irmT The Institute of Risk Management Tanzania

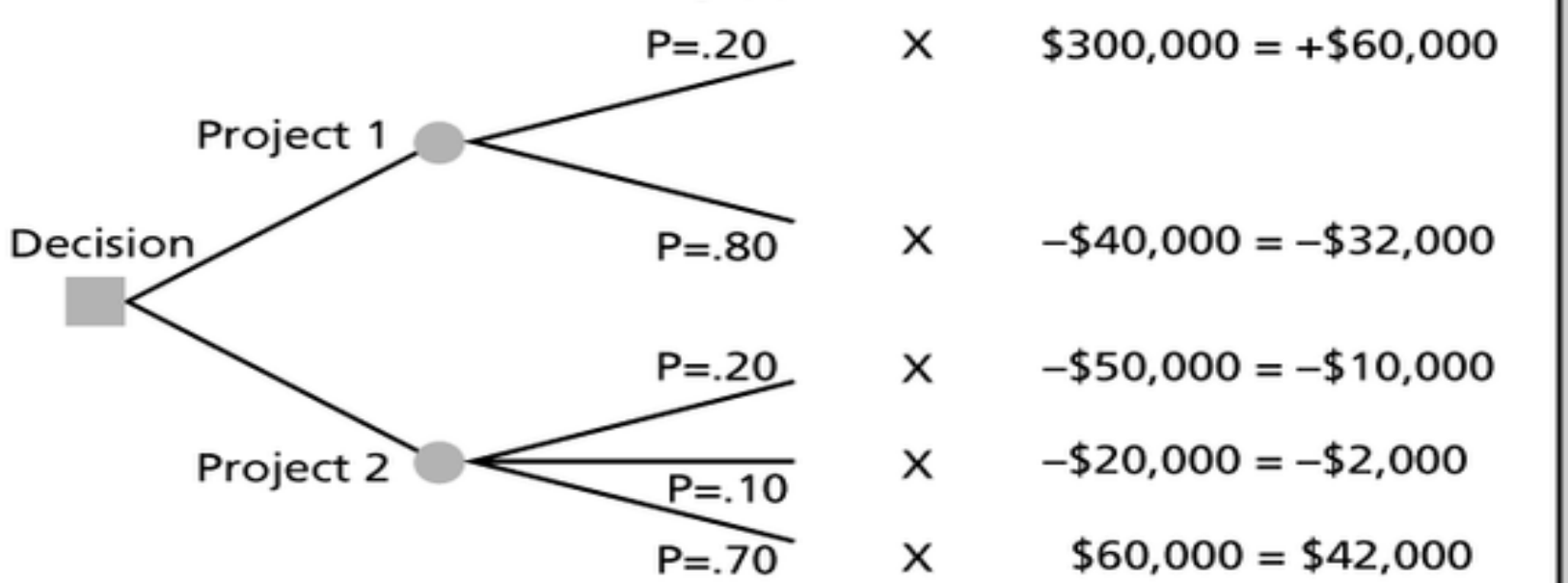
# Potential Risk Areas

| Knowledge Area | Risk Conditions |
|---|---|
| Integration | Inadequate planning; poor resource allocation; poor integration management; lack of post-project review |
| Scope | Poor definition of scope or work packages; incomplete definition of quality requirements; inadequate scope control |
| Time | Errors in estimating time or resource availability; poor allocation and management of float; early release of competitive products |
| Cost | Estimating errors; inadequate productivity, cost, change, or contingency control; poor maintenance, security, purchasing, etc. |
| Quality | Poor attitude toward quality; substandard design/materials/workmanship; inadequate quality assurance program |
| Human Resources | Poor conflict management; poor project organization and definition of responsibilities; absence of leadership |
| Communications | Carelessness in planning or communicating; lack of consultation with key stakeholders |
| Risk | Ignoring risk; unclear assignment of risk; poor insurance management |
| Procurement | Unenforceable conditions or contract clauses; adversarial relations |

# Quantifying Risk

- Risk quantification or risk analysis is the process of evaluating risks to assess the range of possible project outcomes
- Determine the risk's probability of occurrence and its impact to the project if the risk does occur
- Risk quantification techniques include expected monetary value analysis, calculation of risk factors, PERT estimations, simulations, and expert judgment

# Expected Monetary Value




Project 1's EMV = $60,000 –32,000 = $28,000

Project 2's EMV = –$10,000 –2,000 + 42,000 = $30,000

# Bid the Best Project by utilizing EMV and your personal risk tolerance

| Project | Chance of Outcome | Estimated Profits |
|---|---|---|
| Project 1 | 50%<br>50% | $120,000<br>-$50,000 |
| Project 2 | 30%<br>40%<br>30% | $100,000<br>$50,000<br>-$60,000 |
| Project 3 | 70%<br>30% | $20,000<br>-$5,000 |
| Project 4 | 30%<br>30%<br>20%<br>20% | $40,000<br>$30,000<br>$20,000<br>-$50,000 |

# Simulation for Quantifying Risk

McDonnell Aircraft Company used Monte Carlo simulation to help quantify risks on several advanced-design engineering projects. The National Aerospace Plan (NASP) project involved many risks. The purpose of this multi-billion dollar project was to design and develop a vehicle that could fly into space using a single-stage-to-orbit approach. A single-stage-to-orbit approach meant the vehicle would have to achieve a speed of Mach 25 (25 times the speed of sound) without a rocket booster. A team of engineers and business professionals worked together in the mid-1980s to develop a software model for estimating the time and cost of developing the NASP. This model was then linked with Monte Carlo simulation software to determine the sources of cost and schedule risk for the project. The results of the simulation were then used to determine how the company would invest its internal research and development funds. Although the NASP project was terminated, the resulting research has helped develop more advanced materials and propulsion systems used on many modern aircraft.

# Expert Judgment

* Many organizations rely on the intuitive feelings and past experience of experts to help identify potential project risks

* The Delphi method is a technique for deriving a consensus among a panel of experts to make predictions about future developments

# Project risk analysis and management

* The Association for Project Management (APM) developed the Project Risk Analysis and Management (PRAM) Guide in the mid-1990s.
* The key considerations that underpin the PRAM approach are set out in Table below.
* Perhaps one of the most important points made is that there is often no historical experience specific to the project that will enable accurate prediction of the impact of risk-based events.
* The PRAM Guide provides steps to project risk management that are broadly consistent with the steps outlined on other other slides

# PRAM Model for Project Risk Management

**Project Risk Analysis and Management is a process that enables the analysis and management of the risks associated with a project**

- Properly undertaken it will increase the likelihood of successful completion of a project to cost, time and performance objectives
- Risks for which there is ample data can be assessed statistically
- However, no two projects are the same
- Often things go wrong for reasons unique to a particular project, industry or working environment
- Dealing with risks in projects is therefore different from situations where there is sufficient data to adopt an actuarial approach
- Because projects involve a technical, engineering, innovative or strategic content, a systematic process is preferable to an intuitive approach
- Project Risk Analysis and Management (PRAM) has been developed to meet this requirement

The PRAM approach represents a continuous process that can be started at almost any stage in the life cycle of a project. There are five points in a project where particular benefit can be achieved from using the PRAM model:

- Feasibility – at this stage the project is most flexible, enabling changes to be made that can reduce the risks at a relatively low cost.
- Sanction – the client can view the risk exposure associated with the project and check that all steps to reduce/manage the risks have been taken.
- Tendering – the contractor can ensure that all risks have been identified and that risk contingency or risk exposure limits have been set.
- Post-tender – the client can ensure that all risks have been identified by the contractor and assess the likelihood of programmes being achieved.
- During implementation – the likelihood of completing the project to cost and times-cale will increase if all risks are identified and correctly managed.

IRMT

irmT
The Institute of Risk Management Tanzania

# Response to Risk

- Risk avoidance: eliminating a specific threat or risk, usually by eliminating its causes
- Risk acceptance: accepting the consequences should a risk occur
- Risk mitigation: reducing the impact of a risk event by reducing the probability of its occurrence

# Risk Mitigation Strategies

| Technical Risks | Cost Risks | Schedule Risks |
|---|---|---|
| Emphasize team support and avoid stand alone project structure | Increase the frequency of project monitoring | Increase the frequency of project monitoring |
| Increase project manager authority | Use WBS and PERT/CPM | Use WBS and PERT/CPM |
| Improve problem handling and communication | Improve communication, project goals understanding and team support | Select the most experienced project manager |
| Increase the frequency of project monitoring | Increase project manager authority | |
| Use WBS and PERT/CPM | | |

# Risk Planning

- A risk management plan documents the procedures for managing risk throughout the project
- Contingency plans are predefined actions that the project team will take if an identified risk event occurs
- Contingency reserves are provisions held by the project sponsor for possible changes in project scope or quality that can be used to mitigate cost and/or schedule risk

# Risk Management Questions

* Why is it important to take/not take this risk in relation to the project objectives?
* What specifically is the risk and what are the risk mitigation deliverables?
* How is the risk going to be mitigated? (What risk mitigation approach is to be used?)
* Who are the individuals responsible for implementing the risk management plan?
* When will the milestones associated with the mitigation approach occur?
* How much is required in terms of resources to mitigate risk?

# Response to Risks

- Risk response control involves executing the risk management processes and the risk management plan to respond to risk events
- Risks must be monitored based on defined milestones and decisions made regarding risks and mitigation strategies
- Sometimes workarounds or unplanned responses to risk events are needed when there are no contingency plans

# Tracking risks

- Top 10 risk item tracking is a tool for maintaining an awareness of risk throughout the life of a project
- Establish a periodic review of the top 10 project risk items
- List the current ranking, previous ranking, number of times the risk appears on the list over a period of time, and a summary of progress made in resolving the risk item

# Example for Risk Tracking

| | Monthly Ranking | | | |
|---|---|---|---|---|
| **Risk Item** | **This Month** | **Last Month** | **Number of Months** | **Risk Resolution Progress** |
| Inadequate planning | 1 | 2 | 4 | Working on revising the entire project plan |
| Poor definition of scope | 2 | 3 | 3 | Holding meetings with project customer and sponsor to clarify scope |
| Absence of leadership | 3 | 1 | 2 | Just assigned a new project manager to lead the project after old one quit |
| Poor cost estimates | 4 | 4 | 3 | Revising cost estimates |
| Poor time estimates | 5 | 5 | 3 | Revising schedule estimates |

# Tools for Tracking Risks

- Databases can keep track of risks
- Spreadsheets can aid in tracking and quantifying risks
- More sophisticated risk management software helps develop models and uses simulation to analyze and respond to various project risks

# Good Project Risk Management

- Unlike crisis management, good project risk management often goes unnoticed
- Well-run projects appear to be almost effortless, but a lot of work goes into running a project well
- Project managers should strive to make their jobs look easy to reflect the results of well-run projects

# Discussion Questions

- Can you avoid risks?
- What are common sources of risk for IT projects?
- How does spreadsheet help to quantify risk?
- How does simulation help to quantify risk?
- What is the best way to plan for risks?
- What is the difference between contingency plan and contingency reserve?

# Discussion Questions

- Read and comment on interview questions and answers at the end of this chapter. What question or which response do you find interesting and why?
- Which group of risks (internal, external) described in this chapter is more critical to an information system project? Why? What is the most critical risk for any information system project?

# Discussion Questions

- Is user involvement important to risk management? Why?
- Comment on sources of risk:
  - continued management support
  - top management style
  - alignment with organizational needs
  - user acceptance
  - shifting goals and objectives

# Discussion Questions

- Comment on sources of risk:
  - vendors
  - consultants
  - contract employees
  - market and change fluctuation
  - government regulation
- What are effective ways of avoiding the risk of losing internal talents to external providers?

# Risk Management and Projects

Embedding risk management within project management leads some to consider that it is just another project management technique or that its use is optional and appropriate only for large, complex or innovative projects. These attitudes often result in risk management being applied without full commitment or attention, and are often responsible for the failure of risk management to deliver the benefits.

To be fully effective, risk management must be closely integrated into the overall project management process. It must not be seen as optional, or applied sporadically only on particular projects. Risk management must be built in to project management and not seen as a bolt-on.

Built-in risk management has two key characteristics:

- First, project management decisions are made with an understanding of the risks involved. This understanding includes the full range of project management activities, including scope definition, pricing/budgeting, value management, scheduling, resourcing, cost estimating, quality management, change control and post-project review.
- Second, the risk management process must be integrated with other project management processes. Not only must these processes use risk data, but there should also be a seamless interface across process boundaries. This has implications for the project toolset and infrastructure, as well as for project procedures.

I R M T

irm
The Institute of Risk Management Tanzania

I
R
M
T

# Fraud Risk Management

# What is Fraud?

- Fraud is a broad legal concept that generally refers to an intentional act committed to secure an unfair or unlawful gain.
- Misconduct is also a broad concept, generally referring to violations of laws, regulations, internal policies, and market expectations of ethical business conduct.
- It is an intentional act by one or more individuals among management, those charged with governance, employee or third parties involving the use of deception to obtain an unjust or illegal advantage

# Why People Commit Fraud?

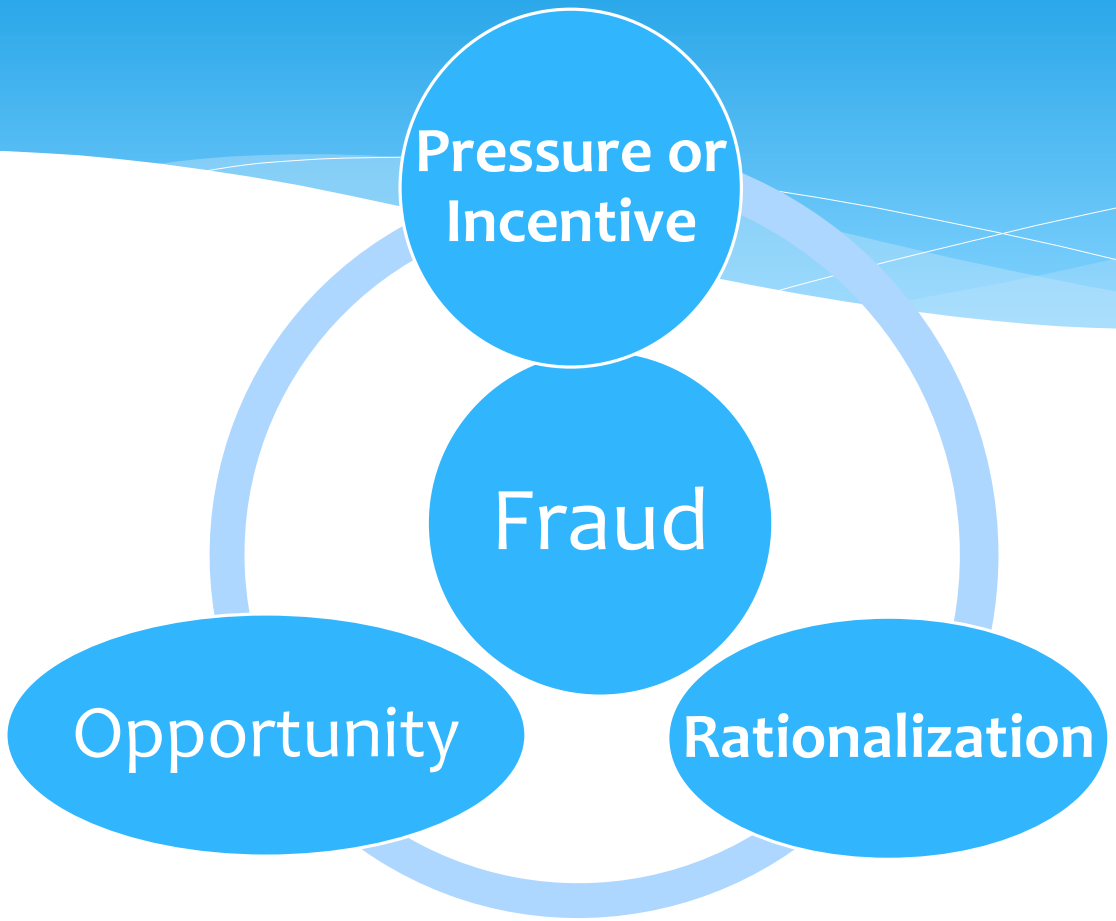
* Pressure on employee to misappropriate cash or organizational assets
* Employees committing fraud are not career criminals, they are trusted employees
* Dr. Donald Cressey, a criminologist developed a model to get reasons for why people in trust commit fraud
* Model is referred as fraud triangle

# Causes of Fraud - Rationalization

- Most of fraudsters are first time offenders with no criminal past and therefore don't view themselves as criminals

- They must always justify the crime in a way that makes it an acceptable and justifiable act (rationalization) e.g. I was underpaid, my employer cheated me, my employer is dishonest, I was entitled to the money or I was only borrowing money.

# What causes fraud?- Fraud Triangle



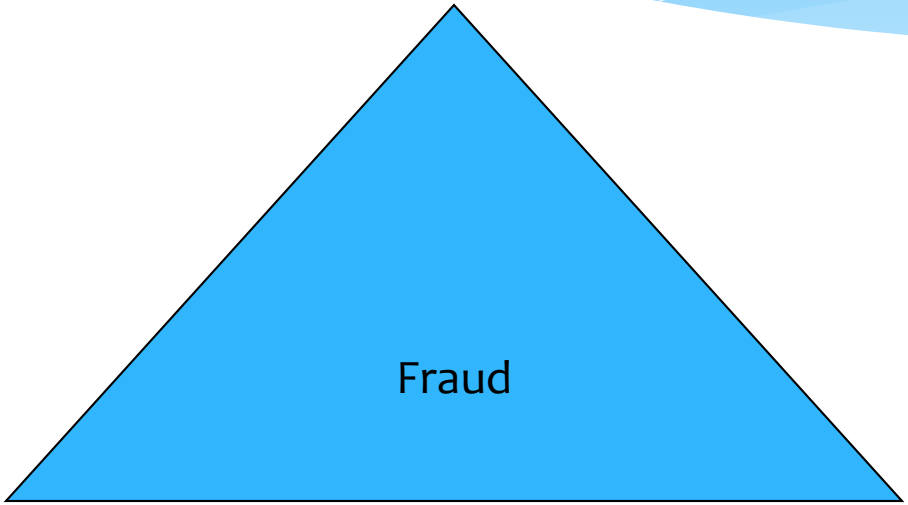

**All the three factors must be present for fraud to occur, if any one of the three is missing, fraud will not occur**



IRMT
irmT The Institute of Risk Management Tanzania

# Why fraud happens?

Opportunity- *due to weak And override of controls*




Pressure

*Unrealistic Corporate Target can Force Employees to Commit fraud*

Need/ Rationalization

- *Every one Does it*
- *Simply borrow -money*

I R M T

# Causes of Fraud (Pressure/Incentive)

- It is a perceived non-sharable financial pressure
- Non-Shareable involves some sort of embarrassment, shame or disgrace
- It is the first motivation for crime
- A person may have financial problem that cannot be solved through legitimate means
  - Consideration for illegal acts such as stealing cash or falsifying a financial statement as a way to solve problem
  - It can be deep personal debt or a job/business is in jeopardy e.g. Desire for status symbol eg. Big house, nicer car; need to meet productivity targets; drug or gambling addition or inability to pay bills
  - It can sexual addiction and importance of status

# Causes of Fraud (Opportunity)

- It is a perceived opportunity defining method by which crime can be committed
- Involves uses of position of trust to solve financial problems
- It is critical that the fraudster be able to solve problem in secret since motivation is over the status
- Always the fraudster will act in secret e.g. forcing bank reconciliation to balance if he had paid a cheque to oneself.

# Fraud Triangle - Limitations

- Not applicable to professional fraudsters or predatory employees ( employees taking job with intent to stealing from the employer)

- Rationalization is only necessary for first commitment of fraud and afterwards it is abandoned



IRMT

irmT The Institute of Risk Management Tanzania

# Fraud Triangle-Deterrence measures

- Reduce pressures on employees that might push them to committing fraud
- Reduced perceived opportunities to commit fraud
- Dispel rationalization for engaging in fraudulent conduct
- Sanctions does not work, why
  - Fraudsters never think that they can be caught in a perceived opportunity
  - Fraudsters always rationalize their conduct
  - Sanctions are only secondary consideration

# Types of Fraud

**Fraudulent Financial Reporting**

**Asset Misappropriation**

**Other Questionable or Improper Business Practices**

- Manipulation, falsification/alteration of records or documents
- Misappropriation of assets
- Suppression or omission of the effect of transaction from records or documents
- Recording transaction without substance
- Misapplication of accounting principles

# Fraud Indicators (Red Flags)

- Aggressive application of accounting codes
- Information provided unwillingly or after unreasonable delay
- Unsupported transactions
- Fewer confirmation responses
- Evidence of unduly lifestyle by officers or employees
- Long outstanding imprest balances
- Poor documentation
- False & improper entries in records
- Unauthorized payments
- Unauthorized use of corporate assets
- Misapplication of funds

# Fraud Indicators (Red Flags)

* Undue secrecy
- Questionable practices
- Significant manager or director transactions
- Drop of sales or earnings
- Aggressive accounting treatment
- Posting of transactions to headquarters
- Receipt of poor quality goods
- Related party arrangements
- Weak security checks for employees
- Delay in submission of reports

# Fraud indicators (Red flags)

- Flouting directives and regulations
- Personal interest
- Uncorrected entries and stock adjustments
- High fly management decisions
- Incompatible functions done by one person
- Misuse of computer for private business
- Frequent use of allocated issue voucher even when the system is available
- Questionable system adjustments

# Fraud Indicators

- Unauthorized transactions
- Cash shortages
- Unexplained variation in prices
- Missing documentation
- Excessive refunds
- Living beyond ones means
- Drug and alcoholic abuse
- High personal debt/loses
- Compulsive gambling/stock speculation
- Risk of increase IT, increases the risk of manipulation, access control

# Fraud Indicators

- Management Environment
  - Pressure
  - Management style and attitude
- Competitive and business environment e.g. technology
- Employee relationship (spouse receiving non competitive contract)
- Attractive assets
- Internal controls
- Lack of separation of duties
- Too much trust placed on few employees

# Personal Fraud Indicators

- Although the level of fraud risk at an organisation may be assessed as low, individuals in the business can have a personal motivation to commit fraud
  - Personal pressures
  - Individual performance targets
  - Infiltration by organised crime
- Controls may be overridden or ignored by certain individuals:
  - Powerful (overrides controls, staff intimidated)
  - Successful (not to be bothered, too busy earning money)
  - Trusted (responsibility has moved beyond their job description)

# Managing Fraud -Forces

Code of Ethics

Staff Regulations

Director & Officer Liability

Internal Audit

Risk Management

**Entity Governance and Responsibility**

Business Plan and Budget

Procurement and Finance Acts

Customer Service Surveys

Stakeholders pressures

Reputation and Credibility

# Business environment

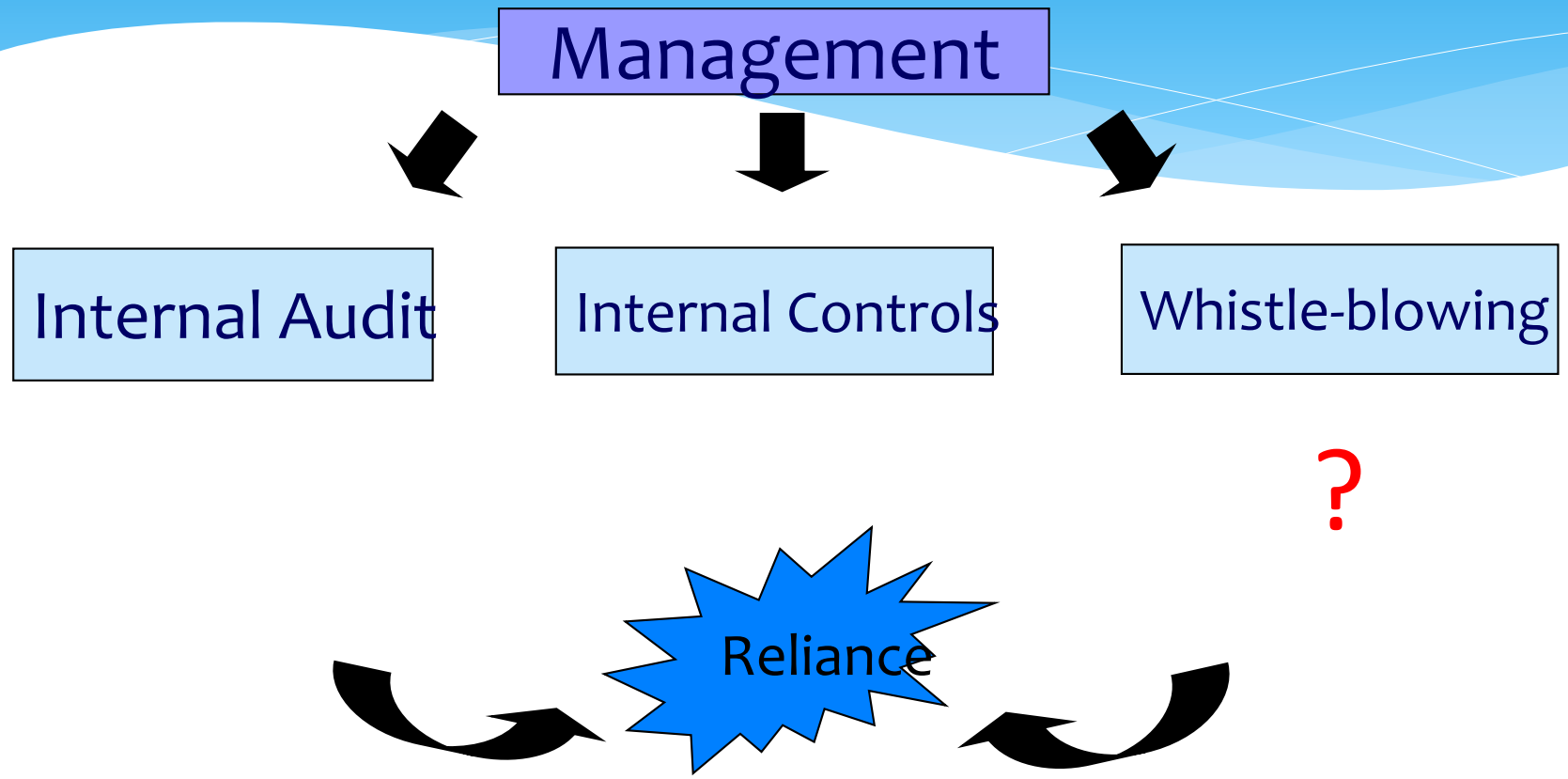
- Rapid increase of activities Weak competition
- Rapidly growing sales
- Relatively high profitability
- ….. In such an environment, effective anti-fraud measures can be ascribed low priority or be undetected because the current level of profitability allows for fraud losses to be absorbed within existing profit margins.
- …. Consider tough times ahead…. More competition, changing government regulations?

# Do we Have Any Fraud Mitigation?

What are they?

1. Reviewed and Strengthening of internal controls
2. Periodic compliance audit
3. Employee hotline
4. Appointed compliance personnel
5. Establish and implement code of conduct for all employees
6. Conducted background check for hires with budgetary responsibility
7. Instituted fraud awareness training
8. Tied employee evaluations to ethics or compliance objectives
9. What is your answer on the above from 0-10

# Fraud Risk Management Techniques

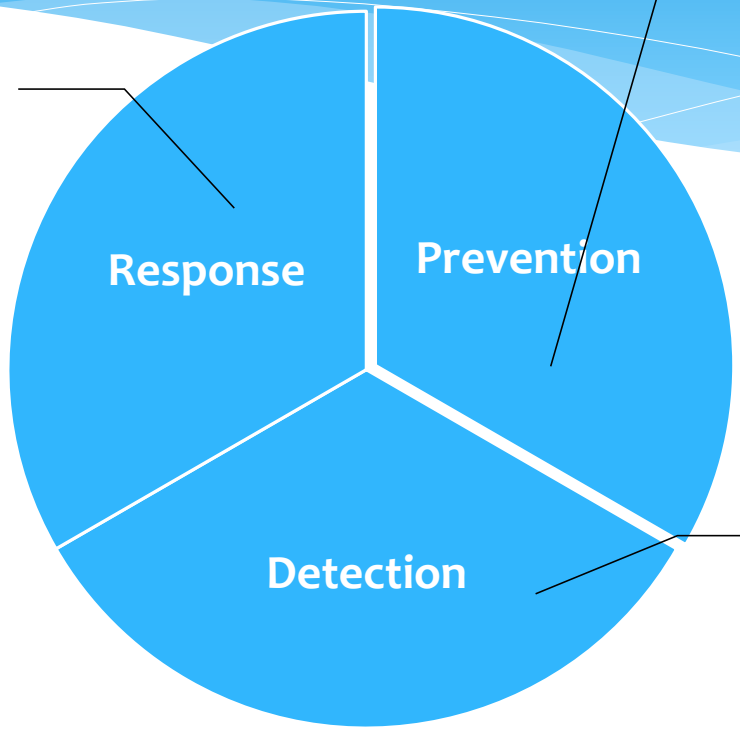


# Controls Barriers

- Good controls on paper are not strictly followed in practice
- Grey areas in the rules – open to interpretation
- Lack of segregation of duties
- Collusion
- Management override
- Failure of senior management to lead by example
- Bureaucracy &/or formulaic compliance
- Failure to share knowledge of fraud experience, control weaknesses and control improvements
- Clash of cultures

# Objectives of Fraud Risk Management

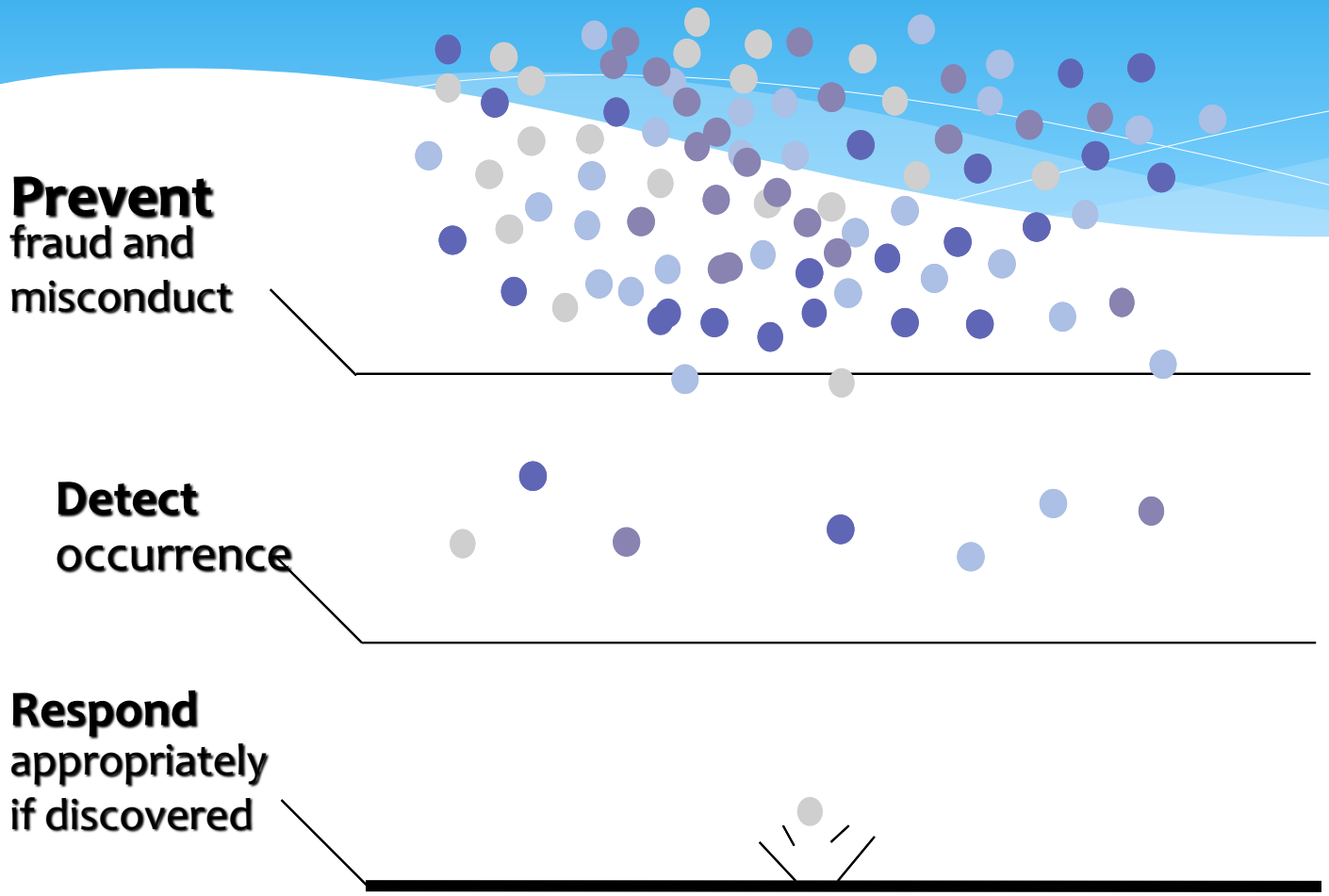
controls designed to take corrective action and remedy the harm caused by fraud or misconduct




controls designed to reduce the risk of fraud and misconduct from occurring in the first place

controls designed to discover fraud and misconduct when it occurs

# Fraud Risks Management - Measures

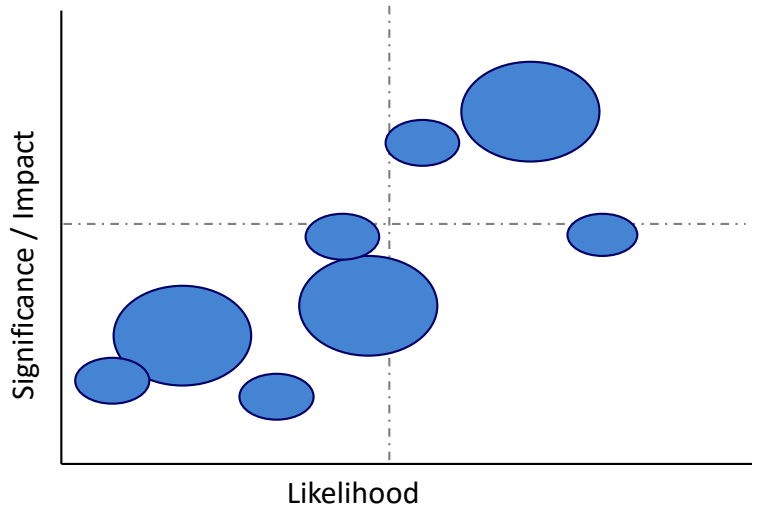


# Fraud Risk Management - components

| Prevention | Detection | Response |
|---|---|---|
| Board/audit committee oversight<br>Executive and line management functions<br>Internal audit, compliance, and monitoring functions | | |
| • Fraud and misconduct risk assessment<br>• Code of conduct and related standards<br>• Employee and third-party due diligence<br>• Communication and training<br>• Process-specific fraud risk controls | • Hotlines and whistle-blower mechanisms<br>• Auditing and monitoring<br>• Proactive forensic data analysis | • Internal investigation protocols<br>• Enforcement and accountability protocols<br>• Disclosure protocols<br>• Remedial action protocols |

# Fraud Risk Assessment

- Before an organisation can develop an effective program to prevent and detect fraud, it must first understand the types of fraud risk, including specific types of frauds and schemes, to which it may be vulnerable.




Qualitative factors in the assessment include:

- the accounting system
- complexity, volume and nature of transactions
- internal controls in place
- compliance, training and monitoring

Incorporates the views of:

- management;
- control functions;
- line employees

Management are then able to:

- Prioritise identified risks and evaluate the existing controls
- Link each risk to specific controls and commit resources to implement any enhancements

# Fraud Risk Management Experiences

Surveys suggest that:

1. Over 50% of frauds are discovered as a result of information provided by staff
2. Losses after an introduction of a whistle-blowing hotline can be reduced by up to 60%.
3. Staff prefer the following reporting channels:
   - 57%: a telephone hotline;
   - 20%: conventional mail; and
   - 16%: e-mail.

*Source: 2006 ACFE Report to the Nation on Occupational Fraud & Abuse*

# FRM – Hotline Best Practices

| | |
|---|---|
| Confidentiality | All matters treated confidentially; reported on a need to know basis |
| Anonymity | Process should allow for anonymous submission & resolution |
| Availability | Should be available in remote outposts, not just head office |
| Assistance – Real Time | A 'live' response – operators need to be qualified, trained & able to provide advice |
| Procedures | Consistent protocols to gather information and manage the call |
| Classify & Notify | Qualified staff assess the allegation; protocols establish basis for escalation & investigation |
| Communicate | Publicise the hotline prominently; commit to, & test for, non-retaliation |

# FRM - Response

- Objective is to take corrective action & remedy the harm caused by fraud or misconduct:
- Examine the primary cause of the control breakdown, ensuring that risk is mitigated and controls are strengthened.
- Discipline those involved in the inappropriate actions, as well as those in management positions who failed to detect or prevent such events.
- Communicate to the wider population of employees that management took appropriate, responsive action.

# FRM - Basis of Investigation

- Consideration should be given to:
  - Data and information gathering;
  - Interviewing techniques;
  - Appropriate resource;
  - Analytical tools such as data mining; and
  - Organisation intelligence information.

# Fraud investigation

- Once the symptoms of fraud are found and additional tests have indicated that there is a strong possibility of fraud, the review enters the formal investigation phase.

- Investigator must know;
  - Results of investigation can be used later as an educational tools for auditors, fraud investigators and other employees

# Fraud Investigation- Stages

- Briefing management, followed by terms of reference detailing the initial scope of work.
- Communication with parties involved e.g. Internal audit, audit committee and accounting staff.
- Determining the extent of fraud.
- Interviewing the defrauder (only if fraud is known with certainty).
- Investigating the known area with detailed audit test. E.g. Procurement tendering, wages, cash debtors and stock
- Report to the management on the findings, with copies to interested parties e.g. Internal auditor, audit committee.

# Investigation – Details of Report

- Circumstances which led to investigation
- Fraud discovered and their extent
- Identity of the defrauder
- Effects on the reported profit of the past period
- Effects on f/s of current periods

# Investigation – Details of Report

- IC weakness which allowed the fraud and recommendations for eliminating them
- Report of any interviewing with the defrauder, including offers of restitution etc, which may be relevant to management in deciding what action, if any they should take against him/her
- If there is any suggestion that the internal auditors has been negligent the extent of claim against him.

# Action upon proof of fraud or error

- Investigator should
  - Consider the potential effects in F/s
  - Where the fraud is material the auditor should modify the audit procedures so as to perform procedures appropriate to circumstances depending on the type of the fraud/error suspected, the likelihood of their occurrence and extent of damage in the F/s

# Action Upon Proof of Fraud or Error

- If some proof of fraud exists, management has several options
  - Cause a deeper audit to be done if amount of loss appears substantial
  - Terminate employee responsible if loss is minimal
  - File a claim to recover a loss from clients fidelity insurance agent
  - Arrange with law enforcement agents to probe into the matter

# Action Upon Proof of Fraud or Error

- If some proof of fraud exists, management has several options
  - Engage a private investigator to probe into the loss and document it for claim purpose/prosecution
  - Disregard losses if minimal and tighten controls
  - Alert the directors, audit committees or the Board

# Fraud Deterrence Measures

- Strong internal Control System is not a warrant from fraud
  - Entity should have an effective anti-fraud and corruption strategy which is aimed at encouraging prevention, promote early detection and respond to concern raised
  - Awareness programs to employees
  - Screening job applicants
  - Sound corporate policy on fraud
  - AVOID atmosphere of distrust and paranoia by over-emphasising fraud deterrence measures.

# Fraud Deterrence –Three Lines of Defense

- Management should ensure enforcement of compliance with operations SOPs
- Risk management function should be embedded in business activities
- Internal audit should be proactively risk based

# Fraud Risk Reporting

- It is important to stick to facts, and to discount hearsay, rumour, or opinion and record what is relevant to the cause of the incident and its effect.
- Audit reports on fraud and other improprieties should be addressed to the right person who can take action.

# Fraud Reporting

- Report must contain all details of fraud.
- Must provide framework to analyse the fraud case
- Must enable the user to develop improved management and security policies and detect and prevent fraud.
- Investigation and reporting should proceed in such a way that the outcome will be litigated. Recording exact times, data, names of person and specific; description of evidence are critical in civil or criminal investigation or litigation.

I
R
M
T

# Combating Fraud Risk in Payment Systems



irmT
The Institute of Risk Management Tanzania

# Defining 'Fraud'

*"..a deliberate act of omission or commission by any person, carried out in the course of a banking transaction or in the books of account maintained manually or under computer system in banks, resulting into wrongful gain to any person for a temporary period or otherwise, with or without any monetary loss to the bank."*

*(Report of the Study Group On Large Value Bank Frauds issued by RBI)*

# Payment Systems

- Key participants
  - Bank of Tanzania
  - Stock Exchanges
  - Clearing Houses
  - Banks
  - Other entities
- Mission:
  - To ensure that all the payment and settlement systems operating in the country are safe, secure, sound, efficient, accessible and authorised
- Apex body:
  - The Board for Regulation and Supervision of Payment and Settlement Systems (BPSS)

# Frauds in Payment Systems

- Paper based
  - Cheques
  - Dividend/Interest warrants
  - Demand Drafts/Pay orders
- Electronic
  - CTS (Cheque Truncation System)
  - RTGS/NEFT
  - ECS – Debit and Credit
  - ATMs
  - Credit cards including prepaid
  - Internet Banking
  - Mobile Banking

# Instrument Frauds

- Forgery
- Colour photo copy
- Colour photo copy with MICR coding
- Scanned image printed on security paper
- Large value cheques issued without balance in account

# Electronic Frauds

- Fraudulent RTGS/NEFT requests
  - Physical requests
  - Through internet banking
  - Speedy dissemination of fraud funds to various banks
  - Withdrawal across the country through ATMs or cheques

- ECS frauds
  - Changing account numbers for credit/debit

# Channel Frauds

- ATMs
  - Social engineering
  - Skimming
  - Unauthorised reversals
- Internet
  - Phishing
  - Vishing
- Mobile Banking

# The Challenge to a Bank…

- Financial Loss
- Brand Image & Reputation
- Customer confidence
- Regulator confidence
- Shareholder confidence

# Combating the Challenge…

The "TAP" concept :

- Technology Solutions
- Awareness/Training
- Policy Changes

# Technology & Fraud Mitigation

- Upgrading reader sorter machines
  - UV integration
  - Reading of security features
  - Sorting suspicious instruments into a different pocket
- Transaction monitoring
  - New accounts
  - Accounts with unsatisfactory conduct
  - Clearing accounts
- Transaction monitoring in automated channels
  - Internet banking, ATMS and Mobile

# Awareness

- Customer awareness
  - Newspapers & other media
  - SMS alerts
  - Emails
- Staff awareness
  - Training programmes
    - Practical
    - Online
  - Culture building
  - Rewarding 'fraud preventers'

# Policies for Risk Mitigation

- IT Security Policy
- Outsourcing Policy
- Employee Code of Conduct
- Whistle Blower Policy
- Fraud Policy

# Fraud Governance

- Fraud governance structure
  - Detailed fraud policy
  - Reporting to Board, Special Committee
  - Responsibility of senior management
  - Staff accountability for frauds
  - Fraud is not the responsibility of one department, it has to be owned across the organisation
- Fraud loss limits
  - Triggers for review of product features
- Regular review of fraud prone areas by Special Committee

# Building Blocks in Fraud Management

I R M T

I
R
M
T



irmT
The Institute of Risk Management Tanzania

I
R
M
T

# INSURANCE

# Insurance Terminology

- Exposures
- Deductibles or retentions
- Policy limits
- Coinsurance
- Claims or losses
  - Incurred
  - Paid
  - Loss adjustment expenses
- Loss frequency and severity
- Triggers

# Alternative Risk Transfer (ART) Terminology

- Captives
- Finite insurance or reinsurance
- Insurance-linked bonds
- Insurance securitization
- Cat-E-Puts (Catastrophe equity put options)
- Contingent surplus notes

# Loss Frequency

- Number of losses during policy period
- Often modeled as a Poisson distribution

$$Pr(k) = e^{-\lambda}\lambda^{k}/k!$$

Where Pr = probability

k = number of claims per year (0,1,2,...)

$\lambda$ = expected number of claims per year



IRMT

irmT The Institute of Risk Management Tanzania

# Loss Severity

- Size of loss given a loss has occurred
- Variety of potential severity distributions
  - Empirical
  - Exponential (Gamma)
  - Lognormal
  - Pareto
- Distribution characteristics
  - Non-negative
  - Positively skewed
  - Variance positively correlated with mean

# Hazard Risk Example

- Assume independent losses
- Loss frequency
  - 0 80%
  - 1 15%
  - 2 5%
- Loss severity
  - $1,000 40%
  - $10,000 30%
  - $25,000 20%
  - $100,000 10%

# Hazard Risk Example (2)

| Probability of losses | | | | | | Total Losses | Prob. | Expected Losses | |
|---|---|---|---|---|---|---|---|---|---|
| 1 loss | | | | | | 0 | 0.8000 | 0 | |
| 1000 | 0.060 | | | | | 1000 | 0.0600 | 60 | |
| 10000 | 0.045 | | | | | 2000 | 0.0080 | 16 | |
| 25000 | 0.030 | | | | | 10000 | 0.0450 | 450 | |
| 100000 | 0.015 | | | | | 11000 | 0.0120 | 132 | |
| | | | | | | 20000 | 0.0045 | 90 | |
| 2 losses | 1000 | 10000 | 25000 | 100000 | | 25000 | 0.0300 | 750 | |
| 1000 | 0.0080 | 0.0060 | 0.0040 | 0.0020 | | 26000 | 0.0080 | 208 | |
| 10000 | 0.0060 | 0.0045 | 0.0030 | 0.0015 | | 35000 | 0.0060 | 210 | |
| 25000 | 0.0040 | 0.0030 | 0.0020 | 0.0010 | | 50000 | 0.0020 | 100 | |
| 100000 | 0.0020 | 0.0015 | 0.0010 | 0.0005 | | 100000 | 0.0150 | 1500 | |
| | | | | | | 101000 | 0.0040 | 404 | |
| Total value of two losses | | | | | | 110000 | 0.0030 | 330 | |
| | 2000 | 11000 | 26000 | 101000 | | 125000 | 0.0020 | 250 | |
| | 11000 | 20000 | 35000 | 110000 | | 200000 | 0.0005 | 100 | |
| | 26000 | 35000 | 50000 | 125000 | | | 1.0000 | 4600 | |
| | 101000 | 110000 | 125000 | 200000 | | | | | |

# Analysis of Potential Losses

- Expected losses = 4,600
- Maximum possible loss = 200,000
- Maximum probable loss (0.25%) = 125,000
- Expected losses excess of a Tzs. 100,000 retention = 1,084

# Current State of Hazard Risk Management

- Insurance industry has developed a high level of mathematical sophistication for valuing hazard risks
- Alternative market has also developed for dealing with hazard risks
- Key questions for organizations involve amount of risk to retain (deductible) and how much coverage to purchase (policy limits)
- These questions begin to tie hazard risk into enterprise risk management

# Summary

- There is a standard approach for dealing with each type of risk
- Each area has its own terminology and techniques
- The ERM challenge is to combine these different approaches into a common method that can deal with risk in an integrated manner
- The first step is to understand the different approaches

I
R
M
T

# INSTITUTE OF RISK MANAGEMENT TANZANIA (IRMT)

# STUDENTS SUMMARY NOTES

## MODULE X

# LIQUIDITY RISK AND MODEL RISK

## CERTIFIED FINANICIAL SERVICES RISK MANAGEMENT PROFESSIONAL COURSE

## Certified Financial Services Risk Professional Examination (CFSRP)

I R M T



irmT The Institute of Risk Management Tanzania

# What is Liquidity Risk?

**Introduction**

Organization must have sufficient liquidity to meet commitments as they fall due. **Liquidity risk** is the risk that a bank will not have sufficient liquid resources available to meet commitments.

Maturing assets might turn out to be non-performing. This may prompt the bank to liquidate other investments. The volume of these other investments liquidated could significantly move the market price of the assets. In extreme cases there might not even be a viable market in which to trade.

# What Is Liquidity Trading Risk?

In case financial institution owns 100, 1,000, 10,000, or even 100,000 shares in IBM, liquidity risk is not a concern. Several million IBM shares trade on the New York 499, Stock Exchange every day. The quoted price of the shares is very close to the price that the financial institution would be able to sell the shares for.

However, not all assets are as readily convertible into cash. For example, a $100 million investment in the bonds of a non-investment-grade U.S. company might be quite difficult to sell at close to the market price in one day. Shares and debt of companies in emerging markets are likely to be even less easy to sell.

# What Is Liquidity Trading Risk? Cont…

The price at which a particular asset can be sold depends on:

1. The mid-market price of the asset, or an estimate of its value
2. How much of the asset is to be sold
3. How quickly it is to be sold
4. The economic environment

When there is a market maker who quotes a bid and offer price for a financial asset, the financial institution can sell the asset at the bid and buy at the offer.

# What Is Liquidity Trading Risk?

However, it is usually stated (or understood) that a particular quote is good for trades up to a certain size. Above that size, the market maker is likely to increase the bid–offer spread. This is because the market maker knows that as the size of a trade increases, the difficulty of hedging the exposure created by the trade also increases.

When there is no market maker for a financial instrument, there is still an implicit bid–offer spread.

# Funding Risk

This refers to the inability to meet payment obligations to creditors or investors when they do not want to roll over their positions.

This can force unwanted liquidation of the portfolio. Liquidity funding risk is related to liquidity trading risk because one way a financial institution can meet its funding requirements is by liquidating part of its trading book.

It is therefore important for a financial institution to quantify the liquidity of its trading book so that it knows how easy it would be to use the book to raise cash.

# Funding Risk Cont…

The financial institution wants to make sure that it will be able to survive stressed market conditions where there is a general shortage of liquidity.

The financial institution's analysis should therefore be based on stressed market conditions, not normal market conditions.

# Funding Risk Cont…

Liquidity funding risk . This is the financial institution's ability to meet its cash needs as they arise. As mentioned out earlier liquidity is not the same as solvency. Financial institutions that are solvent (i.e. have positive equity) can, and sometimes do, fail because of liquidity problems. The firm can be solvency however has no available cash to meet its current commitment, therefore it is insolvent.

# Causes of Liquidity Problems

Liquidity funding problems at a financial institution can be caused by:

a) Liquidity stresses in the economy (e.g., a flight to quality such as that seen during the 2007 to 2009 crisis). Investors are then reluctant to provide funding in situations where there is any credit risk at all.
b) Overly aggressive funding decisions. There is a tendency for all financial institutions to use short-term instruments to fund long-term needs, creating a liquidity mismatch. Financial institutions need to ask themselves: "How much of a mismatch is too much?"
c) A poor financial performance, leading to a lack of confidence. This can result in a loss of deposits and difficulties in rolling over funding.

# Liquidity Black Holes

The most severe liquidity crises occur when we have liquidity black holes. They develop when the entire market moves to one side. During a price decline, when everyone wants to sell, liquidity will dry up and distress sales will happen.

Liquidity holes may develop when banks with similar positions, do same trades to achieve a delta neutral position. Liquidity can become a serious problem due to herd behavior.

# Liquidity Black Holes Cont…

There is a large canon of literature about stock market crashes. Practitioners often describe crashes as **liquidity holes,** or more dramatically **liquidity black holes.**

In the sense that price drops sharply without important new events and the stock market can remain low for a substantial amount of time without immediately bouncing back.

I
R
M
T

# MARKING TO MARKET: PANACEA OR PANDORA'S BOX?

# Case for Marking to Market

Market price reflects current terms of trade between willing parties.

Market price gives better indication of current risk profile.

Market discipline Informs investors, better allocation of resources.

If the fundamentals are volatile, then so be it. Market price is volatile but it simply reflects the volatility of the fundamentals.

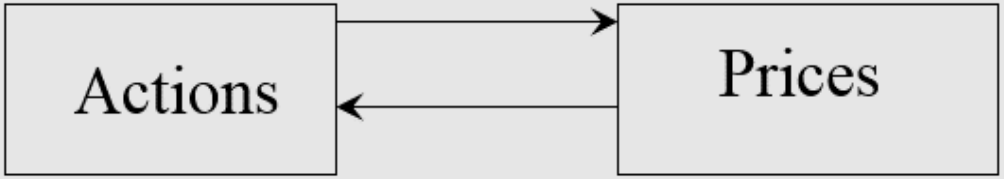
# Theory of the Second Best

When there is more than one imperfection in an economy, removing one of them need not improve welfare.

In the presence of other imperfections (illiquidity, agency problems, etc.) marking to market need not be welfare improving.

# "Artificial" Volatility

- Dual role of market price
  - Reflection of fundamentals
  - Influences actions




- *Reliance* on market prices *distorts* market prices



IRMT
irmT The Institute of Risk Management Tanzania

# Three Notions of Value

- Fundamental value $v$
- Book value $v_0$
- Market price $p = \delta v - \gamma s$



IRMT

irmT The Institute of Risk Management Tanzania

# Fundamental Value $v$

- Not contractible

- But firm has good information on $v$
  - $v$ is common knowledge (base case)
  - $v$ is observed with negligible noise (main model)



IRMT
irmT The Institute of Risk Management Tanzania

# Book Value $\nu_0$

- Book value determined by past decisions (exogenous to model)
- Common knowledge at time of decision
- Contractible



IRMT

irmT The Institute of Risk Management Tanzania

# Market Price

- Market price

$$p = \delta v - \gamma s$$

- Lower ability to extract value $(\delta < 1)$
- Limited absorption capacity $(\gamma > 0)$



IRMT

irmT The Institute of Risk Management Tanzania

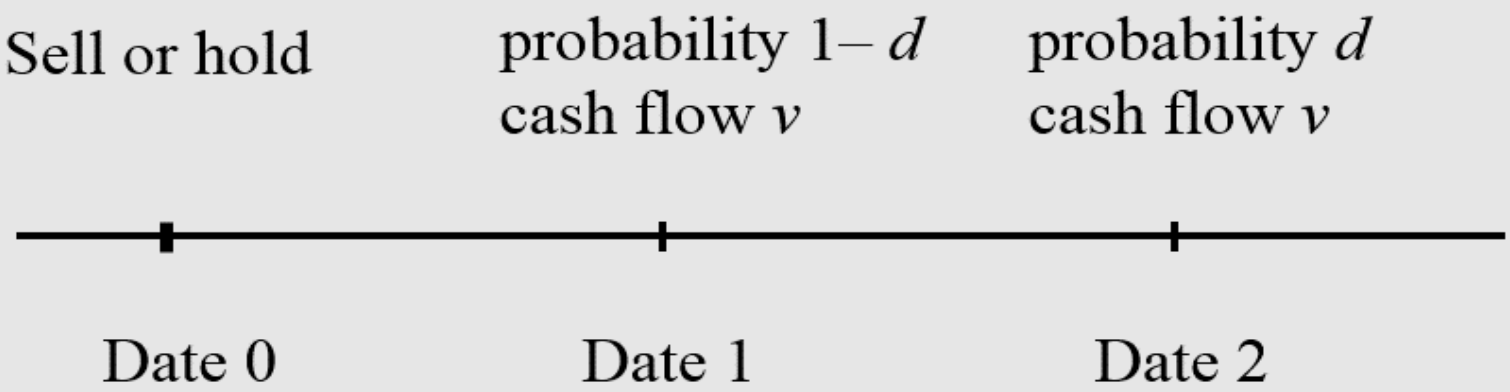
# Interpretation of Strategic Effects

- Marketable assets and possibility of "liquidity holes"
- Hedging credit risk against spike in spreads
  - Loan sales
  - Credit derivatives
  - "reach for yield"

# Horizon Mismatch

- Manager chooses at date 0
  - Sell asset (buy default protection)
  - Hold asset
- Aims to maximize **date 1 accounting value**
  - depends on accounting regime in place
- But asset may be long-lived…

# Duration of Asset



# Mark to Market Regime

- Sell when $v$ is low relative to $v_0$
  - market price is excessively volatile
- Sell when others sell
  - actions are strategic complements
  - multiple equilibria when $v$ is common knowledge

# Global Game

- Firm observes $v$ with small noise
- Take limit as noise tends to zero
- Unique equilibrium
  - Fundamental uncertainty dissipates but strategic uncertainty remains

# Shape of Strategic Uncertainty in Global Game

- Conditional on being at switching point, what is the density of $s$?

- Answer: In the limit as noise tends to zero, $s$ is uniformly distributed on [0, 1]
  - Morris and Shin (2003)

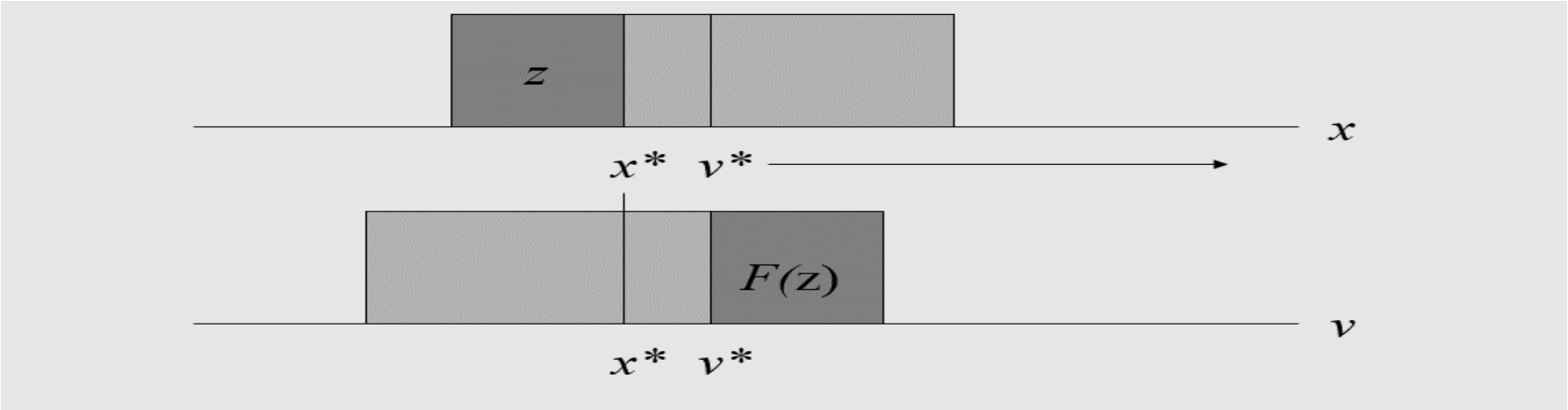


IRMT

irmT The Institute of Risk Management Tanzania

"I am the marginal player. What is the probability that proportion $z$ or less have signal lower that me?"

(i.e.) What is $F(z)$, the value of the cumulative distribution function of s evaluated at $z$?



- Answer:

$$F(z) = z$$

- Cumulative distribution function is the identity function

- So, density over $s$ is uniform



IRMT

irmT The Institute of Risk Management Tanzania

# Historical Cost Regime

- Sell when $v$ is high
- Hold when $v$ is low
- Interior solution for intermediate $v$



IRMT

irmT The Institute of Risk Management Tanzania

# Mark to Market Regime

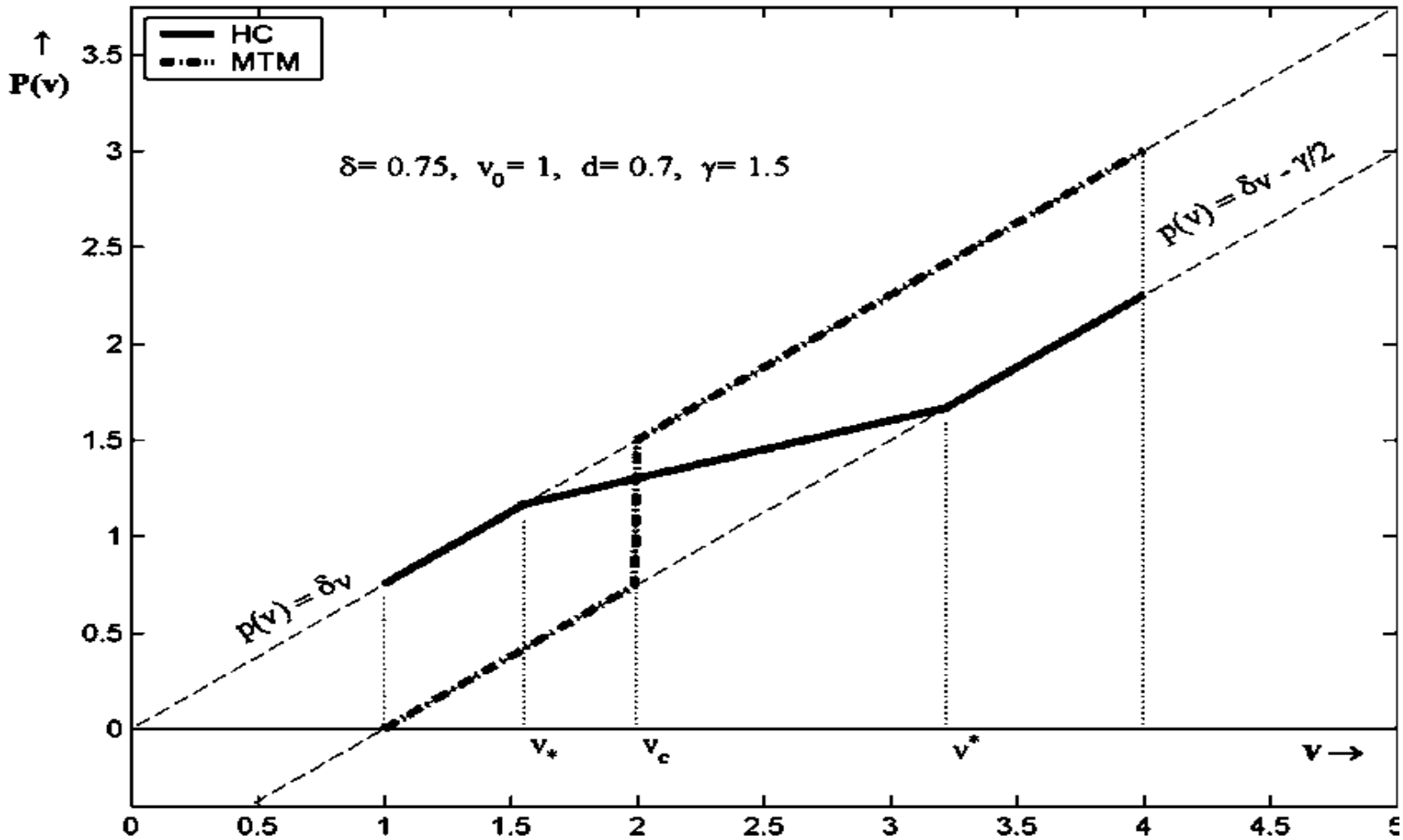
- Hold when $v$ is high
- Sell when $v$ is low
- Unique equilibrium in switching strategies



IRMT

irmT The Institute of Risk Management Tanzania

# Equilibrium Date 1 Price



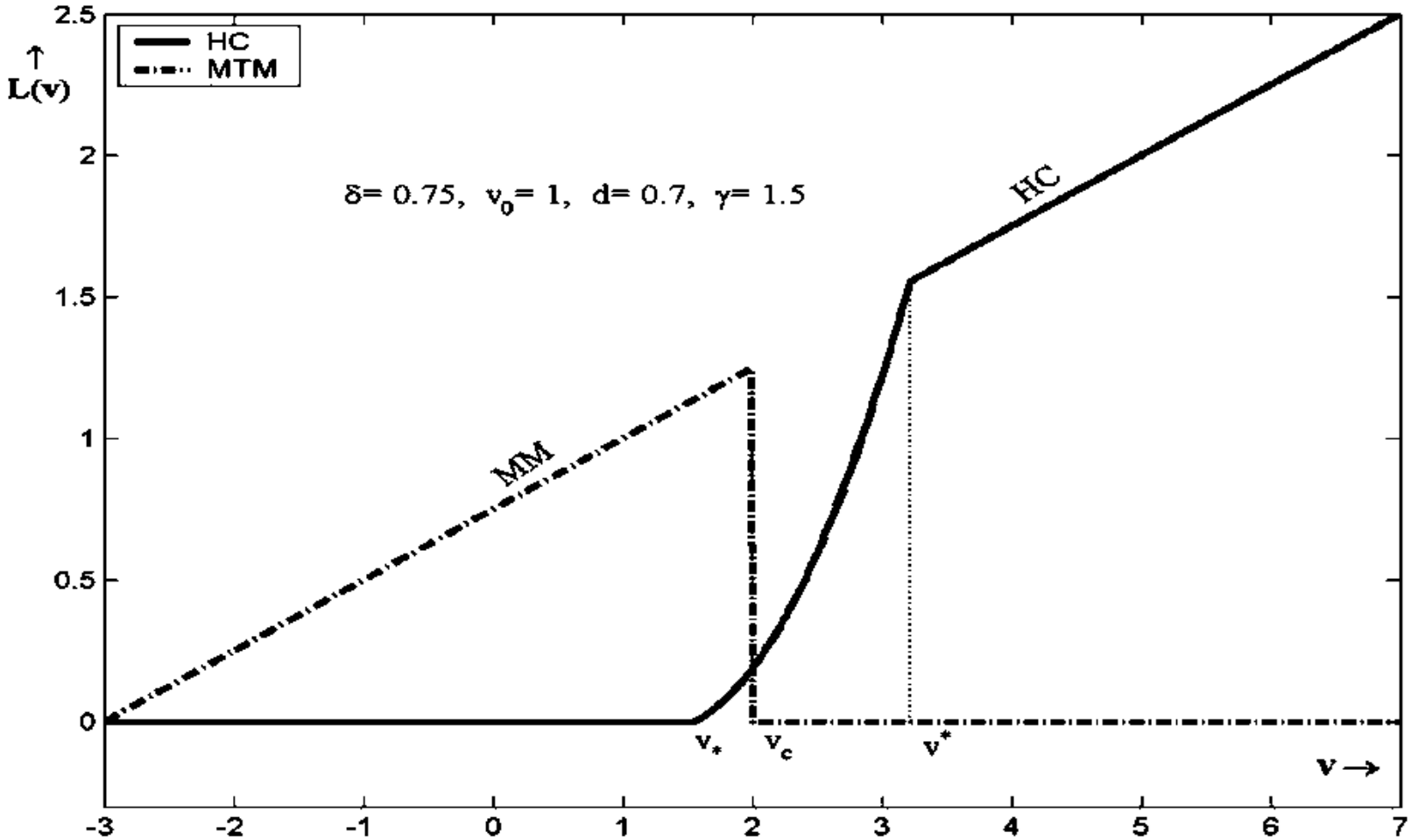




IRMT

irmT The Institute of Risk Management Tanzania

# Equilibrium Loss

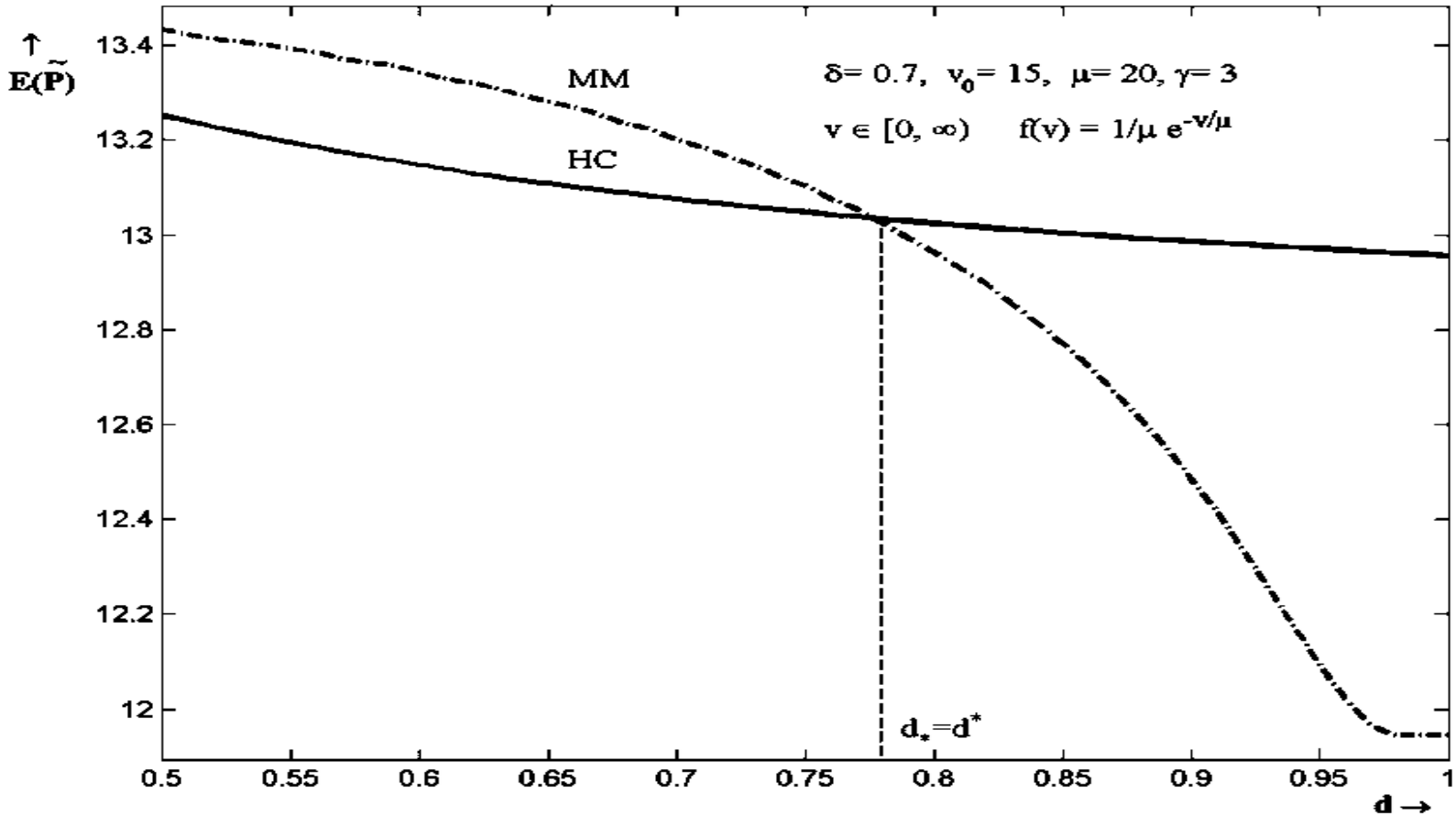





I R M T

irmT The Institute of Risk Management Tanzania

# Effect of Duration



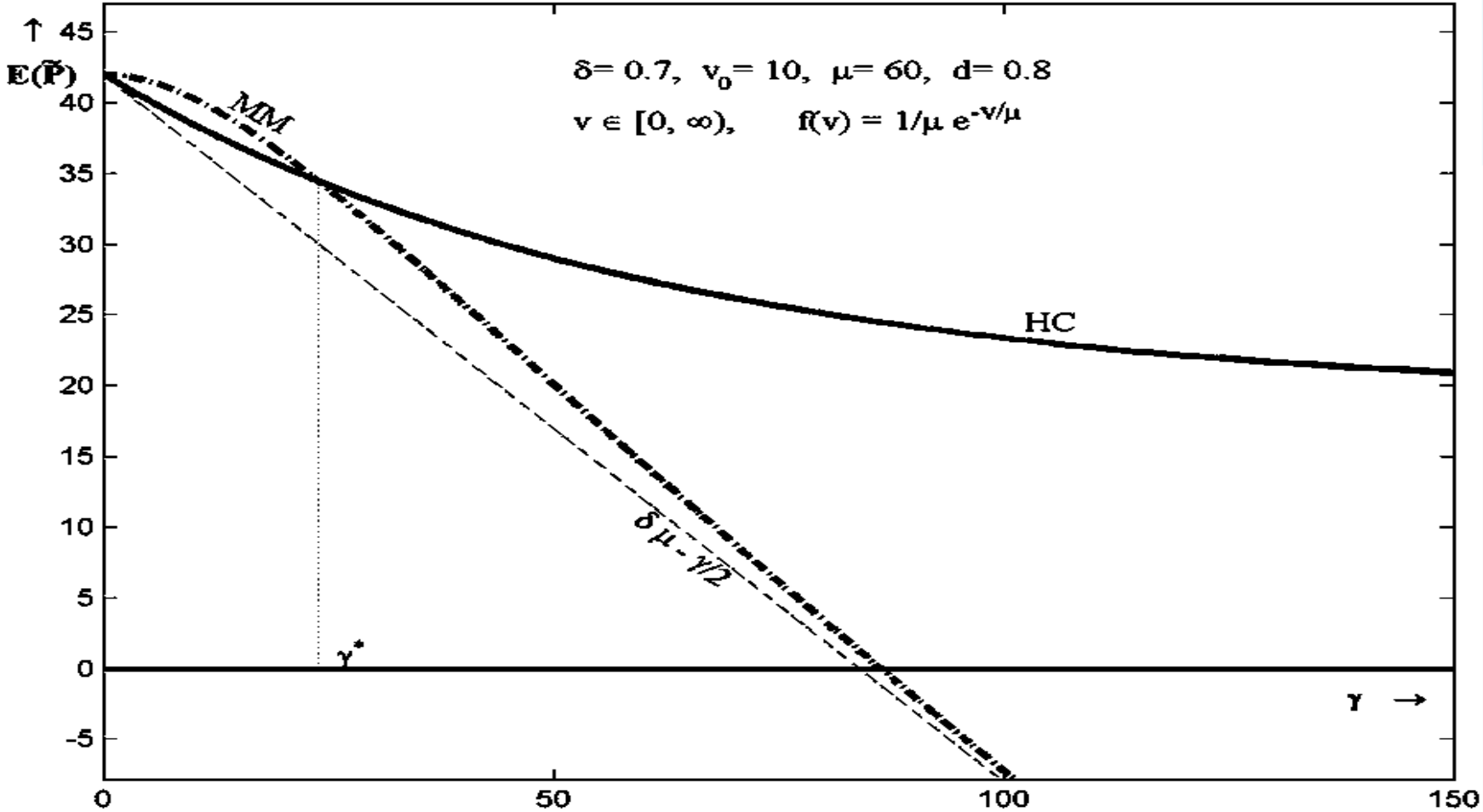




IRMT

irmT The Institute of Risk Management Tanzania

# Effect of Illiquidity







IRMT

irmT The Institute of Risk Management Tanzania

# Marking to Market is Superior When Asset is

**Liquid**

* Minimise feedback through strategic complementarity

**Junior**

* Limited downside potential, large upside (e.g. stocks)

**Short-lived**

* Minimise effect of horizon mismatch

# Damage from Marking to Market is Large When Asset is

**Illiquid**
Stronger strategic effects

**Senior**
Limited up-wide, large downside (e.g. loans, insurance liabilities)

**Long-lived**
Greater horizon mismatch

# Hedging and Dangers of Building the Model

**Introduction**

Liquidity problems are liable to arise when companies hedge illiquid assets with contracts that are subject to margin requirements.

Gold-mining companies often hedge their risks by entering into agreements with financial institutions to sell gold forward for two or three years. Often the gold-mining company is required to post margin and the amount of the margin required is calculated every day to reflect the value of its forward agreements.

# Hedging and Dangers of Building the Model Cont…

IRMT

If the price of gold rises fast, the forward agreements lose money and result in big margin calls being made by the financial institution on the gold-mining company. The losses on the forward agreements are offset by increases in the value of the gold in the ground—but this is an illiquid asset.

# Hedging and Dangers of Building the Model Cont…

**Hedge** refers to an offsetting contract made in order to insulate the home currency value receivable or payables denominated in foreign currency. In other words; Hedging involves engaging in a financial transaction to offset a existing position to reduces or eliminate risk.

**Objectives of Hedging**

The objectives of hedging is to offset exchange risk arising from transaction exposure.

# Types of Hedging

a) Forward Market Hedges: Use forward contracts to offset exchange rate exposure
b) Money Market Hedges: Use borrowing and lending in the money markets.
c) Hedging with Swaps: Use combination of forward and money market instruments.
d) Hedging with foreign currency futures
e) Hedging with foreign currency options

# Forward Market Hedges

**Objective:** To nullify future spot rate

**Scenarios:**

a) **Expected inflows of Foreign Currency:** Make forward contracts to sell the foreign currency at a specified rate to insulate against depreciation of value of that foreign currency (In terms of home currency)

b) **Expected Outflows of Foreign Currency:** Make Forward contracts to buy the foreign currency at a specified rate to insulate against appreciation of value of the currency (In terms of home currency)

# Money Market Hedges

**Objective:** Borrow/lend to lock in home currency value of cash flow.

**01. Expected inflow of foreign currency:**

- Borrow present value of the foreign currency at a fixed interest and convert it into home currency.
- Deposit the home currency at a fixed interest rate
- When the foreign currency is received, use it to pay off the foreign currency loan

# Money Market Hedges Cont…

**02. Expected Outflow of Foreign Currency:**

- Determine PV of the foreign currency to be paid (using foreign currency interest rate as the discount rate)
- Borrow equivalent amount of home currency (considering spot exchange rate)
- Convert the home currency into PV equivalent of the foreign currency (in the spot market now) and make a foreign currency deposit
- On payment day, withdraw the foreign currency deposit (which by the time equals the payable amount) and make payment

# Comparison: Forward and Money Market Hedge

- The covered interest parity implies that a firm cannot be better off using money market hedge compared to forward hedge.

- In reality, firms find use of forward contracts more profitable than use of money market instrument; because firms:

  (a) Borrow at a rate>inter-bank offshore lending rate

  (b) Put deposits at a rate< inter-bank offshore deposit rate

# Hedge Using Swaps

**Swaps refers** exchange pf am agreed amount of currency for another currency at a specific future date. This is equivalent to currency forward contract in a sophisticated way.

**Example:** A US firm has receivable in Euro from a Belgian buyer; so it is looking for euro denominated liability to hedge the receivable. On other hand, a Belgian firm exports to USA and has US$ denominated receivable; it needs US$ liability to hedge receivables in US$

# Hedge Using Swaps Cont…

**The two firm can agree that:**

- US firm borrow (Say $100,000) at 11%
- Belgian firm borrow ($100,000/E0.6 Per $) 166,667 euro at 10%
- US firm receives euros from buyer and give it to the Belgian firm so that it (Belgian) can repay euro denominated loan
- The Belgian firm receives US$ from buyer and give it to the US Firm so that it (US Firm) can repay US$ denominated loan.
- Both firms lock in currency spot rate for future payments by swapping receivables

# Dangers in Model Building

The art of model building is to capture what is important for valuing and hedging an instrument without making the model more complex than it needs to be. Sometimes models have to be quite complex to capture the important features of a product, but this is not always the case.

One danger in model building is ***over fitting***. Consider the problem posed by the volatility surface, Researchers have shown that we can exactly match the volatility surface with a single model by extending the Black–Scholes–Merton.

# Dangers in Model Building Cont…

Model so that volatility is a complex function of the underlying asset price and time. But, when we do this, we may find that other properties of the model are less reasonable than those of simpler models.

In particular, the joint probability distribution of the asset price at two or more times might be less than ideal and, in some circumstances, future volatility surfaces given by the model might look quite different from those observed in the market today.

# Detecting Model Problems

The risk management function within a financial institution should carefully monitor the financial institution's trading patterns. In particular, it should keep track of the following:

- The type of trading the financial institution is doing with other financial institutions
- How competitive it is in bidding for different types of structured transactions
- The profits being recorded from the trading of different products

# Managing Trading Room and Risk Limits

In trading rooms there is a tendency to regard high-performing traders as **"untouchable"** and to not subject their activities to the same scrutiny as other traders.

All traders—particularly those making high profits—should be fully accountable. It is important for the financial institution to know whether the high profits are being made by taking unreasonably high risks. It is also important to check that the financial institution's computer systems and pricing models are correct and are not being manipulated in some way.

# Separate the Front, Middle, and Back Office

The ***front office*** in a financial institution consists of the traders who are executing trades, taking positions, and so on.

**The *middle office*** consists of risk managers who are monitoring the risks being taken.

**The *back office*** is where the record keeping and accounting takes place. Some of the worst derivatives disasters have occurred because these functions were not kept separate.

An Individual can control both the front and back office as a result, able to conceal the disastrous nature of his trades from his superiors at the same time.

# Risk Limits

- The first and most important lesson from the losses concerns risk limits. It is essential that all companies (financial and nonfinancial) define in a clear and unambiguous way limits to the financial risks that can be taken. They should then set up procedures for ensuring that the limits are adhered to.
- Ideally, overall risk limits should be set at board level. These should then be converted to limits applicable to the individuals responsible for managing particular risks. Daily reports should indicate the gain or loss that will be experienced for particular movements in market variables.
- These should be checked against the actual gains and losses that are experienced to ensure that the valuation procedures underlying the reports are accurate.