Deloitte Touche Tohmatsu

International Finance Corporation of Thailand

Project Deliverables

Submitted by:
Deloitte Touche Tohmatsu Emerging Markets

Submitted to:
USAID

Submitted for consideration under
IQC No. PCE-I-00-99-00008-00
Support for Economic Growth and Institutional Reform

June 2000

A

Memorandum

Date: May 24, 2000

To: Visut Sattabudsutthi
Jirapol Pobukadee

Cc: Violetta Kozlowski, Project Director
Wm. Bodine, Ph.D.

From: Fred Zamon

Subject: Final Deliverables to IFCT in Accordance with the Final Work Plan of May 4, 2000 for Technical Assistance to Provide a Risk Management Program for IFCT under Deloitte, Touche, Tohmatsu Emerging Markets SEGIR Financial Services Contract PCE –1-00-99-0008-00.

In final fulfillment of Deliverables to IFCT under the Credit and Market Risk Management Project, this memorandum documents that all Task/Deliverables, including hard copies, computer files with Powerpoint presentations, and overhead transparencies, lesson plans, a Preliminary Implementation Action Plan, and Risk Management Measurement Checklist, were completed and/or delivered as agreed in the Final Work Plan of May 4, 2000.

It is acknowledged that the "Game Plan for Extending Training to Other Institutions" has been discussed with the undersigned. It is agreed that the lesson plans presented will be adapted to the needs of other institutions by IFCT personnel. It is agreed that presentations delivered by the consultants may have to be lengthened or abbreviated, supplemented with additional case studies to meet these requirements and that the undersigned agree that the deliverables do provide adequate organizational structure and materials to facilitate these future IFCT intentions.

In acknowledgement, please countersign this memorandum and date it accordingly.
Thank you again for the opportunity to work with you on this Project.

Frederick J. Zamon, Contract Consultant
Deloitte, Touche, Tohmatsu Emerging Markets — May 24, 2000

Visut Sattabudsutthi, Senior Vice President
Policy & Planning Department, IFCT — May 24, 00

Jirapol Pobukadee, Vice President
Policy & Planning Department, IFCT — May 24, 00

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FINAL WORKPLAN

05/04/2000
Technical Assistance to provide Risk Management Program for IFCT
Deloitte Touche Tohmatsu
SEGIR Financial Services Contract - PCE-I-00-99-0008-00

RESPONSIBLE	TASK / DELIVERABLES	WEEK STARTING: 24-Apr	1-May	8-May	15-May	22-May
Project Management and Supervision						
Violetta Kozlowski	Confirm Project Objectives with IFCT		▨			
Violetta Kozlowski	Supervise Project Implementation	▨	▨	▨	▨	▨
Violetta Kozlowski	Review Project Deliverables			▨		▨
Violetta Kozlowski	Summary Report					▨
Assess Current Risk Management Practices at IFCT						
William Bodine	Meet/interview Management and Staff of all business areas concerned with risk management issues	▨	▨			
Frederick Zamon	As above	▨	▨			
Violetta Kozlowski	As above	▨	▨			
Alvin Ng	Meet/interview IT Area Management and Staff, assess risk mangement issues in other business areas		▨			
Pensiri Dudsdeemaytha	Meet/interview IT Area Management and Staff, assess risk mangement issues in other business areas		▨			
Develop Tailored Risk Management Training Materials for IFCT						
Frederick Zamon	Credit Risk Management overview			▨		
William Bodine	Market Risk Management overview			▨		
Alvin Ng	Preliminary and high level action plan for hardware and software changes/upgrades.			▨		
Pensiri Dudsdeemaytha	Preliminary and high level action plan for hardware and software changes/upgrades.			▨		
Deliver Condensed Training in Risk Management Concepts and Tools to up to 20 Top Level Executives						
Frederick Zamon	Key issues and recommendations in Credit Risk Management				▨	
William Bodine	Key issues and recommendations in Market Risk Management				▨	
Training in Risk Management Concepts and Tools: ~ 40 managers in Policy & Planning, IT, Credit Policy, Treasury, Finance, Lending						
Frederick Zamon	Key Concepts in Credit Risk Management (lecture, case study workshops)				▨	
William Bodine	Key concepts in Market Risk Management, including risk-based capital alocation, VAR (lecture, case study workshops)				▨	
Finalizing Deliverables						
William Bodine, Frederick Zamon	Finalized Training Materials; Quantitative risk evaluation formulas, Lesson Plans for subsequent IFCT in-house training; List of analytical risk management tools, Game plan for extending training to other institutions					▨
Alvin Ng, Pensiri Dudsdeemaytha	IT system high-level preliminary improvement plan to strengthen IFCT Credit Risk and Market Risk Management					▨

▨ Full time
▨ Part-time

Client approval

Concur:_____

Frederick J. Zamon
Professional Profile

Frederick J. Zamon is a globally recognized credit risk specialist with 25 years experience in credit risk management including lending to leading mutli-national companies such as Caterpillar Tractor; Messerschmitt, Belkow Bloehm, GmBh; and Hughes Network Systems. Career responsibilities at Chase Manhattan Bank in New York and elsewhere have included operations and related training in developing, recording and reporting critical management information for short and medium term international loan portfolios, foreign exchange trading, Bills of Exchange, and Euro-Funding for Asset/Liability Management.

Professionally, Mr. Zamon's consulting activities have included U.S. and international commercial lending, treasury, back-office operations, and administration. Responsibilities have also included senior level international assignments in Africa and the Caribbean as well as management, assignments for International Operations and Trade Finance activities. As a credit risk advisor, he has actively directed banking industry clients in the U.S., Middle East, Southeast Asia, Africa, Central and Eastern Europe.

Based in Washington, D.C., Mr. Zamon is a frequent consultant with leading financial industry consulting groups, including KPMG, PriceWaterhouse-Coopers, and Deloitte Touche. Educated at Georgetown University where he earned his B.A. Degree, Mr. Zamon earned his M.A. Degree from American University in Washington, D.C.

A. William Bodine
Professional Profile

A. William Bodine is a globally recognized specialist in market risk analysis and his pioneering work in disciplined asset management at Citicorp is documented in a Case Study at Harvard Business School. Currently, Senior Capital Markets Advisor to the Republic of Kazakhstan, he has also served as an advisor to two private equity funds of the Rockefeller Family and the Asian Development Bank.

As an instructor in global capital markets, he has lectured at St. Catherine's College, Oxford; The London School of Economics; and Harvard Business School. Dr. Bodine pioneered the first Risk Analysis & Management Course at The New York Institute of Finance and has been a frequent lecturer at The EuroMoney Institute of Finance since 1989. He has also served as an advisor and instructor to The Saudi Arabia Institute of Banking in Riyadh.

Previously, Group Head/Managing Director of J.P. Morgan's Investment Advisory Group, Dr. Bodine also served as Director of Investment Research for Citicorp's Global Investment Management Group. Professionally, he has been designated as a CFA Examiner, a Chartered Investment Counselor, and a Supervisory Analyst of The New York Stock Exchange.

Dr. Bodine holds a Doctorate from Marlborough University in the U.K., did his MBA studies at Harvard Business School and completed his B.A. Degree at the University of California at Los Angeles.

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Training Materials

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Note:

The Powerpoint Executive Briefing on the Credit and Market Risk Training Project was:

- **Presented to approximately 40 Executives of IFCT on May 15, 2000.**
- **It was presented during the morning session of the first day of the 4-Day Seminar on Credit and Market Risk Management to 53 Senior and Middle Management personnel of IFCT to provide them a background on the subject matter, and to inform them what their superiors had received. This occurred on May 17, 2000.**
- **This material was embellished with examples and experiences of the presenters for the participants in the 4-Day Seminar.**

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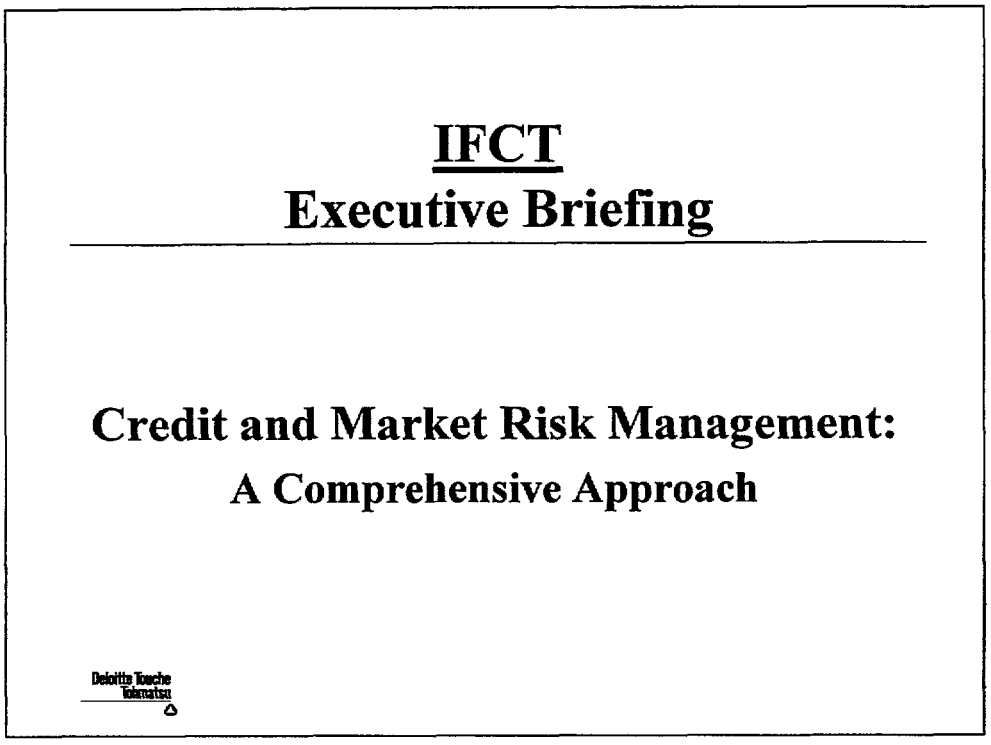

Thank you for your kind comments President Anothai or Good Morning President Anothai, ladies and gentlemen.

As you all know from events beginning in the summer of 1997, market and credit risk an topics of great concern.

Bankers and all members of the financial community in the USA share your concern.

IFCT Credit and Market Risk Management

Executive Briefing

What is the difference between credit risk and market risk?

"Under extreme conditions, discontinuous jumps in market valuations raise the specter of insolvency, and market risk becomes indistinct from credit risk"

Alan Greenspan May 4, 2000

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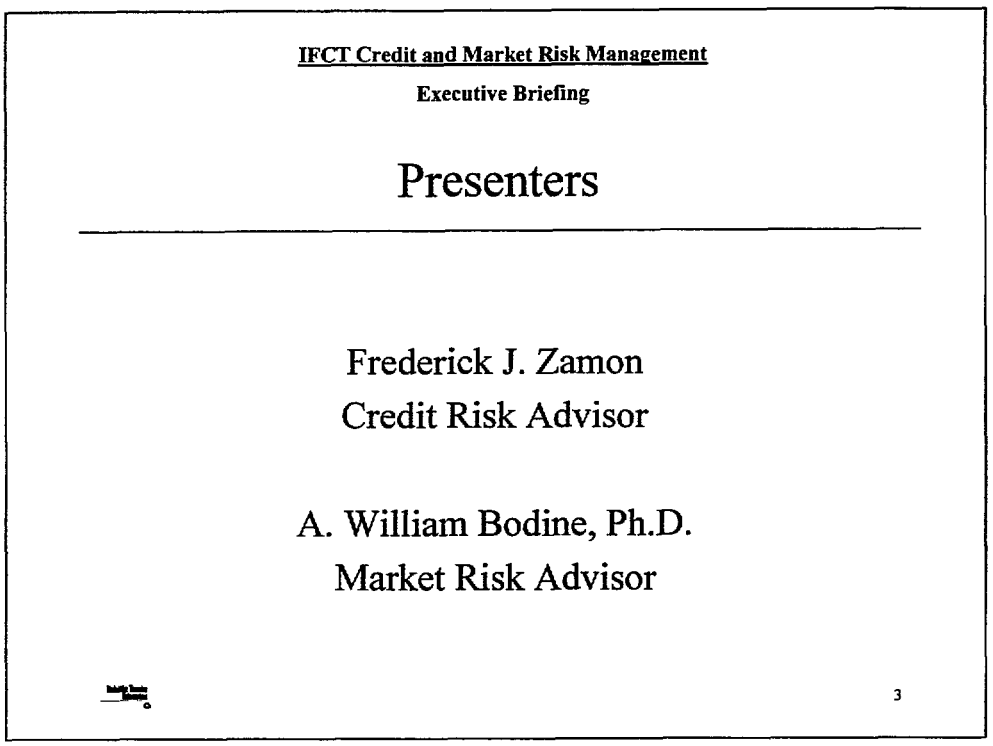
On May 4, this year Alan Greenspan, our Chairman of the Federal Reserve, out Central Bank, responded to the question:

What is....

His response was: Under...

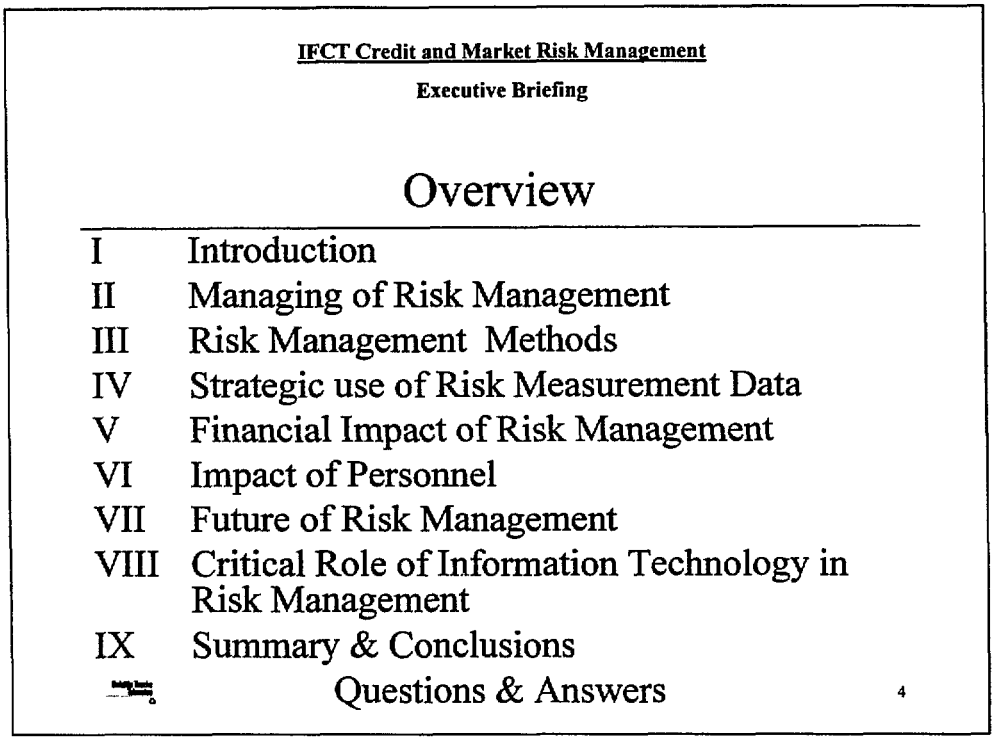
Our topic this morning is not just a Thai banking interest, it is a world wide concern.



I am as you know, Fred Zamon. My associate, Dr. Bodine and I will be presenting a substantial amount of material this morning. We have agreed to follow a procedure where I will speak for a short while, then he will speak for a short while.

This presentation is based on our own expertise and a lot of what we have learned from interviews we have conducted over the last three week period. We apologize in advance for any misinterpretations we may have made and that becomes obvious in our presentation. We accept any and all corrections.

We have a great deal to cover before 12:30, so we ask that you put questions down on your handouts and save them until after the presentation.



Here is an Overview of our presentation

And with that, I will turn the next slide over to Dr. Bodine..

I Introduction

- Evolution of the Supervisory Approach to Capital
- Risk Management Defined
- Importance of Risk Management
- IFCT's Current Risk Management Activities
- Primary Risks Defined

Introduction

Evolution of Supervisory Approach to Capital

Focus:	Risk weighted Regulatory Capital Minimums	Risk Modeling Scenario Analysis	Capital Adequacy Relative to Risk
Method:	Financial Analysis	Sensitivity Analysis	Comprehensive & Quantitative Analysis
Period:	Pre-1989	Mid-1990's	Present

Past Environment of Unmeasurable Certainty → New Reality of Measurable Uncertainty

Introduction

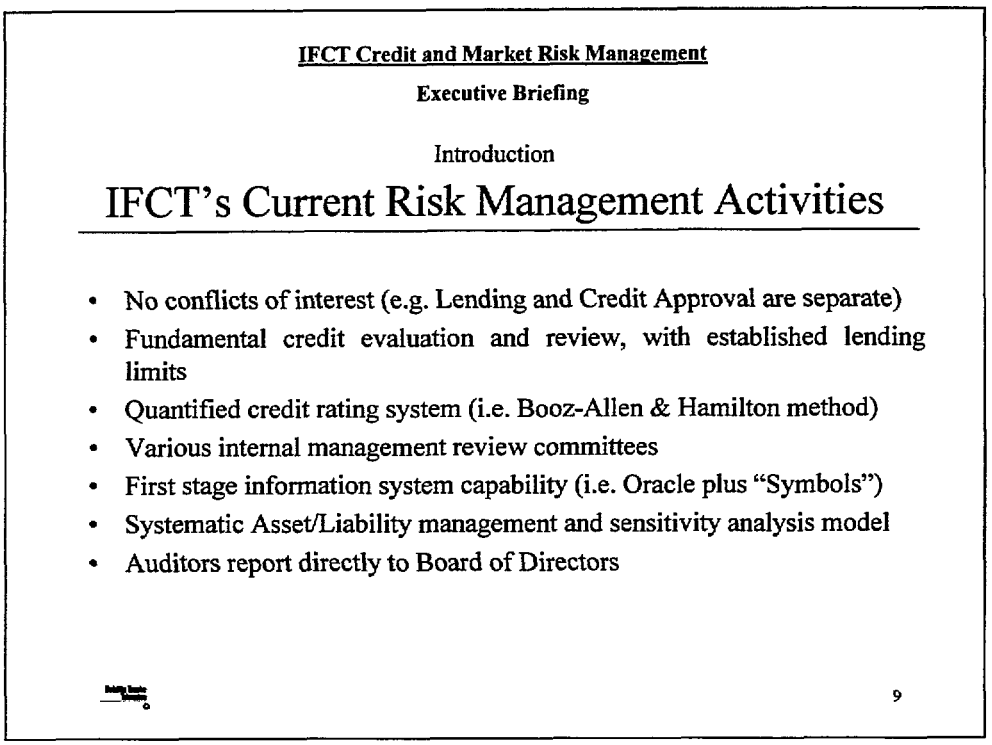
Risk Management Defined

Risk management today adds to traditional fundamental and financial analysis a systematic effort to use quantitative data to identify, analyze and control risk factors influencing credit and market risk.

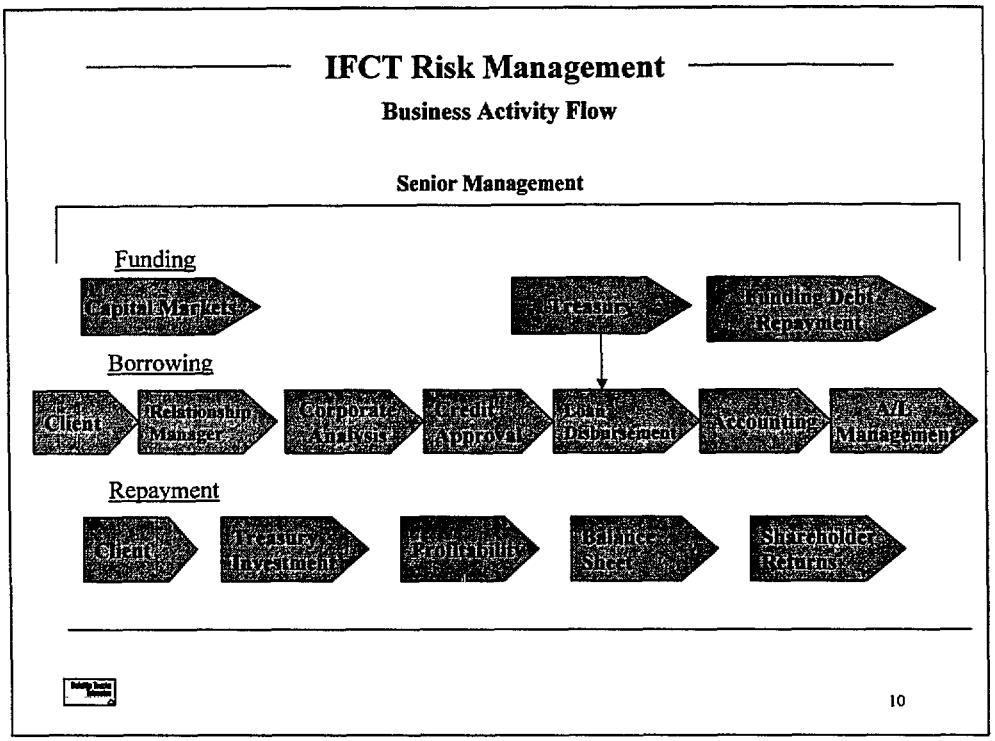
Introduction

Importance of Risk Management

- Impacts profitability
- Essential for risk/reward analysis of products & businesses
- Permits efficient Asset/Liability management
- Essential to protect corporate capital account
- Provides a rational basis for managing the corporation
- Basis for allocating capital on a risk adjusted basis
- Permits shareholders to evaluate corporate performance



From our interviews, we have discovered the following on IFCT's risk management activities.



Following the flow of business activity, we have discovered
.

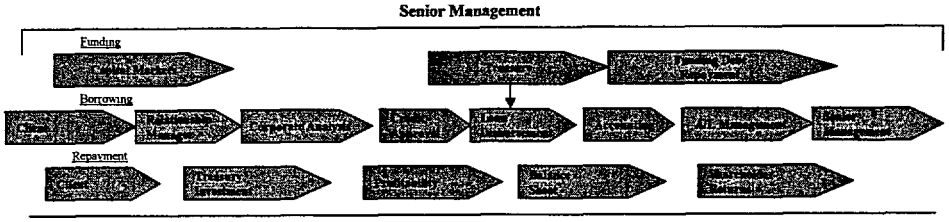
Why is this important? Because it indicates to us that IFCT's flows are comparable to banks world wide and that the Bank is meeting or exceeding international standards.

And it helps us assess IFCT's risk management position and where we can identify opportunities IFCT can implement to enhance this position.

Dr. Bodine

IFCT Risk Management

Business Activity Flow



Role/Function:

Risk Management Activities

- **Funding**
- **Customer**
- **Relationship Manager**
- **Corporate Analysis**
- **Credit/Policy Approval**
- **Loan Disbursement**
- **Accounting**
- **Asset/Liability Mgmt.**
- **Treasury/Investment**
- **Information Systems**
- **Senior Management**

Fundemental Analysis				+	Quantitative Analysis			
Corp. Mgmt.	Financ'l	Market	Technical					

General Observations:

- o Able & professional personnel
- o Sound policies & procedures
- o Diligent & conscientious personnel
- o Started modern information system

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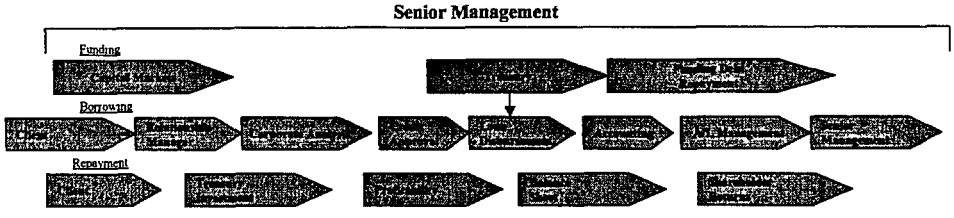
IFCT Risk Management

Business Activity Flow



Role/Function:

Risk Management Activities

- **Funding**
- **Customer Relationship Manager**
- **Research**
- **Credit/Policy Approval**
- **Loan Disbursement**
- **Accounting**
- **Asset/Liability Mgmt.**
- **Treasury/Investment**
- **Information Systems**
- **Senior Management**

Fundemental Analysis				+	Quantitative Analysis			
Client Mgmt.	Financ'l	Market	Technical		VAR	CAR	Risk/Reward	RORAC

General Observations:
- o Able professional personnel
- o Sound policies & procedures
- o Diligent & conscientious personnel
- o Started modern information system

Major Opportunities:
- o Add Modern Risk Management methods, systems, & infrastructure

Note: Fundamental Analysis + Quantitative Analysis = Comprehensive Analysis

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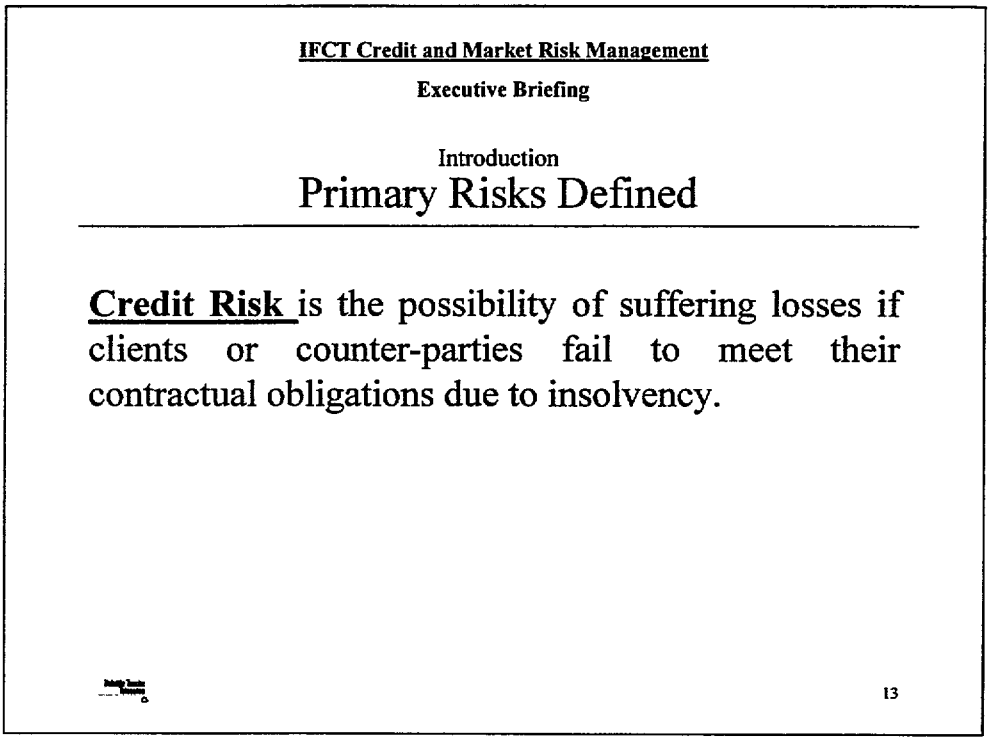

The Credit Risk-Rating System is a two step process.

First the borrower is graded.

The borrower grade is used as a base in determining the risk rating.

The second step is to adjust the borrower grade for the risk associated with the specific transaction.

Borrower risk is the risk of loss driven by factors intrinsic to the borrower. It is measured on analysis of the following factors:

Borrower Risk
- Character of management and controls
- Earnings and operating cash flow trends
- Asset and liability values and structure
- Financial Flexibility and Debt capacity
- Financial reporting, including timeliness and audited statements
- Management and controls
- Borrowing entity
- Industry and operating environment

Transaction Risk
- Collateral Quality and Control
- Guarantees/Third-Party Support
- Tenor
- Term & Documentation

Introduction

Primary Risks Defined

Credit Risk is the possibility of suffering losses if clients or counter-parties fail to meet their contractual obligations due to insolvency.

Market Risk is the possibility of suffering losses in asset values from changes in normal market influences or unexpected forces, including interest and exchange rates as well as stock and commodity prices.

Introduction

Primary Risks Defined

Credit Risk is the possibility of suffering losses if clients or counter-parties fail to meet their contractual obligations due to insolvency.

Market Risk is the possibility of suffering losses in asset values from changes in normal market influences or unexpected forces, including interest and exchange rates as well as stock and commodity prices.

Operational Risk is the possibility of financial loss due to unexpected events in the operating and technological environment of an enterprise.

Introduction

Credit, Market, and Operational Risks

- Apply to balance sheet items:

  Short, Medium, and Long-term Securities
  Short, Medium, and Long-term Loans
  Equity Investments

- Apply to off-balance-sheet items:

  Foreign Exchange Forwards
  Foreign Exchange Swaps
  Derivatives (currency & interest rate swaps)
  Letters of Credit
  Guarantees

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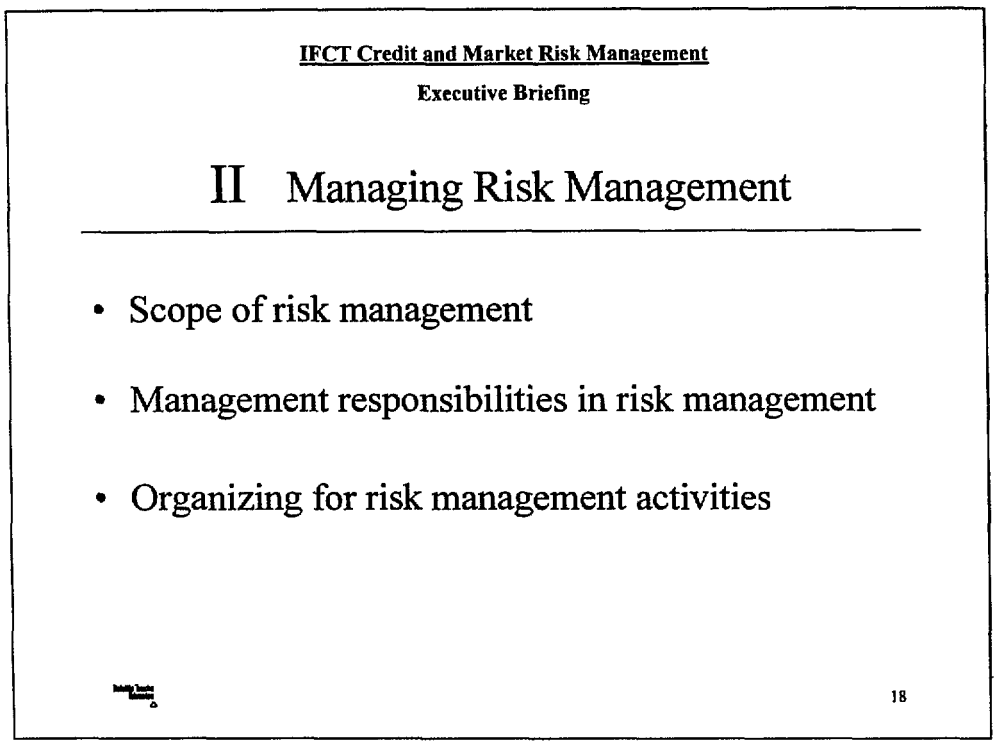
Introduction

Conceptual Framework for Sound Risk Management

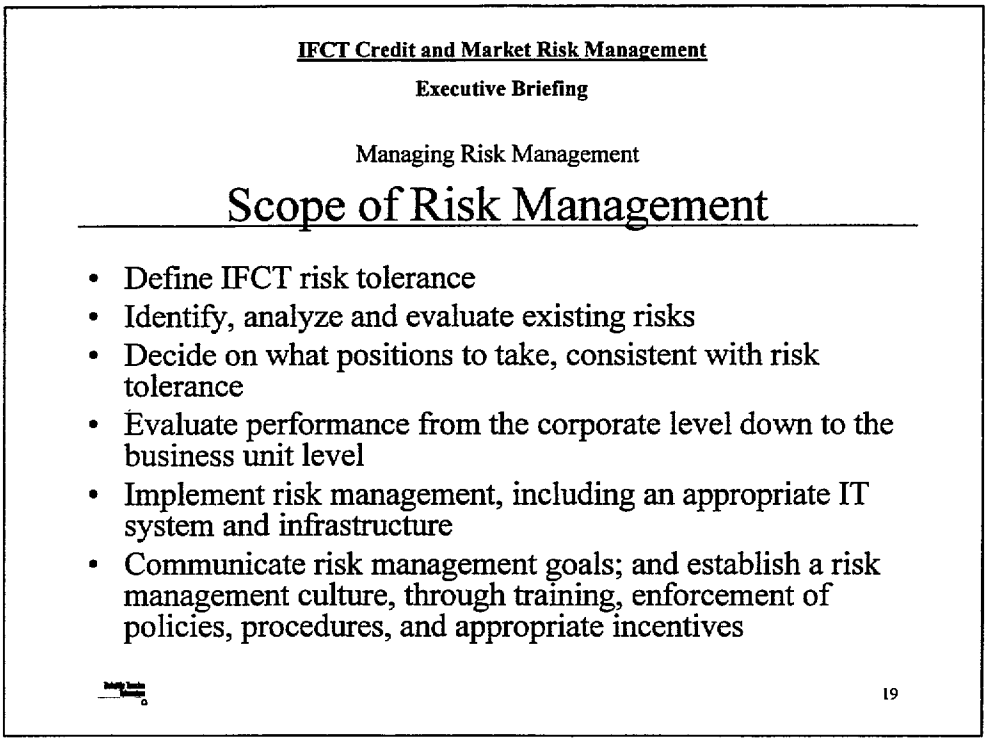
- Identify and understand all material risk factors
- Collect timely and quality data
- Apply adequate risk measurements commensurate with complexity of IFCT's assets and liabilities
- Establish an efficient, adaptable, and scalable system for risk monitoring, management, and control



Managing Risk Management is our next topic. Management as I am sure you all know means Planning, Organizing, Leading, and Controlling your activity.

Women do naturally! Men seem to have to learn it.

What is important is that we try to break up the aggregate of all business risks and risk management related activities into manageable pieces. So in the next few minutes we will present enough manageable pieces to keep us all employed for the next 2-5 years.

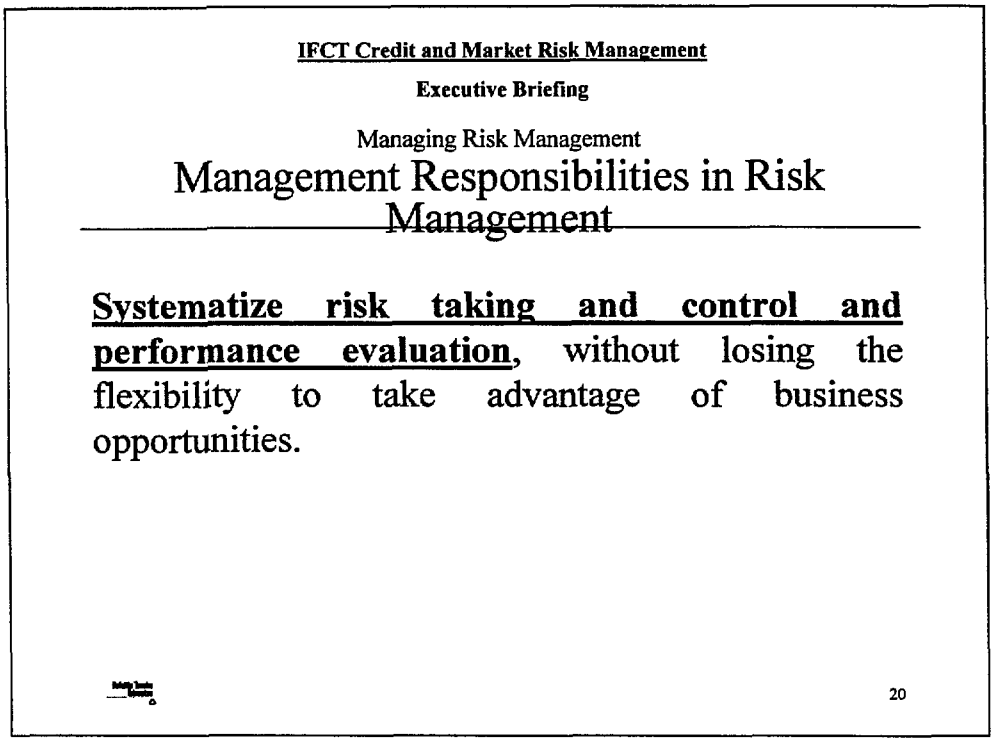


The scope of risk management includes:

.....

.....

The most important I leave until last. It is also the most difficult.

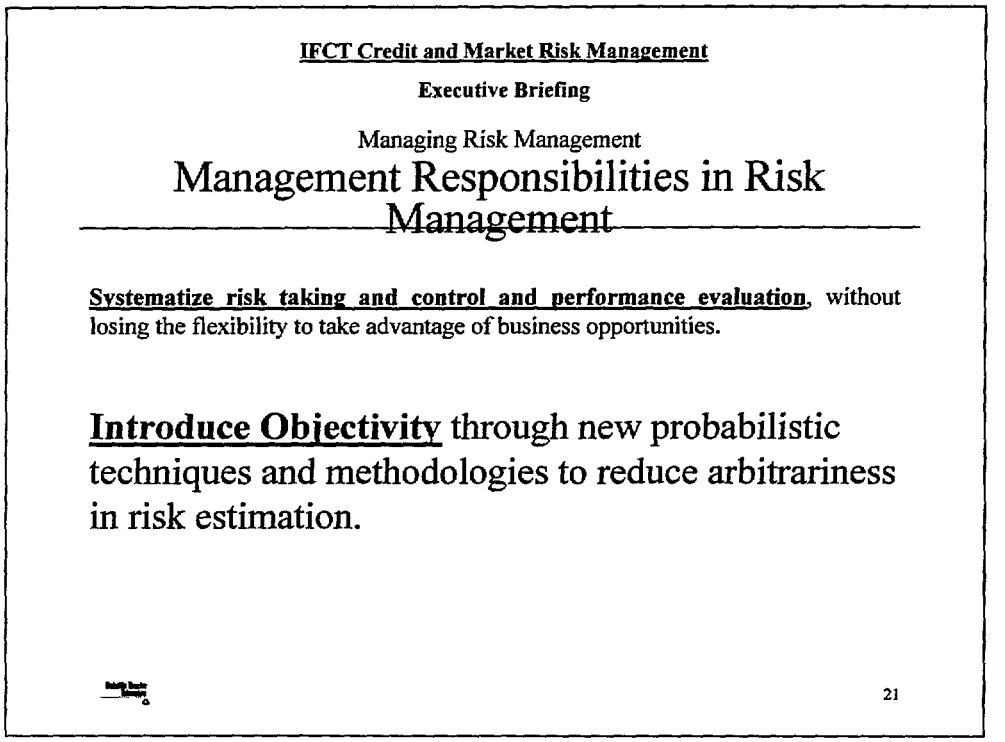


I can sense that you are all saying we do manage. We do plan, organize, lead, and control. What is new about the responsibilities in Risk Management.

It is based on the fundamental analysis you all do and the Quantitative Analysis we will be learning about today.

These tools allow managers from very top of IFCT to the lowest level to Systematize....

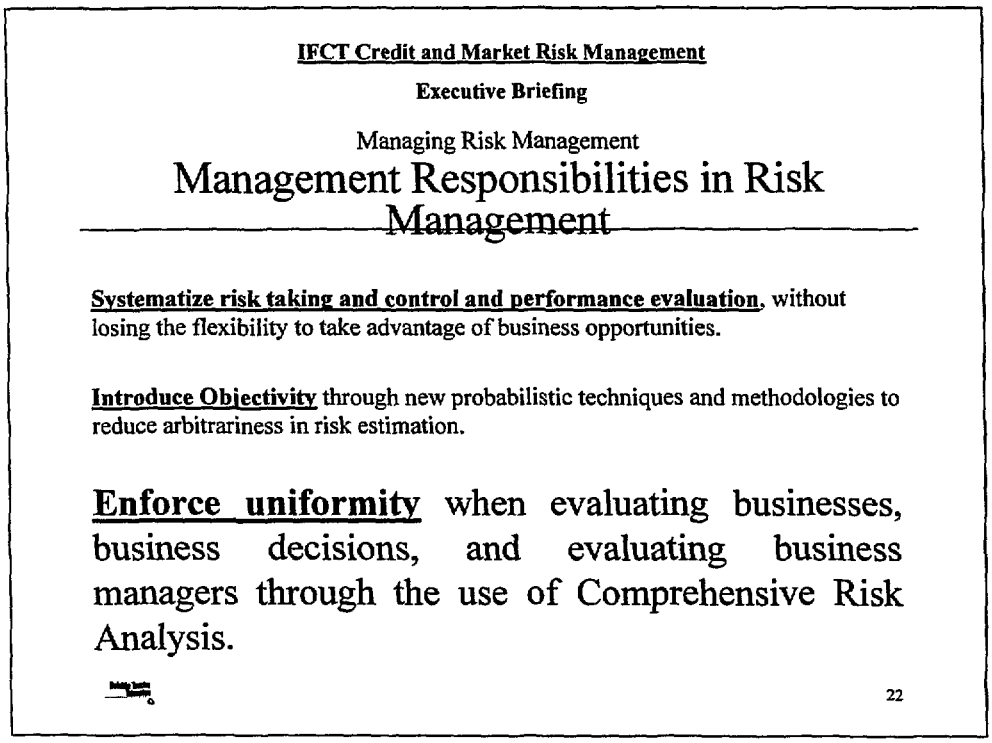
Systematization is based on policies and procedures you have and a MIS that you are developing.



Next, these tools allow the introduction of

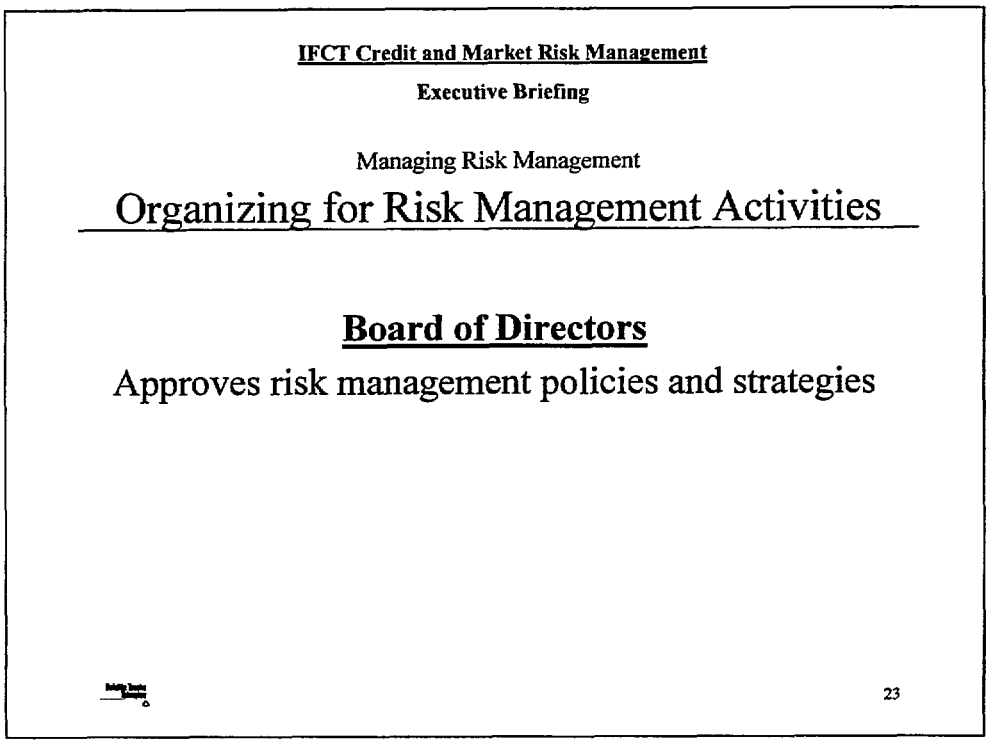
Objectivity comes from the statistical enhancement of the forecasting process.

It allows a more quantitative approach to measuring risk factors.



Finally, these tools facilitate uniform enforcement.

Uniform measures allow consistent standards of comparison of performance.



Organizing for efficiency requires segregation and delegation of specific risk management tasks. This is necessary to break the project into manageable pieces.

Sound management practice as we know requires delegation of authority necessary to exercise delegated responsibilities if employees are to be held accountable for their performance. The organizational representation here assumes that combination

Managing Risk Management

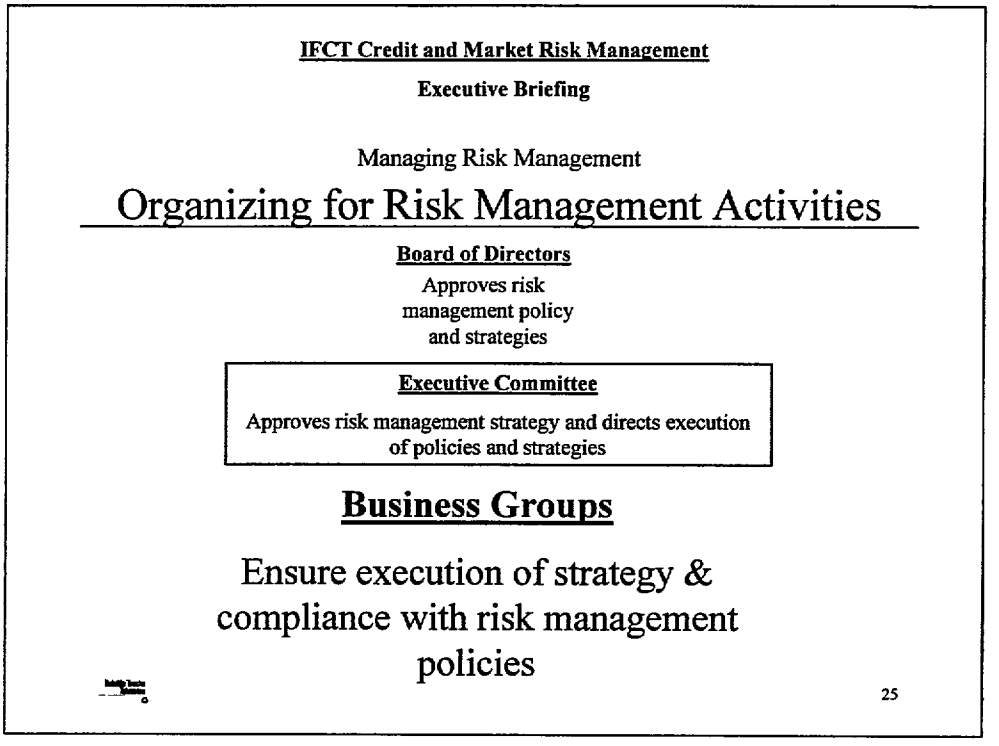
Organizing for Risk Management Activities

Board of Directors

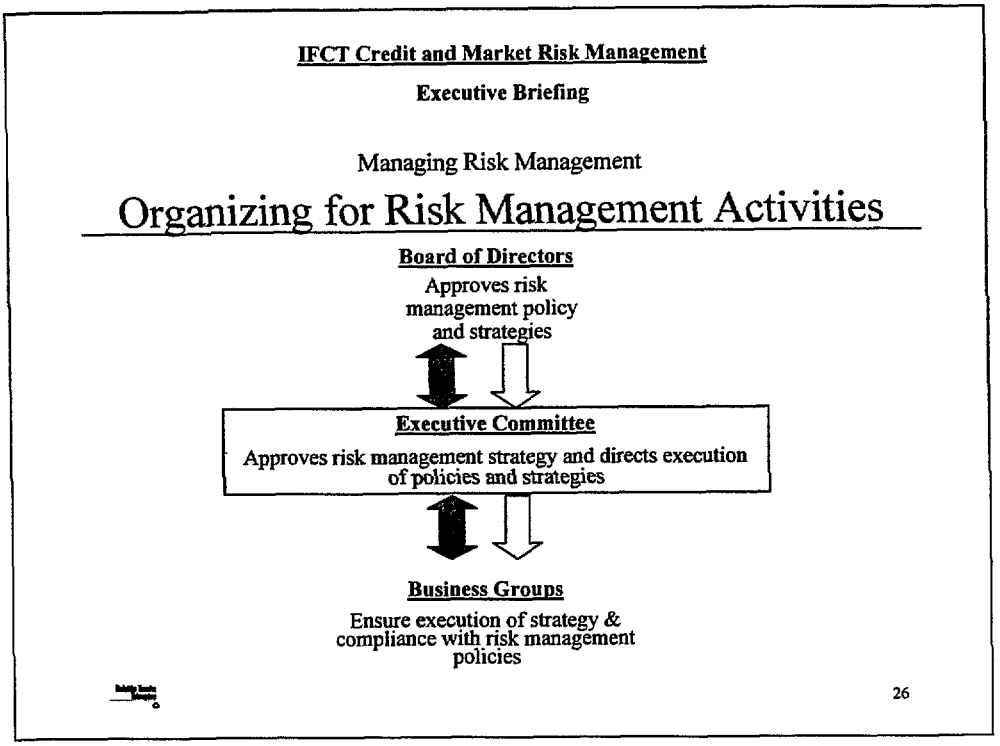
Approves risk management policy and strategies

Executive Committee

Approves risk management strategy and directs policies and strategies



Adding the business groups now starts to fill out the structure



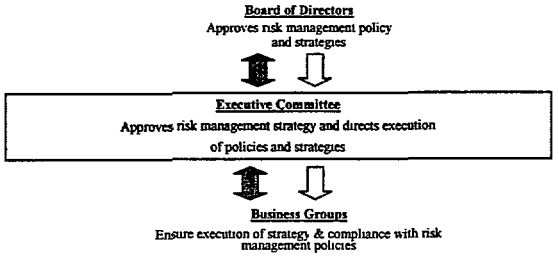
Lines of communication and authority

IFCT Credit and Market Risk Management

Executive Briefing

Managing Risk Management

Organizing for Risk Management Activities



Risk Committee

Controls corporate risks generated by business activities

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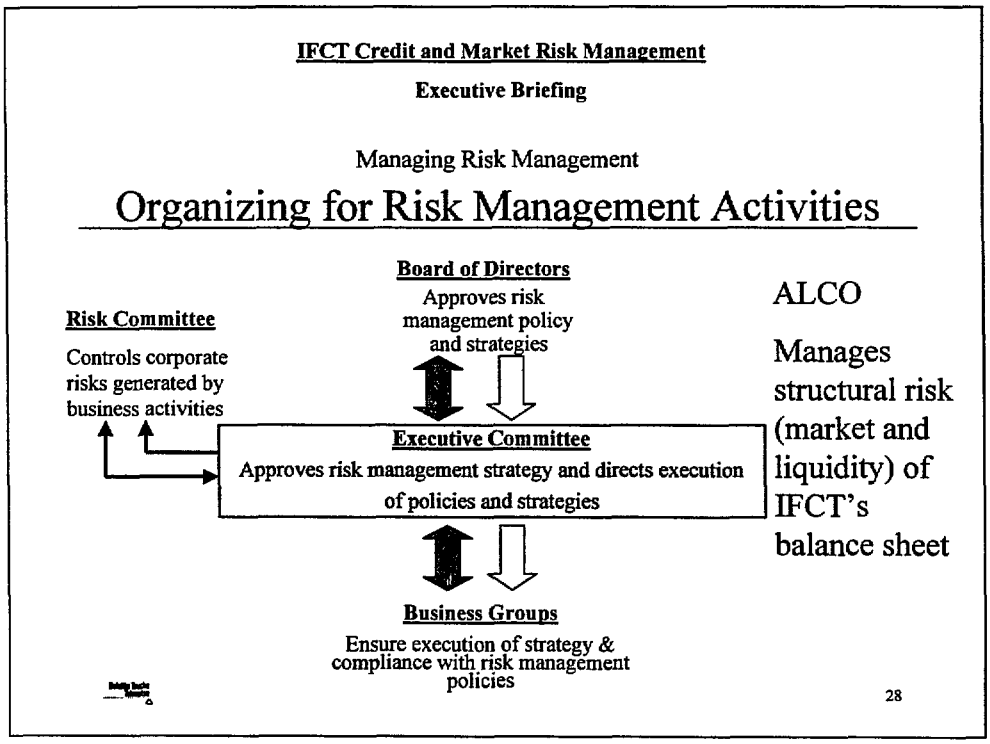
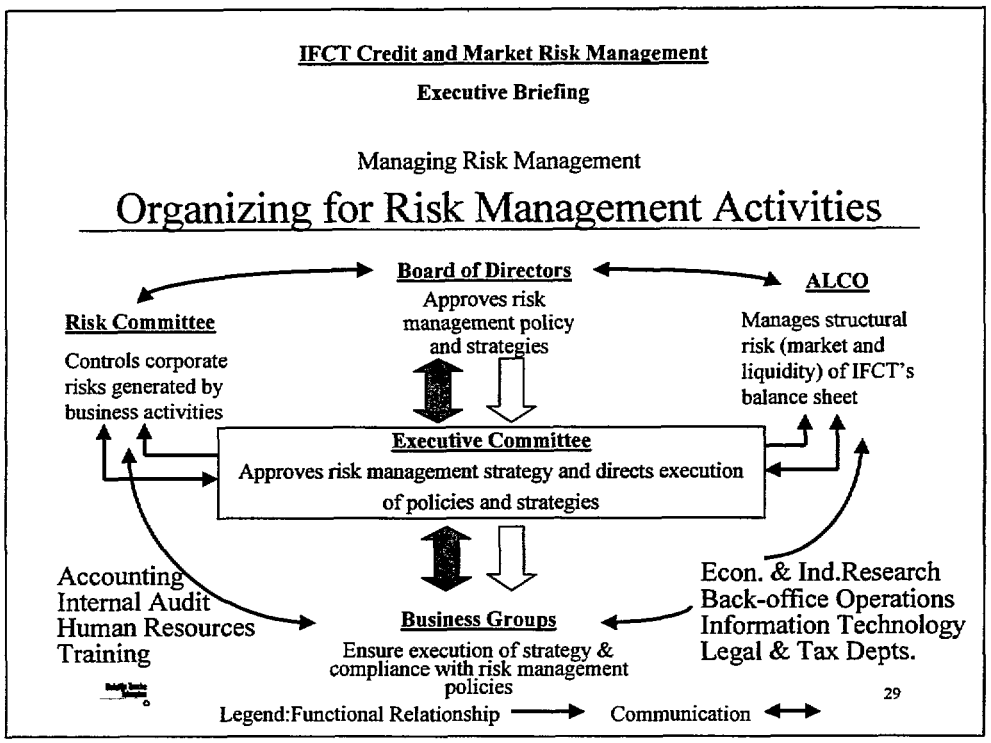


Finally we add ALCO and their implementation arm, ALM, the Asset Liability Managers.



In many organizations, as in IFCT, ALCO is made up of the same members of the Executive Committee and advisors. Risk Management is also done here.

In the interest of breaking out the specialty skills associated with the Loan Portfolio, Investments, and Treasury instruments, we are suggesting a separate group may be useful. One that only thinks "Credit Risk" as compared with Market Risk.

We re-emphasize these support groups in this slide. They cannot be left out of the communication loop.

III Risk Management Methods

- Factors for Analysis in Risk Management
- Simulation and Probability Measures
- Expert Panels & Systems
- Primary Measures in Corporate Risk Management
- Measurements of Credit Risk
- Measurements of Market Risk
- Market Risk Multi-Factor Model

Risk Management Methods

Factors For Analysis in Risk Management

- Develop & define market and credit risk valuation and measurement methodologies
- Perform solvency analysis on clients and counter-parties and assign risk ratings
- Analyze the division of capital-at-risk among business units
- Analyze proposals from business groups on credit and market risk limits
- Analyze risk/return profiles and sensitivity to changes in position
- Perform stress testing to analyze potential loss in a market crisis
- Evaluate requests to exceed limits and report to the Risk Committee
- Evaluate risks associated with new products and activities of business units

Risk Management Methods

Simulation and Probability Measures

- Volatility: Calculate historical variation of asset price/value in terms of standard deviation
- Beta Measure: Calculate historical price/value changes vs. a market index (i.e., Market beta=1.0)
- Probability: Calculate distribution patterns of return and risk (i.e., standard deviation) of assets
- Simulation (Monte Carlo): Relative factor model which predicts profit and loss distribution

Risk Management Methods

Expert Panels & Systems

Combining Measurement Methods for Making Decisions

Multi-Factor Model Combining Expert Panels & Scenario Analysis

Predictive Factors					Expert Panel				Scenarios		
(Probability Analysis)		X	Weighting	X	Estimate	=	Result		Expected	Best	Worst
1			0.350		0.500		0.175				
2			0.500		0.800		0.400				
3			0.150		0.600		0.090				
			Weighted Measure								

Risk Management Methods

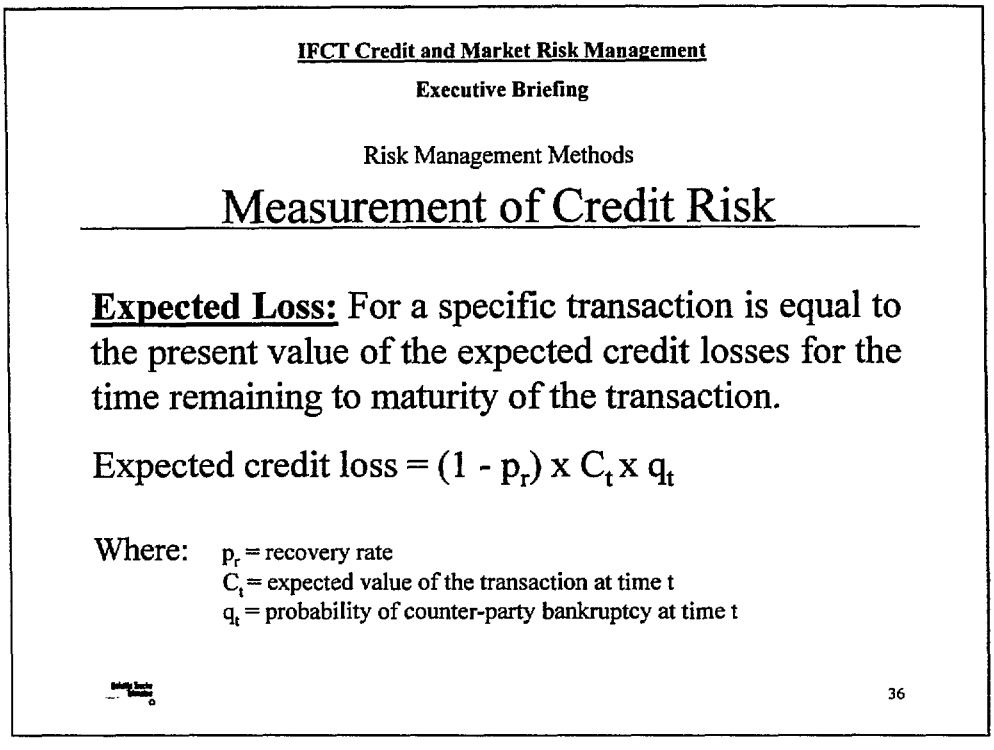
Primary Measures in Corporate Risk Management:Formulas

- Value-at-Risk (VAR) = Maximum expected loss - Expected loss in value
- Capital-at-Risk (CAR) = VAR + Financial Assets - Capital Compensation

Where: Capital Compensation = CAR x Risk Free Rate x Time

- Return-on-Risk Adjusted Capital(RORAC) =

$$\frac{\text{Change in Value - Financial Costs + Capital Compensation}}{\text{CAR}}$$



The definition is not difficult.

Measuring the factors is. If there is one equation in the lenders math book that causes an upset stomach, this is it.

But the best lenders are the ones that can determine the answer even without all the factors.

IFCT Credit and Market Risk Management

Executive Briefing

Risk Management Methods

Measurement of Portfolio Credit Risk

Credit Provision: For a specific transaction is equal to the present value of the *sum* of expected credit losses for the time remaining to maturity of the transaction.

$$\text{Credit Provision} = (1 - p_r) \times \sum_{t=1}^{n} \times C_t \times q_t \times D_t$$

Where: p_r = recovery rate
C_t = expected value of the transaction at time t
q_t = probability of counter-party bankruptcy at time t
D_t = discount factor from time t to present

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If the last equation makes the lending officer's job a challenge, this one defines the risk committee's challenge.

It aggregates all loans.

IFCT Credit and Market Risk Management

Executive Briefing

Risk Management Methods

Measurement of Corporate Credit Risk

Capital at Risk is the Maximum Credit Loss less the credit provision. The maximum credit loss is selected from a credit loss distribution determined through scenarios that simulate:

- Changes in market variables (interest and currency rates), which determine credit exposure for different products
- Changes in credit quality and therefore the delinquency of counter-parties

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Capital at Risk is also the realm of the Credit Risk Committee. It also involves ALCO, where market risk becomes a factor.

Risk Management Methods

Measurement of Corporate Credit Risk

Return on Credit Risk-Adjusted Capital (RORAC) is the expected after-tax* return (IRR to shareholders) divided by CAR.

Expected Return = (Interest Margin) + Commissions - Credit Provision + Capital Compensation - Taxes*

*Note: IFCT is not subject to Thai taxes

Risk Management Methods

Measurement of Credit Risk

Sample Calculation

Return on Credit Risk-Adjusted Capital (RORAC)

Expected return	=	7.00 million
Financing cost	=	(5.00) million
Capital compensation	=	0.86 million (CAR of 17.14 x 5%)
Total	=	2.86 million

$$\text{RORAC} = \frac{2.86}{17.14} \times (1 - 0.35) = 10.85\%$$

Note: 35% tax rate is assumed, although IFCT is not subject to Thai taxes

Risk Management Methods

Measurement of Market Risk

- Value-at-Risk (VAR) Measure: Calculates maximum expected loss over targeted time frame within a given confidence level
- Capital-at-Risk (CAR) Measure: Calculates minimum capital required to avoid bankruptcy if maximum loss
- Return on Risk Adjusted Capital: Calculates after tax return associated with an asset divided by the Capital-at-Risk

IFCT Credit and Market Risk Management

Executive Briefing

Market Risk Multi-Factor Model

Predictive Factors	Weighting	Application:
Price Momentum	33.3%	Universe Decile Ranking System (1-10)
Valuation (Yield & P/BValue)	33.3%	Investment in top Decile stocks
Earnings Momentum	33.3%	Re- balance portfolio monthly
	100.0%	

Performance Results (S&P 500 Universe): **Consistently 200+ basis points over S&P Index**

Source: Citicorp Investment Management

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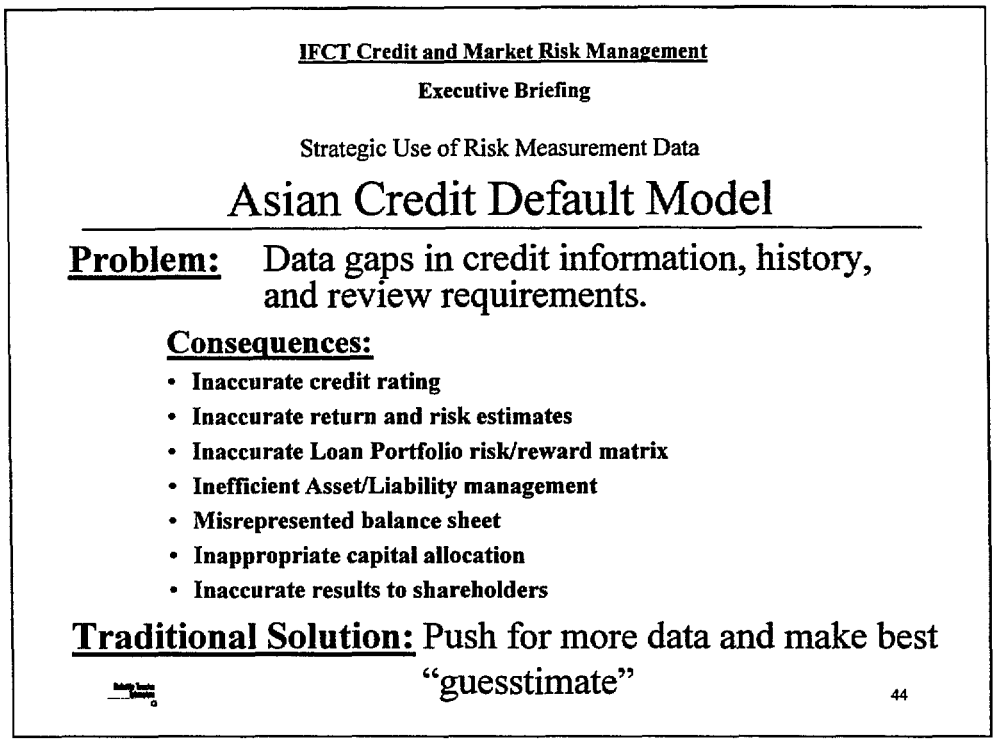
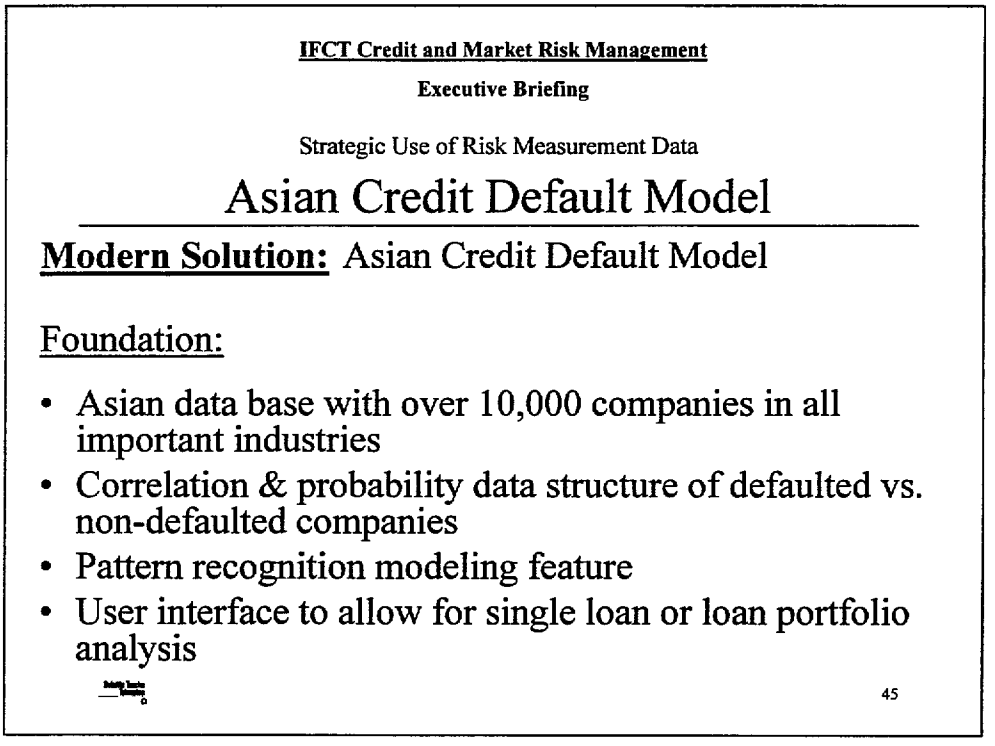
IV Strategic Use of Risk Measurement Data

- Application of Credit Risk Measures in Loan Portfolio Analysis
- Application of Market Risk Measure in Treasury and Investment Management
- Integration of All Key Risk Data for Asset/Liability Management
- Strategic Management of Corporate Directions
- Risk Adjusted Return-on-Capital Allocation

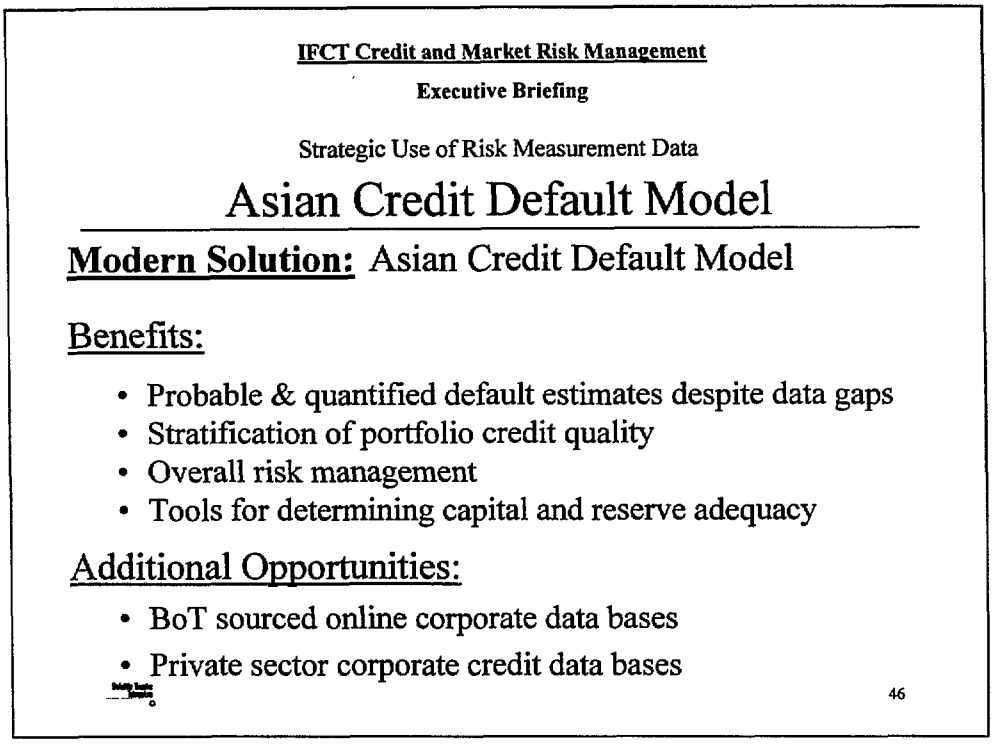


Understanding quantitatively, credit and market risk, requires Data. Reliable data and relevant data.

Establishing an Asian Credit Default Model is critical to establishing a reliable estimated default frequency.



We have heard of a Model based on a Banker's Trust Model for Asia. It is now available and is called Default Filter.



Benefits above

Bill, Dr. Bodine, has a picture worth a thousand words.

Bill

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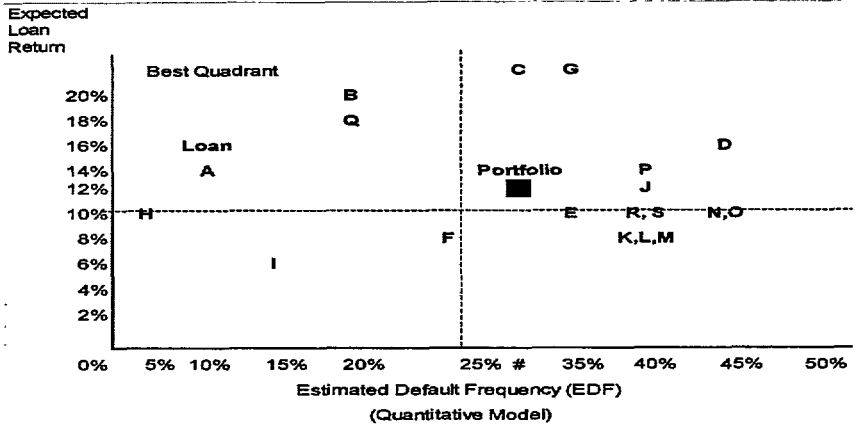
Strategic Use of Risk Measurement Data

Application of Credit Risk Measures in Loan Portfolio Analysis



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Strategic Use of Risk Measurement Data

Application of Market Risk Measure in Treasury & Investment Management

Analytical Approach	Functional Application
Risk/reward analysis of single assets	Lending, Treasury, Investment
Plotting of assets in risk/reward matrix	Lending, Treasury, Investment
Aggregate portfolio risk/reward analysis	Lending, Treasury, Investment
Risk/reward quadrant analysis	Lending, Treasury, Investment
Strategic decisions and planning	A/L, RORAC Allocation

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Executive Briefing

Strategic Use of Risk Measurement Data

Senior Manager Risk Reporting

Risk/Return Evaluation

	Results			Average CAR for the Fiscal Year			RORAC for the Fiscal Year
	Since last report	Since Beginning of the Month	Since Beginning of the Year	Market	Credit	Total	Total
Business 1							
Business 2							
Business 3							
Total							

Explanation of Results Since Last Report

	Sensitivity		Change	
	Interest Rate	Exchange Rate	Interest Rate	Exchange Rate
Business 1				
Business 2				
Business 3				

Comments

Person Responsible
Tel: xxx-xxxx

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Strategic Use of Risk Measurement Data

Senior Manager Risk Reporting

- Profitability & Risk Map Report to Executive Committee and Board of Directors
- Credit Risk Report to Risk Committee
- Banking Results & Risk Factor Report to Asset/Liability Committee
- Capital-at-Risk by Business Unit
- Market Risk Control Report to Risk Management Committee
- Capital-at-Risk & RORAC vs. Business by Credit Rating

(See forms in hand-out packets.)

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Strategic Use of Risk Measurement Data

Asset/Liability Management

Measures ➡ Application ➡ Data Integration ➡ Asset/Liability ➡ Corporate Mgt.

Examples of Measures	Application	Benefit to Asset/Liability Management
CORPORATE ANALYTICS:	FOCUS:	MORE EFFICIENT MANAGEMENT:
Correlation Analysis	Economic Factors	Quantify economic factors
Covariance Analysis	Industry Factors	Diversify industry exposures
Multi-Factor Model	Interest Rates	Determine interest rates factors
Expert Panel/Systems	Exchange Rates	Refined basis for judgements
Risk/Reward Matrix	Loan Portfolio	Disciplined portfolio management
Value-at-Risk (VAR)	Loan Portfolio	Estimate probable value at risk
Attribution Analysis	Securities Portfolio	Identify, measure performance factors
Risk Premium Analysis	Asset Allocation	Quantitative based asset allocation
Capital-at-Risk (CAR)	Corporate Capital	Quantification of maximum risk to capital
RORAC	Capital Allocation	Risk based capital allocation

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Strategic Use of Risk Measurement Data

Asset/Liability Management

Measures ➡ Application ➡ Data Integration ➡ Asset/Liability ➡ Corporate Mgt.

Examples of Measures	Application	Benefit to Asset/Liability Management
ASSET ANALYTICS:	ASSETS:	MORE ACCURATE PROFILE OF ASSETS.
Default Model	Loans	Probability based estimate default risk
Duration, Convexity, VAR	Treasury Notes	Quantified probability of interest rate risk and VAR
Option Model, VAR	Futures Contracts	Quantified probability capital risk exposure
Volatility, VAR	Repos	Quantified return variance and Market VAR
Duration, Convexity, VAR	Bond Investments	Quantified probability of interest rate risk and VAR
Beta, Volatility, VAR	Listed Equities	Quantified probability of return variance & Market VAR
Risk/Reward Matrix, VAR	Private Equities	Quantified diversification risk and Market VAR
Valuation Analysis, VAR	Corporate Property	Valuation of hard assets and Market VAR

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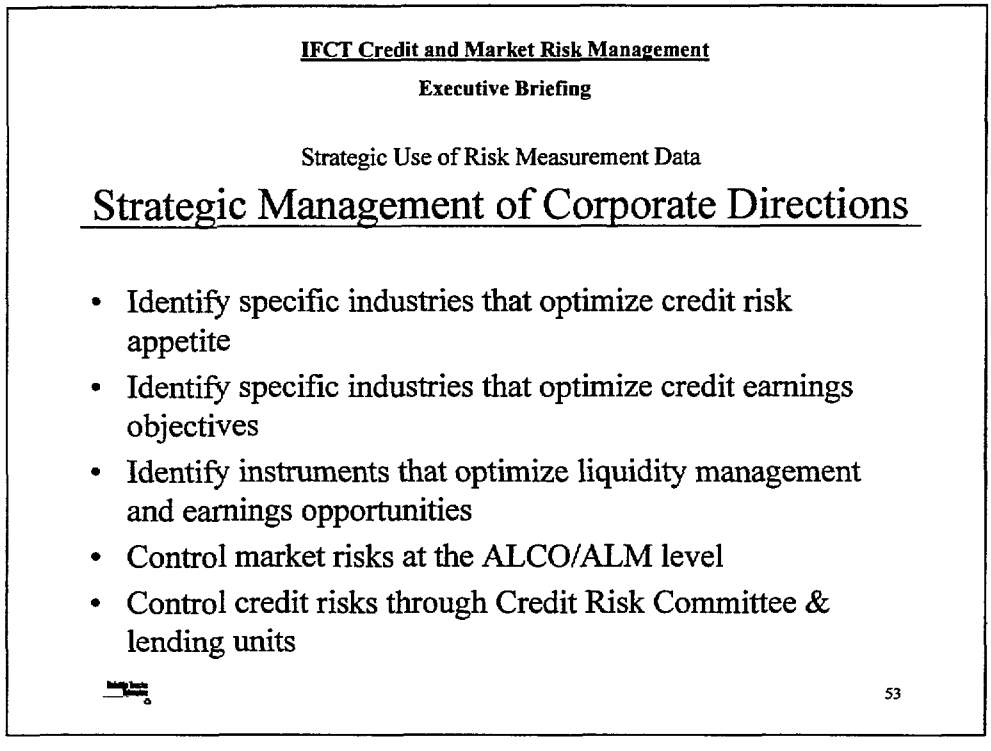

Strategy is said to be a detailed plan for achieving success

It can be said that it is all the activity that occurs prior to committing oneself to an action.

Strategic Use of Risk Measurement Data

Return on Risk-Adjusted Capital Allocation

- Alter IFCT's credit risk exposure
- Modify credit provision
- Evaluate business activity and results
- Determine capital allocation to new products & lines of business
- Demonstrate management's effective risk control to shareholders

V Financial Impact of Risk Management

- Risk Management & Profitability
- Risk Management & Liquidity (Cash Flow)
- Risk Management and Balance Sheet Assets
- Risk Management and Balance Sheet Liabilities

Financial Impact of Risk Management

Risk Factor Linkage to Profitability

Risk Measurement Steps:

- Determine interdependence between changes in the corporation's value & positions in each risk factor
- Measure level of assumed risk

Basic Formula: $\text{Sensitivity}_i = \frac{\triangle \text{ value}}{\triangle \text{ factor}_i}$

Risk Factors	Instrument	Equivalent	Sensitivity	Units
Risk Factor 1	Inst. 1	N_1	Sensitivity_1	u_1
Risk Factor 2	Inst. 2	N_2	Sensitivity_2	u_2
Risk Factor 3	Inst. 3	N_3	Sensitivity_3	u_3

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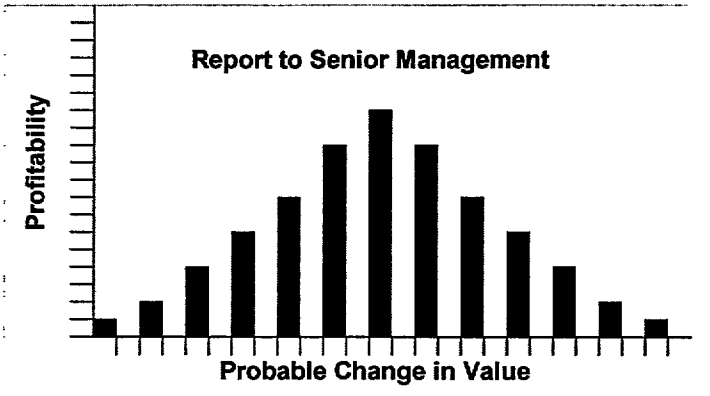
Factor Analysis & Profitability Expectations



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Financial Impact of Risk Management

Risk Management & Liquidity (Cash Flow)

Balance Sheet Liquidity

Assets	Liabilities
Risk Identification & Measurement	Risk Management & Control
Fundamental Analytics Plus Quantitative Analytics	Application → Higher Confidence Greater Accuracy Increased Liquidity

Key Objective: **Protect the Corporate Capital Account**

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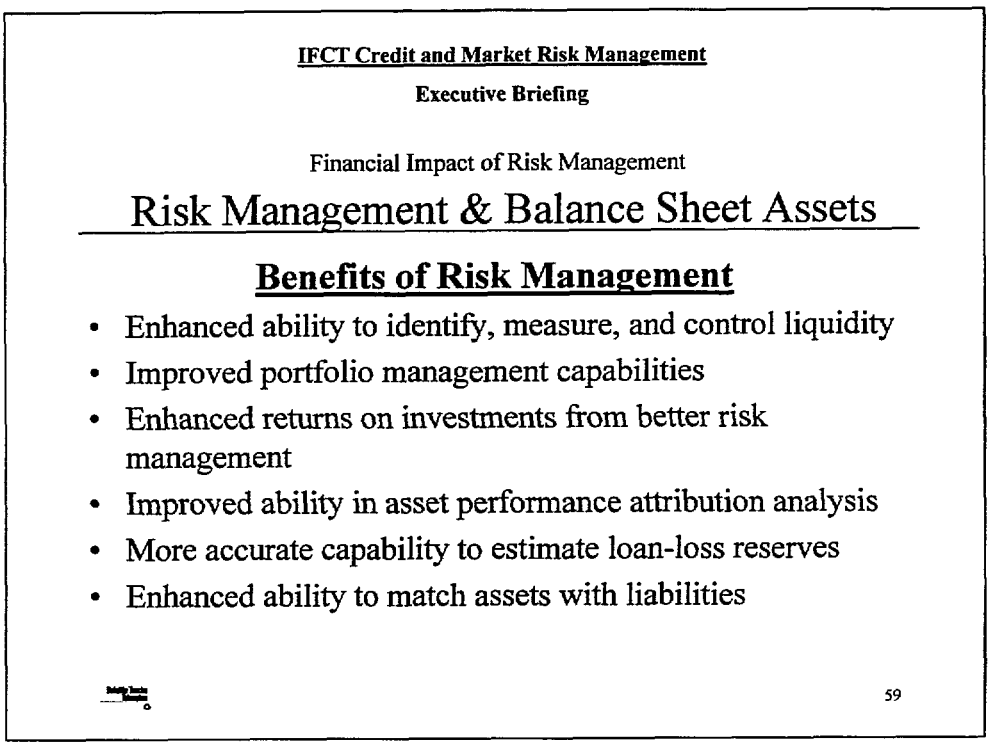


We say, an ounce of prevention is worth a pound of cure.

Preventative maintenance is critical.

Financial Impact of Risk Management

Risk Management & Balance Sheet Liabilities

Benefits of Risk Management

- Enhanced abilities to manage liquidity
- Improved ability to determine maturity & price for notes, other borrowings, and debentures
- Improved ability to protect shareholder's capital
- Improved ability to match liabilities & assets
- Improved ability to allocate capital on a risk-adjusted basis (RORAC)

VI Impact of Personnel

Functional Areas Affected

- Funding
- Lending: Corporate, Project Finance & SME
- Credit Analysis
- Treasury Management
- Asset/Liability Management
- Corporate Profitability & Strategy

Impact of Personnel

Critical Personal Attributes

Integrity	**Understanding**
Energy	**Basic Skills**
Good Judgement	**Reliability**
Diligence	**Energy**
Good Health	**Confidence**
Cheerfulness	**Adaptability**

Authority + Responsibility = Accountability

Reward or Penalty

Impact of Personnel

Modern Tools to Enhance Personal Attributes

Loan Default Risk Model:

- Improves credit rating process
- Improves return/risk estimates
- Improves asset/liability management
- Improves capital allocation
- Improves reports to shareholders

Impact of Personnel

Modern Tools to Enhance Personal Attributes

Consensus Estimates & Probability Analysis Provide:

- Higher confidence level
- More precise risk/return forecasts
- More consistent estimates and forecasts
- More objective estimates and forecasts
- More efficient information management

VII Future of Risk Management

- Existing Environment and Methods
- Future Risk Identification Analytics & Applications
- Future Risk Measurement & Applications
- Future Risk Management Analytics & Applications
- VAR Probability Distribution Illustrated
- Comparison of VAR Methods
- Understanding & Misunderstanding VAR

IFCT Credit and Market Risk Management

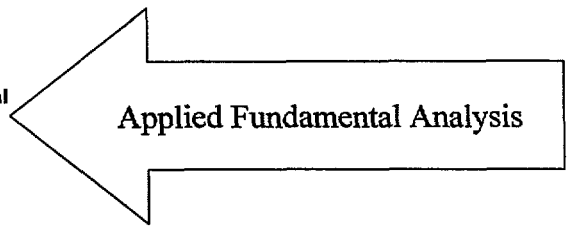
Executive Briefing

Future of Risk Management

Existing Environment & Methods

Fundamental Analysis

Role/Function:	Corp. Mgmt.	Financial	Market	Technical
Funding				
Customer Relationship Manager				
Research				
Credit/Policy Approval				
Loan Disbursement				
Accounting				
Asset/Liability Mgmt.				
Treasury/Investment				
Information Systems				
Senior Management				



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Executive Briefing

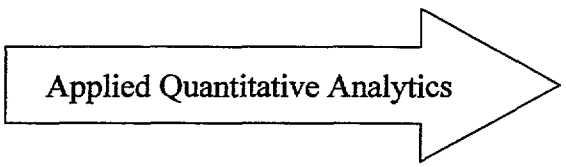
Future of Risk Management

Future Risk Identification Analytics & Applications

Business Application

Measures of Risk Identification:	**Credit**	**Research**	**Loan Portfolio**	**Treasury**	**Investment**	**A/L**

- **Asset Volatility**
- **Regression Analysis**
- **Correlation Analysis**
- **Covariance Matrix**
- **Simulation (Monte Carlo)**
- **Risk Premium Analysis**
- **Portfolio Volatility**
- **Portfolio CAR**



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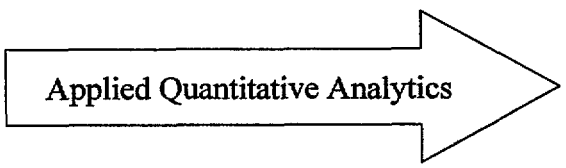
Future of Risk Management

Future Risk Measurement & Applications

Business Application

Measures of Risk Measurement:	Credit	Research	Loan Portfolio	Treasury	Investment	A/L

- **Credit Value at Risk**
- **Market Value at Risk**
- **Capital at Risk**
- **Default Model**
- **Beta**
- **Convexity**
- **Modified Duration**



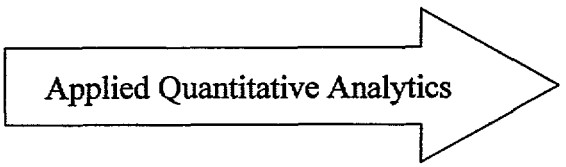
Future of Risk Management

Future Risk Management Analytics & Applications

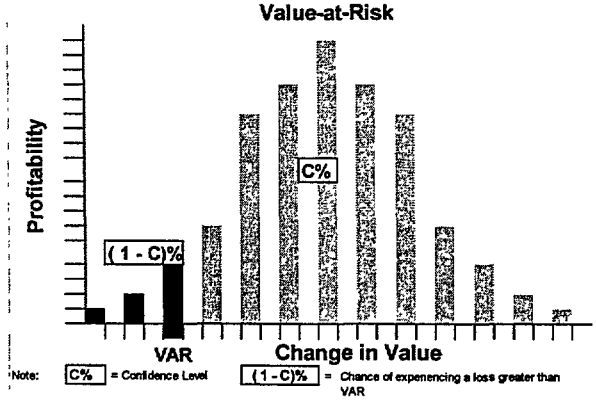
Business Application

Measures of Risk Management:	Credit	Research	Loan Portfolio	Treasury	Investment	A/L

- **Expert Panels/Systems**
- **RORAC**
- **Attribution Analysis**
- **Risk/Reward Matrix**
- **Stress Testing**
- **Back Testing**
- **Multi-Factor Models**



VAR Probability Distribution Illustrated



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Future of Risk Management

Comparison of VAR Methods

	Delta Normal	Historical Simulation	Scenarios: Stress Testing	Scenarios: Monte Carlo
Credit Assets:				
• Valuation	Linear	Full	Full	Full
• Non-linear	No	Yes	Yes	Yes
Market Assets:				
• Non-Normal Distribution	No	Yes	Yes	Yes
• Measure Extreme Events	Somewhat	Somewhat	Yes	Possible
• Use Correlation	Yes	Yes	No	Yes

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IFCT Credit and Market Risk Management

Executive Briefing

Future of Risk Management

Comparison of VAR Methods

	Delta Normal	Historical Simulation	Scenarios: Stress Testing	Scenarios: Monte Carlo
Implementation:				
• Avoid Model Risk	Somewhat	Yes	No	No
• Ease of Computation	Yes	Somewhat	Somewhat	No
• Communicability	Easy	Easy	Good	Difficult
• Major Pitfalls	Non-linearity Extreme Events	Time Variation Extreme Events	Wrong Guess Correlation	Model Risk

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Understanding & Misunderstanding Value-at-Risk

What is Value at Risk?

- Statistical estimate of risk over given time horizon
- Expresses risk in common terms across instruments and assets
- Calculated on a portfolio basis

What Value at Risk is NOT!

- A prediction of the amount or frequency of loss
- A worst case analysis
- An unambiguous measure of risk
- 100% accurate
- Risk management (only a tool of risk management)

VIII Critical Role of Information Technology in Risk Management

- Functional Requirements of IT in Risk Management
- Information Technology Activities in Risk Management
- Key Information Technology Design Considerations
- How Information Technology is Linked to Risk Management

IFCT Credit and Market Risk Management

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Critical Role of Information Technology in Risk Management

Functional Requirements of IT in Risk Management

Levels	Market Risk	Credit Risk
Front Office	Pricing Formulas Sensitivity Measures	Credit Line Information Credit Management
Middle Office	Value-at-Risk Stress Testing Capital Adequacy(BIS)	Credit Administration Credit Analysis
Senior Management	Capital Allocation	

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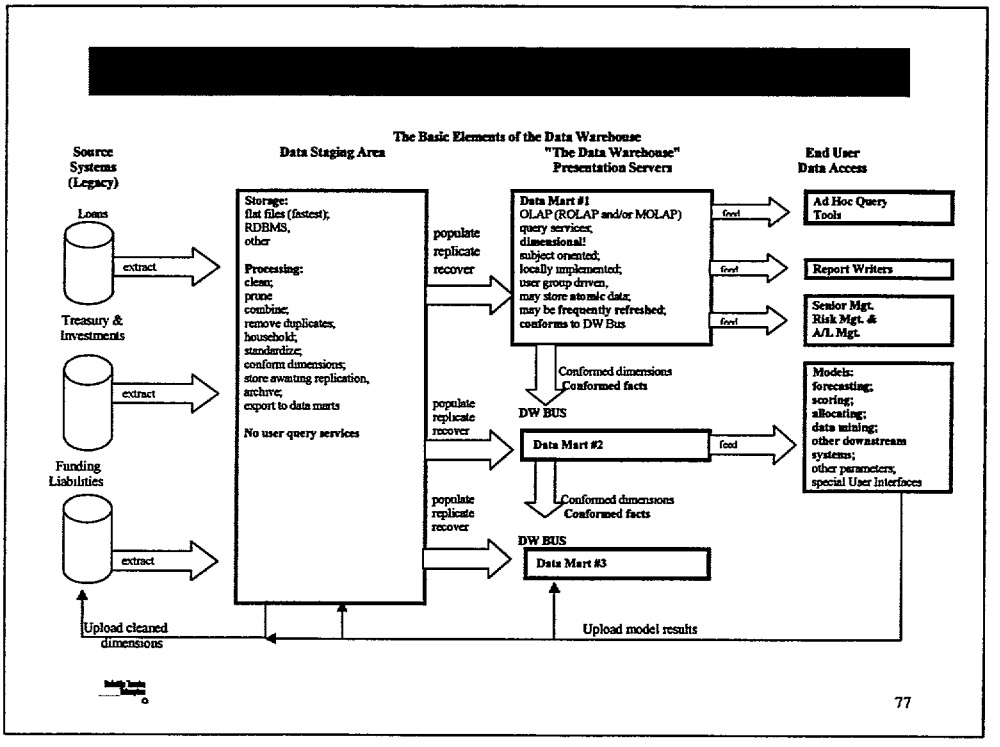
IFCT Credit and Market Risk Management

Executive Briefing

Critical Role of Information Technology in Risk Management

Information Technology Activities in Risk Management

Levels	Measures	Timeliness	Scope	Examples
Front Office	Instrument Specific	Real Time	Portfolio-wide	Delta Convexity Duration
Middle Office	Instrument Independent	Daily/Monthly	Desk-wide Firm-Wide	VAR, CAR, Stress-Testing Back-Testing
Back Office	Performance Related	Daily/Monthly	Group-wide	RORAC



The purpose of this schematic is not to frighten or intimidate. It is a flow chart of a typical data warehouse configuration.

Lines of business should be in the driver's seat.

Critical Role of Information Technology in Risk Management

Key Information Technology Design Considerations

- Requirement for real-time data is most urgent in Front Office
- Risk data required by Front Office varies by, & is specific to the nature of assets traded
- Risk-related conclusions of Middle & Back Office must be clearly independent from Front Office
- Credit & Market risk become more closely linked the higher one goes in the organization
- At the risk control level, credit & market risk are virtually inseparable

IX Summary & Conclusions

Risk management matters to management and shareholders. Without risk management, in today's environment, the corporation becomes vulnerable.

Summary & Conclusions

Risk management should be organized and directed from the corporate level, and linked to operating units.

Summary & Conclusions

Risk measurements provide disciplined, objective, systematic, and quantified tools for risk management.

Summary & Conclusions

In a stressful environment, risk management tools are not a substitute for experience and good judgement.

Summary & Conclusions

Risk management tools must not replace existing fundamental evaluation systems.

Summary & Conclusions

Senior management must take the lead to establish a corporate wide risk management culture.

Summary & Conclusions

Risk measure requires an integrated information system including modern hardware and software support.

Summary & Conclusions

Finally, in today's environment, risk management is the only rational method for allocating capital to business units, evaluating the effectiveness of managers, and achieving business success.

We are here to assist, but you must lead the effort.

FINI

QUESTIONS & ANSWERS

FINI

QUESTIONS & ANSWERS

IFCT Executive Briefing
Resource Requirements & Scheduling

		Fan	Front Office			Coache	Regular Line-Up						Special Teams				
	Project Task	Business End Users	Business Sponsor	IS Sponsor	Business Driver	Business Project Lea	Project Manager	Business Sys. Analys	Data Modeler	DW DBA	Data Staging Design	DW Educator	EAI Appl'n Developer	Tech/Security Archite	Tech Support Specia	Data Staging Progra	Data Steward	DW QA Analyst
	ARCHITECTURE																
	TECHNICAL ARCHITECTURE DESIGN																
1	Create Architecture Task Force																
2	Gather & Document Technical Requirements																
3	Review Current Technical Environment																
4	Create Architecture Plan																
5	Determine Phased Implementation Approach																
7	Create Infrastructure Plan																
8	Develop Configuration Recommendations																
9	User Acceptance/Project Revie																
	IMPLEMENT TACTICAL SECURITY MEASURES																
1	Develop Tactical Security Plan																
2	Secure Physical Environment																
3	Install Virus Checking Software																
4	Secure Access Into Environment																
5	Secure Access out of Environment																
6	Implement Rigorous Password Scheme																
7	Implement Controls for Software Installation																
8	Audit Security Violations																
9	Monitor Security Privileges by Individual																
#	User Acceptance/Project Revie																
	DEVELOP STRATEGIC SECURITY PLAN																
1	Design Security Architecture																
2	Implement Access Tokens (Ekm, Passwords)																
3	Implement Public/Private Keys for Authentication																
4	Implement Secure Tunneling for Remote Access																
5	Centralize Authentication & Access Control																
6	Impl. Signed Certificates for Software Downloads																
7	User Acceptance/Project Revie																

LEGEND:

Primary Responsibility for the Task =
Involved in the Task =
Provides Input to the Task =
Informed Task Results =
Optional Involvement in the Task =

Seminar Outline:
Distributed to Participants With Copies of Slides

IFCT Risk Management Training
Four Day Seminar Outline

Day One: May 17, 2000: **GENERAL ORIENTATION**

9:00 Am to 12:00 PM

- Introduction to Risk Management
- Managing Risk Management
- Risk Management Methods

10:30 AM to 10:45 AM – Coffee

- Strategic Use of Risk Measurement Data
- Financial Impact of Risk Management
- Human Resources & Risk Management
- Future of Risk Management
- Critical Role of Information Technology

12:00 PM to 1:00 PM – Lunch

1:00 to 5:00 PM – Discussion Examples & Case Studies

- Credit Value-at-Risk
- Market Value-at-Risk

3:30 PM to 3:45 PM - Coffee

- Capital-at-Risk
- Return-on-Risk Adjusted Capital

Day Two – May 18, 2000 **CREDIT RISK MANAGEMENT**

9:00 AM to 12:00 PM

- Nature of Available Credits in Thai Market
- Credit Risks associated with available credits

10:30 AM to 10:45 AM – Coffee

- Industry Models & Historical Common Size Ratio Analysis
- Credit Risk Analysis System

IFCT Risk Management Training Four Day Outline:

12:00 PM to 1:00 PM – Lunch

1:00 PM to 5:00 PM

- Case Studies
- Three Critical Analytical Factors (Return, Risk & Cost)

3:30 PM to 3:45 PM - Coffee

- Aggregate Loan Portfolio Analysis
- Summary & Conclusions: Q&A

Day Three – May 19, 2000 **MARKET RISK MANAGEMENT**

9:00 AM to 12:00 PM

- Balance Sheet Dynamics & Analysis
- Social Commitment in Lending Activities
- Capital Market Risk Exposures

10:30 AM to 10:45 AM – Coffee

- Risk & Reward Analysis
- Examples & Lessons of Financial Disasters
- Measuring Capital Market Risk

12:00 AM to 1:00 PM – Lunch

1:00 PM to 5:00 PM

- Approaches to Measuring VAR
- Risk Adjusted Return on Capital

3:30 PM to 3:45 PM - Coffee

- Case Studies: Interest Rates
- Case Studies: Currency
- Case Studies: Return-on-Risk Adjusted Capital

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IFCT Risk Management Training Four Day Outline:

Day Four – May 20, 2000 **Linking Credit Risk & Market Risk**

9:00 AM to 12:00 PM

- Financial Market Perspective
- Developed Market vs. Emerging Market Model
- Fundamental Characteristics of Thai Credit & Capital Markets

10:30 AM to 10:45 AM – Coffee

- Recent IFCT Challenges & Opportunities
- Related Issues: Bankruptcy Law & Tax Treatment of Loan Losses
- New Lending Directions – SME Discussion

12:00 PM to 1:00 PM – Lunch

1:00 PM to 5:00 PM

- Information Technology & Reporting Systems
- Case Studies – Role Discussions:

  Loan Officer
  Credit Review
  Loan Portfolio Management
  Asset/Liability Manager

3:30 PM to 3:45 PM – Coffee

- Summary & Conclusions
- Q&A

Fred Zamon
A. William Bodine

Industrial Finance Corporation of Thailand

Four Day Risk Management Seminar

DAY ONE

EXECUTIVE BRIEFING
&
SURVEY OF RISK MANAGEMENT TECHNIQUES
&
APPLICATIONS

May 17th 2000

Presented By

ZAMON

Frederick J. ~~Zoman~~

&

A. William Bodine, Ph.D.

Bangkok, Thailand

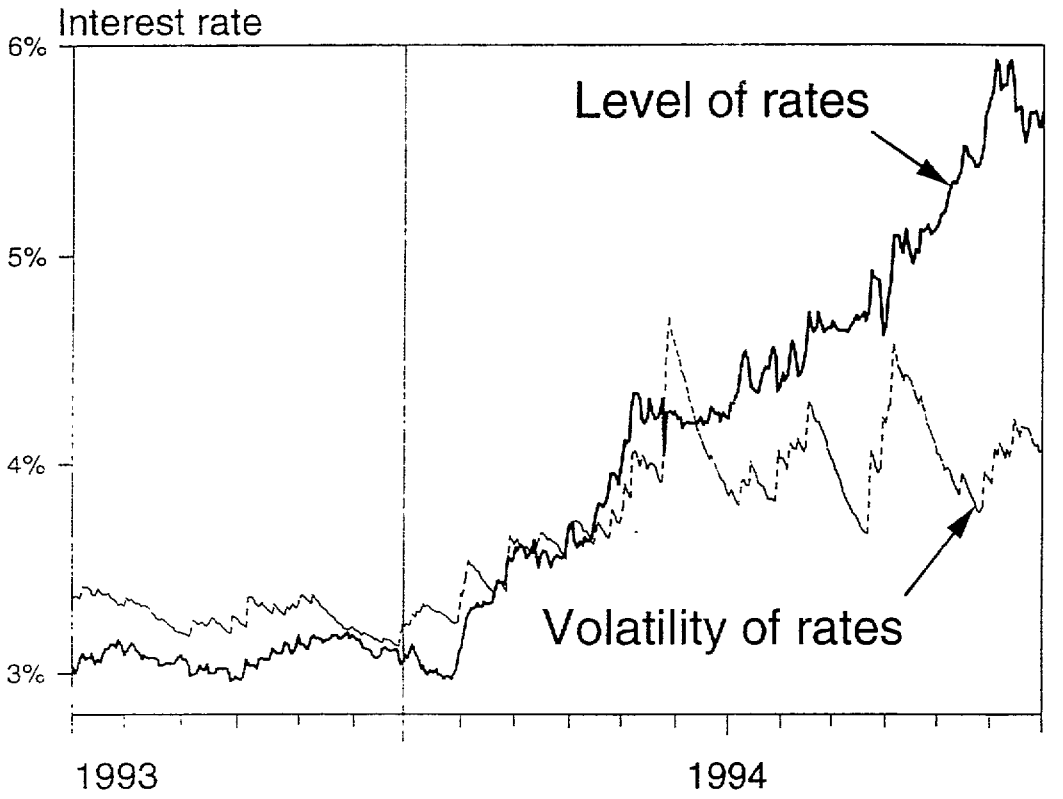
The Evolution of Risk Management Tools

1972	Foreign currency futures
1973	Equity options
1975	T-bond futures
1981	Currency swaps
1982	Interest rate swaps; T-note futures; Eurodollar futures; Equity index futures; Options on T-bond futures; Exchange-listed currency options
1983	Options on equity index; Options on T-note futures; Options on currency futures; Options on equity index futures; Interest rate caps and floors
1985	Eurodollar options; Swaptions
1987	OTC compound options; OTC average options
1989	Futures on interest rate swaps; Quanto options
1990	Equity index swaps
1991	Differential swaps
1993	Captions; Exchange-listed FLEX options
1994	Credit default options

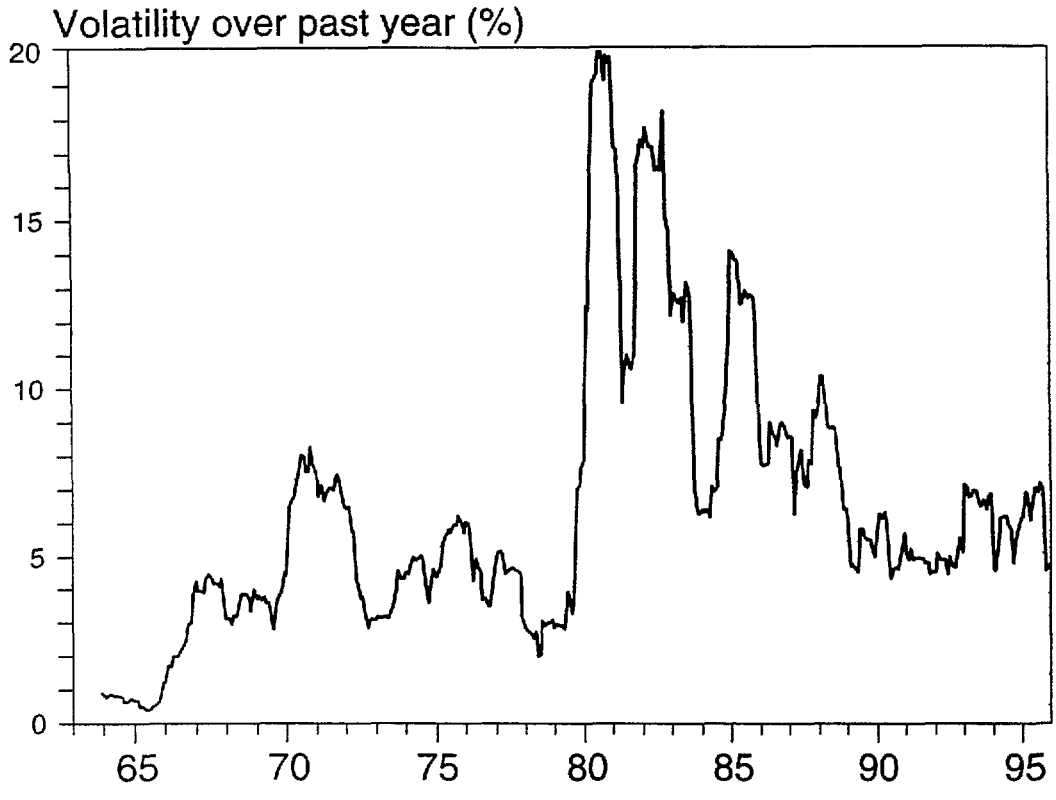
Table 11-1. Probability of Bankruptcy (in %) as a Function of Credit Rating

	AA	A	BBB	BB+	BB–
Year 1	0.03	0.09	0.31	0.93	2.43
Year 2	0.04	0.15	0.45	1.41	3.25
Year 3	0.07	0.21	0.62	1.76	3.52
Year 4	0.10	0.28	0.78	1 98	3 49
Year 5	0.13	0.36	0.92	2.09	3 32
Year 6	0.18	0.44	1.04	2.12	3 08
Year 7	0.22	0.51	1.13	2.10	2 83
Year 8	0.27	0.58	1.19	2.04	2.60
Year 9	0.31	0.64	1.24	1.96	2.38
Year 10	0.36	0.69	1 27	1.88	2.19
Cumulative	1.71	3.95	8.95	18.28	29.08

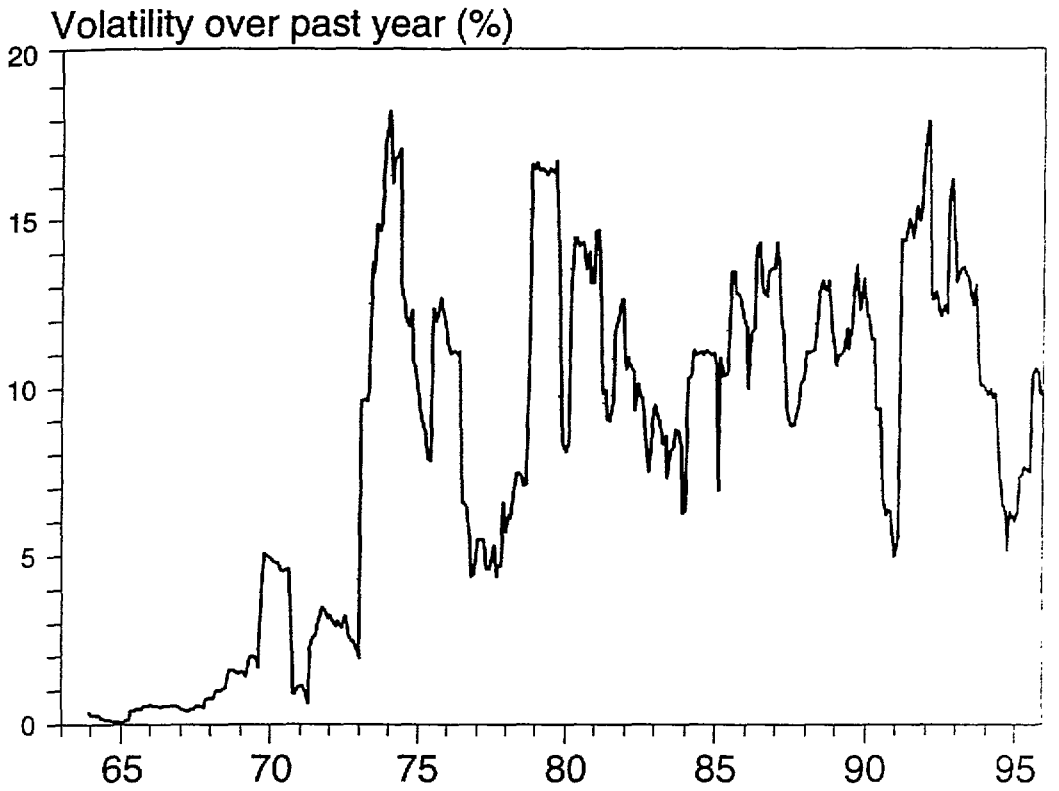
Interest Rates: Level and Volatility



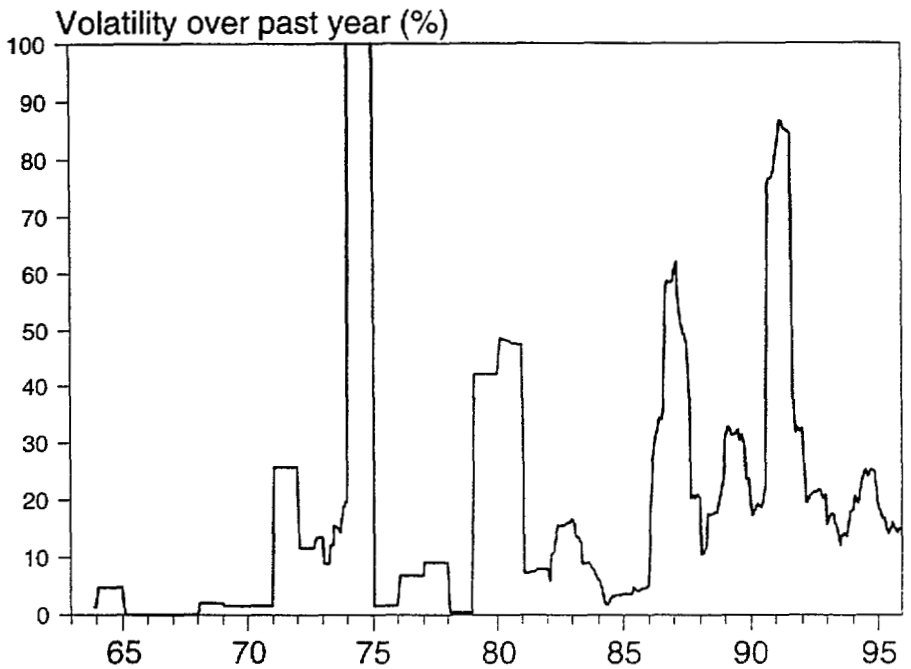
Volatility in Interest Rates



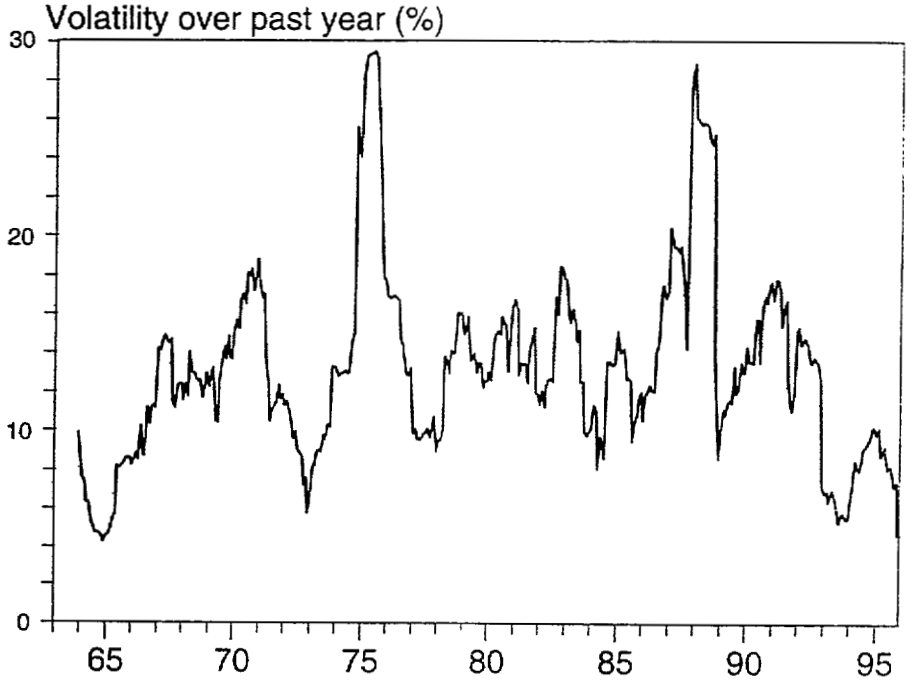
Volatility in the German Mark/Dollar Rate



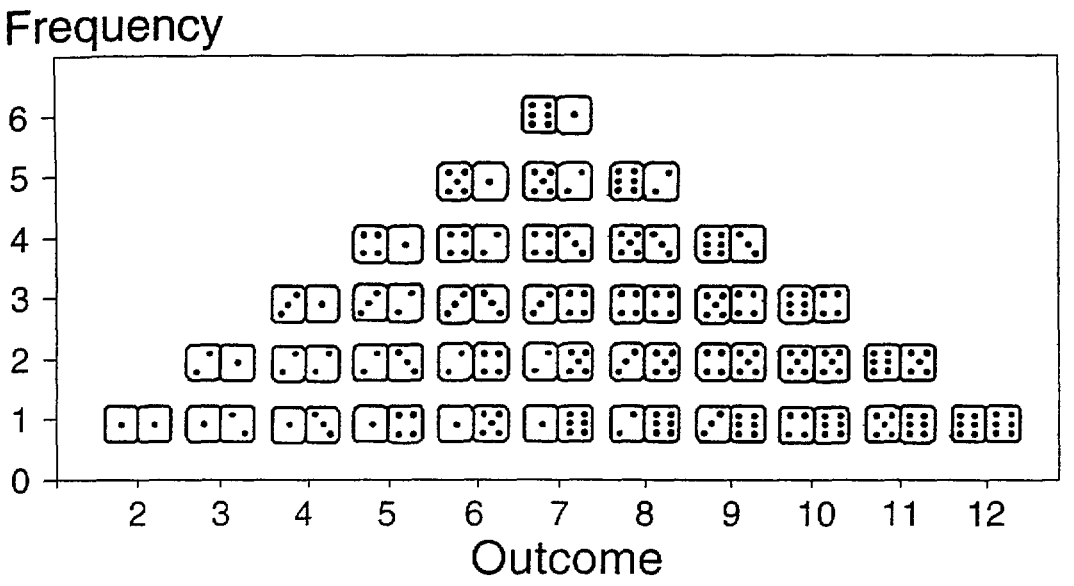
Volatility in Oil Prices



Volatility in Stock Prices



Distribution of Payoff



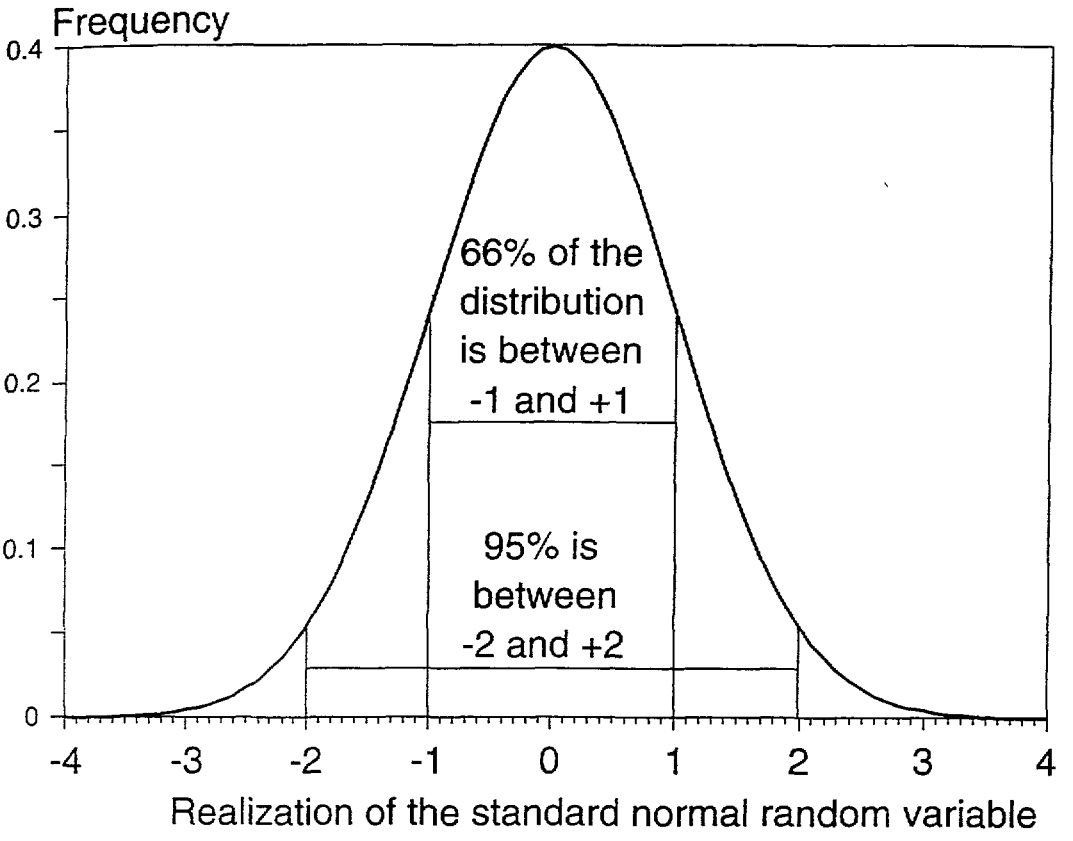
Computing Expected Value and Standard Deviation

Value (x_i)	2	3	4	5	6	7	8	9	10	11	12	Total
Frequency of Occurrence (n_i)	1	2	3	4	5	6	5	4	3	2	1	36
Probability of Occurrence (p_i)	$\frac{1}{36}$	$\frac{2}{36}$	$\frac{3}{36}$	$\frac{4}{36}$	$\frac{5}{36}$	$\frac{6}{36}$	$\frac{5}{36}$	$\frac{4}{36}$	$\frac{3}{36}$	$\frac{2}{36}$	$\frac{1}{36}$	1
Computing $E(X)$: $p_i x_i$	$\frac{2}{36}$	$\frac{6}{36}$	$\frac{12}{36}$	$\frac{20}{36}$	$\frac{30}{36}$	$\frac{42}{36}$	$\frac{40}{36}$	$\frac{36}{36}$	$\frac{30}{36}$	$\frac{22}{36}$	$\frac{12}{36}$	$\frac{252}{36}$
Computing $V(X)$: $p_i[x_i - E(X)]^2$	$\frac{25}{36}$	$\frac{32}{36}$	$\frac{27}{36}$	$\frac{16}{36}$	$\frac{5}{36}$	$\frac{0}{36}$	$\frac{5}{36}$	$\frac{16}{36}$	$\frac{27}{36}$	$\frac{32}{36}$	$\frac{25}{36}$	$\frac{210}{36}$

These probabilities define a *probability distribution function* (pdf) that by construction must sum to unity:

$$\sum_{i=1}^{11} p_i = 1.$$

Normal Distribution



Lower Quantiles of the Normal Distribution

Percentile	99.99	99.9	99	97.72	97.5	95	90	84.13	50
Value	−3.715	−3.090	−2.326	−2.000	−1.960	−1.645	−1.282	−1.000	0.000

Comparison of Distributions

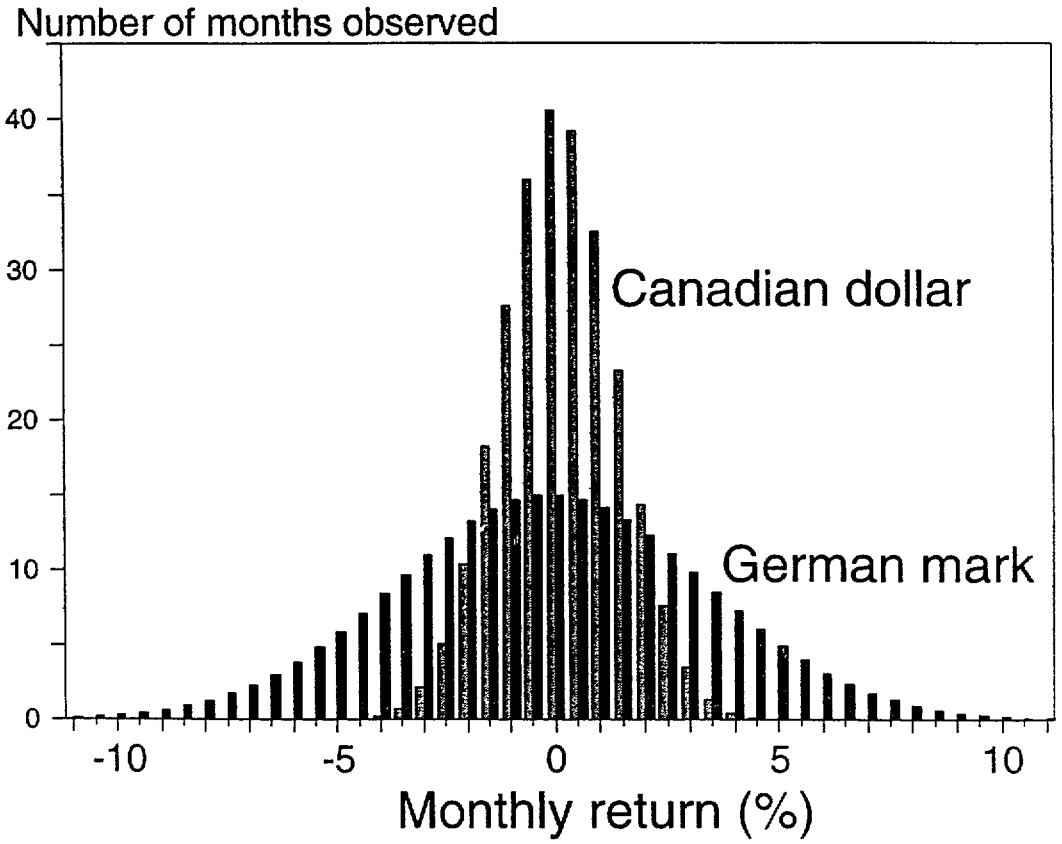
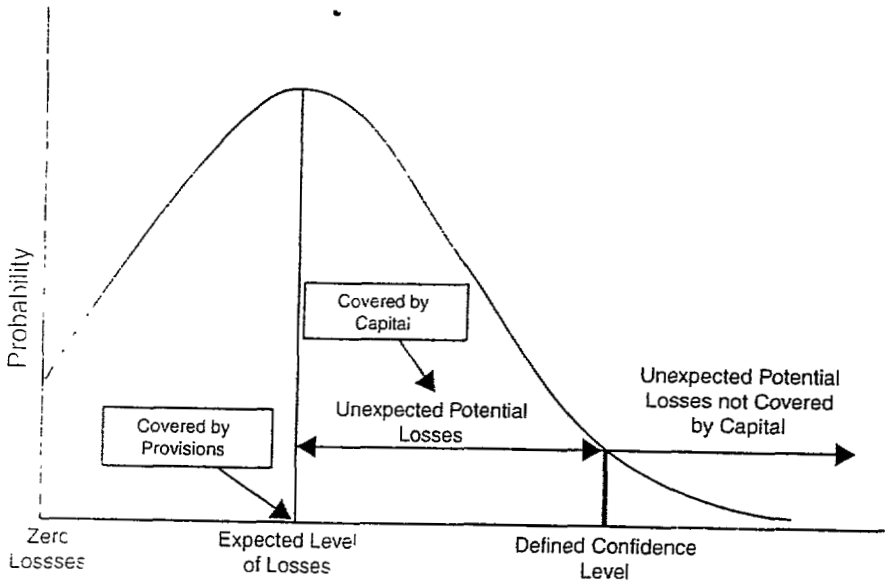
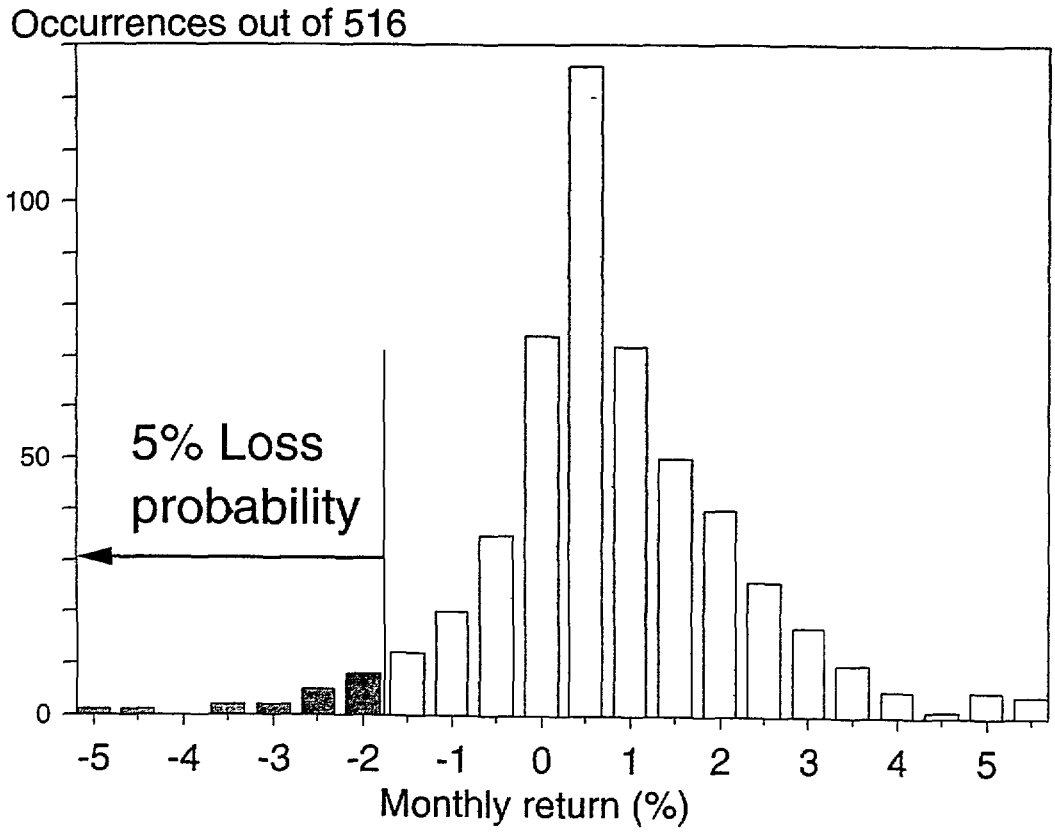


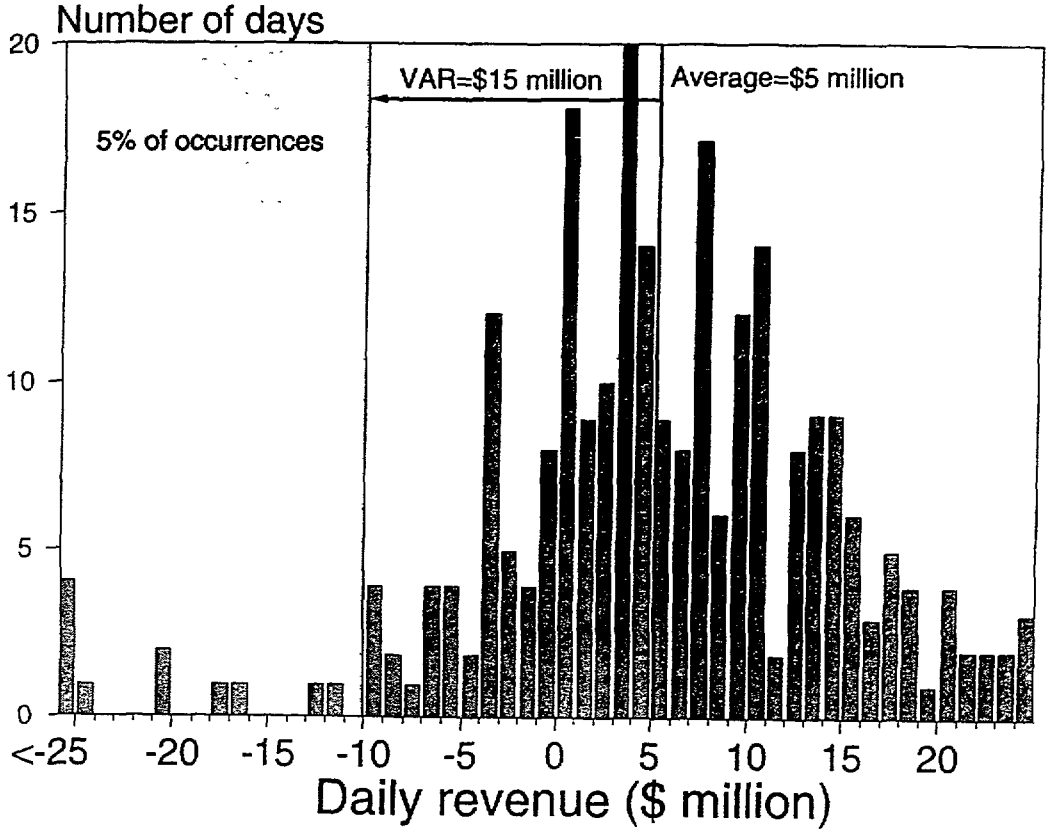
Figure 5-1. Potential Losses Due to Credit Risk



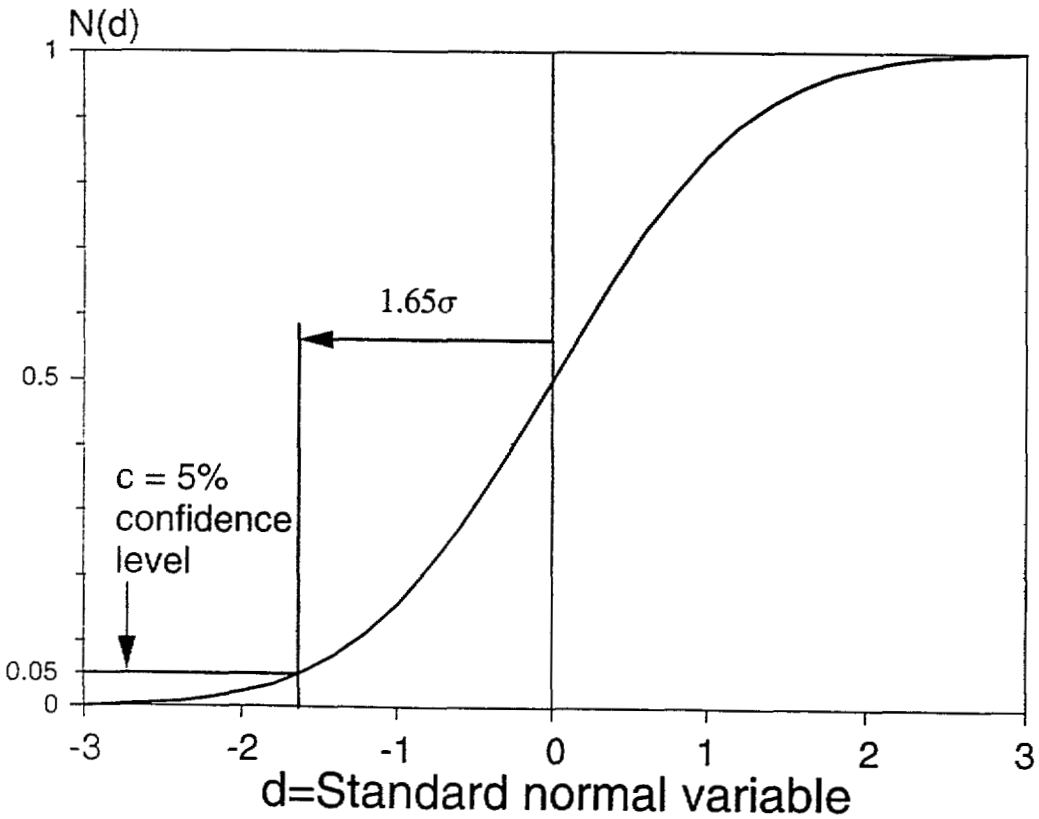
Measuring Value at Risk



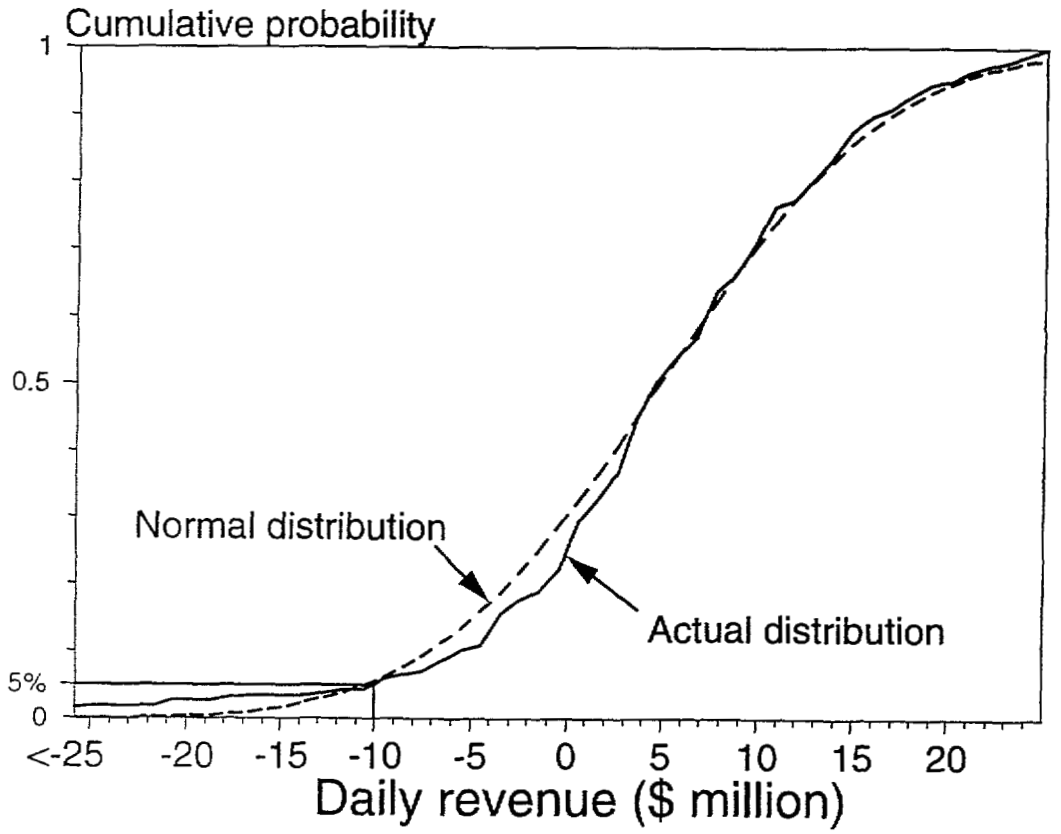
Distribution of Daily Revenues



Cumulative Normal Probability Distribution



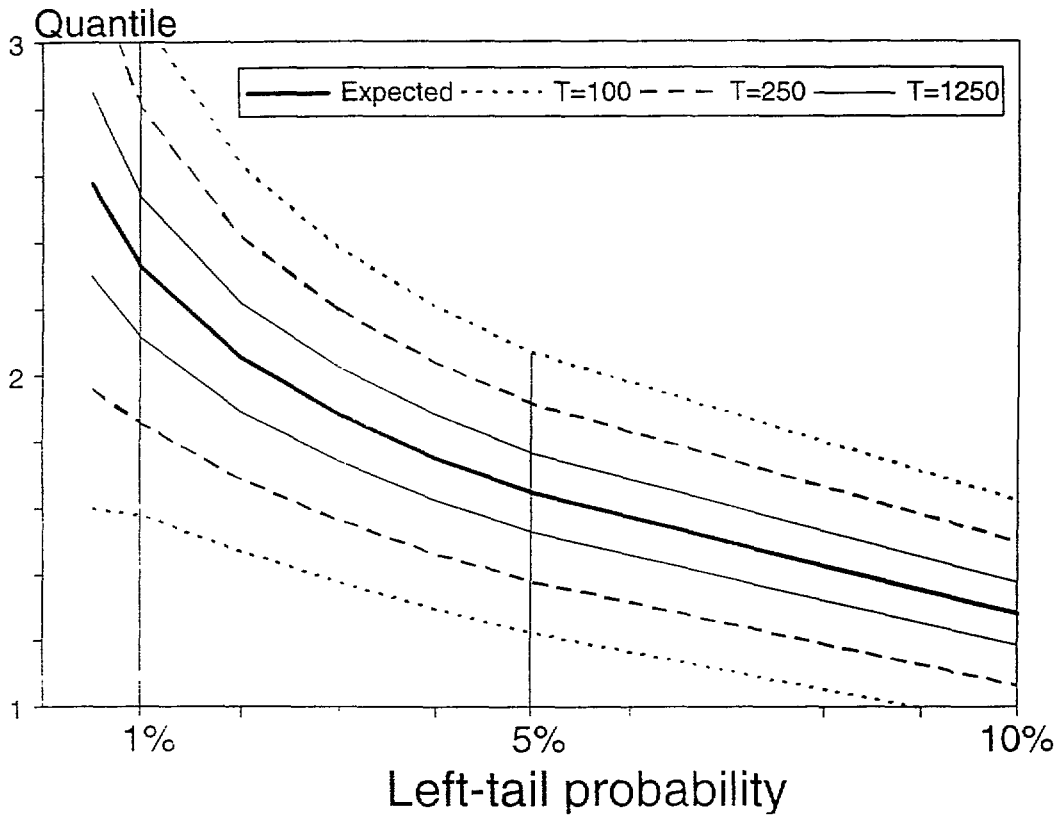
Comparison of Cumulative Distributions



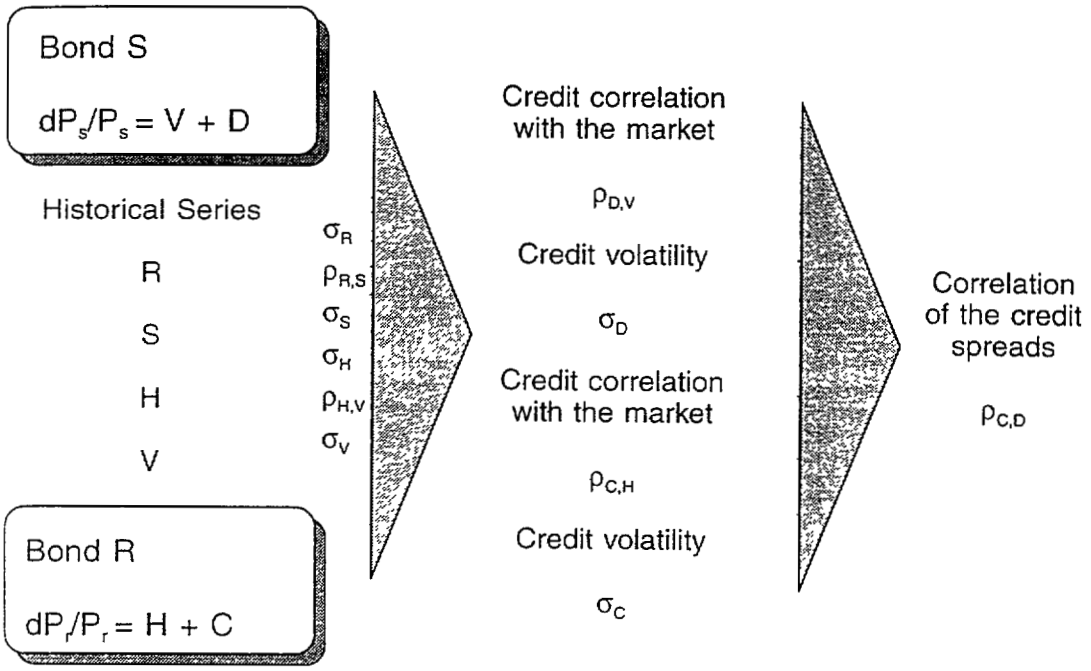
Equivalence between Horizon and Confidence Level Normal Distribution, Annual Risk=12.16% (Basle Parameters: 99% Confidence over Two Weeks)

Confidence Level c (%)	Number of SD α	Horizon Δt	Actual SD $\sigma\sqrt{\Delta t}$	Cutoff Value $\alpha\sigma\sqrt{\Delta t}$
Baseline:				
99	−2.326	2 weeks	2.381	−5.54
57.56	−0.456	1 year	12.160	−5.54
81.89	−0.911	3 months	6.079	−5.54
86.78	−1.116	2 months	4.964	−5.54
95	−1.645	4 weeks	3.367	−5.54
99	−2.326	2 weeks	2.381	−5.54
99.95	−3.290	1 week	1.684	−5.54
99.99997	−7.153	1 day	0.766	−5.54

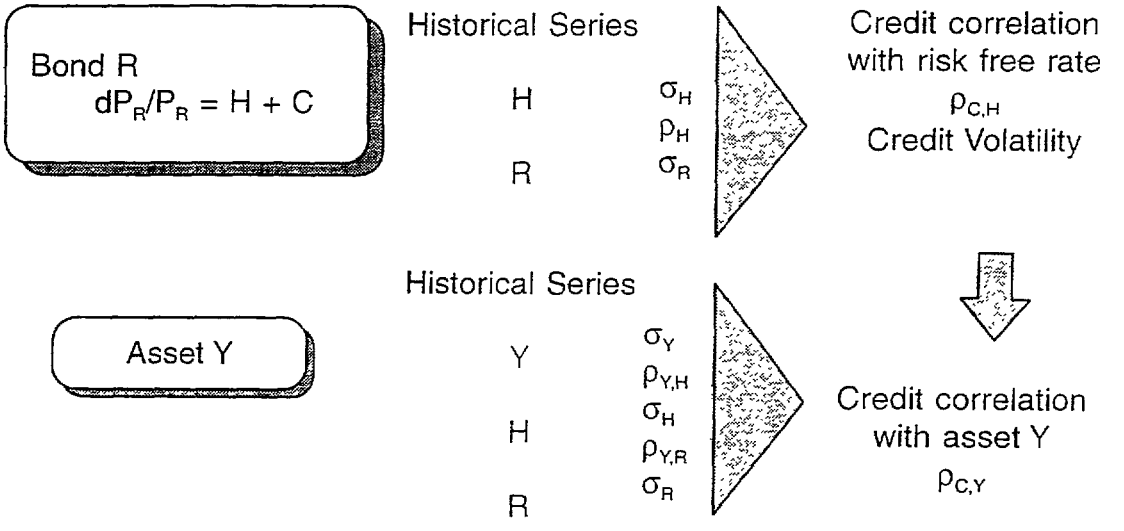
Confidence Bands for Sample Quantiles



Risk Parameters for Representative Bonds Belonging in Different Categories



Risk Parameters of a Representative Bond vs. other Assets



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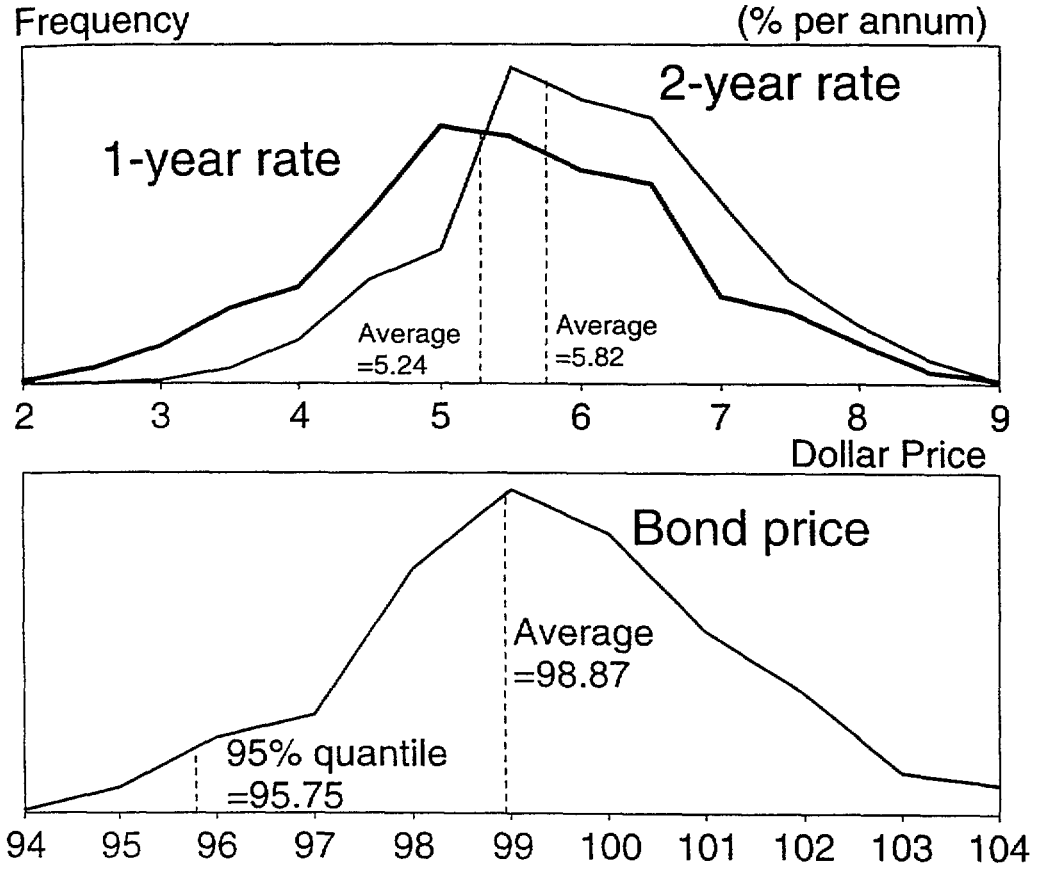
[27] From

$$\text{covariance}(R,S) = \text{covariance}(H + C, V + D)$$

and assuming that the credit correlation between a bond and the market is independent of its duration such that:

$$\rho_{C,V} \approx \rho_{C,H}$$
$$\rho_{D,H} \approx \rho_{D,1}$$

Simulations of Bond Prices: Distributions



DURATION

We observe that bonds with longer maturities display greater price movements. Maturity, however, is an imperfect measure of risk because it accounts for only the repayment of principal and ignores all coupon payments. In contrast, *duration* provides a better measure of price risk, because it accounts for all payments and not only the principal. Duration also measures the sensitivity of an asset's price to movements in yields. This is why duration is such a valuable tool for risk management.

Duration is a characteristic of an asset. Duration was first defined by Macaulay in 1938 as the weighted maturity of each bond payment, where the weights are proportional to the present value of the cash flows:

$$D = \sum_{t=1}^{T} t \times w_t = \sum_{t=1}^{T} t \times \frac{C_t/(1+y)^t}{\sum C_t/(1+y)^t}. \tag{6.20}$$

Computing Duration

Time (year)	Payment	Yield (%)	PV of Payment	Time × PV
1	6	6.00	5.66	5.66
2	6	6.00	5.34	10.68
3	6	6.00	5.04	15.11
4	6	6.00	4.75	19.01
5	106	6.00	79.21	396.05
Sum			100.00	446.51
Duration				4.4651

Duration and Yield Volatility (8% yield, 8% coupon bonds)

Maturity (years)	Duration (years)	Yield Volatility (% per annum)	Risk (% per annum)
1	0.93	1.17	1.08
2	1.78	1.24	2.22
3	2.59	1.24	3.21
5	3.99	1.18	4.70
7	5.21	1.12	5.82
10	6.71	1.05	7.04
30	11.26	0.94	10.58

Mapping for a Bond Portfolio

Term (year)	6% 5-Year	4% 1-Year	Spot Rate	Mapping		
				Principal	Duration	Cash Flow
1	6	104	4.000	.00	.00	105.77
2	6	0	4.618	.00	.00	5.48
2.733	—	—		—	200.00	—
3	6	0	5.192	200.00	.00	5.15
4	6	0	5.716	.00	.00	4.80
5	106	0	6.112	.00	.00	78.79
Total				200.00	200.00	200.00

4 CONVEXITY

While duration is useful for predicting the effect of interest rate changes on the value of fixed-income accounts, it should only be regarded as a first-order approximation valid for small changes in yield. Further precision can be obtained by considering convexity.

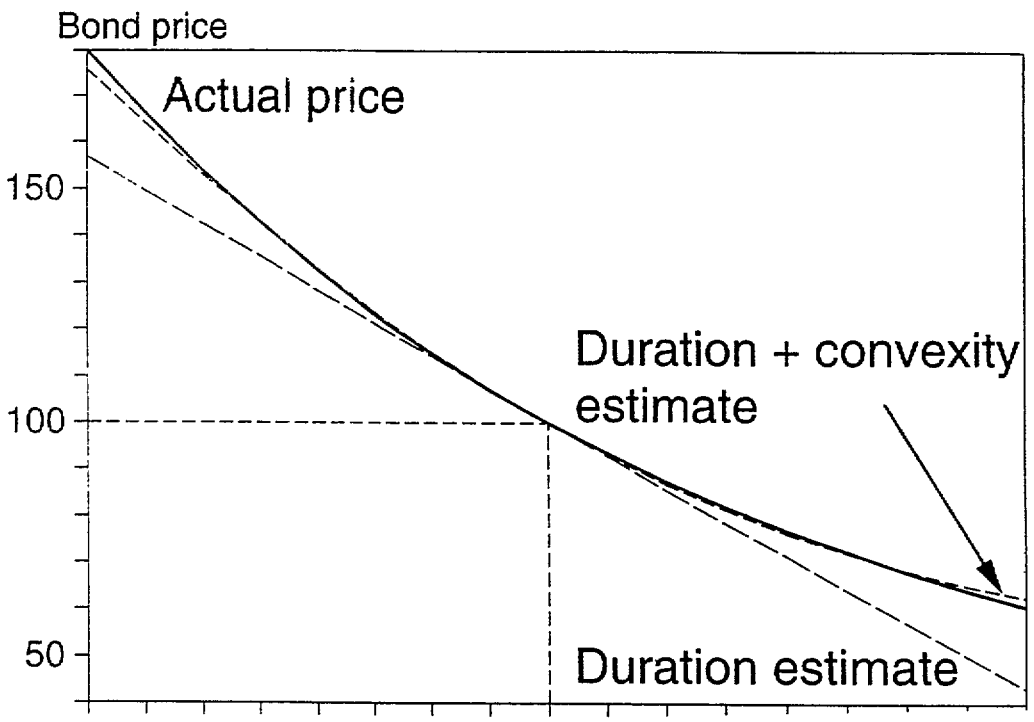
Convexity is a second-order effect that describes the way in which duration changes as yield changes. The convexity measure can be obtained by differentiating equation (6.21) twice with respect to yield and dividing by price:

$$C = -\frac{dD^*}{dy} = \frac{1}{P}\frac{d^2P}{dy^2} = \frac{1}{P}\frac{1}{(1+y)^2}\sum_{t=1}^{T}\frac{t(t+1)C_t}{(1+y)^t}. \qquad (6.29)$$

Convexity is measured in units of periods squared.

To see why convexity may be important, we can approximate a bond rate of return, or relative change in bond price, by a Taylor expansion with two terms:

Price Approximations



Risk and Correlations for U.S. Bonds (monthly VAR at 95 % level)

Term (year)	VAR (%)	1Y	2Y	3Y	4Y	5Y	7Y	9Y	10Y	15Y	20Y	30Y
1	0.470	1										
2	0.987	.897	1									
3	1.484	.886	.991	1								
4	1.971	.866	.976	.994	1							
5	2.426	.855	.966	.988	.998	1						
7	3.192	.825	.936	.965	.982	.990	1					
9	3.913	.796	.909	.942	.964	.975	.996	1				
10	4.250	.788	.903	.937	.959	.971	.994	.999	1			
15	6.234	.740	.853	.891	.915	.930	.961	.976	.981	1		
20	8.146	.679	.791	.832	.860	.878	.919	.942	.951	.991	1	
30	11.119	.644	.761	.801	.831	.853	.902	.931	.943	.975	.986	1

Principal Components of Correlation Matrix: U.S. Bonds

Maturity (year)	*Percentage of Variance Explained by*			Total Variance Explained
	Factor 1 "Level"	Factor 2 "Slope"	Factor 3	
1	72.2	17.9	9.8	99.8
2	89.7	7.8	0.5	98.0
3	94.3	4.5	0.7	99.5
4	96.5	2.2	1.0	99.7
5	97.7	1.1	0.9	99.7
7	98.9	0.0	0.4	99.3
9	98.2	0.7	0.2	99.1
10	98.1	1.2	0.1	99.4
15	94.1	5.3	0.2	99.6
20	87.2	11.0	0.9	99.1
30	83.6	14.5	0.9	99.0
Average	91.9	6.0	1.4	99.3

Computing the VAR of a $200 Million Bond Portfolio (monthly VAR at 95% level)

Term (year)	Cash Flows x($m)	$x \times V$ (%)	Correlation Matrix R 1Y	2Y	3Y	4Y	5Y	Var ($m)
1	105.77	49.66	1					
2	5.48	5.40	.897	1				
3	5.15	7.65	.886	.991	1			
4	4.80	9.47	.866	.976	.994	1		
5	78.79	191.15	.855	.966	.988	.998	1	
Total	200.00	263.35						
VAR ($m)								
Undiversified		$2.63						
Diversified								$2.57

Computing the VAR from the Change in Prices of Zeroes

Cash Term (year)	Old Flows ($m)	Old Zero Value	Zero PV of Flows	Zero Risk (VAR)	New Zero Value	PV of Flows
1	109	0.9615	105.77	0.4696	0.9570	105.27
2	6	0.9136	5.48	0.9868	0.9046	5.43
3	6	0.8591	5.15	1.4841	0.8463	5.08
4	6	0.8006	4.80	1.9714	0.7848	4.71
5	106	0.7433	78.79	2.4261	0.7252	76.88
Total			200.00			197.37
Loss						$2.63*m*

Benchmarking a $100 Million Bond Index (monthly VAR at 95% level)

Vertex	Risk (%)	Position: JPM US Index ($m)	Position: Portfolio 1 ($m)	2 ($m)	3 ($m)	4 ($m)	5 ($m)
≤1m	0.022	1.05	0.0	0.0	0.0	0.0	84.8
3m	0.065	1.35	0.0	0.0	0.0	0.0	0.0
6m	0.163	2.49	0.0	0.0	0.0	0.0	0.0
1Y	0.470	13.96	0.0	0.0	0.0	59.8	0.0
2Y	0.987	24.83	0.0	0.0	62.6	0.0	0.0
3Y	1.484	15.40	0.0	59.5	0.0	0.0	0.0
4Y	1.971	11.57	38.0	0.0	0.0	0.0	0.0
5Y	2.426	7.62	62.0	0.0	0.0	0.0	0.0
7Y	3.192	6.43	0.0	40.5	0.0	0.0	0.0
9Y	3.913	4.51	0.0	0.0	37.4	0.0	0.0
10Y	4.250	3.34	0.0	0.0	0.0	40.2	0.0
15Y	6.234	3.00	0.0	0.0	0.0	0.0	0.0
20Y	8.146	3.15	0.0	0.0	0.0	0.0	0.0
30Y	11.119	1.31	0.0	0.0	0.0	0.0	15.2
Total		100.00	100.0	100.0	100.0	100.0	100.0
Duration		4.62	4.62	4.62	4.62	4.62	4.62
VAR ($m)							
Absolute		1.99	2.25	2.20	2.13	2.07	1.10
Relative		0.00	0.43	0.29	0.16	0.20	0.36

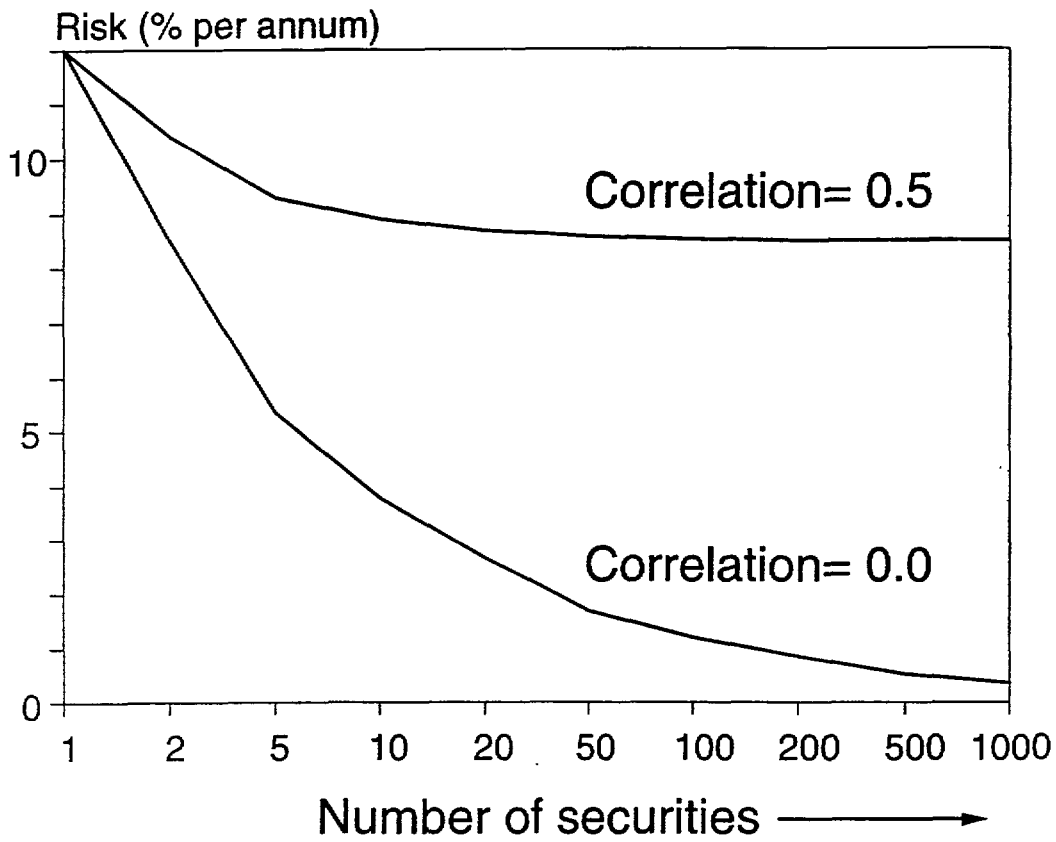
Computing the VAR of a $100 Million FRA (monthly VAR at 95% level)

Term (days)	PV of Flows x	Risk (%) V	Correlation Matrix R		VAR $(VRV)x$	$x(VRV)x$	Incremental VAR βxVAR
180	-$97.264	0.1629	1	0.8738	0.00039	–0.0381	-$0.116
360	$97.264	0.4696	0.8738	1	0.00149	0.1454	$0.444
Total	$0					0.1072	$0.327
VAR ($m)						$0.327	

Computing the VAR of a $100 Million Interest Rate Swap (monthly VAR at 95% level)

Term (year)	Flow Fixed	Flow Floating	Rate (% per annum)	PV of Flows ($) x	Var of Flows $x \times V$	Incremental VAR ($m)
1	−6.195	–	5.813	−5.855	−0.027	0.024
2	−6.195	–	5.929	−5.521	−0.054	0.053
3	−6.195	–	6.034	−5.196	−0.077	0.075
4	−6.195	–	6.130	−4.883	−0.096	0.096
5	−106.195	–	6.217	−78.546	−1.905	1.905
Total	−100.00					
VAR	($m)					
Undiversified					$2.160m	
Diversified						$2.152m

Risk and Number of Securities



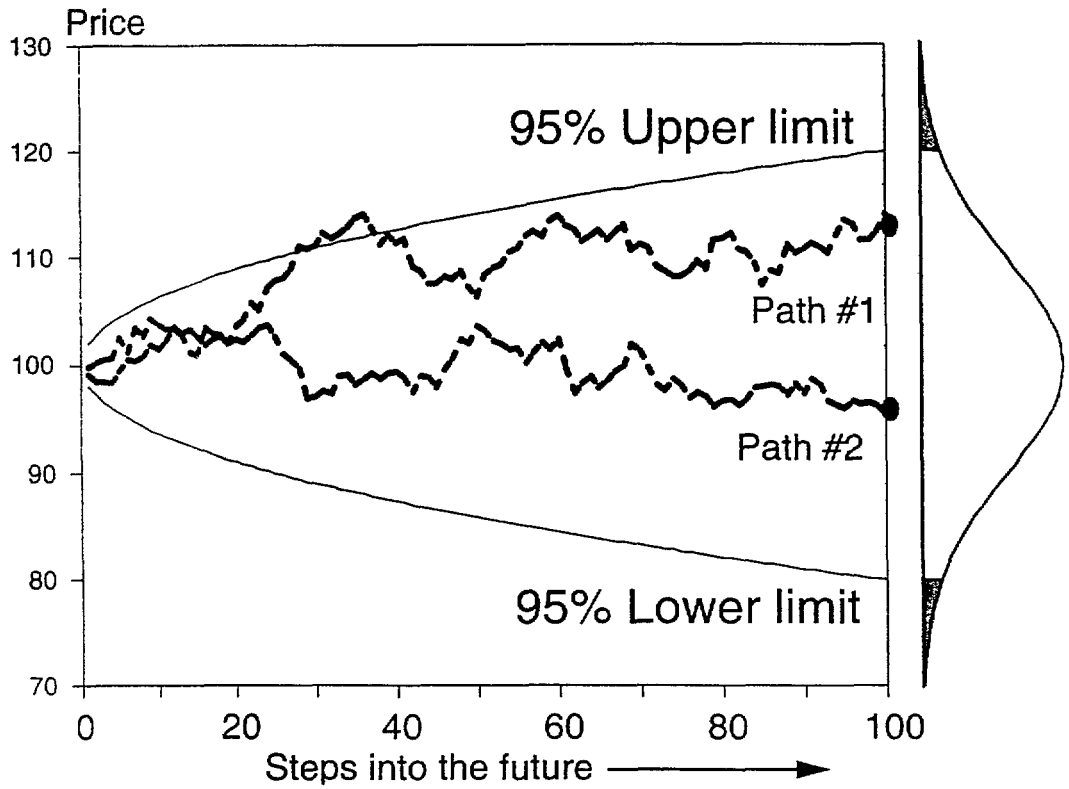
Risk and Return over Various Horizons
U.S. Stocks, 1973–1994

Horizon	Years T	Mean m	Risk s	Ratio mys	Probability of Loss (%)
Annual	1	11.1000	15.40	0.7208	23.6
Quarterly	0.25000	2.7750	7.70	0.3604	35.9
Monthly	0.08333	0.9250	4.45	0.2081	41.8
Weekly	0.01918	0.2129	2.13	0.0998	46.0
Daily	0.00397	0.0440	0.97	0.0454	48.2
Hourly	0.00050	0.0055	0.34	0.0161	49.4

Computing the VAR of a $100 Million Stock Portfolio (monthly VAR at 95% level)

		Covariance Matrix			
	Cash ($m)	GM	FORD	HWP	VAR($m)
VAR		14.01	13.41	15.68	
Beta		0.806	1.183	1.864	
Cov. Matrix					
Full					
GM	33.33	72.17	43.92	26.32	11.76
FORD	33.33	43.92	66.12	44.31	
HWP	33.33	26.32	44.31	90.41	
Diagonal					
GM	33.33	72.17	11.35	17.87	10.13
FORD	33.33	11.35	66.12	26.23	
HWP	33.33	17.87	26.23	90.41	
Beta					
GM	33.33	7.73	11.35	17.88	7.30
FORD	33.33	11.35	16.65	26.24	
HWP	33.33	17.88	26.24	41.32	
Undiversified					
GM	33.33	72.17	69.08	80.78	14.37
FORD	33.33	69.08	66.12	77.32	

Simulating Price Paths



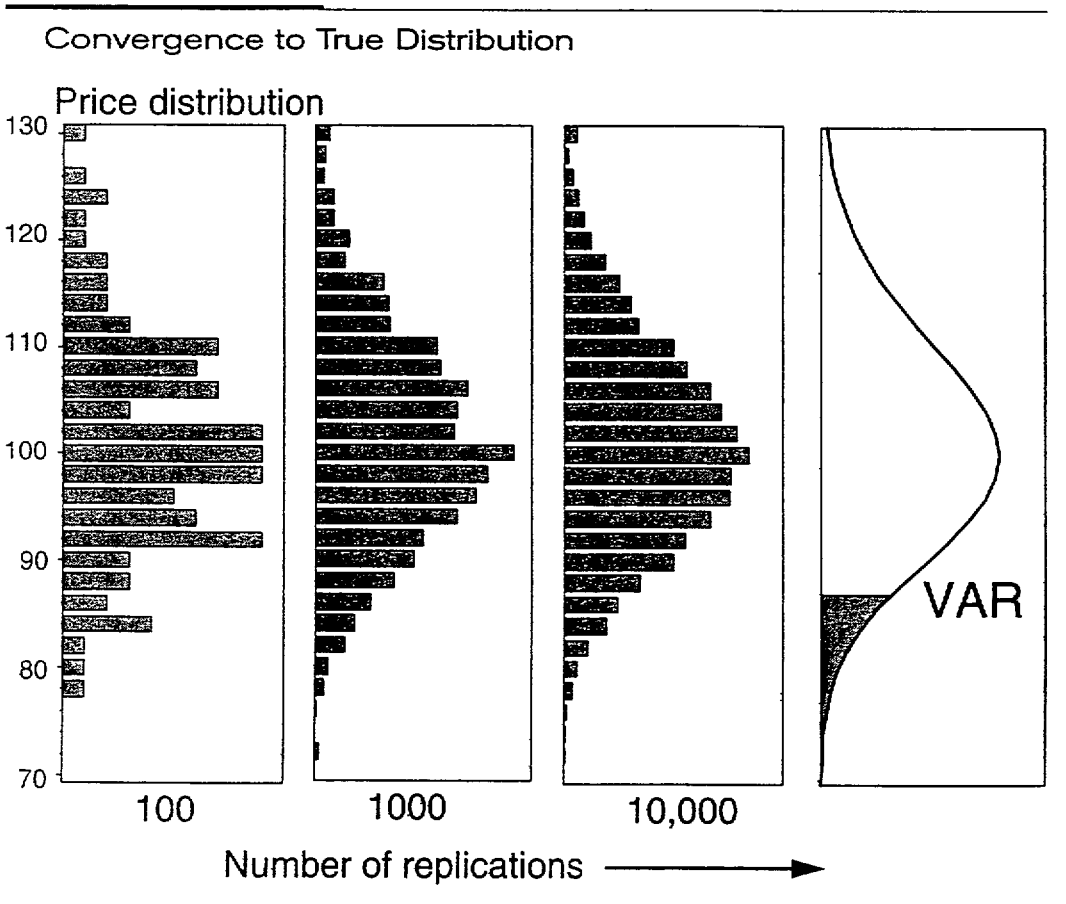
Computing VAR

Once a price path has been simulated, we can build the portfolio distribution at the end of the selected horizon. The simulation is carried out by the following steps:

1. Choose a stochastic process and parameters.
2. Generate a pseudo-sequence of variables $\epsilon_1, \epsilon_2, \ldots, \epsilon_n$, from which prices are computed as $S_{t+1}, S_{t+2}, \ldots, S_{t+n}$.
3. Calculate the value of the asset $F_{t+n} = F_T$ under this particular sequence of prices at the target horizon.
4. Repeat steps 2 and 3 as many times as necessary, say, 10,000, obtaining a distribution of values, $F_T^1, \ldots, F_T^{10,000}$, from which the VAR can be reported. At the selected significance level c, the VAR is the portfolio value exceeded in c times 10,000 replications.

Figure 12–2 illustrates the convergence of the empirical distribution toward the true one. With 100 replications, the histogram representing the distribution of the ending price is quite irregular. The histogram becomes smoother with 1,000 replications, even more so with 10,000 replications, and should eventually converge to the continuous distribution in the right panel.

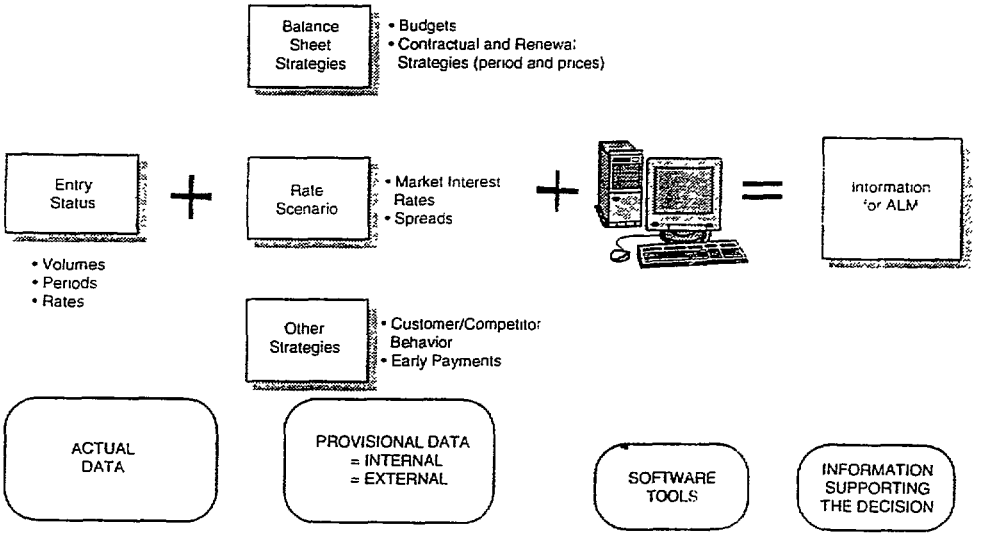
If the underlying process is normal, the empirical distribution must converge to a normal distribution. In this situation, Monte Carlo analysis should yield exactly the same result as the delta-normal method: The VAR estimated from the sample quantile must converge to the value of $\alpha\sigma$. Any deviation must be due to sampling variation.



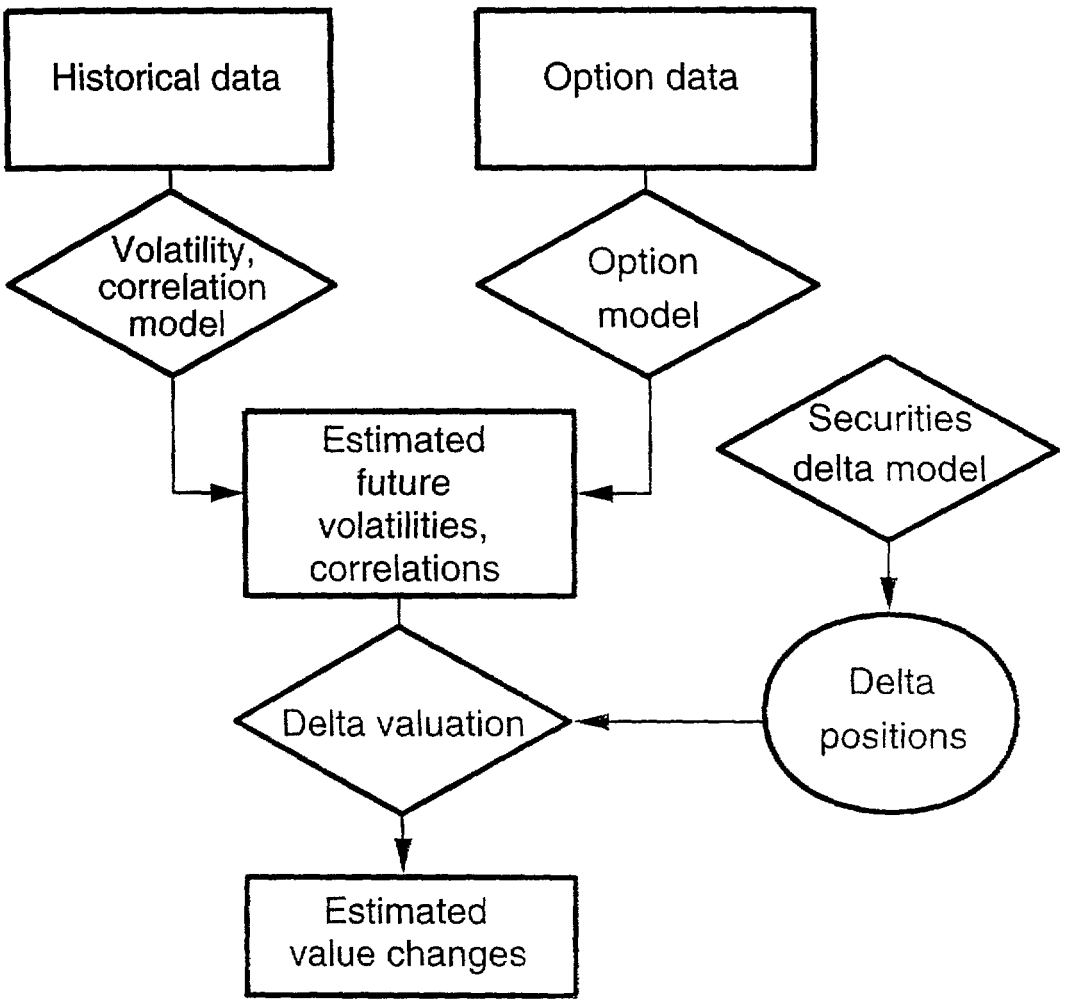
Comparison of Value at Risk to Credit Risk

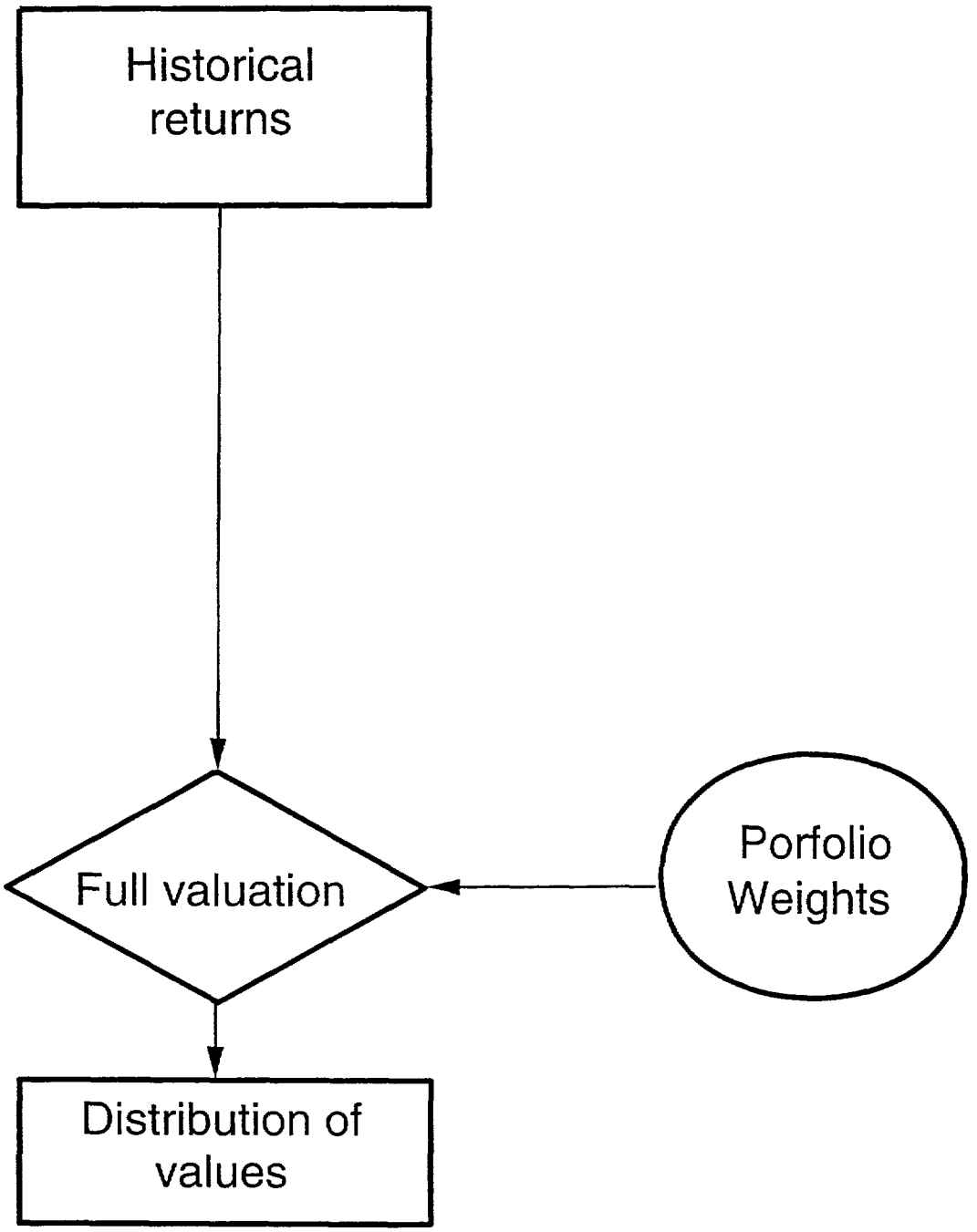
Item	Value at Risk	Credit Risk
Source of risk	Market risk	Market risk and default
Unit to which risk limits apply	Some level of trading organization	Legal entity of counterparty
Time horizon	Short (days)	Potentially long (years)
Legal issues	Not applicable	Very important

Figure 4-1. Simulated Method

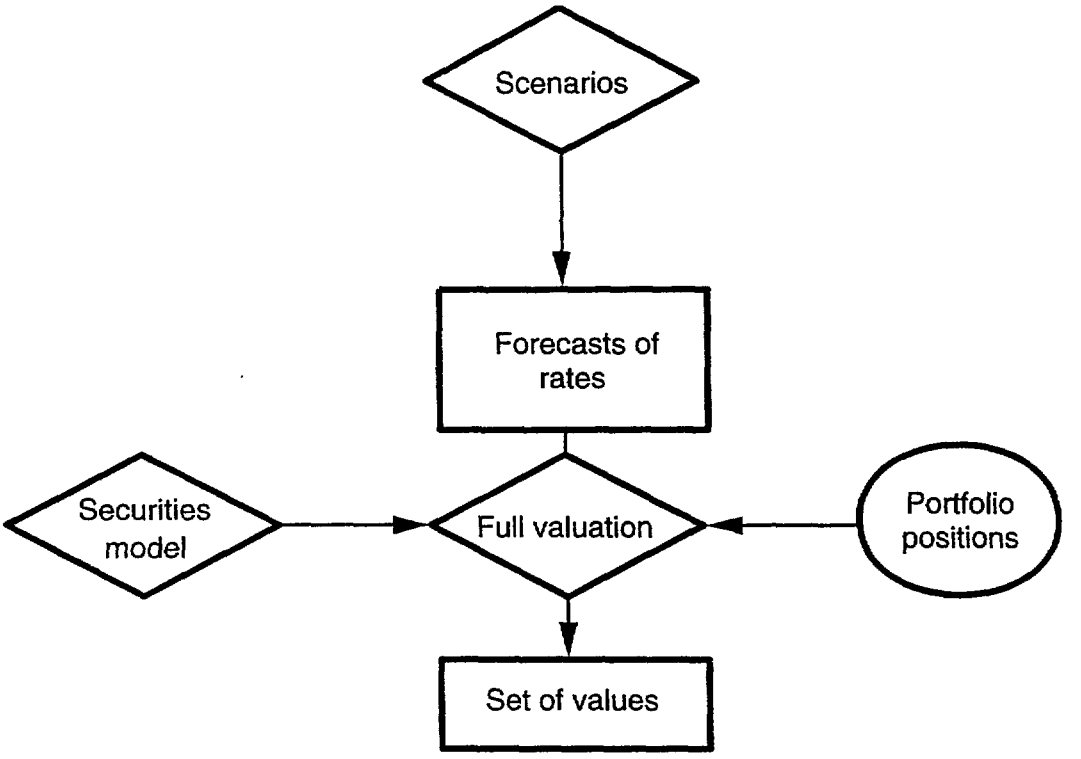


Delta-Normal Method

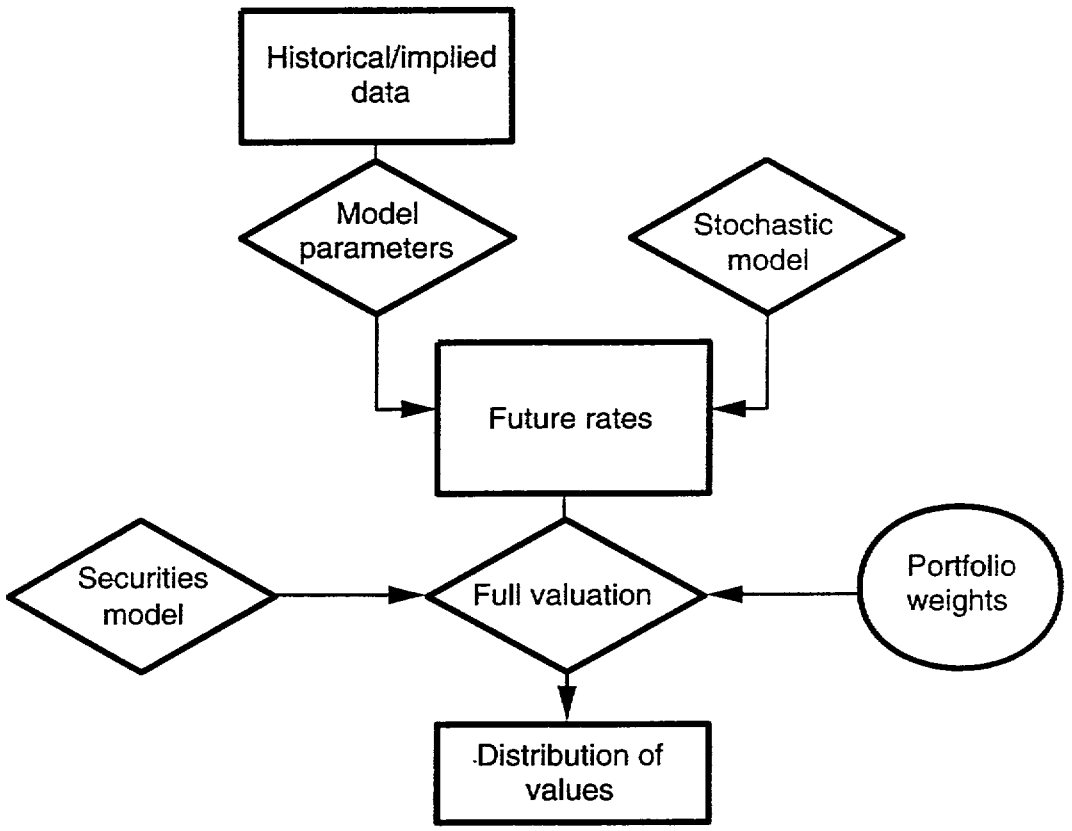



Historical returns
Full valuation
Porfolio Weights
Distribution of values

Stress-Testing Method



Monte Carlo Method



Comparison of Approaches to VAR

	Delta Normal	Historical Simulation	*Scenarios*	
			Stress Testing	**Monte Carlo**
Position				
Valuation	Linear	Full	Full	Full
Nonlinear assets	No	Yes	Yes	Yes
Distribution				
Historical	Normal	Actual	Subjective	Full
Time varying	Yes	No	Subjective	Yes
Implied	Possible	No	Possible	Yes
Market				
Non-normal distribution	No	Yes	Yes	Yes
Measure extreme events	Somewhat	Somewhat	Yes	Possible
Use correlations	Yes	Yes	No	Yes
Implementation				
Avoid model risk	Somewhat	Yes	No	No
Ease of computation	Yes	Somewhat	Somewhat	No
Communicability	Easy	Easy	Good	Difficult
Major pitfalls	Nonlinearities, extreme events	Time variation, extreme events	Wrong guess, correlations	Model risk

Figure 1 **CreditMetrics Components "Road Map"**

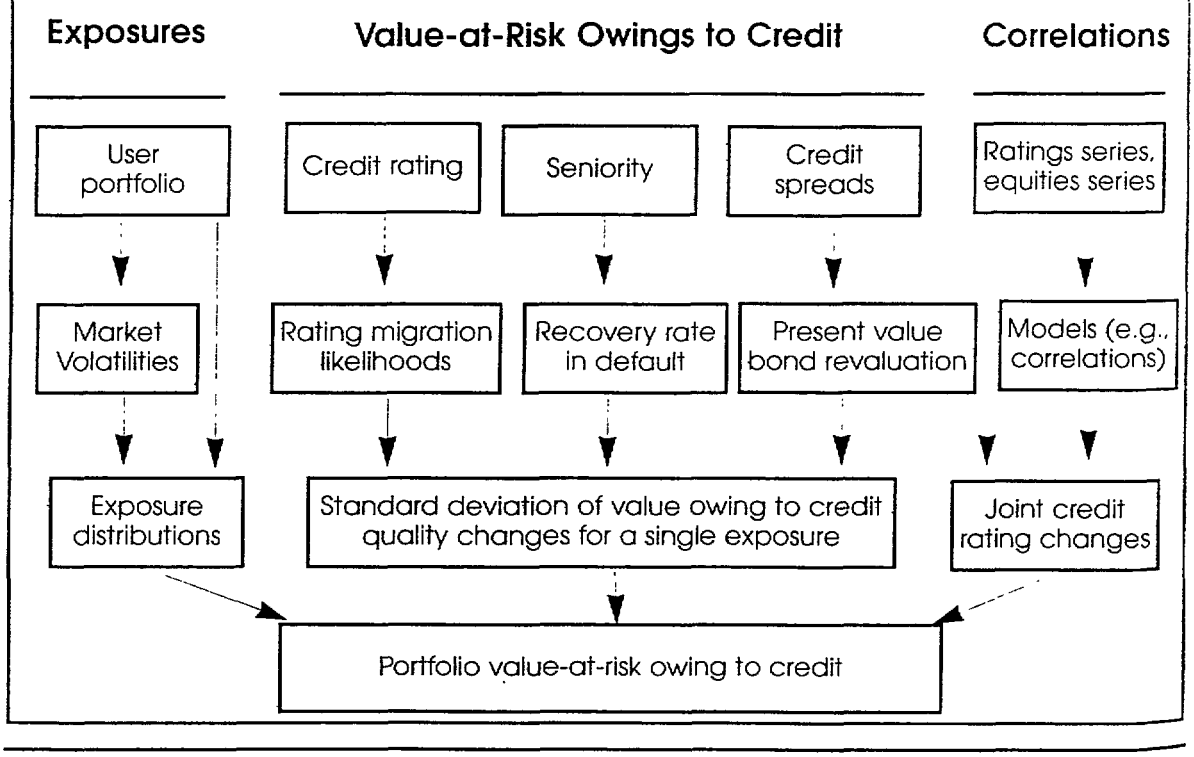


Figure 2

Initial Rating	Rating at Year-End (%)							
	AAA	AA	A	BBB	BB	B	CCC	Default
AAA	90.81	8.33	0.68	0.06	0.12	0	0	0
AA	0.70	90.65	7.79	0.64	0.06	0.14	0.02	0
A	0.09	2.27	91.05	5.52	0.74	0.26	0.01	0.06
BBB	0.02	0.33	5.95	86.93	5.30	1.17	0.12	0.18
BB	0.03	0.14	0.67	7.73	80.53	8.84	1.00	1.06
B	0	0.11	0.24	0.43	6.48	83.46	4.07	5.20
CCC	0.22	0	0.22	1.30	2.38	11.24	64.86	19.79

Source: *CreditWeek*, April 15, 1996, pp. 44-52.

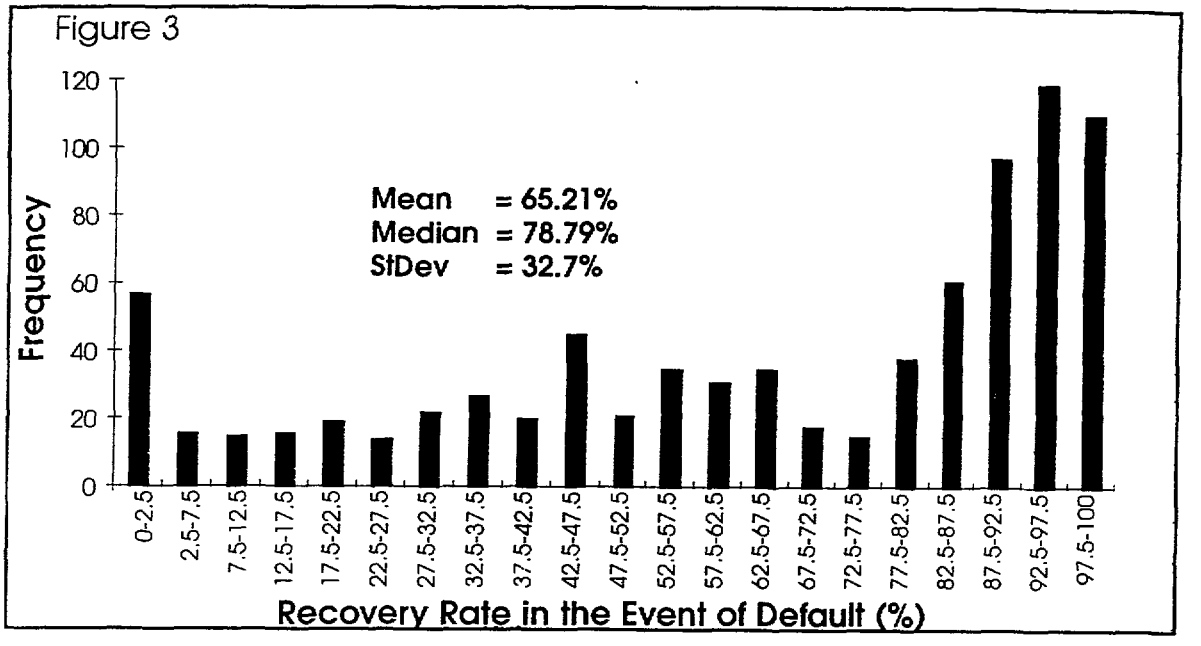


Figure 3
Frequency
120
100
80
60
40
20
0
Mean = 65.21%
Median = 78.79%
StDev = 32.7%
0-2.5
2.5-7.5
7.5-12.5
12.5-17.5
17.5-22.5
22.5-27.5
27.5-32.5
32.5-37.5
37.5-42.5
42.5-47.5
47.5-52.5
52.5-57.5
57.5-62.5
62.5-67.5
67.5-72.5
72.5-77.5
77.5-82.5
82.5-87.5
87.5-92.5
92.5-97.5
97.5-100
Recovery Rate in the Event of Default (%)

Figure 4

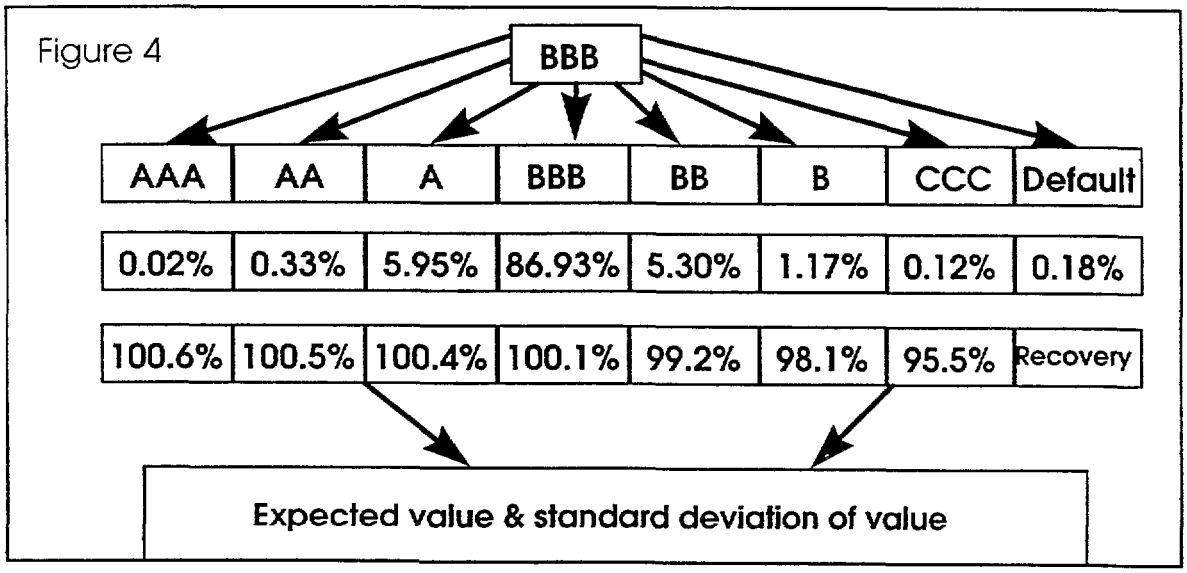

BBB
AAA
AA
A
BBB
BB
B
CCC
Default
0.02%
0.33%
5.95%
86.93%
5.30%
1.17%
0.12%
0.18%
100.6%
100.5%
100.4%
100.1%
99.2%
98.1%
95.5%
Recovery
Expected value & standard deviation of value

Figure 5

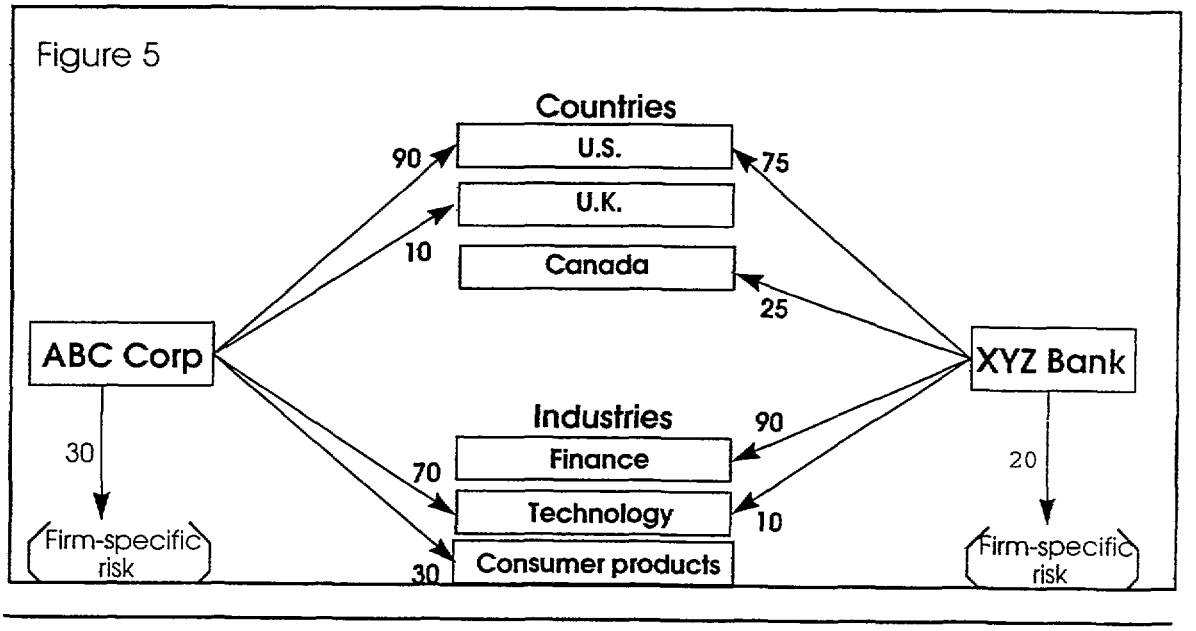
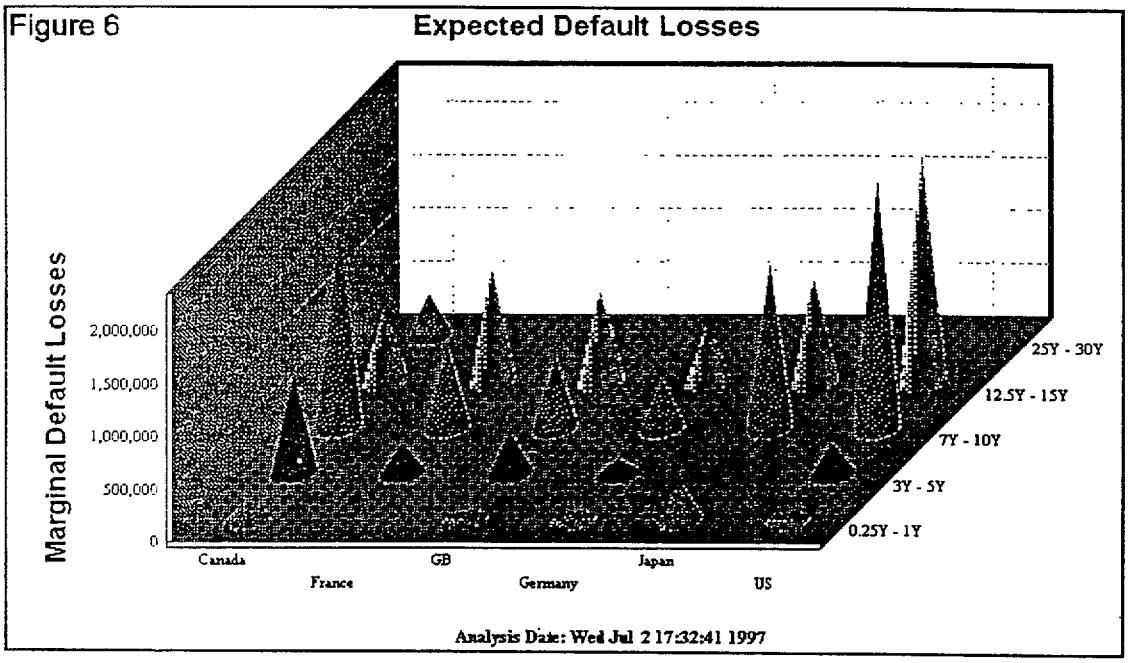

Countries
U.S.
U.K.
Canada
90
10
75
25
ABC Corp
XYZ Bank
Industries
Finance
Technology
Consumer products
90
70
10
30
30
20
Firm-specific risk
Firm-specific risk

Figure 6


Expected Default Losses
Marginal Default Losses
2,000,000
1,500,000
1,000,000
500,000
0
Canada
France
GB
Germany
Japan
US
25Y - 30Y
12.5Y - 15Y
7Y - 10Y
3Y - 5Y
0.25Y - 1Y
Analysis Date: Wed Jul 2 17:32:41 1997

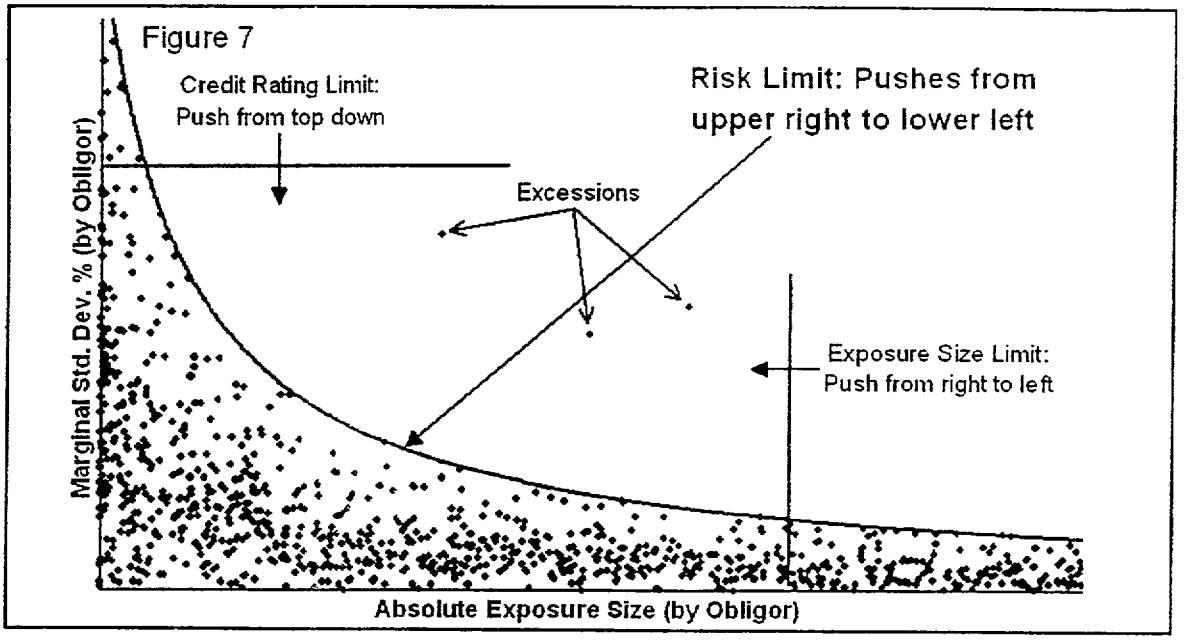


Figure 7
Credit Rating Limit:
Push from top down
Risk Limit: Pushes from
upper right to lower left
Excessions
Exposure Size Limit:
Push from right to left
Marginal Std. Dev. % (by Obligor)
Absolute Exposure Size (by Obligor)

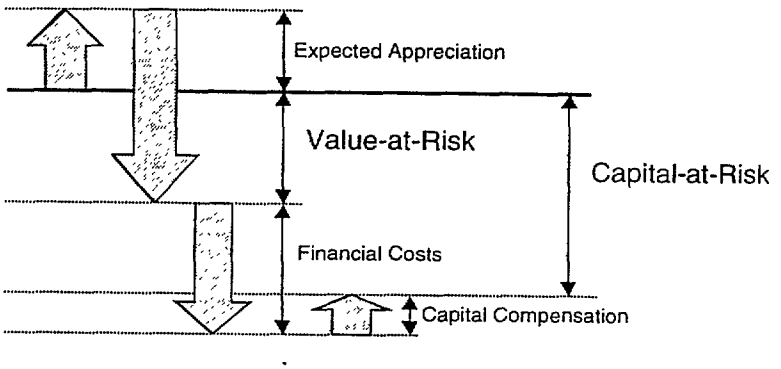
Example:

- $100 Million market value of portfolio assets
- Expected Return = 7%
- Financing Cost = 5%
- Time Horizon: One Year
- Confidence Level = 99.86%
- Maximum Expected Loss = 20%

Thus: $$CAR = \frac{13 + 5}{1.05} = 17.14$$

CAR Calculation:

Value	P&L
107 MM	7 MM
100 MM	0 MM
87 MM	(13 MM)
82.86 MM	(17.14 MM)
82 MM	(18 MM)



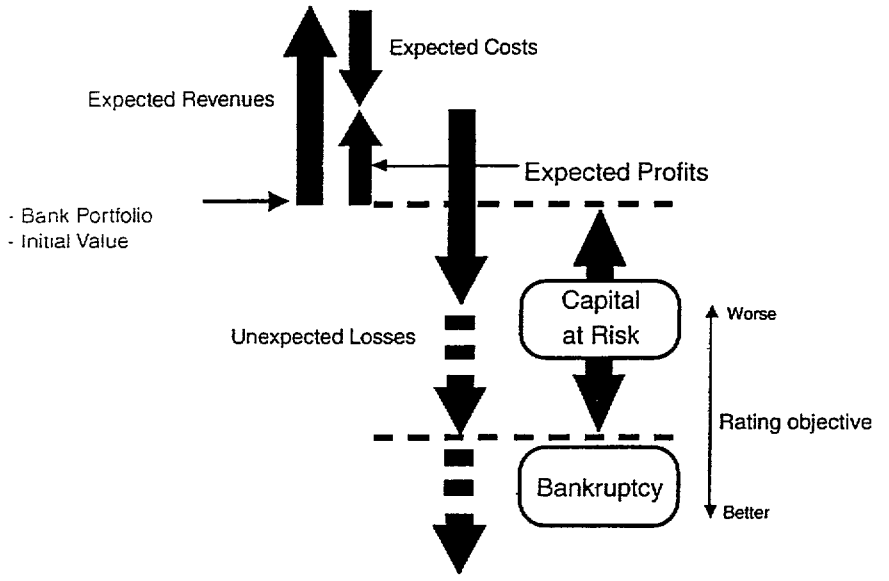
Then to determine RORAC:

Expected Return	=	7.00 Million
Financing Cost	=	(5.00) Million
Capital Compensation	=	0.86 Million (CAR of 17.14 x 5%)
Total	=	2.86 Million

Therefore, RORAC is:

$$RORAC = \frac{2.86}{17.14} \times (1-0.35) = 10.85\%$$

Figure 1-1. Calculation of Capital-at-Risk



- Capital-at-Risk (CAR) = VAR + Financial Assets - Capital Compensation

Where: Capital Compensation = CAR x Risk Free Rate x Time

- Return-on-Risk Adjusted Capital(RORAC) =

$$\frac{\text{Change in Value - Financial Costs + Capital Compensation}}{\text{CAR}}$$

Remarks by Chairman Alan Greenspan:
Distributed to Executive Management

Remarks by Chairman Alan Greenspan

Banking evolution

At the 36th Annual Conference on Bank Structure and Competition of the Federal Reserve Bank of Chicago, Chicago, Illinois

May 4, 2000

The final decades of the twentieth century witnessed remarkable advances in financial engineering, financial innovation, and deregulation. As recently as thirty-five years ago, the universe of financial instruments was composed almost exclusively of deposits; short- and long-term, plain vanilla debt; and equities. Financial institutions, by and large, specialized in relatively narrow portions of these markets. In the intervening years, significant developments in technology and in the pricing of assets have enabled innovations in financial instruments that allow risks to be separated and reallocated to the parties most willing and able to bear them and the degree of specialization by financial intermediaries changed dramatically. In the case of debt instruments, investors may now choose among structured notes, syndicated loans, coupon STRIPs, and bonds secured by pools of other debt instruments. But of all the changes we have observed in the past three decades, two of the most dramatic have been the growing use of financial derivatives and the increasing presence of banks in private equity markets. Today I should like to evaluate the scope of these latter progressions, the risks they entail, and some of the challenges in managing those risks.

It seems undeniable that in recent years the rate of financial innovation has quickened. Many in fact argue that the pace of innovation will increase yet further in the next few years as financial markets increasingly intertwine and facilitate the integration of the new technologies into the world economy. As we stand at the dawn of the twenty-first century, the possible configurations of products and services offered by financial institutions appear limitless. There can be little doubt that these evolving changes in the financial landscape are providing net benefits for the large majority of the American people. The rising share of financial services in the nation's national income in recent years is a measure of the contribution of the newer financial innovations to America's accelerated economic growth. Derivatives and private equities have been in the forefront of the recent financial expansion, fostering the financing of a wider range of activities more efficiently and with improved management and control of the associated risks.

Fear of Change

Nonetheless, some find these developments worrisome or even deeply troubling. The rapid growth and increasing importance of derivative instruments in the risk profile of many large banks has been a particular concern. Yet large losses on over-the-counter derivatives have been few. Derivatives possibly intensified the losses in underlying markets in the liquidity crisis during the third quarter of 1998, but they were scarcely the major players. Credit losses on derivatives spiked but remained well below those experienced on banks' loan

portfolios in that episode.

Derivatives credit exposures, as you all know, are quite small relative to credit exposures in traditional assets, such as banks' loans. In the fourth quarter of last year, for example, banks charged off $141 million of credit losses from derivatives-including options, swaps, futures, and forwards-or only 0.04 percent of their total credit exposure from derivatives. This in part reflects the fact that in some derivative contracts, most notably in interest rate swaps, there is no principal to be exchanged and thus no principal at risk. In comparison, net charge-offs relative to loans were 0.58 percent in that quarter-also small but, nonetheless, almost fifteen times as much. In the third quarter of 1998, at the height of the recent financial turmoil, the loan charge-off rate at U.S. banks was 4½ times that of derivatives.

In a similar vein, concerns of highly leveraged positions caused by derivatives have led to fears of "excessive leverage." But leverage, at least as traditionally measured, is not a particularly useful concept for gauging risk from derivatives. A firm might acquire an interest rate cap, for example, to hedge future interest rate uncertainty and hence to reduce its risk profile. Yet if the cap is financed through debt, measured leverage increases. Thus, although one may harbor concerns about the overall capital adequacy of banks and other participants in derivatives markets and their degree of leverage, the advent of derivatives appears to make measures of leverage more difficult to interpret but not necessarily more risky. To be sure, the unfamiliar complexity of some new financial instruments and new activities, or the extent to which they facilitate other kinds of risk-taking, cannot be readily dismissed even by those of us who view the remarkable expansion of finance in recent years as a significant net benefit.

What I suspect gives particular comfort to those of us most involved with the heightened complexity of modern finance is the impressive role private market discipline plays in these markets. Importantly, derivatives dealers have found that they must maintain strong credit ratings to participate in the market. Participants are simply unwilling to accept counterparty credit exposures to those with low ratings. Besides requiring a strong capital base and high credit ratings, counterparties in recent years have increasingly insisted both on netting of exposures and on daily posting of collateral against credit exposures. U.S. dealers, in particular, have rapidly expanded their use of collateral to mitigate counterparty credit risks. In these programs, counterparties typically agree that, if exposures change over time and one party comes to represent a credit risk to the other, the party posing the credit risk will post collateral to cover some (or all) of the exposure. These programs offer market participants a powerful tool for helping control credit risk, although their use does, as we all know, pose significant legal and operational issues.

Legitimate Concerns

Despite the commendable historical loss record and effective market discipline, there are undoubtedly legitimate concerns and avenues for significant improvement of risk management practices. Moreover, during the recent phenomenal growth of the derivatives market, no significant downturn has occurred in the overall economy to test the resilience of derivatives markets and participants' tools for managing risk. The possibility that market participants are developing a degree of complacency or a feeling that technology has inoculated them against market turbulence is admittedly somewhat disquieting.

Such complacency is not justified. In estimating necessary levels of risk capital, the primary

concern should be to address those disturbances that occasionally do stress institutional solvency-the negative tail of the loss distribution that is so central to modern risk management. As such, the incorporation of stress scenarios into formal risk modeling would seem to be of first-order importance. However, the incipient art of stress testing has yet to find formalization and uniformity across banks and securities dealers. At present most banks pick a small number of *ad hoc* scenarios as their stress tests. And although the results of the stress tests may be given to management, they are, to my knowledge, never entered into the formal risk modeling process.

Additional concern derives from the fact that some forms of risk that we understand to be important, such as liquidity and operational risk, cannot at present be precisely quantified, and some participants do not quantify them at all, effectively assuming them to be zero. Similarly, the present practice of modeling market risk separately from credit risk, a simplification made for expediency, is certainly questionable in times of extraordinary market stress. Under extreme conditions, discontinuous jumps in market valuations raise the specter of insolvency, and market risk becomes indistinct from credit risk.

Of course, at root, effective risk management lies in evaluating the risk models upon which capital allocations and economic decisions are made. Regardless of the resources and effort a bank puts into forecasting its risk profile, it ought not make crucial capital allocation decisions based on those forecasts until their accuracy has been appraised. Yet forecast evaluation, or "backtesting," procedures to date have received surprisingly little attention in both academic circles and private industry.

Quite apart from complacency over risk-modeling systems, we must be careful not to foster an expectation that policymakers will ultimately solve all serious potential problems and disruptions. Such a conviction could lull financial institutions into believing that all severe episodes will be handled by their central bank and hence that their own risk-management systems need not be relied upon. Thus, over-reliance on public policy could lead to destabilizing behavior by market participants that would not otherwise be observed-what economists call moral hazard.

There are many that hold the misperception that some American financial institutions are too big to fail. I can certainly envision that in times of crisis the financial implosion of a large intermediary could exacerbate the situation. Accordingly, the monetary and supervisory authorities would doubtless endeavor to manage an orderly liquidation of the failed entity, including the unwinding of its positions. But shareholders would not be protected, and I would anticipate appropriate discounts or "haircuts" for other than federally guaranteed liabilities.

As we consider potential shortcomings in risk management against the backdrop of an absence of significant credit losses in derivatives, one is compelled to ask: Has the financial system become more stable, or has it simply not been tested?

Probability distributions estimated largely, or exclusively, over cycles that do not include periods of financial stress will underestimate the likelihood of extreme price movements because they fail to capture a secondary peak at the extreme negative tail that reflects the probability of the occurrence of extreme losses. Further, because the experience during crises indicates heightened correlations of price movements, joint distributions estimated

over periods that do not include severe turbulence would inaccurately estimate correlations between asset returns during such episodes. The benefits of diversification will accordingly be overestimated.

Another aspect of the system that may not have been appropriately tested is the set of credit risk modeling systems that have evolved alongside the growth in derivatives. Such models embody procedures for gauging potential future exposure. Prevailing prices will doubtless change in the future, so counterparties must assess whether those contracts with small or even negative current values now have the *potential* to result in large positive market values and, hence, a potential credit loss on default. Do such calculations adequately account for the possibility of prolonged disruptions or recessions? Are assumptions relating exposures to default probabilities sufficiently inclusive? These and other support columns underlying estimation of potential future exposure should continue to be examined under a critical light.

Private Equity Activity

Derivatives, no doubt reflecting their growth, their extensive use in hedging that facilitates additional risk-taking, and their gigantic notional values, continue to be the quintessential image of financial engineering and innovation. But another dramatic change in the activities of banking organizations has received less attention: merchant banking. Indeed, the most dramatic change in the financial landscape that the Gramm-Leach-Bliley Act may have induced is not the combination of banking, securities underwriting, and insurance, but rather the generalized merchant banking powers for financial holding companies. And even this change is really evolutionary for a handful of very large U.S. banking organizations.

By merchant banking, I mean financial equity investment in nonfinancial firms, most often, but not always, in nonpublic companies, with the investor providing both capital and financial expertise to the portfolio company. Such investments are usually held for three to five, but often as long as ten or more, years for subsequent resale to other investors. The recent financial modernization legislation gives banking organizations broad authority to make merchant banking investments but prohibits them from routinely managing the portfolio companies in which they have invested except in extraordinary circumstances for limited periods. In addition, banks' credit extensions to the firms in which their parents or affiliates hold equity are limited by the same section 23 A and B restrictions imposed on bank lending to their affiliates.

Prior to the recent legislation, banking organizations could make only limited types of merchant banking investments, and these were made principally through three vehicles. First, since the late 1950s, banks and bank holding companies have been authorized to operate small business investment companies (SBICs) that can invest in up to half of the equity of an individual *small business*, currently defined by regulation as one with less than about $20 million of pre-investment capital. The aggregate limit of such investments cannot exceed 5 percent of the bank or BHC's capital. Second, Edge corporations, which are primarily subsidiaries of banks but can also be subsidiaries of holding companies, can acquire up to 20 percent of the voting equity and 40 percent of the total equity of nonfinancial companies outside the United States. Finally, BHCs more generally can acquire up to 5 percent of the voting shares and up to 25 percent of the total equity of *any* company without aggregate limit. I have, of course, been referring to equity investments of banking organizations for their own account. BHC's section 20s-and any future investment banking affiliates-also hold equities in trading accounts as part of their underwriting and trading

activities. These daily mark-to-market holdings are quite large at a couple of banking organizations that have a significant equity underwriting business but are rather modest for others.

Through the three long-term holding vehicles, banking organizations have made direct equity investments on their own and in partnership with others. They have also made indirect investments through private investment groups, sometimes acting as the manager of the group for performance-based fees. In the early 1960s, banking organizations were probably the dominant source of venture capital in the United States, and still play an important role-perhaps accounting currently for 10 to 15 percent of the domestic private equity market. What has changed with the recent legislation is the generalized grant of authority for bank holding companies that qualify as financial holding companies to exercise merchant banking powers. There are now about 155 domestic and more than 10 foreign financial holding companies that could-but not necessarily will-undertake merchant banking. Two-thirds of the financial holding companies have less than $500 million in assets; about one-third have less than $150 million.

In evaluating that general grant of merchant banking authority, it is useful to consider the experience of banking organizations that have been active participants in the private equity market in recent decades. To date, there have been no significant problems. To be sure, the record on private equity investment by banks is one of substantial year-to-year variation in return, just as one might expect with any portfolio of risky assets. Some of the deals have resulted in total write-offs, but over all the rates of return, especially in recent years, have been quite impressive-30 percent or so per year in the last five years. In part, perhaps in large part, this reflects the substantial rise in equity prices.

Still another historical factor has been the quite conservative treatment of equity portfolios by banking organizations. Both banks and independent securities firms engaging in merchant banking have tended to allocate substantial *internal* capital to support their private equity investment activity-between 50 and 100 percent-and to recognize unrealized capital gains only on traded equities or when some triggering event supported the revaluation of nontraded shares and then only subject to a discount. In effect, banks have locked up significant internal capital for their equity purchases and have been conservative in recognizing gains in their earning flows and, consequently, in their capital.

For a small number of large banking organizations, equity portfolios are a significant share of their business already. As of year-end 1999, for the five large banking organizations with more than one billion dollars invested, at cost, in equities, these assets accounted for between approximately 10 percent and 25 percent and more of tier-1 capital and between more than 10 percent and 35 percent at carrying value. Moreover, the pre-tax gains recognized last year-either at sale or because of revaluation-accounted for between 5 and 30 percent of pre-tax reported earnings in 1999 at these five banking organizations. In the first quarter of this year, such gains accounted for 16 percent to more than one-half of pre-tax income.

It is likely that authorization of merchant banking powers will lead both to deeper participation by the current large players and to wider merchant banking activity across banking organizations. To limit risks to the bank subsidiary of the financial holding companies and to the insurance fund, the Federal Reserve interim regulations require that

before this activity commences, the organizations establish appropriate internal controls to manage the risks associated with this activity. It must be kept in mind, as I pointed out in other contexts, that most bad commercial loans are made during prolonged periods of prosperity. I suspect that the experience of bank equity investment has been similar. Current interim regulations-which propose for comment a 50 percent capital charge on all nontrade account equities held by banking organizations-should not be viewed separately from the current state of the economy any more than commercial banking should be.

In any event, at those entities with significant merchant banking portfolios, the above average variance in stock prices will doubtless add to the variability of earnings of the overall organization-and hence, one can conclude, to the organization's valuation in the marketplace. There is, indeed, general agreement that the price-earnings ratio of trading banks is lower than that of other banks of the same size, although it has been difficult because of the dynamics of other variables to nail down empirically the appropriate orders of magnitude. And, I suspect, that if the data were readily available, we might be able to demonstrate the same pattern at institutions significantly involved in the private equity market and perhaps even in derivatives trading. Any earnings stream that shows variability has been appropriately discounted. That is not to say that real economic value is not being created for banking organizations, their shareholders, and the economy from what appears to be a greater-and perhaps expanding-flow of venture and other equity capital from banking organizations. But despite the very good record to date in both the derivatives and private equity activities of banking organizations, we all would be remiss if we did not note that there are risks in these activities that, during some periods in the future, will create reduced returns, if not significant overall losses, for individual organizations. However, the same might be said about portfolios of loans-the traditional historical major asset of banks-and one that will continue to dominate the business of most banks for the foreseeable future.

Conclusion

I have noted many times over the years that the purpose of banks and banking organizations is to take risk in order to contribute to, and facilitate the growth, and other needs, of an economy. We must be cautious, however, that we understand the nature of the new risks that have evolved with information innovation technologies and be certain that they are managed in ways that do not undermine this economic role.

Balancing these objectives is no easy task. We need to ensure that strong risk-management systems are in place and that the management of banking organizations use these systems both to enhance their awareness and understanding of the risks knowingly taken and to manage those risks accordingly. But systems are never perfect; mistakes will be made; and tails in loss distributions do represent a reality that sooner or later occurs.

Individual foreign and domestic banking organizations in the past have, from time to time, suffered large losses in the derivatives and private equity markets. We will not be immune from such events in the future. But so long as we recognize the risks and insist on good risk-management system, and so long as supervision moves-as it has-from balance sheet analysis to a review, evaluation, and criticism of risk management systems, economic growth is, I suggest, enhanced by the kinds of financial innovation that technology and deregulation are now producing.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Industrial Finance Corporation of Thailand

Four Day Risk Management Seminar

DAY TWO

CREDIT RISK
&
RELATED CASE STUDIES

May 18th 2000

Presented By

Frederick J. Zoman

Bangkok, Thailand

IFCT
Credit Risk Management Training Seminar

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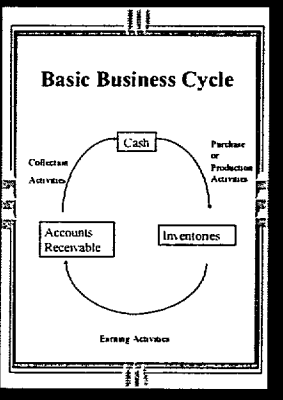
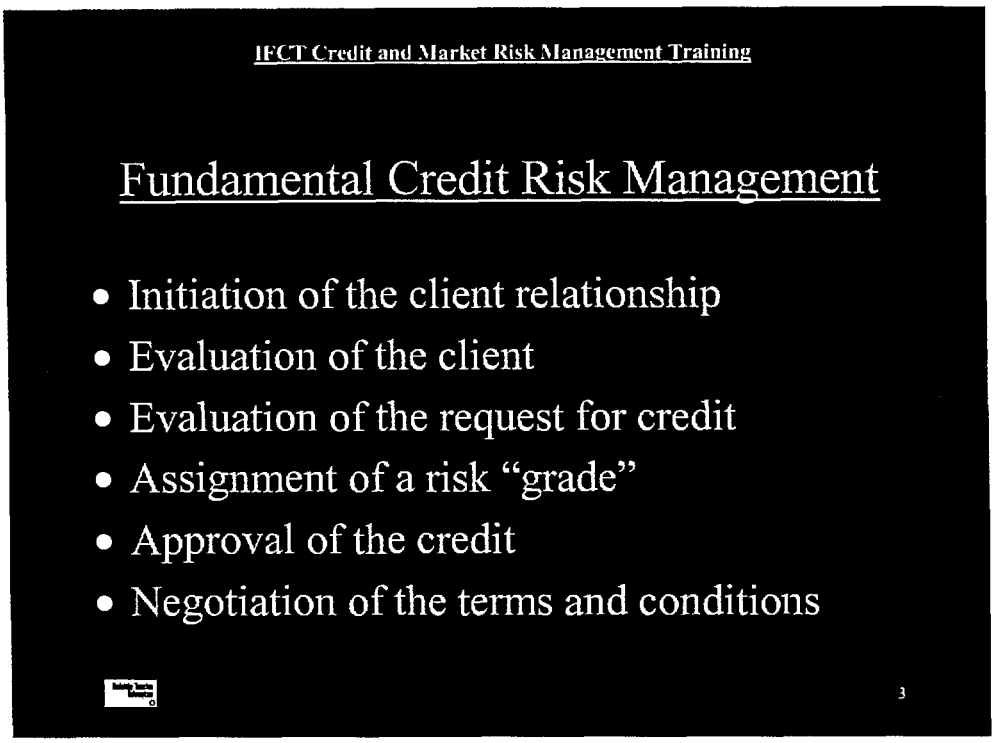
1

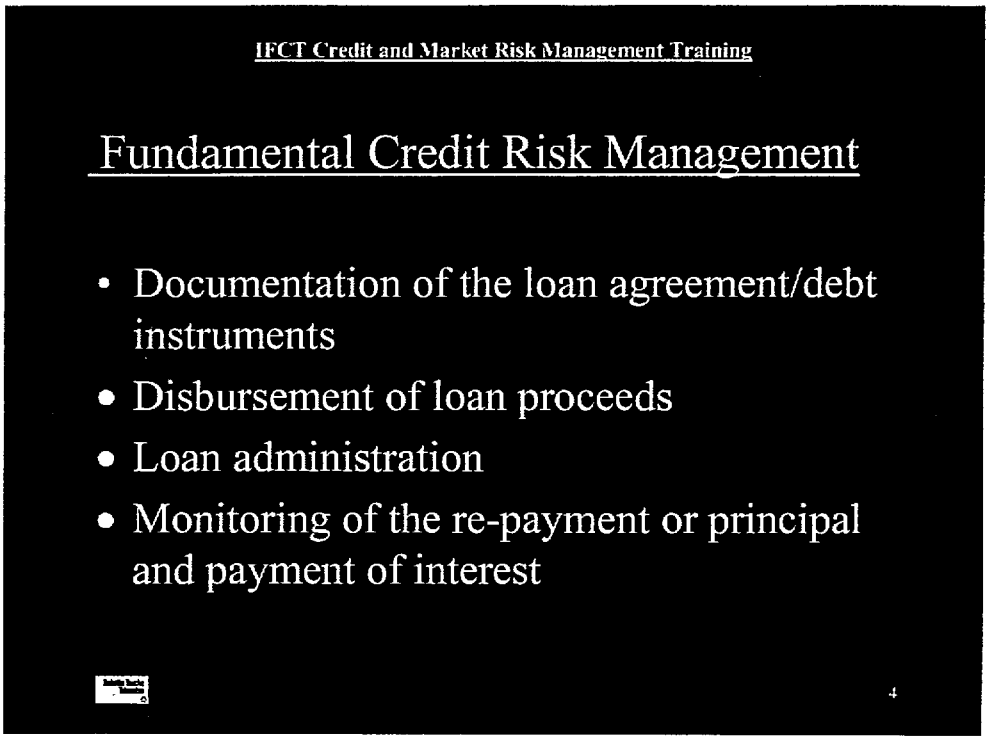
The Conversion Process





The Credit Risk Management System and Criteria for Success

The credit risk management system must balance aggressive loan generation based on the bank's strategic plan against guidelines for prudent risk management. To achieve this balance, lending officers must continually assess the current economic situation and the ever-changing levels of credit risk of each of his/her clients. The "Credit Risk Management System" is really the aggregate of all decisions made by lending officers to extend credit to their clients. Its strength lies in each lending officer's ability to implement an efficient risk rating system. A credit risk management system can only be as successful as the consistent, bank-wide application of the underlying risk rating system. It allows the bank to categorize or "grade" clients by defined risk levels. It is the end-point of the lending process. Every lending office must accept the lending process and risk rating system as his own personal responsibility within the strategic plan of the IFCT. Whether the emphasis is on the analysis of borrower risk or transactional risk, the lending process as described below provides the required tools to be successful in either analysis

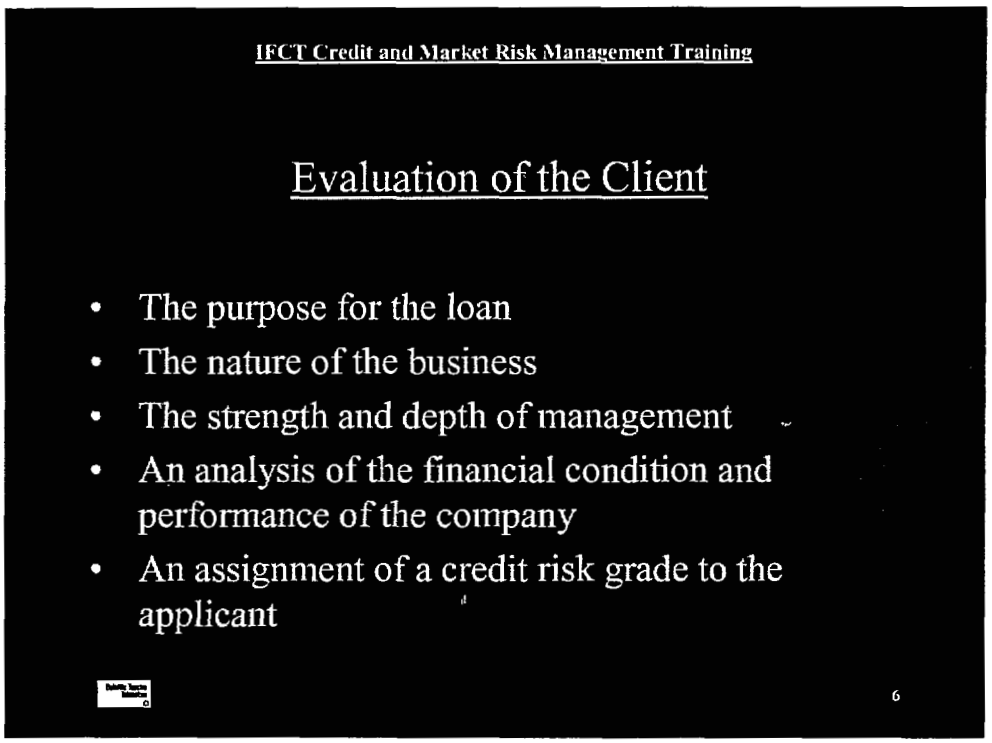


Initiation

A credit application can begin with a request from a client or potential client. It can originate from the successful marketing efforts of the lending officer, or through referral from another client. It is normal to request at least for following from an applicant:

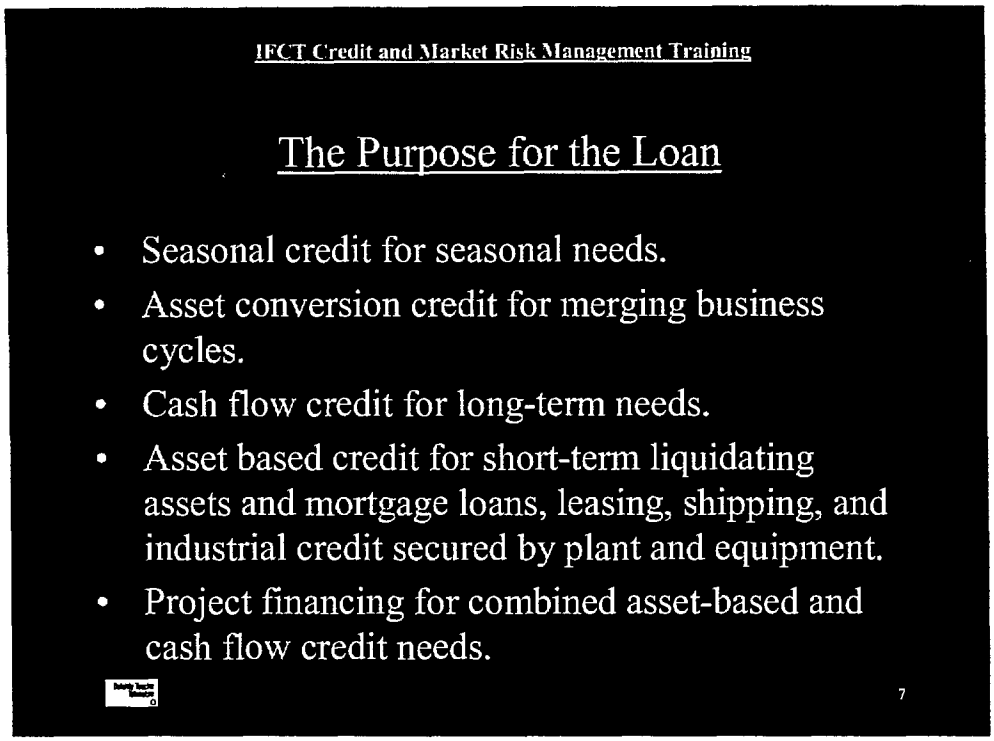
Initiation of the Client Relationship

- Legal evidence of corporate existence, such as a certificate of incorporation, business license, or charter
- Corporate by-laws, outlining signature and borrowing authorities
- Financial statements for three years, or in the case of a new entity, a business plan and financial projections
- Personal financial statements of owners of closely held businesses, and possibly, tax statements
- Business references, especially from other lending institutions



Evaluation

With this information, the lending officer will be able to determine if the applicant meets the bank's risk tolerance criteria. Only after evaluation will the lending officer be able to structure the facility, negotiate its terms, and obtain approval of the required lending officers of the bank



Seasonal credit should be given for seasonal needs. Loans are short-term, usually from 30 to 90 days, and are intended to meet peak requirements in the business cycle. It is usual that an annual "clean up" period is required by the lender. This proves that the borrower is completing his business cycle. Bank financing here is intended to cover the gap that exists between aggregate equity plus supplier credit and the aggregate of inventory and receivables until all receivables are converted to cash.

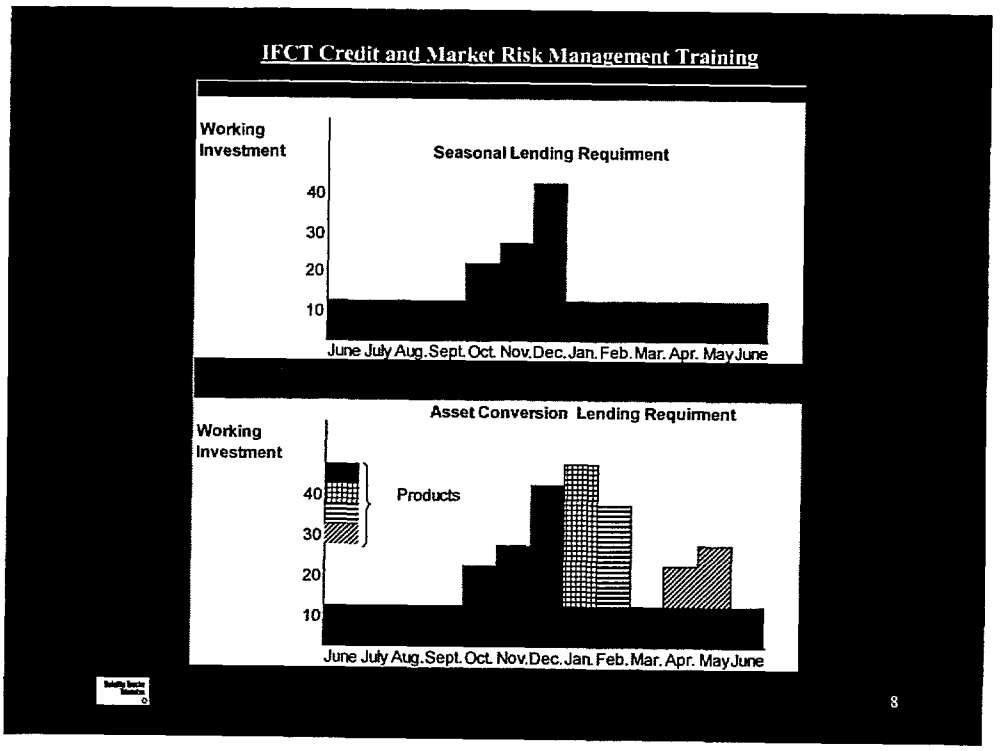
Working Investment = Inv. + Rec. less A/P + Accrued Exp.

Different from Working Capital which is:

Current Assets - Current Liabilities

Asset conversion credit should be given when there is an on-going need to finance the gaps between trade credit and the collection of proceeds from the sale of a company's manufactured goods. These loans are usually provided under a short-term line of credit where outstanding loans under the line rise and fall as the borrower's credit needs require. Unlike seasonal credit, the normal business cycle may be hard to identify, or, an overlapping of cycles requires the need for bank financing. The lender may or may not require a "clean up" period. A rapid growth, beyond what equity alone will support, is a common cause for legitimate asset conversion credit.

Cash flow credit should be given for long-term needs. It is common to provide


IFCT Credit and Market Risk Management Training
Working Investment
Seasonal Lending Requirment
40
30
20
10
June July Aug. Sept. Oct. Nov. Dec. Jan. Feb. Mar. Apr. May June
Asset Conversion Lending Requirment
Working Investment
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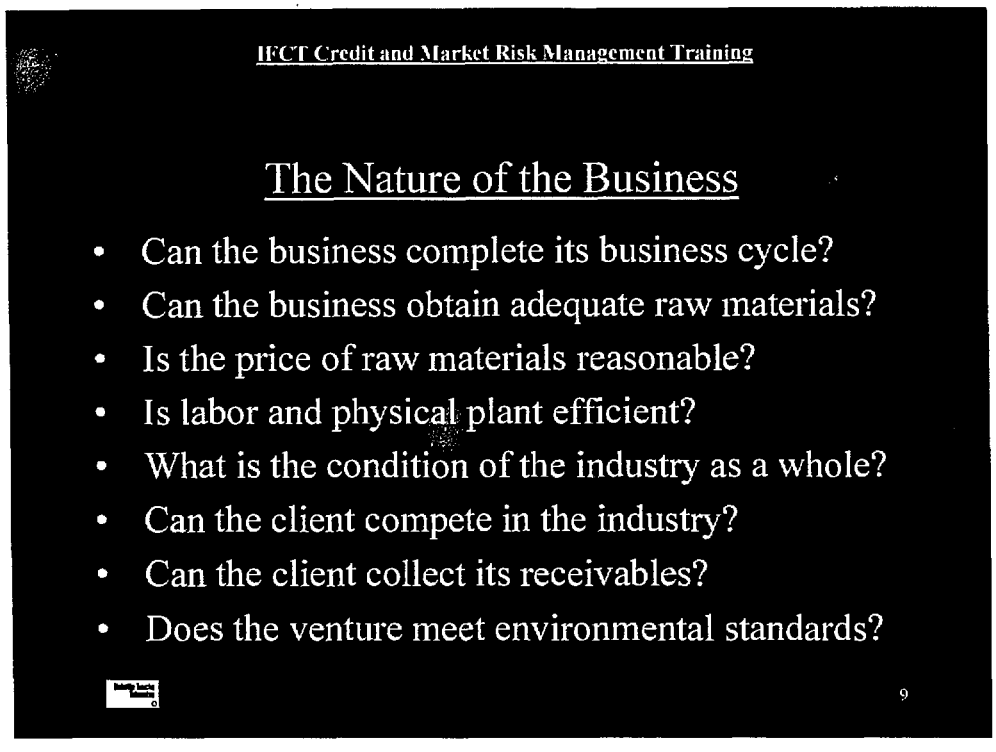
8



Thorough evaluation of inventory and receivables should include an analysis and comparison over time of days-on-hand, the quality of inventory and a schedule of aging of receivables.

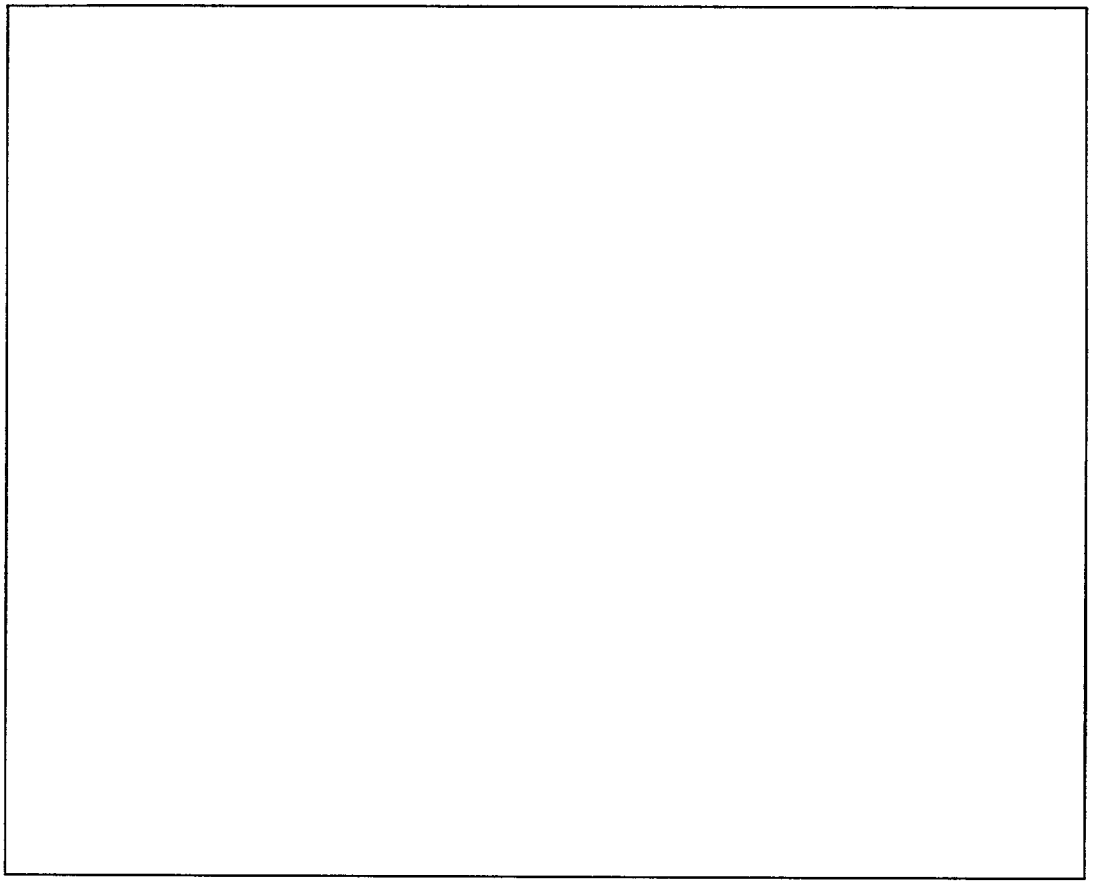
Trade accounts payable, accrued expenses, and other current liabilities should be analyzed and understood. Comparison should be made with similar firms in the same industry.

Project analysis must include a longer term analysis of cash flows from the time the project comes on stream, engineering, and the state of the technology. Especially where that technology will be when the project is finally completed.

Examine the nuclear power industry as a case in point.

The Strength and Depth of Management

- Is management skilled in the business and industry?
- Does management have a reputation for keeping their commitments?
- What is their ownership interest in the business?
- What financial assets do they contribute to the structure of the credit?

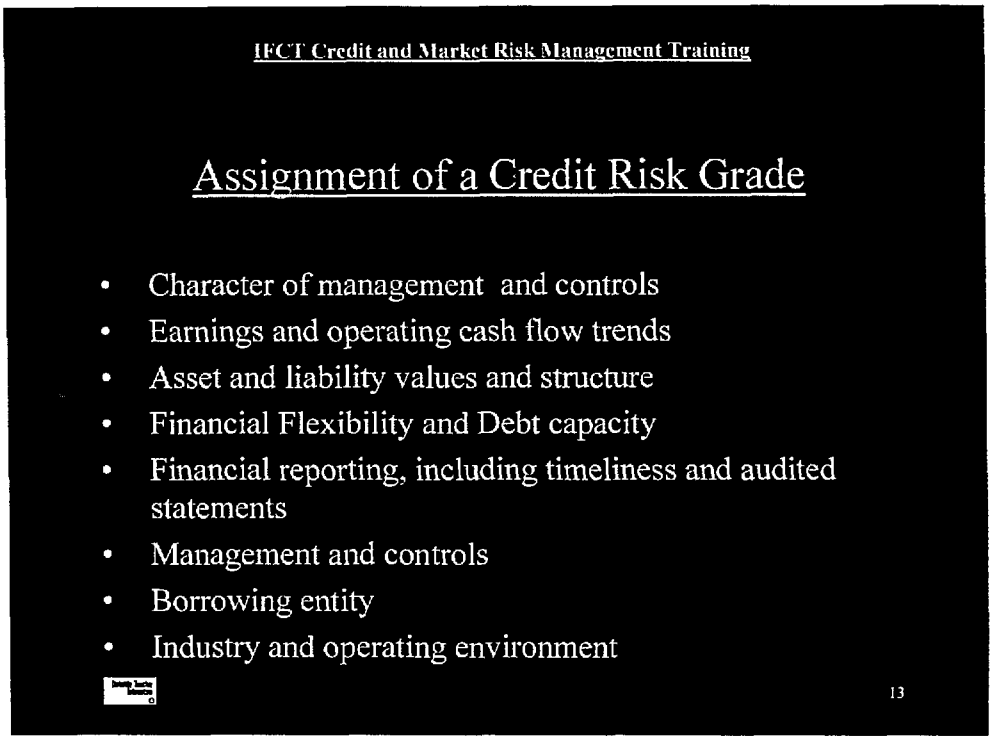


An Analysis of Financial Condition & Performance

- Is there acceptable history of financial information?
- Do items on the balance sheet as a percent of total assets compare favorably with the balance sheet items as a percent of total assets of other companies in the same general business? ("common size" data)
- Does the company show positive financial trends?
- Does historical analysis show completed conversion cycles?

An Analysis of Financial Condition & Performance

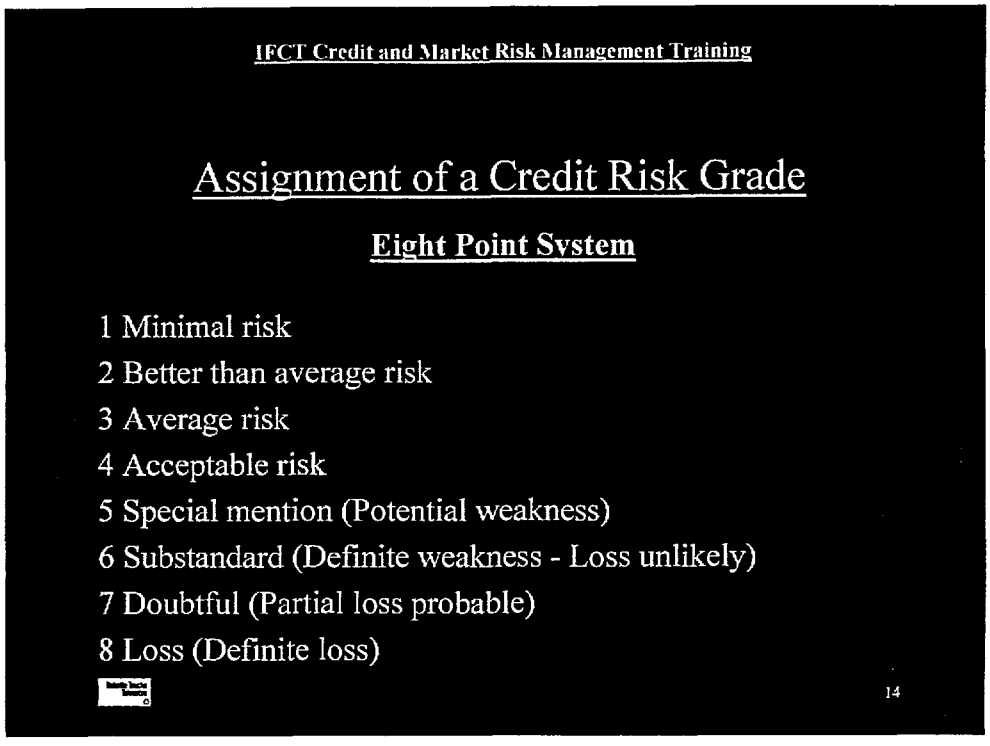
- Do performance ratios compare favorably with peer companies and industry analysis? These ratios include, but are not limited to:
  - inventory, receivables, accrued expenses, days-on-hand
  - gross profit margin
  - net profit margin
  - returns as a percent of sales
  - operating expense as a percent of sales and/or net income
  - return on equity
  - return on assets



Credit Risk Rating System

As previously mentioned, a credit risk management system is only as good as the underlying credit risk rating that supports it. Such a system provides the lending officer with the tools necessary to monitor the changing fortunes of his clients. The key is having sufficient "pass" categories of risk to allow timely detection of credit deterioration before it is too late to take correcting action. The credit risk rating system must include and extend beyond regulatory requirements.

The Credit Risk-Rating System is a two step process. First the borrower is graded "The borrower grade is a conceptual too. It is the mechanism within the risk-rating process used to determine the risk of a particular borrower. It is the benchmark used as a basis for determining the risk rating. The borrower grade is, in effect, the risk of an unsecured line of credit to the borrower. Simply stated, the borrower grade is used as a base in determining the risk rating." The second step is to adjust the borrower grade for the risk associated with the specific transaction.



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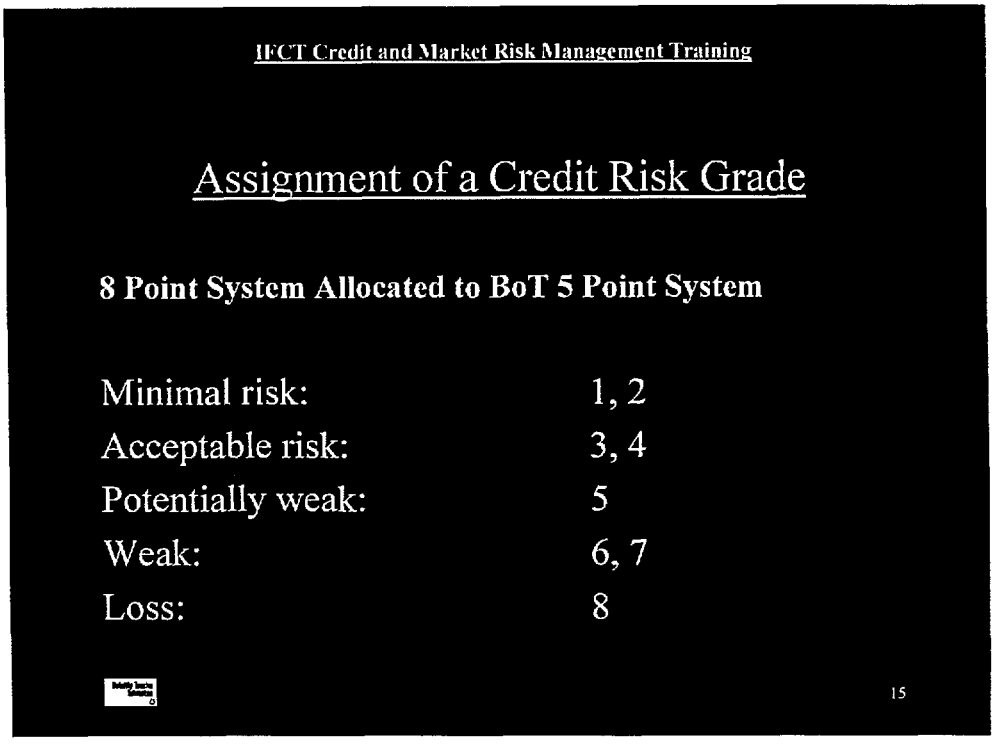

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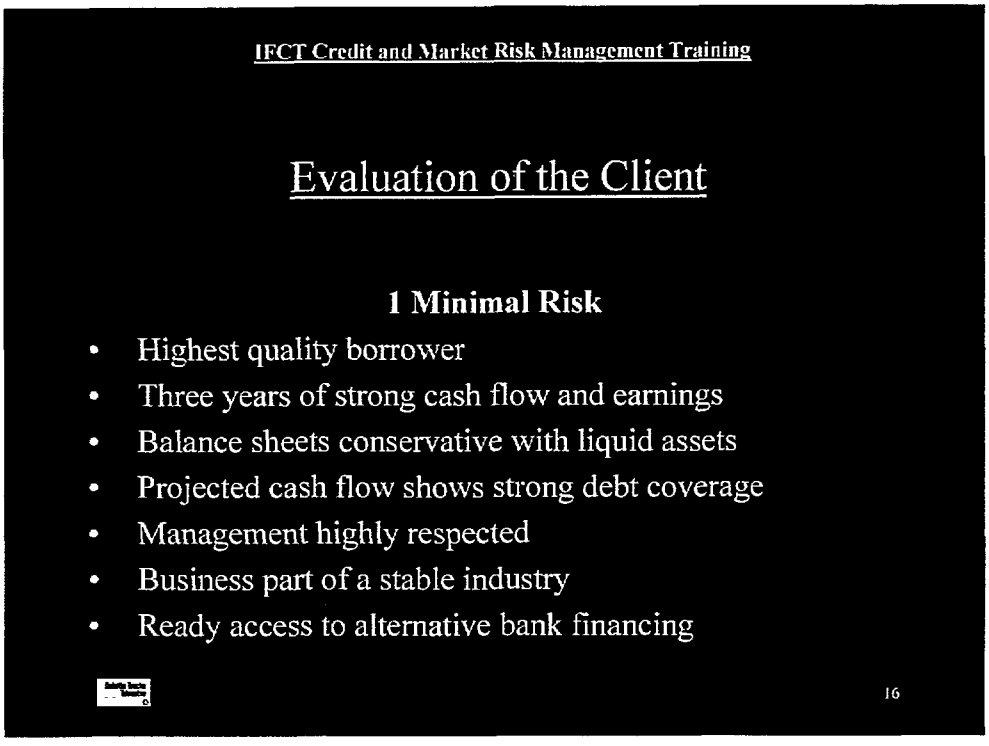


All borrowers can experience a decline in performance. The grades above are intended to identify any such declines that would increase the lender's potential loss. This decline could be caused by factors internal or external to the company. Internal decline will be reflected in the process of analyzing the company's financial statements.

In addition, all companies may be vulnerable to the following external factors:

The potential for an increase in cost of operations without corresponding increases in gross revenue.

External factors that affect these costs include price levels of key input commodities such as energy, agricultural goods, imported raw materials, interest rates, and many other inputs.

The appearance of competitors with advantages, such as a cheaper source of raw materials unavailable to the company.

Sudden changes in legislation or regulation in the market that change price or cost structures, business licenses, and import/export regulations.

Rapid technological change, such as that experienced in the pharmaceutical industry, the computer industry, or bioengineering industry.

Changes in fashion or fad, such as in the garment industry, music, television, and toy industries.

Adverse changes in political events, natural disasters, and wars.

Reliance on a very few customers for the majority of its revenues.

Evaluation of the Client

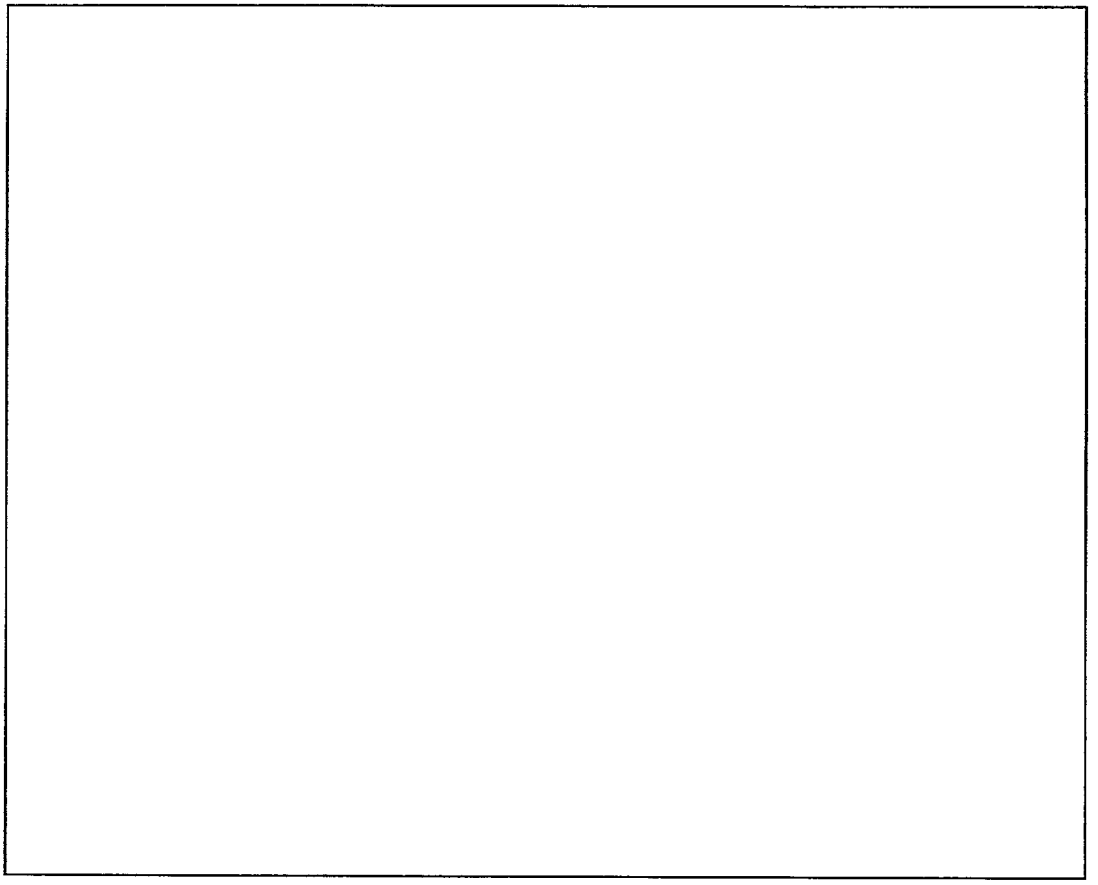
2 Better than Average Risk

- Modest degree of risk
- Reasonable stability of margins and cash flows
- Reasonable balance sheet liquidity
- Diversity of assets
- Strong management
- Reasonable access to alternative bank financing at favorable rates and terms

Evaluation of the Client

3 Average Risk

- Smaller margins and cash flows
- Smaller but adequate debt service capabilities
- Satisfactory asset quality and liquidity
- Good management in critical positions
- Limited access to alternative bank financing at favorable rates and terms
- Occasional loss year, but with financial strength to overcome adversity



Evaluation of the Client

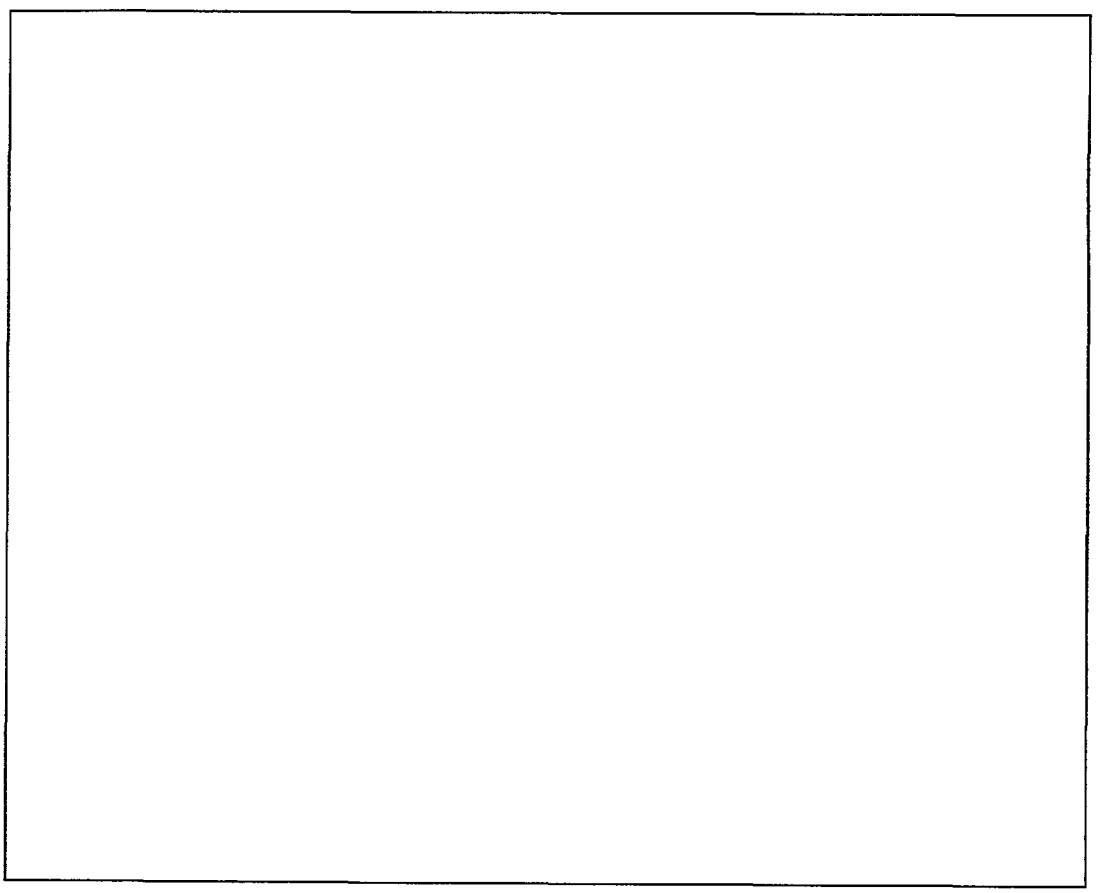
4 Acceptable Risk

- Declining earnings and strained cash flows
- Weakening market fundamentals and increasing leverage
- Limited debt capacity
- Management of good character, but exhibit lack of depth
- Limited access to alternative bank financing at higher rates and less terms
- Vulnerable to adverse market trends and/or in declining industry

Evaluation of the Client

5 Special Mention (Potential Weakness)

- Exhibit downward trends in margins and cash flows
- Potential for weakening of debt service capability
- Some elements of asset quality weak
- Management weak in some areas with no depth
- Difficult to obtain alternative bank financing
- Regulators would grade as "special mention"



Evaluation of the Client

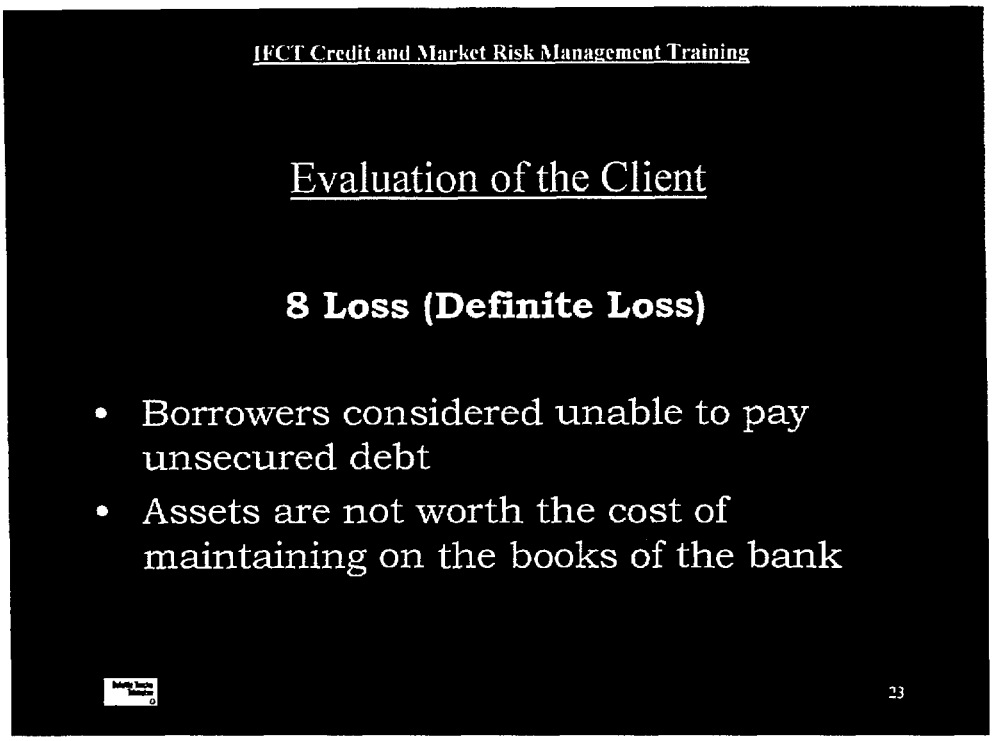
6. Substandard (Definite Weakness - Loss Unlikely)

- Exhibit well-defined weaknesses that threaten orderly liquidation of debt
- Inadequate equity or collateral coverage of debt
- Assets in aggregate considered substandard, but individually may be of higher quality
- Management skills questionable with identifiable weaknesses
- Regulatory authorities would rate firm "substandard"

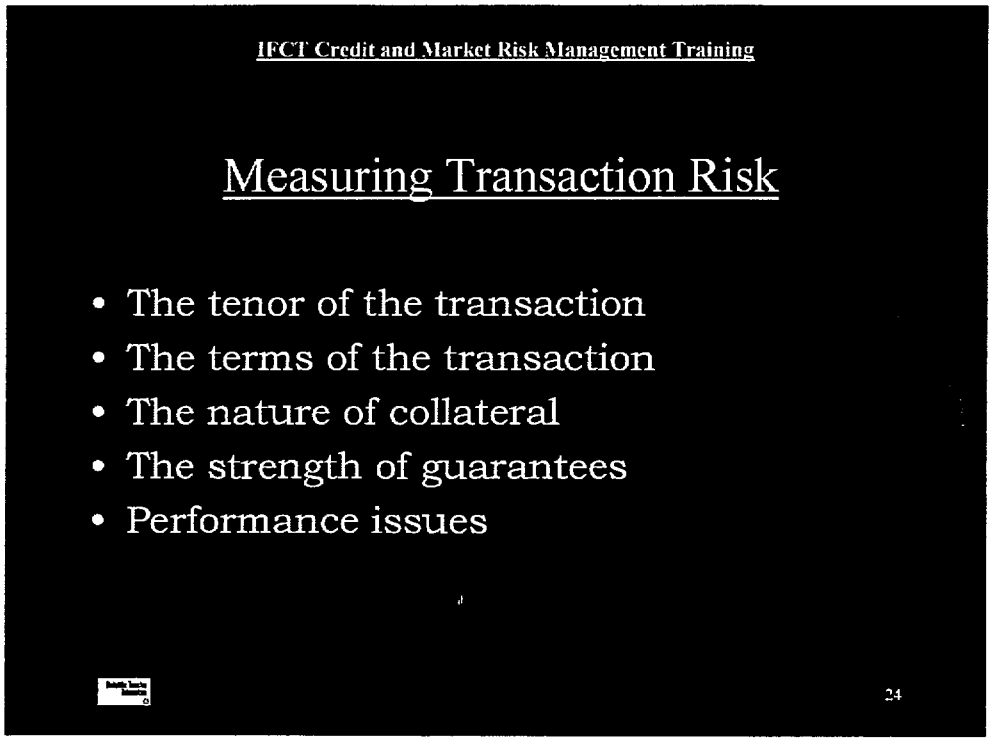
Evaluation of the Client

7 Doubtful (Partial Loss Probable)

- Exhibit all characteristics of substandard credits with added fact that collection of debt in full is questionable and improbable
- Only external factors can contribute to collection, such as liquidating collateral, calling guarantees, or liquidating assets pledged by others (hypothecated collateral)
- Management considered dishonest and/or undependable
- Provision for charge-off should be made
- Regulatory authorities would rate "Doubtful"



Once a borrower is graded, then the grade can adjusted for the nature of the transaction being considered by the bank. This adjustment will result in a final risk rating. The rating will still be in the 8 categories above. The difference will be that the nature of the transaction will affect the rating up or down or leave it unchanged.



These risks can then be applied to the grade above. A matrix for such a comparison is presented on the following slide. It is important to note that the nature of a transaction can move a risk rating more than a single grade. For a transaction in a business unrelated to the experience of management, or history of the company, the risk rating may even make the rating unacceptable, even for a minimal risk borrower.

For those institutions whose borrowers are heavily transaction oriented, measuring these factors are even more important. Collateral control, third party guarantees, the tenor, and covenants should be designed to strengthen the transaction in every case. The reason for this is that in transaction based lending, a failure in the primary purpose of the loan, the transaction, will either prevent completion of the business cycle or prevent the transaction from generating the cash flow required to repay the principal and interest of the loan.

In addition, all of the evaluative factors used to rate a borrower will take on added importance. Management's abilities and strength of character and the strength of the industry will have to compensate for the lack of an equity cushion or cash flows from other on-going business cycles. A strong asset and liquidity position may not be available to protect the lender. In this case, measuring risk will take special attention to assets that are

Transaction Risk

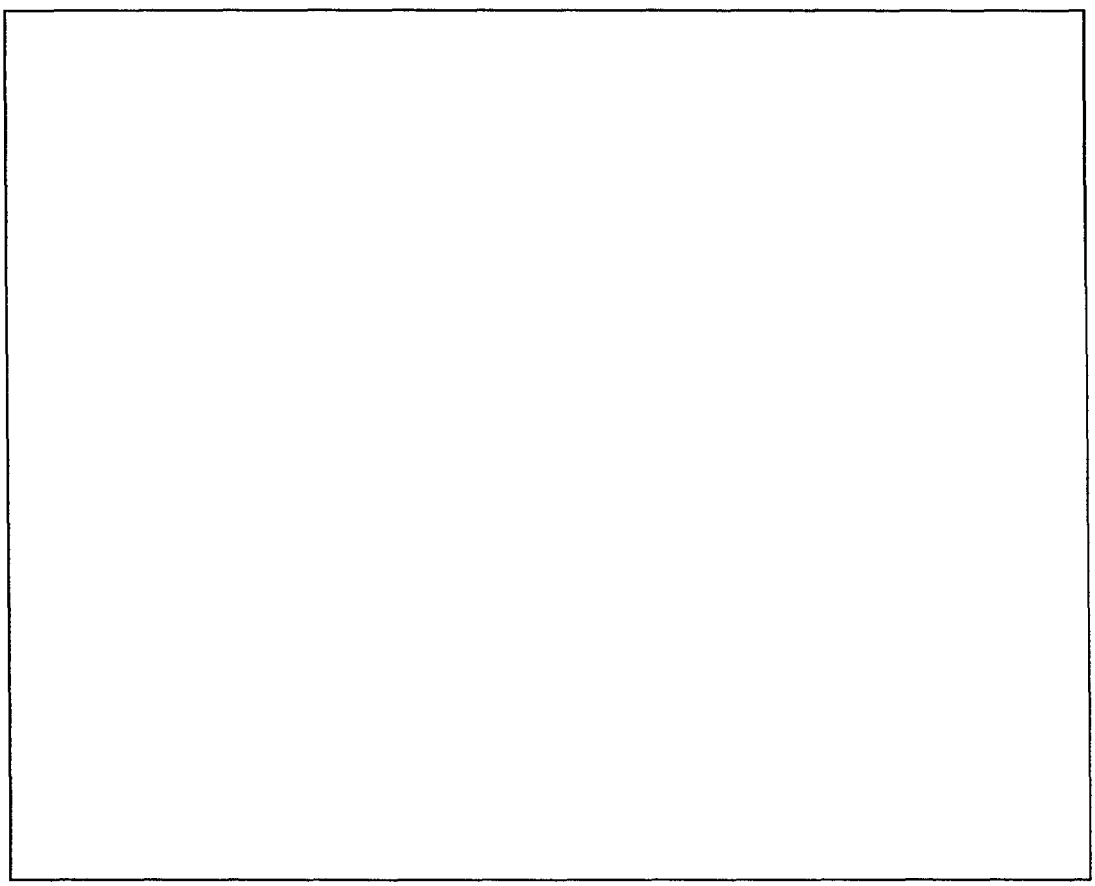
Impact on Borrower Grade	DETERMINANTS			
	Collateral Quality and Control	Guarantees/Third-Party Support	Tenor	Terms/Documentation
Strongly Improves	Cash, cash equivalents, government securities, or properly margined highly diversified readily marketable securities, traded on major exchanges, held by bank in vault. Highest quality or highly diversified accounts receivable. Highly conveyable multi-use	Guarantor rating significantly better than borrower grade Unconditional coverage in full for any and all obligor's indebtedness Covers all economic and political risks, if applicable	Overnight loans to 30 days.	Conditions that result in quick calling of loan principal ("triggers"), such that the tenor is reduced.
Improves	Value is certain with moderate volatility, and the value of the collateral provides a margin over the supported obligation. Collateral of average liquidity Accounts receivable with good turnover and modest concentrations Raw materials or finished inven	Guarantor rating better than borrower grade. Coverage conditional, yet intended to cover all obligor's indebtedness under all economic and political risks.	Short-term loans less than one year	Covenants require action before problems are substantial
Neutral	Value highly difficult to determine or highly volatile. Value provides a minimal margin over supported obligation. Collateral with poor liquidity where liquidation erodes value Real estate with specialized use or poor location. Useful life of collateral	Coverage is very conditional and does not cover all the obligor's indebtedness under all economic and political risks Guarantor vulnerable to decline in its performance	1 to 3 years and fully amortizing, that is, no balloon payments.	All needed documents are sustainable, perfected, and uncontestable Loan agreement workable and covenants are appropriate Reasonable covenants for advance notice of potential problems.
Detracts	Not Applicable Collateral does not detract from borrower grade	Guarantor or owner with substantial financial weakness.	4 to 7 years and fully amortizing.	Weak loan agreements without proper covenants or triggers Significant assets pledged to other creditors effectively subordinating the bank's position.
Strongly Detracts	Not Applicable Collateral does not detract from borrower grade	Guarantor or owner with substantial financial weakness	8 years and beyond	Bank subordinate to other creditor claims. Highly generalized documents make perfection, quality, and sustainability of bank's claims highly questionable.

Negotiation

- Tenor matches the purpose of the loan.
- Repayment conditions match the purpose of the loan and the nature of the transaction.
- A checklist exists for receiving progress reports and financial statements to monitor the transaction and the financial condition of the firm.
- Security is appropriately identified, and the bank's interest in any security is documented.
- Other covenants that provide cross-conditions of default, negative pledges, etc.

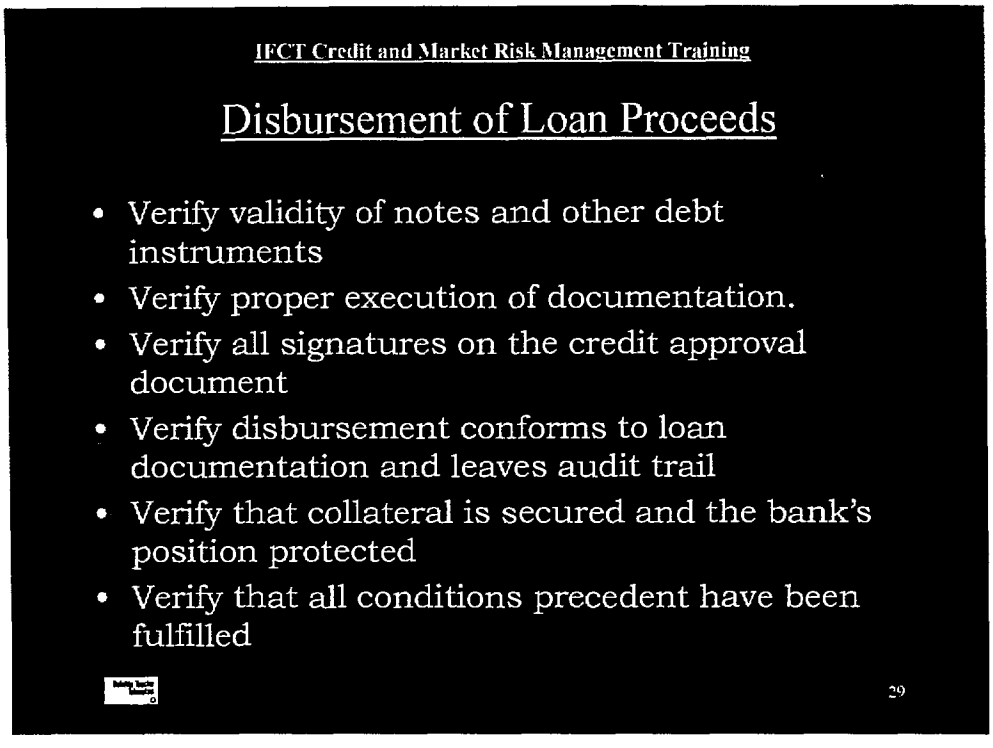
Approval

- Special country analysts and economists
- Industry lending specialists
- Project engineers, and finally,
- Appropriate senior lending officers.



Documentation of the Loan Agreement/Debt Instruments

- Drafting of legal documents
- Review of all documents
- Verification and validation of collateral, endorsements, guarantees
- Waiver of terms in the agreement to accommodate potential violations of other credit agreements
- Verification of all signatures on the credit application



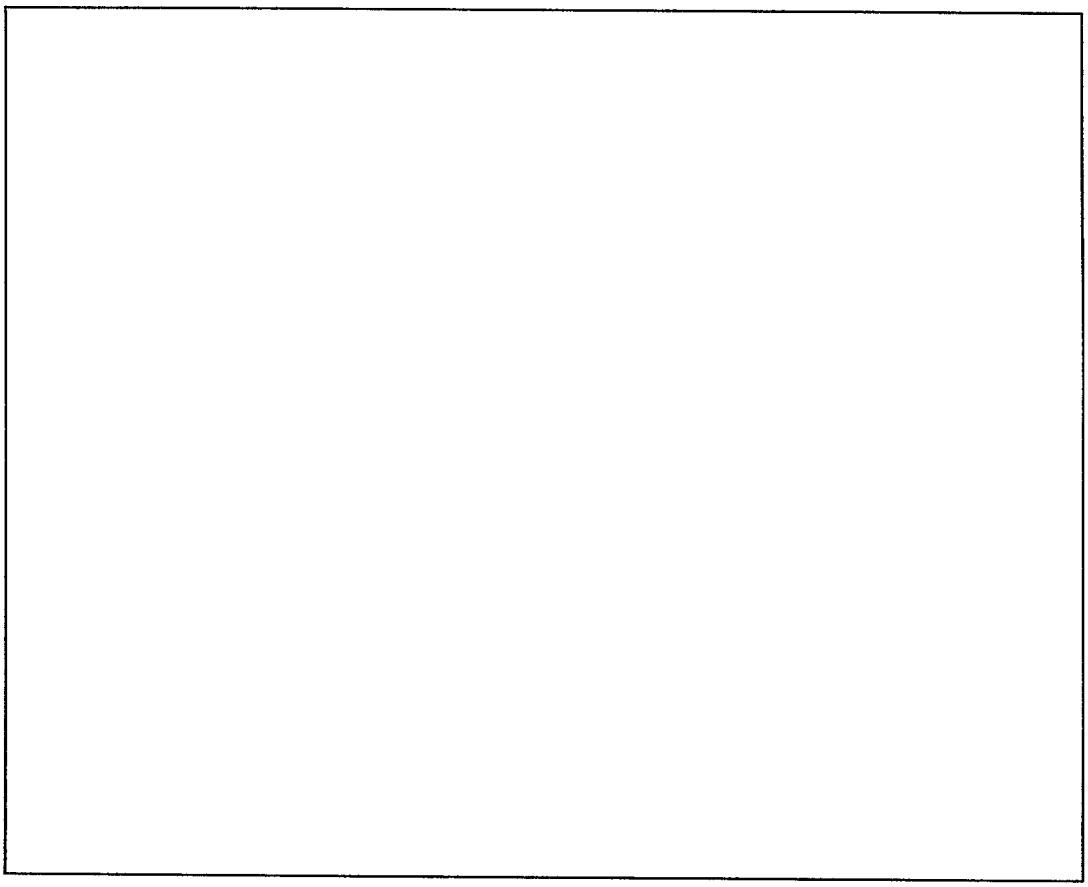
Disbursement of loan proceeds will occur when the loan administration unit receives authorization to disburse form the lending officer and verification that all relevant documents are in hand and officially signed, all collateral has been received or registered in the bank's name.

Loan Administration

- Administration of credit agreement
- Timely receipt and analysis of financial figures
- Compliance with covenants
- Maintenance of collateral

Monitoring of the Re-payment of Principal and Payment of Interest

- Receipt of timely payment of interest
- Receipt of timely re-payment of principal
- Reporting of late payments
- Aging of portfolio
- Reporting on non-performing loans



Loan Work-out Activities

- Early recognition through risk rating system.
- Coordinated management of:
- Collection strategy
- Re-negotiation of terms and conditions of the credit
- Collection efforts
- Legal efforts
- Reorganization of the borrower

IFCT Credit and Market Risk Management Training

RATIOS										
Current Ratio	1.32	1.18	1.55	1.89	1.67					
Quick Ratio	0.94	0.74	0.90	1.21	1.08					
Ratio - C.A to Total Liabilities	0.82	0.72	0.76	0.75	0.63					
Ratio - Total Liabs to Tangible N.W.	1.13	1.39	1.23	1.18	1.42					
Ratio - NWI to Sales	0.09	0.08	0.10	0.08	0.07					
						COMMON SIZE				
BALANCE SHEETS	1994	1995	1996	1997	1998	1994	1995	1996	1997	1998
ASSETS										
Cash	10,000	8,000	7,500	7,000	5,000	5%	5%	5%	5%	4%
Short-term Investments										
Receivables	35,500	32,000	29,000	25,600	22,000	19%	19%	18%	18%	17%
Prepayments	6,400	5,300	3,000	5,000	4,500	3%	3%	2%	3%	3%
Inventory	30,000	27,000	28,500	21,000	17,000	16%	16%	18%	15%	13%
Taxation										
CURRENT ASSETS	81,900	72,300	68,000	58,600	48,500	44%	42%	42%	41%	37%
Land,Buildings & Equipment	136,900	128,700	115,000	100,000	95,000	73%	75%	71%	69%	72%
(Accumulated Depreciation)	(31,500)	(28,700)	(22,000)	(14,400)	(12,000)	-17%	-17%	-14%	-10%	-9%
FIXED ASSETS	105,400	100,000	93,000	85,600	83,000	56%	58%	58%	59%	63%
Investments										
Sundry Receivables										
Intangibles										
TOTAL ASSETS	187,300	172,300	161,000	144,200	131,500	100%	100%	100%	100%	100%

IFCT Credit and Market Risk Management Training

LIABILITIES	1994	1995	1996	1997	1998	1994	1995	1996	1997	1998
Bank Overdraft/Short-term Loan										
Accounts Payable	25,000	27,000	22,600	20,000	18,000	13%	16%	14%	14%	14%
Accrued Expenses	8,900	7,800	6,800	4,000	4,300	5%	5%	4%	3%	3%
Taxation	27,100	25,200	14,000	6,000	5,500	14%	15%	9%	4%	4%
Dividends										
Current Portion of Long-term Debt	1,000	1,200	1,300	1,200	1,300	1%	1%	1%	1%	1%
Sundry Current Liabilities										
CURRENT LIABILITIES	62,000	61,200	43,900	31,200	29,100	33%	36%	27%	22%	22%
LONG TERM DEBT	37,500	39,000	45,000	47,000	48,000	20%	23%	28%	33%	37%
Shareholders Loans										
TOTAL LIABILITIES	99,500	100,200	88,900	78,200	77,100	53%	58%	55%	54%	59%
Stated Capital	7,000	6,800	6,800	6,800	5,000	4%	4%	4%	5%	4%
Income Surplus	68,750	53,800	53,800	47,700	43,400	37%	31%	33%	33%	33%
Capital Surplus	12,050	11,500	11,500	11,500	6,000	6%	7%	7%	8%	5%
NET WORTH	87,800	72,100	72,100	66,000	54,400	47%	42%	45%	46%	41%
TOTAL LIABILITIES AND EQUITY	187,300	172,300	161,000	144,200	131,500	100%	100%	100%	100%	100%

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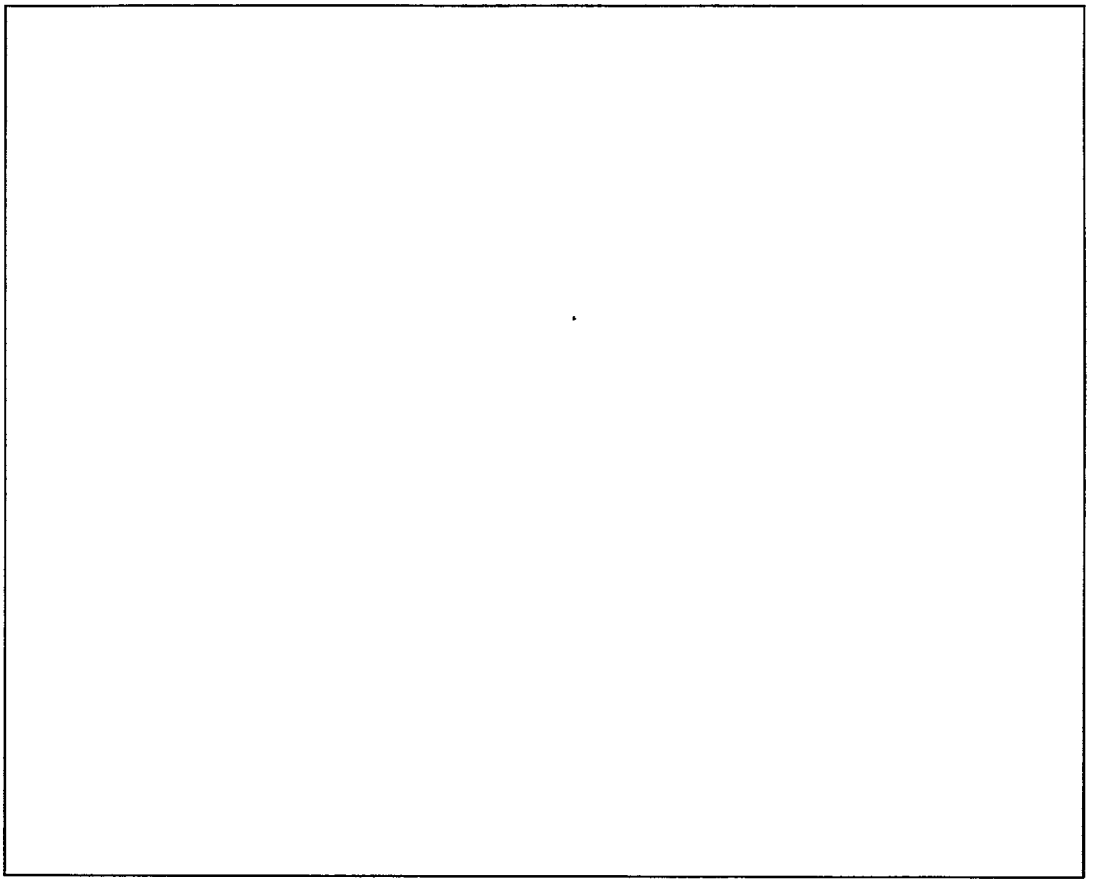
PROFIT AND LOSS ACCOUNTS										
SALES VOLUME						COMMON SIZE				
NET SALES	348,150	328,000	299888	295,000	248,000	100%	100%	100%	100%	100%
Less: Cost of Sales	205,000	197,000	190000	189,000	145,000	60%	62%	64%	64%	60%
Depreciation										
GROSS PROFIT	135,150	123,000	109,000	106,000	95,000	40%	38%	36%	36%	40%
Selling, General & Admin Expenses	100,000	92,000	89000	98,000	88,000	29%	29%	30%	31%	33%
Contribution to Retirement Fund	1,000	1,900	1500	1,700	1,000	0%	1%	1%	1%	0%
NET OPERATING PROFIT	34,150	29,100	18,200	14,300	14,000	10%	9%	6%	5%	6%
Other Income/(Deductions)										
Interest Expenses	(2,250)	(2,340)	(2,500)	(2,500)	(2,000)	-1%	-1%	-1%	-1%	-1%
Other Expenses										
Other Income	500	600	400	700	600	0%	0%	0%	0%	0%
PROFIT BEFORE TAX & UNUSUAL ITEMS	32,400	27,360	16,100	12,500	12,600	10%	9%	5%	4%	5%
Provision for Income Tax	15,550	13,135	9,000	6,500	6,500	5%	4%	3%	2%	3%
NET PROFIT BEFORE UNUSUAL ITEMS	16,850	14,225	7,100	6,000	6,100	5%	4%	2%	2%	3%
Unusual Credits and Charges										
Profit/(Loss) on Sale of Fxd. Assets										
Profit/(Loss) on Sale of Investments										
NET PROFIT AFTER UNUSUAL ITEMS	16,850	14,225	7,100	6,000	6,100	5%	4%	2%	2%	3%
Cash Dividends - Ordinary Shares	1,900	1,730	1,000	800	800	1%	1%	0%	0%	0%
RETAINED EARNINGS FOR PERIOD	14,950	12,495	6,100	5,200	5,300	4%	4%	2%	2%	2%
Credits and Charges to Net Worth:										
Proceeds from Shares sold										
(Purchase) of Own Shares										
INCREASE IN NET WORTH	14,950	12,495	6,100	5,200	5,300	4%	4%	2%	2%	2%

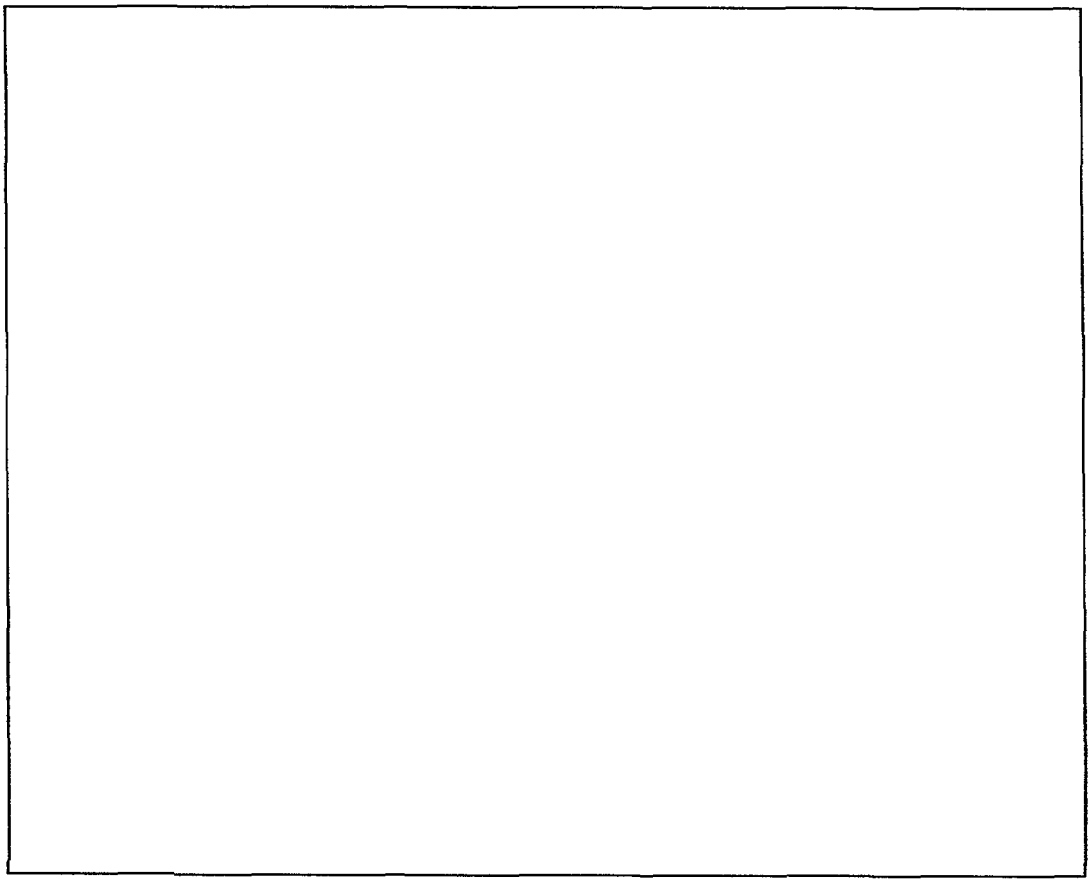
Building IFCT's Quantitative Credit Risk Management System

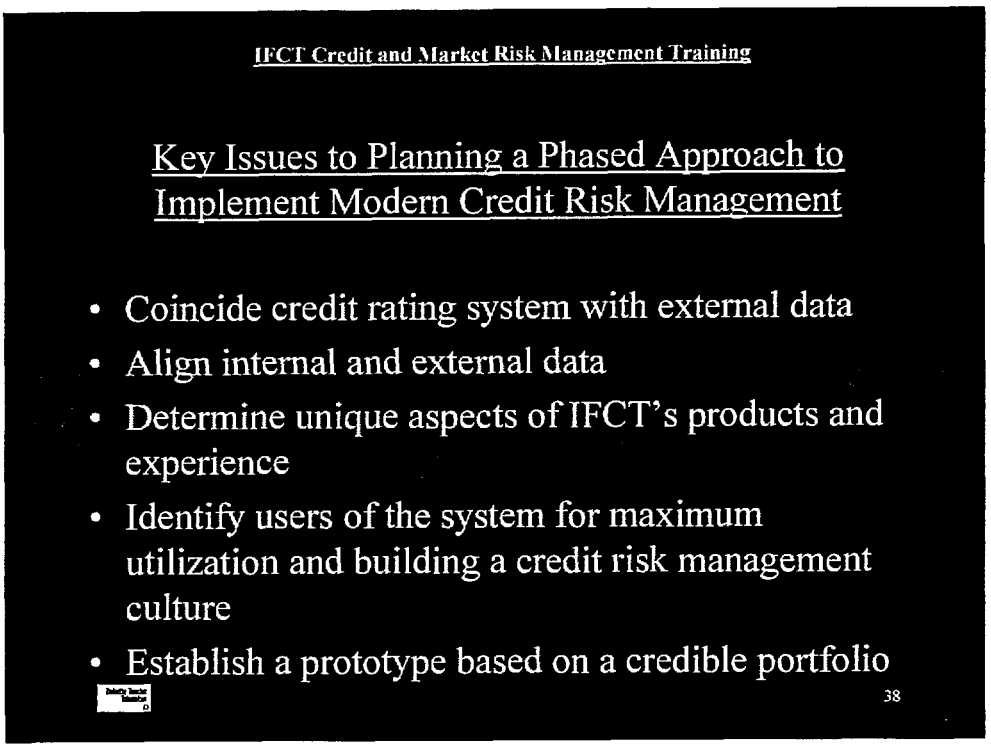
- Decision processes must link strategic planning with overall risk appetite
- Pricing models and planning process must be adjusted for a portfolio management approach
- Performance measurement models must be updated for a portfolio management approach with a "portfolio-level credit VaR"



Key Issues to Planning a Phased Approach to Implement Modern Credit Risk Management

- Considering credit practices, historical experience, and products, decide on the most appropriate:
  - data sets for market rates
  - data sets for loss migration, recoveries, and correlations
  - data sets that must be purchased or customized
- Organize origination, account management, and pricing decisions as an integral part of modern performance measures
- Determine how portfolio data can be captured and coded for input into the portfolio management system





A detailed understanding of the methodology and assumptions is a critical starting point for the portfolio management team. There are large requirements for a combination of position data (Credit Exposures), historical information (loss migrations, loss-given defaults), market data (yield curves and correlation matrices), and account data (customer identification and industry and country codes.)

By first analyzing a few portfolios in one or two business lines, portfolio managers can test the system and gain experience. Commercial loans are a common choice because"

They are graded

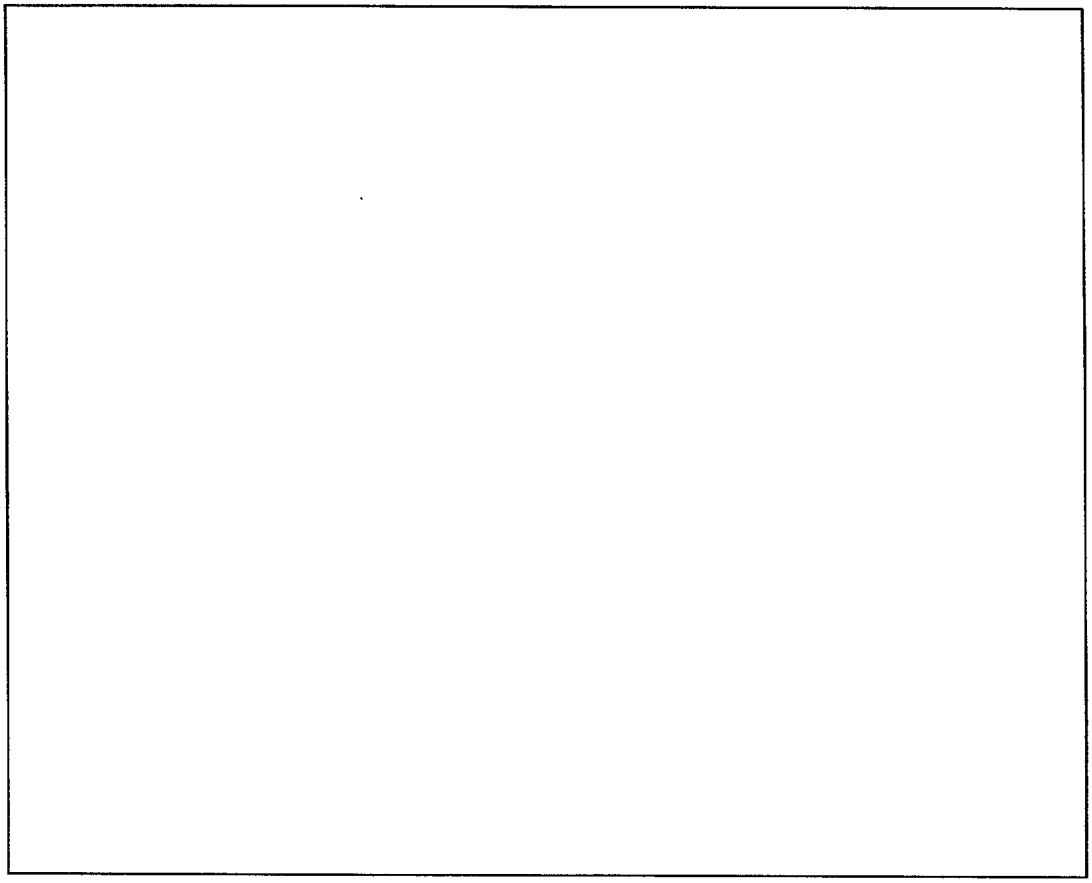
Experience matches external data

The exposures are large

The number of accounts is relatively low

Key Issues to Planning a Phased Approach to Implement Modern Credit Risk Management

- Build a systems infrastructure
- Build a data infrastructure
- Choose an exposure measurement methodology that will accommodate cash flow mapping, derivatives, and open commitments
- Update the credit grading system quarterly
- Assess internal data against external data



Key Issues to Planning a Phased Approach to Implement Modern Credit Risk Management

- Plan systems architecture
- Construct appropriate interfaces with each bank system
- Do not fail to execute careful data mapping, programming, testing, and production procedures
- Design reports thoughtfully, and do not hesitate to change them as needed

Key Issues to Planning a Phased Approach to Implement Modern Credit Risk Management

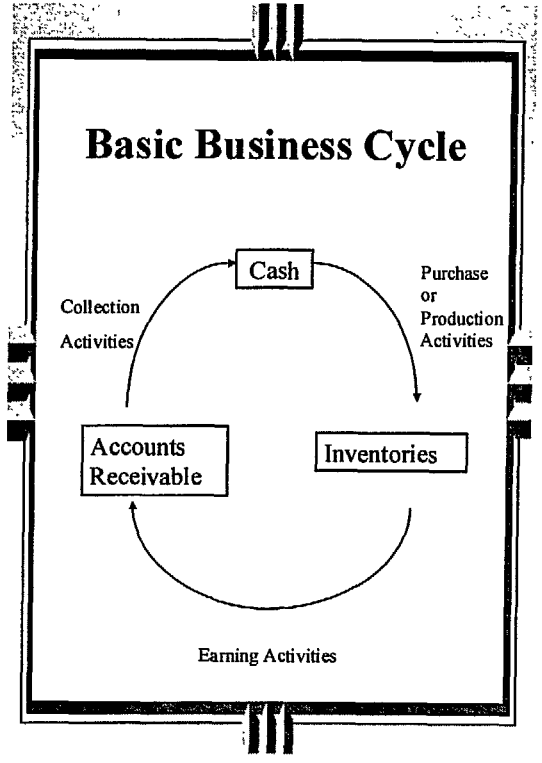
- Update limits
- Train users including business development and support staff
- Verify and calibrate risk models
- Implement process changes and aggressively manage credit risk on a portfolio basis

IFCT

Credit Risk Management Training Seminar

Deloitte Touche Tohmatsu

The Conversion Process



Fundamental Credit Risk Management

- Initiation of the client relationship
- Evaluation of the client
- Evaluation of the request for credit
- Assignment of a risk "grade"
- Approval of the credit
- Negotiation of the terms and conditions

Fundamental Credit Risk Management

- Documentation of the loan agreement/debt instruments
- Disbursement of loan proceeds
- Loan administration
- Monitoring of the re-payment or principal and payment of interest

Initiation of the Client Relationship

- Legal evidence of corporate existence, such as a certificate of incorporation, business license, or charter
- Corporate by-laws, outlining signature and borrowing authorities
- Financial statements for three years, or in the case of a new entity, a business plan and financial projections
- Personal financial statements of owners of closely held businesses, and possibly, tax statements
- Business references, especially from other lending institutions

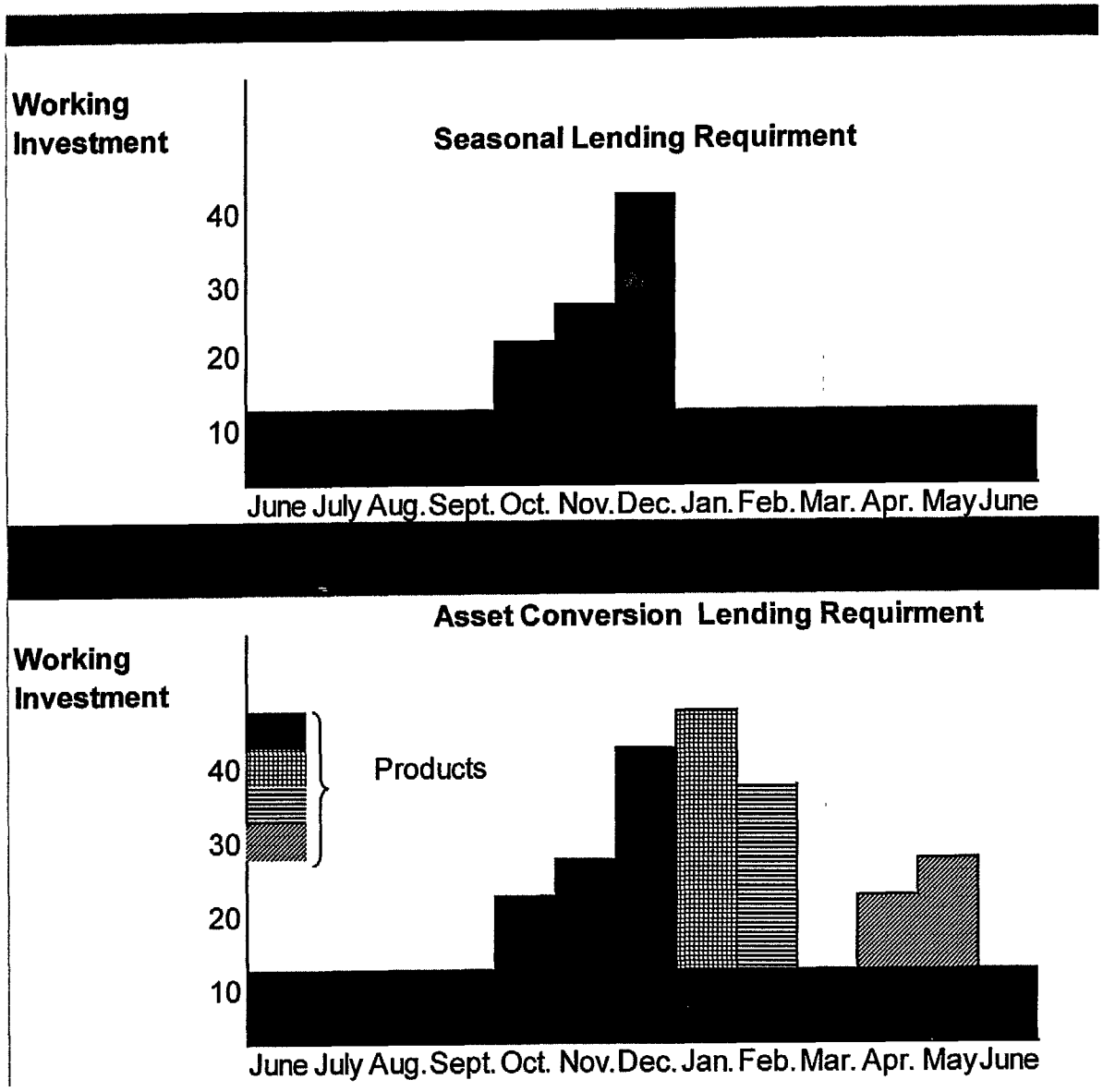
Evaluation of the Client

- The purpose for the loan
- The nature of the business
- The strength and depth of management
- An analysis of the financial condition and performance of the company
- An assignment of a credit risk grade to the applicant

The Purpose for the Loan

- Seasonal credit for seasonal needs.
- Asset conversion credit for merging business cycles.
- Cash flow credit for long-term needs.
- Asset based credit for short-term liquidating assets and mortgage loans, leasing, shipping, and industrial credit secured by plant and equipment.
- Project financing for combined asset-based and cash flow credit needs.

IFCT Credit and Market Risk Management Training



The Nature of the Business

- Can the business complete its business cycle?
- Can the business obtain adequate raw materials?
- Is the price of raw materials reasonable?
- Is labor and physical plant efficient?
- What is the condition of the industry as a whole?
- Can the client compete in the industry?
- Can the client collect its receivables?
- Does the venture meet environmental standards?

The Strength and Depth of Management

- Is management skilled in the business and industry?
- Does management have a reputation for keeping their commitments?
- What is their ownership interest in the business?
- What financial assets do they contribute to the structure of the credit?

An Analysis of Financial Condition & Performance

- Is there acceptable history of financial information?
- Do items on the balance sheet as a percent of total assets compare favorably with the balance sheet items as a percent of total assets of other companies in the same general business? ("common size" data)
- Does the company show positive financial trends?
- Does historical analysis show completed conversion cycles?

An Analysis of Financial Condition & Performance

- Do performance ratios compare favorably with peer companies and industry analysis? These ratios include, but are not limited to:
  - inventory, receivables, accrued expenses, days-on-hand
  - gross profit margin
  - net profit margin
  - returns as a percent of sales
  - operating expense as a percent of sales and/or net income
  - return on equity
  - return on assets

Assignment of a Credit Risk Grade

- Character of management and controls
- Earnings and operating cash flow trends
- Asset and liability values and structure
- Financial Flexibility and Debt capacity
- Financial reporting, including timeliness and audited statements
- Management and controls
- Borrowing entity
- Industry and operating environment

Assignment of a Credit Risk Grade

Eight Point System

1 Minimal risk

2 Better than average risk

3 Average risk

4 Acceptable risk

5 Special mention (Potential weakness)

6 Substandard (Definite weakness - Loss unlikely)

7 Doubtful (Partial loss probable)

8 Loss (Definite loss)

Assignment of a Credit Risk Grade

8 Point System Allocated to BoT 5 Point System

Minimal risk:	1, 2
Acceptable risk:	3, 4
Potentially weak:	5
Weak:	6, 7
Loss:	8

Evaluation of the Client

1 Minimal Risk

- Highest quality borrower
- Three years of strong cash flow and earnings
- Balance sheets conservative with liquid assets
- Projected cash flow shows strong debt coverage
- Management highly respected
- Business part of a stable industry
- Ready access to alternative bank financing

Evaluation of the Client

2 Better than Average Risk

- Modest degree of risk
- Reasonable stability of margins and cash flows
- Reasonable balance sheet liquidity
- Diversity of assets
- Strong management
- Reasonable access to alternative bank financing at favorable rates and terms

Evaluation of the Client

3 Average Risk

- Smaller margins and cash flows
- Smaller but adequate debt service capabilities
- Satisfactory asset quality and liquidity
- Good management in critical positions
- Limited access to alternative bank financing at favorable rates and terms
- Occasional loss year, but with financial strength to overcome adversity

Evaluation of the Client

4 Acceptable Risk

- Declining earnings and strained cash flows
- Weakening market fundamentals and increasing leverage
- Limited debt capacity
- Management of good character, but exhibit lack of depth
- Limited access to alternative bank financing at higher rates and less terms
- Vulnerable to adverse market trends and/or in declining industry

Evaluation of the Client

5 Special Mention (Potential Weakness)

- Exhibit downward trends in margins and cash flows
- Potential for weakening of debt service capability
- Some elements of asset quality weak
- Management weak in some areas with no depth
- Difficult to obtain alternative bank financing
- Regulators would grade as "special mention"

Evaluation of the Client

6. Substandard (Definite Weakness - Loss Unlikely)

- Exhibit well-defined weaknesses that threaten orderly liquidation of debt
- Inadequate equity or collateral coverage of debt
- Assets in aggregate considered substandard, but individually may be of higher quality
- Management skills questionable with identifiable weaknesses
- Regulatory authorities would rate firm "substandard"

Evaluation of the Client

7 Doubtful (Partial Loss Probable)

- Exhibit all characteristics of substandard credits with added fact that collection of debt in full is questionable and improbable
- Only external factors can contribute to collection, such as liquidating collateral, calling guarantees, or liquidating assets pledged by others (hypothecated collateral)
- Management considered dishonest and/or undependable
- Provision for charge-off should be made
- Regulatory authorities would rate "Doubtful"

Evaluation of the Client

8 Loss (Definite Loss)

- Borrowers considered unable to pay unsecured debt
- Assets are not worth the cost of maintaining on the books of the bank

Measuring Transaction Risk

- The tenor of the transaction
- The terms of the transaction
- The nature of collateral
- The strength of guarantees
- Performance issues

Transaction Risk

Impact on Borrower Grade	DETERMINANTS			
	Collateral Quality and Control	Guarantees/Third-Party Support	Tenor	Terms/Documentation
Strongly Improves	Cash, cash equivalents, government securities, or properly margined highly diversified readily marketable securities, traded on major exchanges, held by bank in vault. Highest quality or highly diversified accounts receivable. Highly conveyable multi-use	Guarantor rating significantly better than borrower grade Unconditional coverage in full for any and all obligor's indebtedness. Covers all economic and political risks, if applicable.	Overnight loans to 30 days.	Conditions that result in quick calling of loan principal ("triggers"), such that the tenor is reduced.
Improves	Value is certain with moderate volatility, and the value of the collateral provides a margin over the supported obligation. Collateral of average liquidity. Accounts receivable with good turnover and modest concentrations. Raw materials or finished inven	Guarantor rating better than borrower grade. Coverage conditional, yet intended to cover all obligor's indebtedness under all economic and political risks.	Short-term loans less than one year.	Covenants require action before problems are substantial.
Neutral	Value highly difficult to determine or highly volatile. Value provides a minimal margin over supported obligation. Collateral with poor liquidity where liquidation erodes value. Real estate with specialized use or poor location. Useful life of collateral	Coverage is very conditional and does not cover all the obligor's indebtedness under all economic and political risks.Guarantor vulnerable to decline in its performance.	1 to 3 years and fully amortizing, that is, no balloon payments.	All needed documents are sustainable, perfected, and uncontestable. Loan agreement workable and covenants are appropriate. Reasonable covenants for advance notice of potential problems.
Detracts	Not Applicable: Collateral does not detract from borrower grade.	Guarantor or owner with substantial financial weakness.	4 to 7 years and fully amortizing.	Weak loan agreements without proper covenants or triggers. Significant assets pledged to other creditors effectively subordinating the bank's position.
Strongly Detracts	Not Applicable: Collateral does not detract from borrower grade.	Guarantor or owner with substantial financial weakness.	8 years and beyond	Bank subordinate to other creditor claims. Highly generalized documents make perfection, quality, and sustainability of bank's claims highly questionable.

Negotiation

- Tenor matches the purpose of the loan.
- Repayment conditions match the purpose of the loan and the nature of the transaction.
- A checklist exists for receiving progress reports and financial statements to monitor the transaction and the financial condition of the firm.
- Security is appropriately identified, and the bank's interest in any security is documented.
- Other covenants that provide cross-conditions of default, negative pledges, etc.

Approval

- Special country analysts and economists
- Industry lending specialists
- Project engineers, and finally,
- Appropriate senior lending officers.

Documentation of the Loan Agreement/Debt Instruments

- Drafting of legal documents
- Review of all documents
- Verification and validation of collateral, endorsements, guarantees
- Waiver of terms in the agreement to accommodate potential violations of other credit agreements
- Verification of all signatures on the credit application

Disbursement of Loan Proceeds

- Verify validity of notes and other debt instruments
- Verify proper execution of documentation.
- Verify all signatures on the credit approval document
- Verify disbursement conforms to loan documentation and leaves audit trail
- Verify that collateral is secured and the bank's position protected
- Verify that all conditions precedent have been fulfilled

Loan Administration

- Administration of credit agreement
- Timely receipt and analysis of financial figures
- Compliance with covenants
- Maintenance of collateral

Monitoring of the Re-payment of Principal and Payment of Interest

- Receipt of timely payment of interest
- Receipt of timely re-payment of principal
- Reporting of late payments
- Aging of portfolio
- Reporting on non-performing loans

Loan Work-out Activities

- Early recognition through risk rating system.
- Coordinated management of:
- Collection strategy
- Re-negotiation of terms and conditions of the credit
- Collection efforts
- Legal efforts
- Reorganization of the borrower

IFCT Credit and Market Risk Management Training

RATIOS										
Current Ratio	1.32	1.18	1.55	1.88	1.67					
Quick Ratio	0.84	0.74	0.90	1.21	1.08					
Ratio - C.A to Total Liabilities	0.82	0.72	0.76	0.75	0.63					
Ratio - Total Liabs to Tangible N.W.	1.13	1.39	1.23	1.18	1.42					
Ratio - NWI to Sales	0.09	0.08	0.10	0.08	0.07	COMMON SIZE				
BALANCE SHEETS	1994	1995	1996	1997	1998	1994	1995	1996	1997	1998
ASSETS										
Cash	10,000	8,000	7,500	7,000	5,000	5%	5%	5%	5%	4%
Short-term Investments										
Receivables	35,500	32,000	29,000	25,600	22,000	19%	19%	18%	18%	17%
Prepayments	6,400	5,300	3,000	5,000	4,500	3%	3%	2%	3%	3%
Inventory	30,000	27,000	28,500	21,000	17,000	16%	16%	18%	15%	13%
Taxation										
CURRENT ASSETS	81,900	72,300	68,000	58,600	48,500	44%	42%	42%	41%	37%
Land,Buildings & Equipment	136,900	128,700	115,000	100,000	95,000	73%	75%	71%	69%	72%
(Accumulated Depreciation)	(31,500)	(28,700)	(22,000)	(14,400)	(12,000)	-17%	-17%	-14%	-10%	-9%
FIXED ASSETS	105,400	100,000	93,000	85,600	83,000	56%	58%	58%	59%	63%
Investments										
Sundry Receivables										
Intangibles										
TOTAL ASSETS	187,300	172,300	161,000	144,200	131,500	100%	100%	100%	100%	100%

IFCT Credit and Market Risk Management Training

LIABILITIES	1994	1995	1996	1997	1998	1994	1995	1996	1997	1998
Bank Overdraft/Short-term Loan										
Accounts Payable	25,000	27,000	22,600	20,000	18,000	13%	16%	14%	14%	14%
Accrued Expenses	8,900	7,800	6,000	4,000	4,300	5%	5%	4%	3%	3%
Taxation	27,100	25,200	14,000	6,000	5,500	14%	15%	9%	4%	4%
Dividends										
Current Portion of Long-term Debt	1,000	1,200	1,300	1,200	1,300	1%	1%	1%	1%	1%
Sundry Current Liabilities										
CURRENT LIABILITIES	62,000	61,200	43,900	31,200	29,100	33%	36%	27%	22%	22%
LONG TERM DEBT	37,500	39,000	45,000	47,000	48,000	20%	23%	28%	33%	37%
Shareholders Loans										
TOTAL LIABILITIES	99,500	100,200	88,900	78,200	77,100	53%	58%	55%	54%	59%
Stated Capital	7,000	6,800	6,800	6,800	5,000	4%	4%	4%	5%	4%
Income Surplus	68,750	53,800	53,800	47,700	43,400	37%	31%	33%	33%	33%
Capital Surplus	12,050	11,500	11,500	11,500	6,000	6%	7%	7%	8%	5%
NET WORTH	87,800	72,100	72,100	66,000	54,400	47%	42%	45%	46%	41%
TOTAL LIABILITIES AND EQUITY	187,300	172,300	161,000	144,200	131,500	100%	100%	100%	100%	100%

IFCT Credit and Market Risk Management Training

PROFIT AND LOSS ACCOUNTS SALES VOLUME						COMMON SIZE				
NET SALES	340,150	320,000	299000	295,000	240,000	100%	100%	100%	100%	100%
Less: Cost of Sales	205,000	197,000	190000	189,000	145,000	60%	62%	64%	64%	60%
Depreciation										
GROSS PROFIT	135,150	123,000	109,000	106,000	95,000	40%	38%	36%	36%	40%
Selling, General & Admin Expenses	100,000	92,000	89000	90,000	80,000	29%	29%	30%	31%	33%
Contribution to Retirement Fund	1,000	1,900	1800	1,700	1,000	0%	1%	1%	1%	0%
NET OPERATING PROFIT	34,150	29,100	18,200	14,300	14,000	10%	9%	6%	5%	6%
Other Income/(Deductions)										
Interest Expenses	(2,250)	(2,340)	(2,500)	(2,500)	(2,000)	-1%	-1%	-1%	-1%	-1%
Other Expenses										
Other Income	500	600	400	700	600	0%	0%	0%	0%	0%
PROFIT BEFORE TAX & UNUSUAL ITEMS	32,400	27,360	16,100	12,500	12,600	10%	9%	5%	4%	5%
Provision for Income Tax	15,550	13,135	9,000	6,500	6,500	5%	4%	3%	2%	3%
NET PROFIT BEFORE UNUSUAL ITEMS	16,850	14,225	7,100	6,000	6,100	5%	4%	2%	2%	3%
Unusual Credits and Charges										
Profit/(Loss) on Sale of Fxd. Assets										
Profit/(Loss) on Sale of Investments										
NET PROFIT AFTER UNUSUAL ITEMS	16,850	14,225	7,100	6,000	6,100	5%	4%	2%	2%	3%
Cash Dividends - Ordinary Shares	1,900	1,730	1,000	800	800	1%	1%	0%	0%	0%
RETAINED EARNINGS FOR PERIOD	14,950	12,495	6,100	5,200	5,300	4%	4%	2%	2%	2%
Credits and Charges to Net Worth:										
Proceeds from Shares sold										
(Purchase) of Own Shares										
INCREASE IN NET WORTH	14,950	12,495	6,100	5,200	5,300	4%	4%	2%	2%	2%

Building IFCT's Quantitative Credit Risk Management System

- Decision processes must link strategic planning with overall risk appetite
- Pricing models and planning process must be adjusted for a portfolio management approach
- Performance measurement models must be updated for a portfolio management approach with a "portfolio-level credit VaR"

Key Issues to Planning a Phased Approach to Implement Modern Credit Risk Management

- Considering credit practices, historical experience, and products, decide on the most appropriate:
  - data sets for market rates
  - data sets for loss migration, recoveries, and correlations
  - data sets that must be purchased or customized
- Organize origination, account management, and pricing decisions as an integral part of modern performance measures
- Determine how portfolio data can be captured and coded for input into the portfolio management system

Key Issues to Planning a Phased Approach to Implement Modern Credit Risk Management

- Coincide credit rating system with external data
- Align internal and external data
- Determine unique aspects of IFCT's products and experience
- Identify users of the system for maximum utilization and building a credit risk management culture
- Establish a prototype based on a credible portfolio

Key Issues to Planning a Phased Approach to Implement Modern Credit Risk Management

- Build a systems infrastructure
- Build a data infrastructure
- Choose an exposure measurement methodology that will accommodate cash flow mapping, derivatives, and open commitments
- Update the credit grading system quarterly
- Assess internal data against external data

Key Issues to Planning a Phased Approach to Implement Modern Credit Risk Management

- Plan systems architecture
- Construct appropriate interfaces with each bank system
- Do not fail to execute careful data mapping, programming, testing, and production procedures
- Design reports thoughtfully, and do not hesitate to change them as needed

Key Issues to Planning a Phased Approach to Implement Modern Credit Risk Management

- Update limits
- Train users including business development and support staff
- Verify and calibrate risk models
- Implement process changes and aggressively manage credit risk on a portfolio basis

Comments on Credit Case Study, Day 2 of the 4-Day Seminar to IFCT

Credit Risk Management using new probabilistic techniques requires sophisticated understanding of probabilities and statistical analysis. The credit case study was set up to force IFCT participants to use fundamental credit analysis skills, well known by many, to set the stage for, and establish the relevance of, advanced statistical analysis of the IFCT portfolio, i.e., Value at Risk, Capital at Risk, and RAROC measurements.

Three case studies were designed using Robert Morris Associates Statement Studies as a basis for "Common Size" data similar to that shown in the Credit Training Powerpoint presentation. The first case study used RMA industry statistics compiled from 56 furniture manufactures. The second case study used RMA industry statistics compiled from over 500 computer service companies. The third case study used RMA industry statistics compiled from over 560 grocery stores.

These statistical composites are proprietary and can be obtained from Robert Morris Associates in Philadelphia, PA. Their website is: www.rmahq.org

The methodology used follows:

Participants were divided into 3 groups.

Each group was asked to analyze the reasons that cash, inventory, accounts receivable, accounts payable, and accrued expenses were consistently a certain percentage of total assets. (40 minutes was allocated to this analysis)

The presenter verbally discussed the reasons for these consistencies, eliciting commentary from participants, and establishing agreement among all the groups why each company in a certain industry should have a balance sheet that exhibits similar common size characteristics.

The presenter then established comparisons between the three types of companies and their respective conversion cycles.

Next, the groups were requested to analyze the Income Statement industry statistics for each company with special emphasis on gross and net profit margins. (20 minutes)

The presenter discussed the reasons for consistencies expected in companies in the same industry, and the differences expected between companies in different industries with different conversion cycles and amounts of value-added in the conversion process.

The final point made was to ask the participants to visualize the aggregate portfolio characteristics of the approximately 1,100 companies whose characteristics they now understood. Emphasis was made on the fact that some individual companies with very high individual credit risk would be "balanced" by other stronger companies in the same and different businesses.

Discussion on Normal (Beta) curves, skewed curves, and "tails" ensued. This set the stage for a portfolio management discussion, which closed the case study.

This methodology also prepared the participants for the market risk management session presented on Day 3.

Day 4 put both credit risk management and market risk management together.

The case study on Day 4 required three groups of "natural" collaborators, the IT personnel, credit personnel, and trading personnel, to apply "Expert Panel" criteria to the problem of establishing a plan for implementing Credit and Market Risk Management in their own area of expertise.

INDUSTRIAL FINANCE CORPORATION OF THAILAND

FOUR DAY RISK MANAGEMENT SEMINAR

DAY THREE

MAY 19, 2000

VALUE AT RISK, CAPITAL AT RISK
&
RETURN ON RISK ADJUSTED CAPITAL

PRESENTED BY

A. WILLIAM BODINE, Ph.D.

BANGKOK, THAILAND

VALUE AT RISK (VAR)

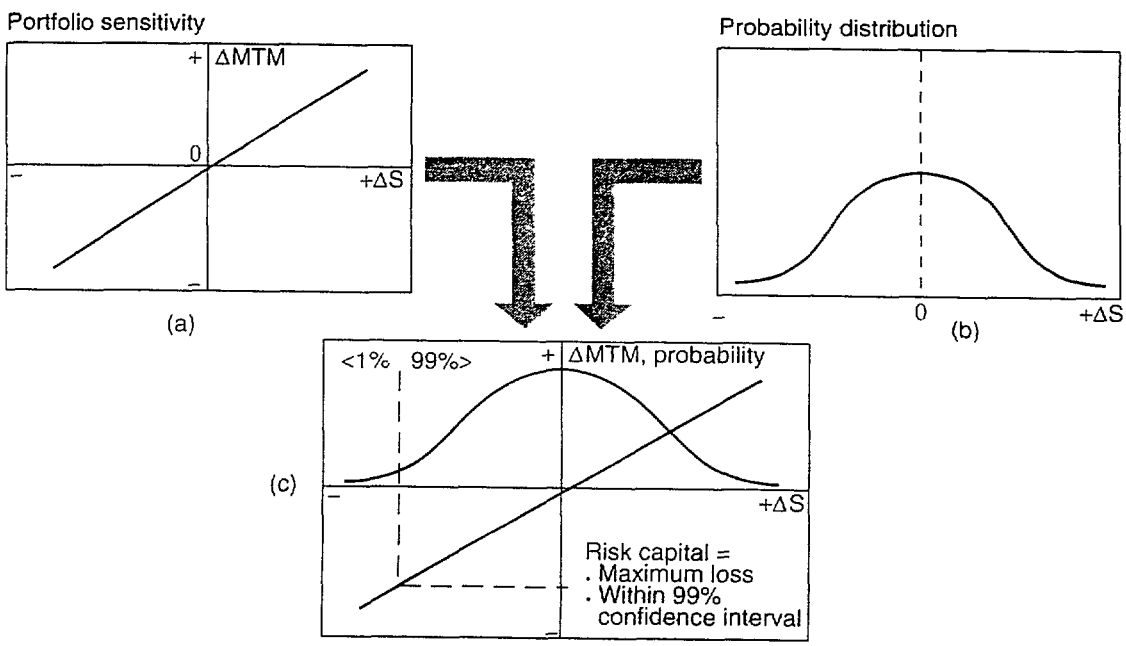
- APPLIES TO AGGREGATE ANALYSIS (I.E. PORTFOLIOS) NOT SINGLE ASSET
- FIRST, REQUIRES A COMPLEX ANALYSIS TO DETERMINE:

  VOLATILITIES OF EACH ASSET OR INSTRUMENT

  THEN, THEIR CORRELATIONS WITH EACH OTHER

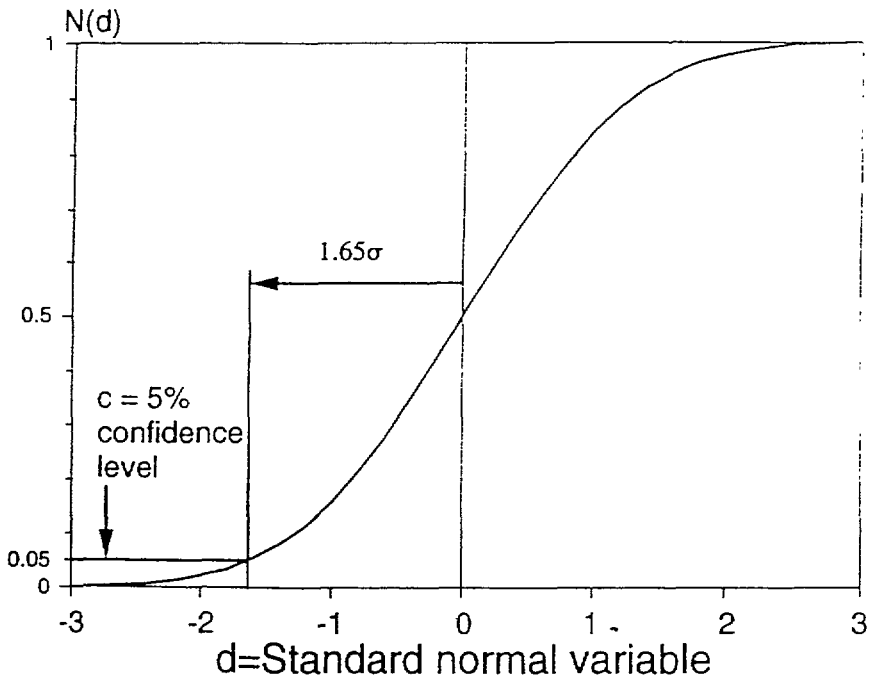
  THIS FIRST ANALYSIS REQUIRES A PROGRAM ANALYSIS WHICH CANNOT BE DONE ON A NORMAL PC OR HAND HELD CALCULATOR EXERCISE

- FIRST ANALYSIS ABOVE IS ESSENTIAL AS A FOUNDATION OF INFORMATION FOR DISPLAYING THE DATA (I.E. A DISTRIBUTION CURVE WITH STANDARD DEVIATIONS) BEFORE VAR CAN BE CALCULATED



VALUE AT RISK (VAR) – Continued:

- NOW, VAR CAN BE CALCULATED AS IN THE FOLLOWING EXAMPLE: A BANK HAS A DIVERSIFIED PORTFOLIO WITH A CURRENT MARKET VALUE OF $ 1 BILLION



USING A ONE DAY RISK EXPOSURE PERIOD AT A CONFIDENCE LEVEL OF 95% (WHICH IS 1.65 STANDARD DEVIATIONS IN A ONE TAIL TEST AS OPPOSED TO A TWO TAIL NORMAL DISTRIBUTION PATTERN) AND A DAILY VOLATILITY OF 1%, VAR IS $16.5 MILLION (1.65 x 0.01 x $1 BILLION

CREDIT VALUE AT RISK (VAR)

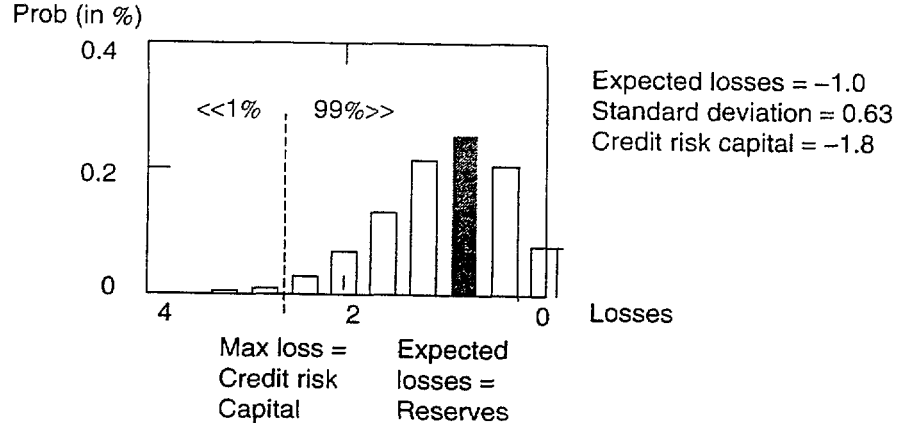
- APPLIES TO AGGREGATE LOAN PORTFOLIO LOAN DEFAULT RISK ANALYSIS
- LIKE MARKET VALUE AT RISK (SEE PREVIOUS EXAMPLE), FIRST, REQUIRES A COMPLEX ANALYSIS TO DETERMINE:

  EXPECTED LOSSES (BASED ON PROBAILITY CALCULATIONS); AND DISTRIBUTION ANALYSIS OF ESTIMATED VALUE OF LOAN LOSSES

  AGAIN, THIS FIRST ANALYSIS REQUIRES A PROGRAM ANALYSIS WHICH CANNOT BE DONE ON A NORMAL PC OR HAND HELD CALCULATOR

- THEN, THIS DISTRIBUTION IS DISPLAYED AS A FOUNDATION OF INFORMATION BEFORE CREDIT VALUE AT RISK CAN BE CALCULATED:

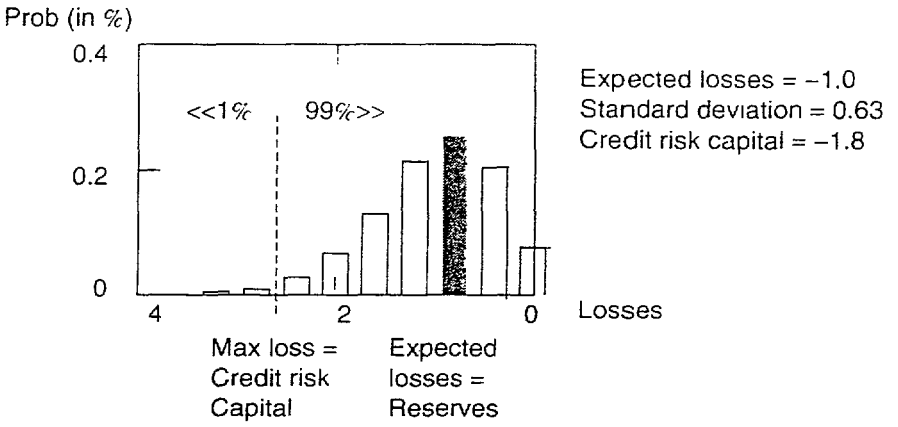
Loss distribution for $100 portfolio, 250 equal and independent credits with prob(default) = 1%



CREDIT VALUE AT RISK (VAR)

Continued:

Loss distribution for $100 portfolio. 250 equal and independent credits with prob(default) = 1%



- THE ABOVE DISTRIBUTION ANALYSIS ILLUSTRATES $100 MILLION LOAN PORTFOLIO REPRESENTING 250 DIFFERENT CREDITS, EACH WITH A PROBABILITY OF DEFAULT OF 1%.

- THUS, EXPECTED LOSSES ARE EQUAL TO $1 MILLION WHILE THE ADDITIONAL MAXIMUM LOSSES (CREDIT VALUE AT RISK) WILL BE LESS THAN OR EQUAL TO $1.8 MILLION WITH A 99% LEVEL OF CONFIDENCE

- NOTE: LOSS DISTRIBUTION IS NOT "NORMAL" AND IN LINE WITH A NORMAL APPORXIMATION OF LOSS (E.G. 2.31 TIMES THE STANDARD DEVIATION OR $1.45 MILLION IN THE CASE OF 99% ONE TAILED CONFIDENCE INTERVAL FOR A NORMAL DISTRIUBUTION

CAPITAL AT RISK (CAR) CONCEPTS

WHAT CAR IS:

- **STATISTICAL ESTIMATE OF MAXIMUM CREDIT LOSS RISK LESS CREDIT PROVISION WHICH CAN IMPACT THE CORPORATE CAPITAL ACCOUNT**
- **EXPRESSES RISK IN COMMON TERMS ACROSS INSTRUMENTS OR A PORTFOLIO**
- **CALCULATED ON A PORTFOLIO BASIS**

<u>NOTE CAR IS NOT</u>

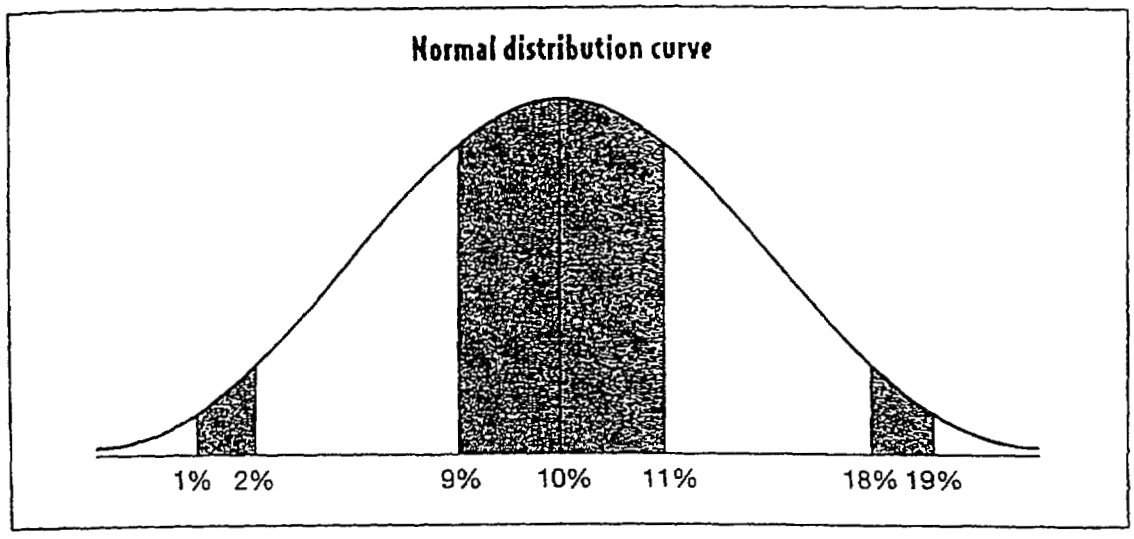
- **A PREDICTION OF THE AMOUNT OR FERQUENCY OF LOSS**
- **A WORST CASE ANALYSIS**
- **AN UNAMBIGUOS MEASURE OF RISK**
- **100% ACCURATE**
- **RISK MANAGEMENT (ONLY A TOOL OF RISK MANAGEMENT)**

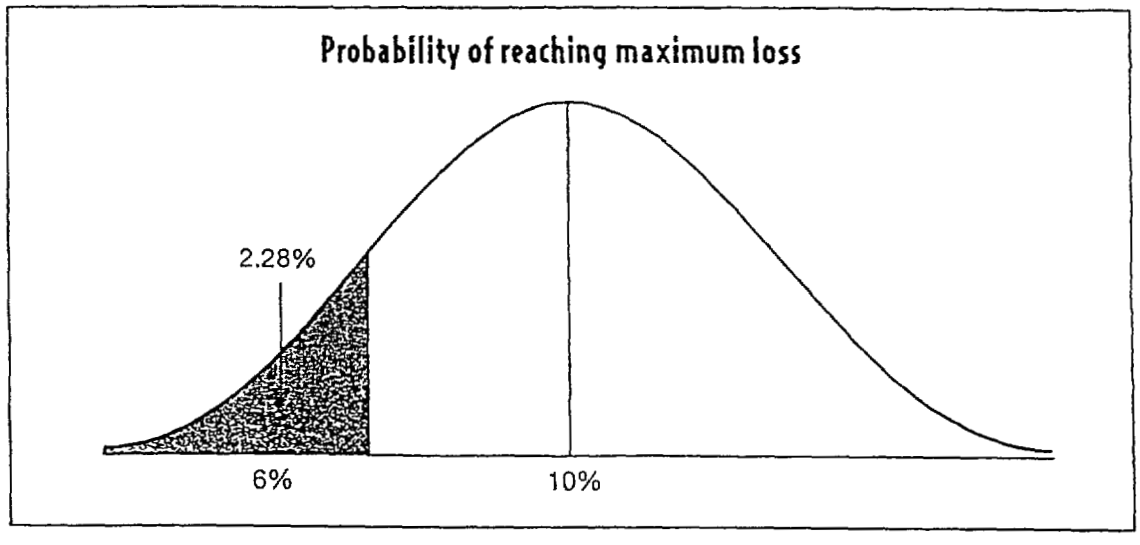
CAPITAL AT RISK APROACH

CAPITAL AT RISK MEASURES AN ATTEMPT THE MINIMUM CAPITAL REQUIRED TO AVOID BANKRUPTCY IF MAXIMUM LOSS ARISES

WE MUST HAVE VAR FOR OF PORTFOLIO IN ORDER TO DEFINE CAR AS MAXIMUM LOSS OF VALUE IN PORTFOLIO FOR A SPECIFIC CONFIDENCE LEVEL DURING A SPECIFIC TIME PERIOD ALSO TAKING INTO ACCOUNT FINANCING COSTS OF THE POSITIONS AND COMPENSATIONON CAPITAL DURING THE TIME PERIOD

NORMAL DISTRIBUTION: MEANS = 10%
STANDARD DEVIATION = 2%





LEVELS OF CONFIDENCE

LEVEL OF CONFIDENCE: 67% 95% 99%

WHAT IS THE PROBABILITY THE ACTUAL RESULT WILL NOT EXCEED THE CAR NUMBER

MEASURED BY STANARD DEVIATION OF ALL RESULTS:

1. **S.D. 67% OF ALL PROBAILITIES**
2. **S.D. 95% OF ALL PROBABILITIES**
3. **S.D. 99% OF ALL PROBABILITIES**

CAR CONCERNED WITH ONE-TAILED (DOWNSIDE) PROBAILITIES

ONE SIDED 99% CONFIDENCE LIMIT (1% PROBABILITY OF RESULTS) 2.33 S.D. FROM MEAN

CAR NUMERICAL EXAMPLE

BASIC FACTS

- **$100 MILLION PORTFOLIO**
- **EXPECTED RETURN = 7% OR $7 MILLION**
- **FINANCING COST = 5% OR $5 MILLION**
- **TIME HORIZON = ONE YEAR**
- **CONFIDENCE LEVEL = 99%**
- **MAXIMUM EXPECTED LOSS = 20%**

THUS VAR

VAR = EXPECTED LOSS OF 20% MINUS EXPECTED RETURN OF 7% OR 13% (i.e. $13 MILLION)

CAR FORMULA

CAR = VAR + FINANCIAL COSTS – CAPITAL COMPENSATION

WHERE:

CAPITAL COMPENSATION = CAR X RISK FREE RATE X TIME

THUS CAR CALULATION

$$\text{CAR} = \frac{\$13 \text{ MILLION} + \$5 \text{ MILLION}}{1.05} = \$17.14 \text{ MILLION}$$

RETURN ON RISK ADJUSTED CAPITAL

CONCEPT

- HIGHER RISK REQUIRES HIGHER REWARD
- COMPARE EXPECTED RETURN WITH PAST RETURNS
- COMMON BASIS FOR CAPITAL ALLOCATION
- STATISTICAL MEASURE OF RETURN ON CAPITAL ADJUSTED FOR RISK
- EXPRESSES RETURN ON COMMON TERMS ACROSS ALL BUSINESS ACTIVITIES OF CORPORATION
- CALCULATED FOR EACH BUSINESS ACTIVITY AND FOR ENTIRE CORPORATION

WHAT RORAC IS NOT

- A PREDICTION OF THE AMOUNT OF THE RETURN
- AN UNAMBIGUOUS MEASURE OF RETURN
- 100% ACCURATE
- RISK MANAGEMENT (ONLY A TOOL OF RISK MANAGEMENT)
- A INDICATION OF AMOUNT FOR CAPITAL ALLOCATION

RORAC CALCULATION

BASIC FACTS

- $100 MILLION PORTFOLIO
- EXPECTED RETURN = 7% OR $7 MILLION
- FINANCING COST = 5% OR $5 MILLION
- TIME HORIZON = ONE YEAR
- CONFIDENCE LEVEL = 99%
- MAXIMUM EXPECTED LOSS = 20%

THUS VAR

VAR = EXPECTED LOSS OF 20% MINUS EXPECTED RETURN OF 7% OR 13% (i.e. $13 MILLION)

CAR FORMULA

CAR = VAR + FINANCIAL COSTS – CAPITAL COMPENSATION

WHERE:

CAPITAL COMPENSATION = CAR X RISK FREE RATE X TIME

THUS CAR CALULATION

$$CAR = \frac{\$13\ MILLION + \$5\ MILLION}{1.05} = \$17.14\ MILLION$$

FINALLY

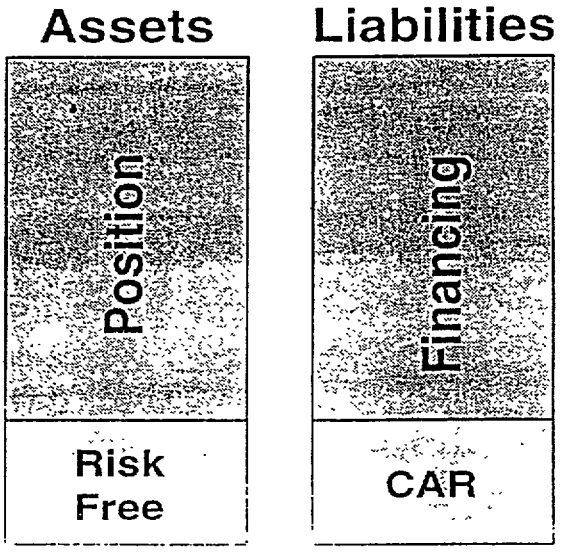
$$RORAC = \frac{EXPECTED\ AFTER\ TAX\ RETURN}{CAR}$$

WHERE	EXPECTED RETURN	= $7 MILLION
	MINUS FINANCING COST	= ($5) MILLION
	PLUS CAPITAL COMPENSATION	= 0.86 (CAR X Rf1)
	($17.14 X 5% = $0.86 MILLION)	$2.86

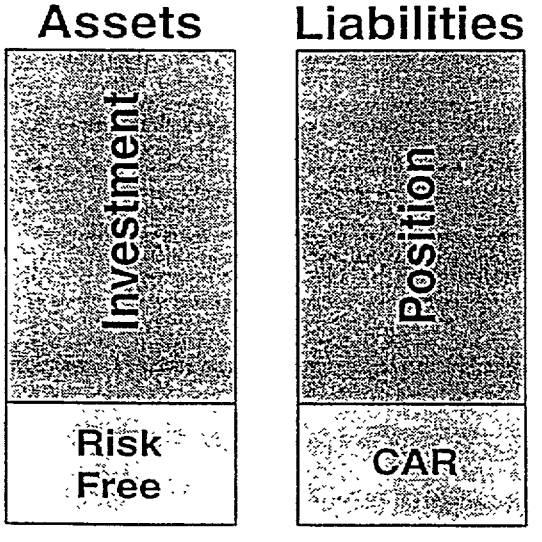
THUS $$RORAC = \frac{\$2.86\ MILLION}{\$17.14\ MILLION} \times (1 - 35\%\ TAX) = \mathbf{10.85\%}$$

BALANCE SHEET & CAR

FINANCING & CAPITAL AT RISK ASSOCIATED WITH A POSITION



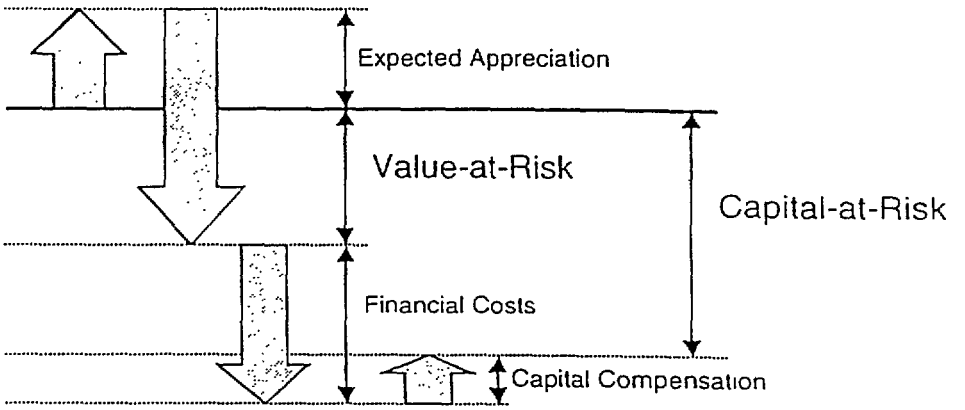
INVESTMENT & CAPITAL AT RISK ASSOCIATED WITH A POSITION



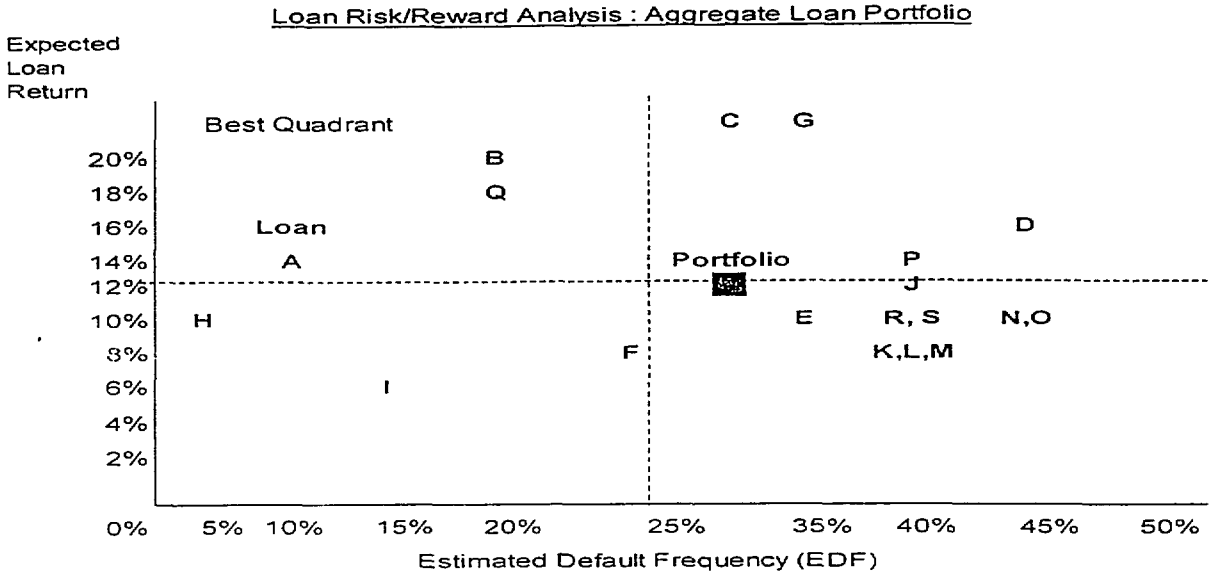
CAR & PROFITABILITY

ASSET VALUE & PROFITABILITY RELATIONSHIP IN CAR

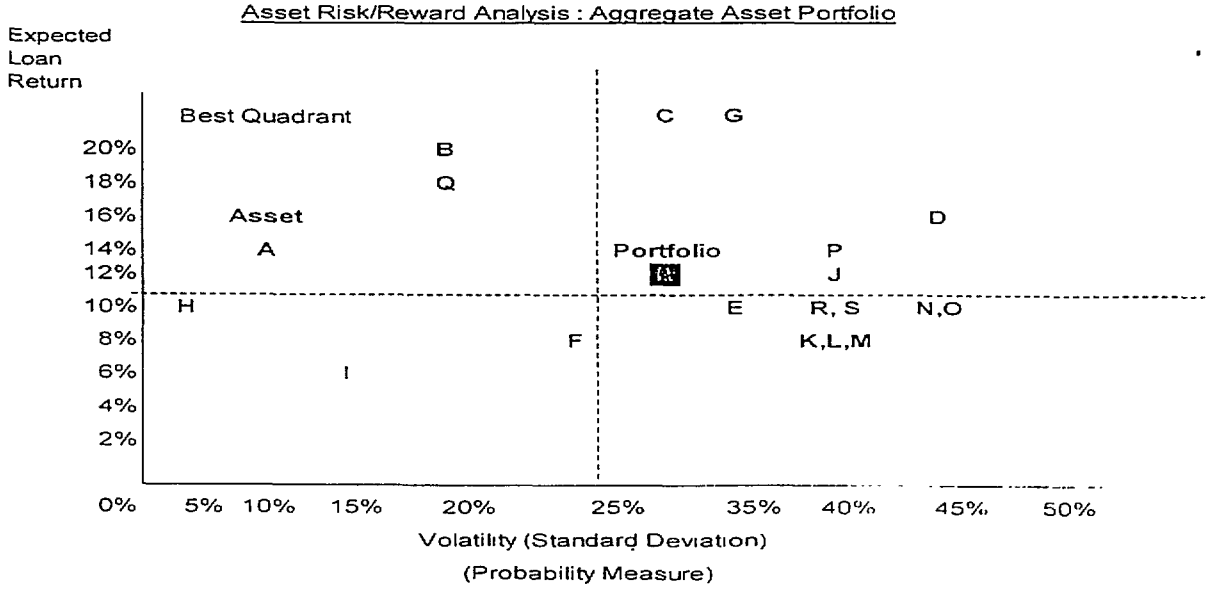
Value	P&L
107 MM	7 MM
100 MM	0 MM
87 MM	(13 MM)
82.86 MM	(17.14 MM)
82 MM	(18 MM)



Application of Credit Risk Measures in Loan Portfolio Analysis



Application of Market Risk Measures in Asset Portfolio Analysis



Risk Management Measurement Check-List

Statistical Measures Used in Risk Management

Statistical Measures:	IFCT Use	Functional Area/Activity	Training Need
• Correlation			
• Regression			
• Standard Deviation			
• Variance			
• Covariance			
• R2			

Credit Risk Measures

Credit Risk Measures:

- Credit Provision
- Credit Risk Capital
- Default Frequency Model
- Credit Return-on-Risk Adjusted Capital

Credit Portfolio Risk Measures:

- Volatility
- Market Value-at-Risk
- Capital-at-Risk
- Risk/Reward Map
- Covariance Matrix
- Risk Adjusted Return-on-Capital
- Attribution Analysis
- Monte Carlo Simulation
- Historical Simulation
- Stress Testing
- Back Testing
- Factor Model

Market Risk Measures

Bond Return Measures:

- Yield
- Yield to Maturity

Bond Risk Measures:

- Duration
- Convexity
- Value-at-Risk
- Price Simulations

Risk Management Measurement Check-List - continued

General Bond Measures:	IFCT Use	Functional Area/Activity	Training Need
• Bond Valuation			
• Yield Curve			
• Zero Coupon Yield Curve			
• Risk Decomposition			
Equity Return Measures:			
• Annual Rate of Return			
• Average Annual Rate			
• Annual Compound Rate			
Equity Risk Measures:			
• Volatility			
• Beta			
• Market Value-at-Risk			
• Capital-at-Risk			
• Risk Adjusted Return-on-Capital			
Market Portfolio Risk Measures:			
• Volatility			
• Beta			
• Market Value-at-Risk			
• Capital-at-Risk			
• Risk/Return Map			
• Covariance Matrix			
• Risk Adjusted Return-on-Capital			
• Attribution Analysis			
• Monte Carlo Simulation			
• Historical Simulation			
• Stress Testing			
• Back Testing			
• Factor Model			
Derivative Risk Measures:			
• VAR of Linear Contracts			
• VAR of Non-Linear Contracts			
• Duration Approximation & Continuous Compounding			
• Black-Scholes Model			
• Dynamic Replication of Call Option			
• Dynamic Replication of Put Option			
• Delta-Gamma Approximation for Long Call			

Industrial Finance Corporation of Thailand

Four Day Risk Management Seminar

DAY THREE

VALUE AT RISK
&
RELATED CASE STUDIES

May 19th 2000

Presented By

A. William Bodine, Ph.D.

Bangkok, Thailand

VAR CONCEPTS

- STATISTICAL ESTIMATE OF RISK OVER GIVEN TIME HORIZON
- EXPRESSES RISK IN COMMON TERMS ACROSS INSTRUMENTS
- CALCULATED ON A PORTFOLIO BASIS

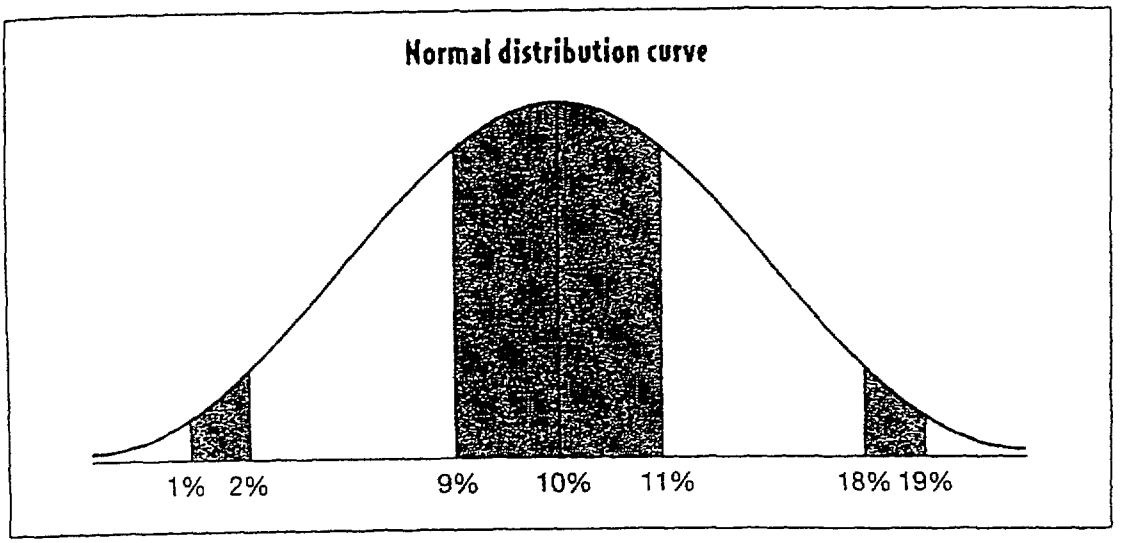
NOTE VAR IS NOT

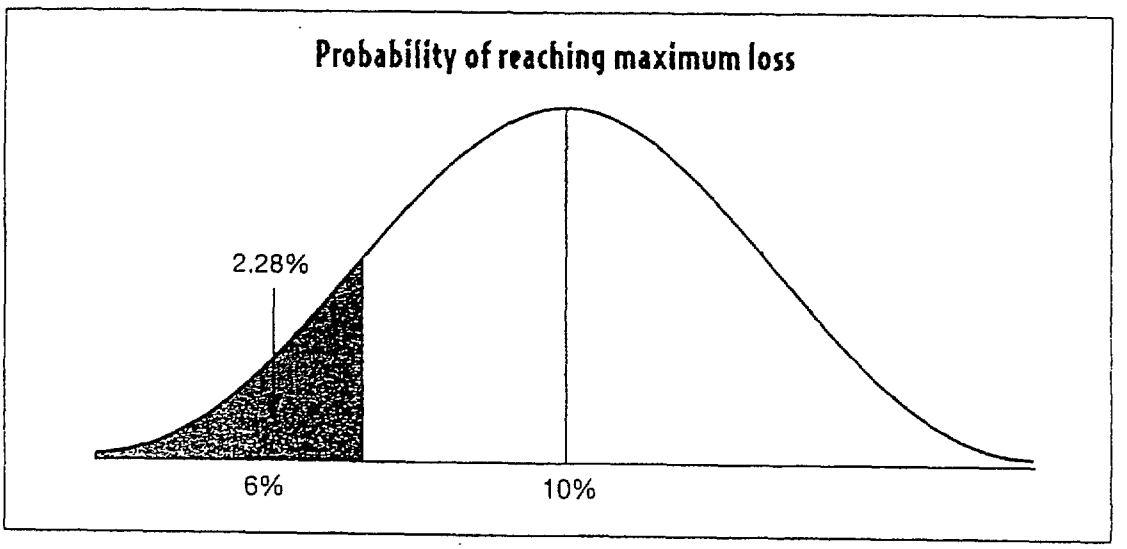
- A PREDICTION OF THE AMOUNT OR FREQUENCY OF LOSS
- A WORST CASE ANALYSIS
- AN UNAMBIGUOUS MEASURE OF RISK
- 100% ACCURATE
- RISK MANAGEMENT

THE VALUE AT RISK APPROACH

VALUE AT RISK MEASURES THE WORST EXPECTED LOSS THAT AN INSTITUTION CAN SUFFER OVER A GIVEN TIME INTERVAL UNDER NORMAL MARKET CONDITIONS AT A GIVEN CONFIDENCE LEVEL

NORMAL DISTRIBUTION : MEAN = 10%
STANDARD DEVIATION = 2%





LEVELS OF CONFIDENCE

LEVEL OF CONFIDENCE : 95%, 97.5%, 99%

WHAT IS PROBABILITY ACTUAL RESULT WILL NOT EXCEED THE VAR NUMBER

MEASURED BY STANDARD DEVIATION OF ALL RESULTS

1 S.D. 67% OF ALL PROBABILITIES
2 S.D. 95% OF ALL PROBABILITIES
3 S.D. 99.9% OF ALL PROBABILITIES

VAR CONCERNED WITH ONE-TAILED (DOWNSIDE) PROBABILITIES

ONE-SIDED 99% CONFIDENCE LIMIT (1% PROBABILITY OF RESULTS) 2.33 S.D. FROM MEAN.

NUMERICAL EXAMPLE

MEAN 10% STANDARD DEVIATION 2%

ONE-SIDED CONFIDENCE INTERVALS

97.5% 2 S.D. = 4%

RETURN NO LOWER THAN 6%

99.0% 2.33 S.D. = 4.66%

RETURN NO LOWER THAN 5.34%

LEVEL OF CONFIDENCE : POINTS TO NOTE

- GREATER LEVEL OF CONFIDENCE : LARGER RISK NUMBER
- SCALE
  - 95% CONFIDENCE INTERVAL (1.65 S.D.) = 1 DAY IN 20
  - 97.5% CONFIDENCE INTERVAL (1.96 S.D.) = 1 DAY IN 40
  - 99% CONFIDENCE INTERVAL (2.33 S.D.) = 1 DAY IN 100
- CHOICE IS SUBJECTIVE
- BOUNDARY BETWEEN FREQUENCY AND USABILITY
  - 1.65 S.D. (95% C.I.) = 1 DAY PER MONTH
  - 3 S.D. (99.9% C.I.) = 1 DAY IN 3 YEARS

VAR : HOLDING PERIOD

- HOW STABLE IS PORTFOLIO
- WHAT IS POSITION HORIZON
- HOW RAPIDLY CAN ONE LIQUIDATE OR HEDGE PORTFOLIO
  - MARKET LIQUIDITY
  - DECISION PROCESS
- ACTIVE TRADING INSTITUTIONS - ONE DAY TO ONE WEEK?
  (BANKS, HEDGE FUNDS, SPECULATORS)
- STRUCTURAL TRADERS - ONE MONTH?
  (UNIT TRUSTS, PENSION FUNDS)
- PASSIVE TRADERS - ONE QUARTER?
  (CORPORATES)

LONGER HOLDING ≡ MORE RISK

RULE OF THUMB : SQUARE ROOT OF TIME

ANNUAL STANDARD DEVIATION = 16%

QUARTERLY STANDARD DEVIATION = $\frac{16}{\sqrt{4}}$ = 8%

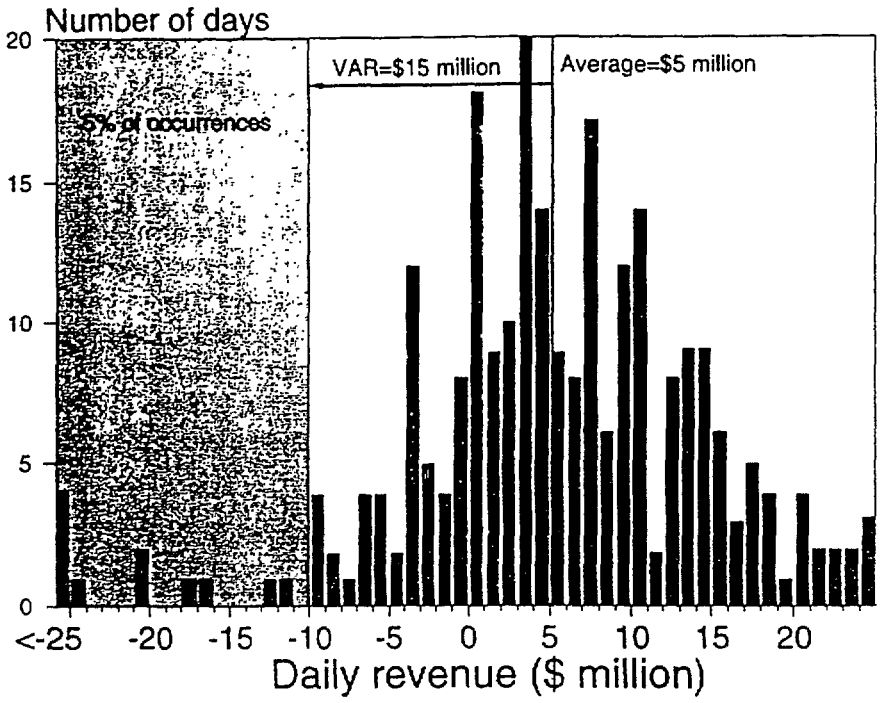
MONTHLY STANDARD DEVIATION = $\frac{16}{\sqrt{12}}$ = 4.62%

DAILY STANDARD DEVIATION = $\frac{16}{\sqrt{256}}$ = 1%

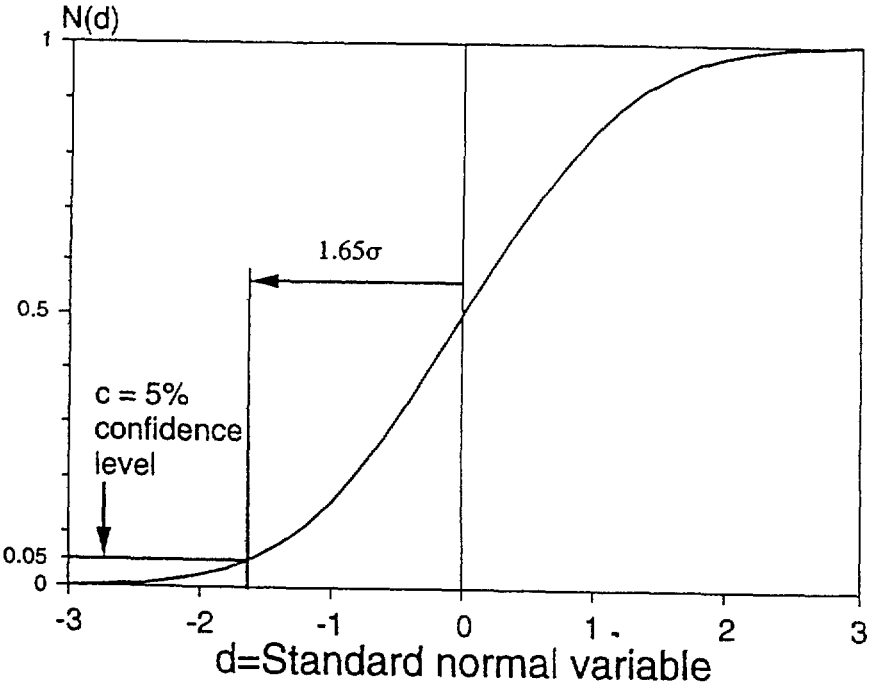
BUT NON-LINEAR POSITIONS
EXPIRING POSITIONS
NON-NORMAL DISTRIBUTIONS

VAR PARAMETERS:
LEVEL OF CONFIDENCE (PARAMETRIC)

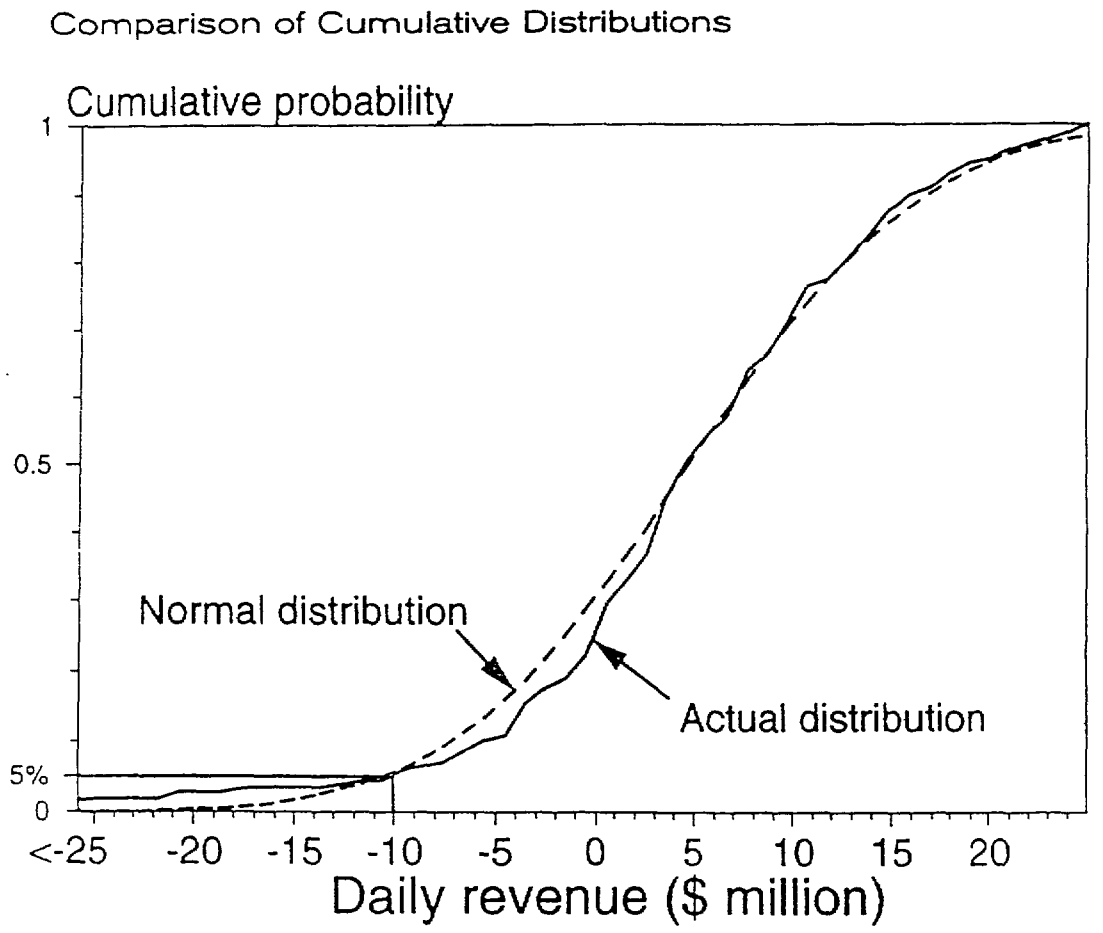
Distribution of Daily Revenues



Cumulative Normal Probability Distribution



VAR PARAMETERS: LEVEL OF CONFIDENCE (EMPIRICAL)

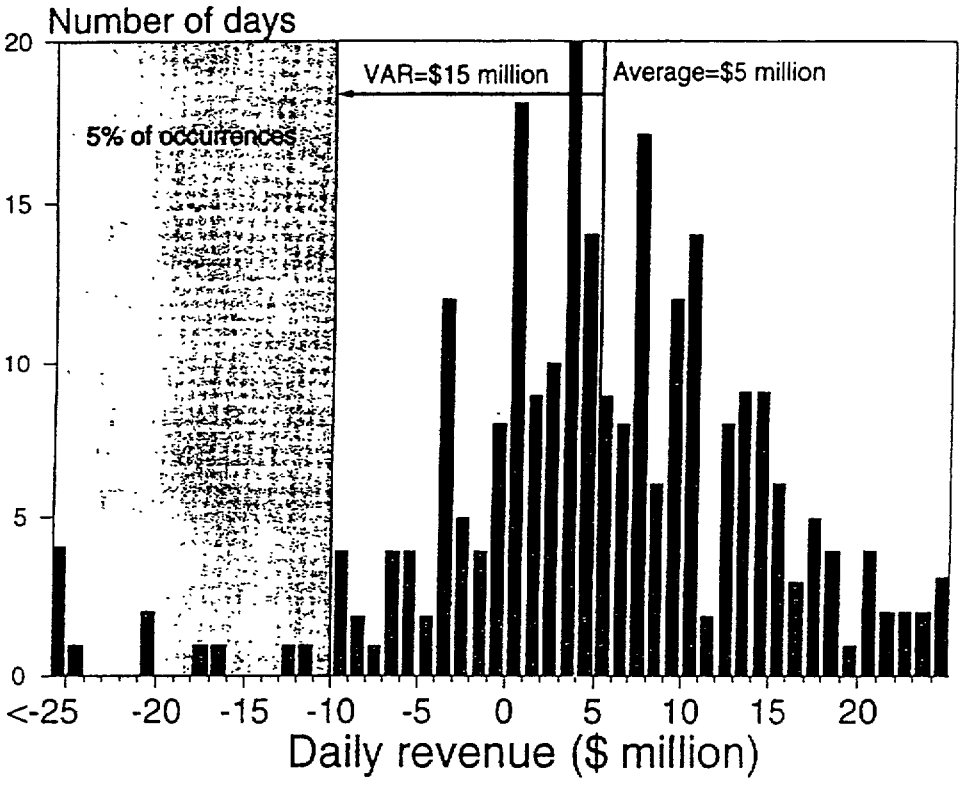


COMPARISONS OF NON-PARAMETRIC AND PARAMETRIC APPROACHES

- PARAMETRIC VAR SIMPLY MEANS THAT IT INVOLVES THE ESTIMATION OF A PARAMETER. HENCE, THE RISKMETRICS VARIANCE-COVARIANCE APPROACH IS PARAMETRIC RELYING ON THE STANDARD DEVIATION OF A NORMAL DISTRIBUTION.

- VAR CAN BE CALCULATED FOR GENERAL DISTRIBUTIONS, WE SIMPLY ESTIMATE THE SAMPLE QUANTILE OF AN EMPIRICAL DISTRIBUTION. THIS IS NON-PARAMETRIC VAR.

Distribution of Daily Revenues



AVERAGE REVENUE = $5.1 MILLION : 254 OBSERVATIONS

5% OF 254 = 12.7

11 OBSERVATIONS < -$10MM } INTERPOLATING GIVES
15 OBSERVATIONS < -$9MM } -$9.6MM

VAR = $5.1MM - (-$9.6MM) = $14.7MM

NOTE THIS SPECIFICATION IS VALID FOR ANY DISTRIBUTION.

HISTORICAL DATA CONSIDERATIONS

VAR LARGELY DEPENDS ON HISTORICAL DATA

QUESTIONS

- HOW MUCH PAST DATA IS NEEDED TO PROVIDE GOOD FORECAST
- IS ALL DATA FROM PAST EQUALLY VALID
- TRADE-OFF BETWEEN LENGTH AND MARKET CHANGE
  - LONGER THE BETTER
  - VOLATILITIES AND CORRELATIONS CHANGE
- WEIGHTING OF RECENT DATA
  - EXPONENTIAL WEIGHTING (J.P. MORGAN)
  - ADJUSTED EXPONENTIAL WEIGHTING (CSFB)
  - GARCH MODELS

CORRELATION ISSUES

- GENERALLY BETWEEN 0.0 AND 1.0
  - INTEREST RATES AND ASSET PRICES TEND TO RISE AND FALL TOGETHER BUT BY DIFFERENT AMOUNTS
- PORTFOLIO EFFECT
  - RISK OF GROUP OF POSITIONS GENERALLY LESS THAN SUM OF RISKS OF INDIVIDUAL POSITIONS
- KEY ASPECT OF VALUE AT RISK
  - TAKES INTO ACCOUNT CORRELATION OF INSTRUMENTS AND RISKS IN PORTFOLIO. MEASURES NET RISK.
- BUT CORRELATION IS DEFINITELY NOT CONSTANT

PROBLEMS WITH THE NORMAL DISTRIBUTION

- KURTOSIS : FAT MIDDLES AND LONG TAILS

- SKEWNESS : CHARACTERISTIC OF OPTION PORTFOLIO RETURNS

- DISCONTINUITIES : STOPS, BARRIERS AND REGULATORY INPUTS

VALUE AT RISK OF A SIMPLE PORTFOLIO (I)

REMEMBER PORTFOLIO VARIANCE FOR TWO ASSETS

$$\sigma_P^2 = w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2 w_1 w_2 \sigma_1 \sigma_2 \rho_{12}$$

PORTFOLIO VALUE = £1,000,000 50/50 TWO ASSETS

ASSET 1 VOLATILITY = 16%

CORRELATION = 0.40

ASSET 2 VOLATILITY = 20%

UNDIVERSIFIED PORTFOLIO VOLATILITY = (0.50) (16) + (0.50) (20)

= 18%

DIVERSIFIED PORTFOLIO VARIANCE = $(0.50)^2 (16)^2 + (0.50)^2(20)^2$ + (2) (0.50) (0.50)(16) (20) (0.4)

= 228

DIVERSIFIED PORTFOLIO VOLATILITY = $\sqrt{228}$ = 15.1%

VALUE AT RISK OF A SIMPLE PORTFOLIO (II)

ASSESS MAXIMUM LOSS AT A 99% CONFIDENCE INTERVAL - THAT IS, WILL OCCUR ONLY 1 PER CENT OF THE TIME

99% CONFIDENCE INTERVAL IS 2.3267 STANDARD DEVIATIONS FROM MEAN

NON-DIVERSIFIED VAR = (2.3267) (0.18) (1,000,000)
= £418,806

DIVERSIFIED VAR = (2.3267) (0.151) (1,000,000)
= £351,332

DIFFERENT TIME HORIZONS

QUARTERLY NON-DIVERSIFIED

$$(2.3267)\left(\frac{0.18}{\sqrt{4}}\right)(1{,}000{,}000) = £209{,}403$$

DIVERSIFIED

$$(2.3267)\left(\frac{0.151}{\sqrt{4}}\right)(1{,}000{,}000) = £175{,}666$$

MONTHLY NON-DIVERSIFIED

$$(2.3267)\left(\frac{0.18}{\sqrt{12}}\right)(1{,}000{,}000) = £120{,}899$$

DIVERSIFIED

$$(2.3267)\left(\frac{0.151}{\sqrt{12}}\right)(1{,}000{,}000) = £101{,}421$$

DAIILY NON-DIVERSIFIED

$$(2.3267)\left(\frac{0.18}{\sqrt{256}}\right)(1{,}000{,}000) = £26{,}175$$

DIVERSIFIED

$$(2.3267)\left(\frac{0.151}{\sqrt{256}}\right)(1{,}000{,}000) = £21{,}958$$

USING VAR TO COMPARE TRADERS

DEFINE CAPITAL AT RISK

AMOUNT OF CAPITAL NEEDED TO COVER 99% OF THE MAXIMUM EXPECTED LOSS OVER A ONE YEAR HOLDING PERIOD

DESK 1 — BOOK VALUE $20MM PROFIT = $1.5MM
VOLATILITY 5% PER ANNUM

DESK 2 — BOOK VALUE $10MM PROFIT = $1.5MM
VOLATILITY 13% PER ANNUM

DESK 1 VAR

$$2.33 \times 0.05 \times \$20MM = \$2.33MM$$

DESK 2 VAR

$$2.33 \times 0.13 \times \$10MM = \$3.029MM$$

REWARD TO RISK RATIO

$$\text{DESK 1} = \frac{\$1.5MM}{\$2.33MM} = 64\%$$

$$\text{DESK 2} = \frac{\$1.5MM}{\$3.029MM} = 50\%$$

THE RISKMETRICS APPROACH (INTEREST RATE EXAMPLE)

INPUTS PROVIDED

- ZERO COUPON RATES
- ZERO PRICE VOLATILITIES
- CORRELATION MATRICES

ALLOCATION OF CASH BETWEEN VERTICES

- PRESERVATION OF MARKET VALUE
- MARKET RISK MUST BE PRESERVED
- SIGN MUST BE PRESERVED

Example: Calculate the Daily Earnings at Risk (DEaR) in a portfolio of Australian Government bonds

Portfolio description

Suppose that our exposure to the market was represented by the J.P. Morgan Australian bond index. In July 1994, the index was composed of 16 issues with maturities ranging from September 1995 to November 2006.

Mapping

To summarily estimate what can happen to the market value of a portfolio over a 24-hour period, it is necessary to first map the position in a standard form. Our recommended method is to decompose all the index bonds into their component cash flows. The first column of the table below indicates the standard maturity vertices for which RiskMetrics™ data is available. The second column maps the current market value of the index cash flows into these standard vertices (for a description on the methodology used, see the RiskMetrics™ Technical Document)

Simulation

Estimating the amount of market risk incurred requires forecasts of volatilities and correlations. The third column in the table below lists the daily estimate of price volatility for zero coupon cashflows on each of the vertices. Column 4 is the estimated undiversified Daily Earnings at Risk of each position along the yield curve, obtained by multiplying the price volatility of the cash flow by its market value. Using standard matrix algebra, we can calculate a diversified Daily Earnings at Risk of the position which is lower than the undiversified estimate because the correlations between the different maturity vertices, while being high, are not equal to 1. The formula used for the diversified DEaR calculation is as follows

$$DEaR = \sqrt{\vec{V} \cdot [C] \cdot \vec{V}^T}$$

where

$$\vec{V} = \begin{bmatrix} DEaR_1 & ..... & DEaR_n \end{bmatrix} \quad \text{(DEaR vector of individual positions)}$$

$$[C] = \begin{bmatrix} 1 & .. & \rho_{n1} \\ .. & 1 & .. \\ \rho_{1n} & .. & 1 \end{bmatrix} \quad \text{(correlation matrix)}$$

$$\vec{V}^T = \begin{bmatrix} DEaR_1 \\ ..... \\ DEaR_n \end{bmatrix} \quad \text{(transposed vector of V)}$$

		Volatility	$\vec{V}$ DEaR	Correlations = C										
Vertices	Position			1m	3m	6m	1yr	2yr	3yr	4yr	5yr	7yr	9yr	10yr	15yr
1m	A$ 1,462,770	0.92%	A$ 13,472	1.00											
3m	A$ 595,210	1.04%	A$ 6,172	0.50	1.00										
6m	A$ 2,146,354	1.20%	A$ 25,713	0.37	0.58	1.00									
1yr	A$ 6,564,634	1.83%	A$ 120,264	0.47	0.61	0.71	1.00								
2yr	A$ 10,208,412	2.81%	A$ 286,448	0.27	0.29	0.57	0.76	1.00							
3yr	A$ 5,899,643	3.04%	A$ 179,526	0.25	0.28	0.55	0.75	0.99	1.00						
4yr	A$ 8,863,220	2.92%	A$ 258,452	0.24	0.27	0.55	0.74	0.99	1.00	1.00					
5yr	A$ 6,999,365	2.76%	A$ 193,462	0.21	0.24	0.53	0.72	0.98	0.99	1.00	1.00				
7yr	A$ 4,292,131	2.62%	A$ 112,239	0.12	0.20	0.43	0.61	0.88	0.91	0.93	0.95	1.00			
9yr	A$ 2,834,083	2.60%	A$ 73,714	0.08	0.17	0.39	0.55	0.83	0.86	0.88	0.91	0.99	1.00		
10yr	A$ 1,137,932	2.60%	A$ 29,529	0.08	0.17	0.41	0.56	0.84	0.87	0.89	0.92	0.99	1.00	1.00	
15yr	A$ 741,319	2.51%	A$ 18,570	0.08	0.18	0.43	0.56	0.84	0.87	0.89	0.92	0.99	1.00	1.00	1.00

			Total	% of Position
Total	A$ 51,745,073	Undiversified DEaR	A$ 1,317,563	2.55
		Diversified DEaR	A$ 1,238,431	2.39

In Australian dollar millions - cash flow map as for July 29th, 1994

STRESS TESTING (SCENARIO ANALYSIS)

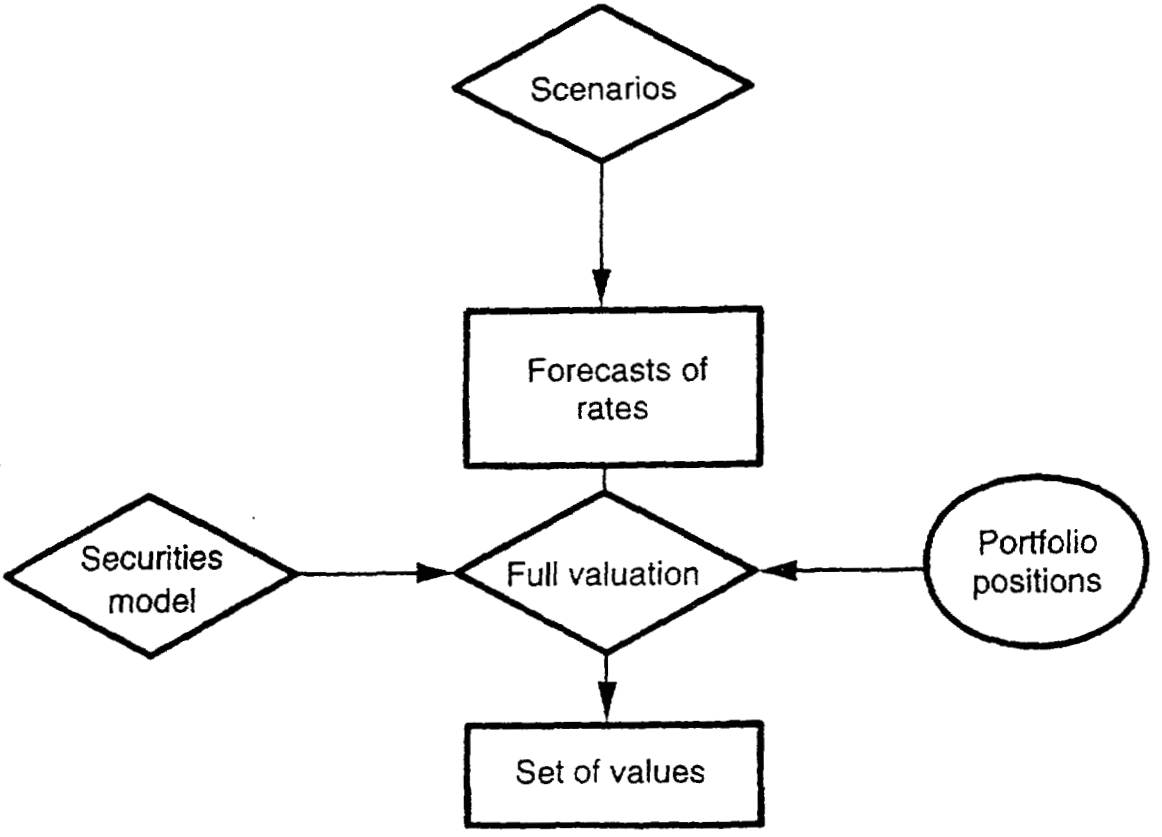
EXAMINATION OF THE EFFECT OF SIMULATED LARGE MOVEMENTS IN KEY FINANCIAL VARIABLES

SUBJECTIVE SPECIFICATION OF SCENARIOS OF INTEREST TO ASSESS POSSIBLE CHANGES IN VALUE OF PORTFOLIO

EXAMPLE : DERIVATIVES POLICY GROUP

PARALLEL YIELD CURVE SHIFTING	± 100 BP
YIELD CURVE TWISTING	± 25 BP
EQUITY INDEX VALUES	± 10%
CURRENCY RATES	± 6%
VOLATILITIES CHANGE	± 20% (OF CURRENT LEVELS)

Stress-Testing Method



POINTS TO NOTE

- CAN COVER SITUATIONS COMPLETELY ABSENT FROM HISTORICAL EXPERIENCE.

- COMPLETELY SUBJECTIVE : ARE PEOPLE GOOD AT PREDICTING EXTREME SITUATIONS

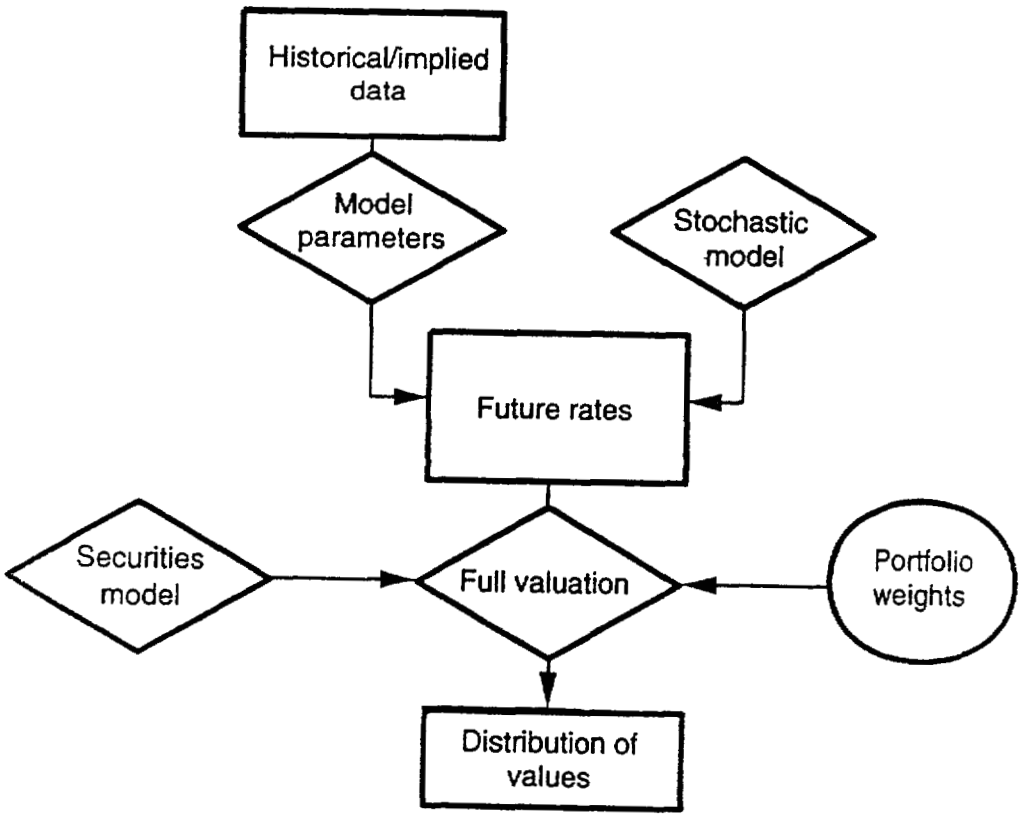
- STRESS TESTING DOES NOT SPECIFY LIKLIHOOD OF WORSE CASE SCENARIOS. EXPECTED RISK IS FUNCTION NOT JUST OF LOSSES BUT OF PROBABILITY OF LOSSES OCCURRING.

- HANDLES CORRELATION POORLY.

MONTE CARLO SIMULATION APPROACH

- RISK MANAGER SPECIFIES A STOCHASTIC PROCESS FOR FINANCIAL VARIABLES AS WELL AS PROCESS PARAMETERS.
- PROCESS PARAMETERS SUCH AS RISK AND CORRELATIONS CAN BE DERIVED FROM HISTORICAL OR OPTION DATA.
- FICTITIOUS PRICE OR RATE PATHS ARE GENERATED FOR VARIABLES OF INTEREST.
- AT EACH TIME HORIZON, PORTFOLIO IS MARKED TO MARKET USING FULL VALUATION.
- EACH 'PSEUDO' REALISATION IS THEN USED TO COMPLETE A DISTRIBUTION OF RETURNS FROM WHICH VAR CAN BE DERIVED.

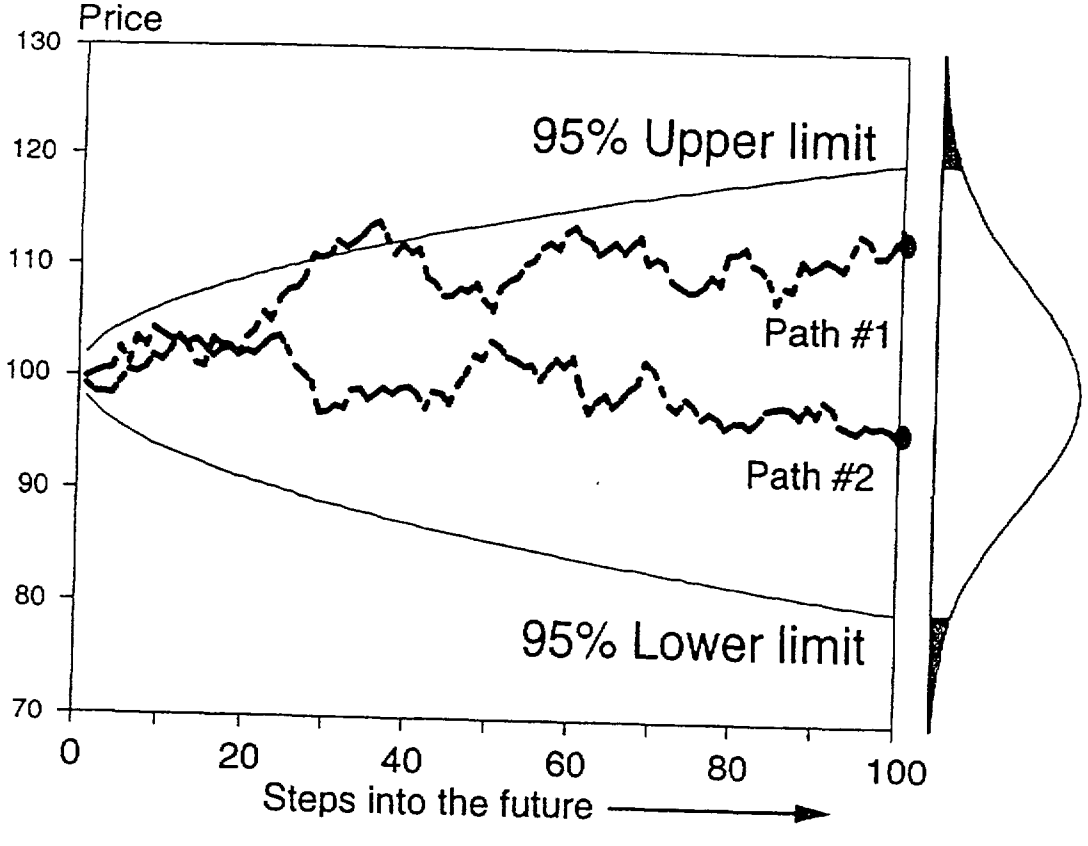
Monte Carlo Method

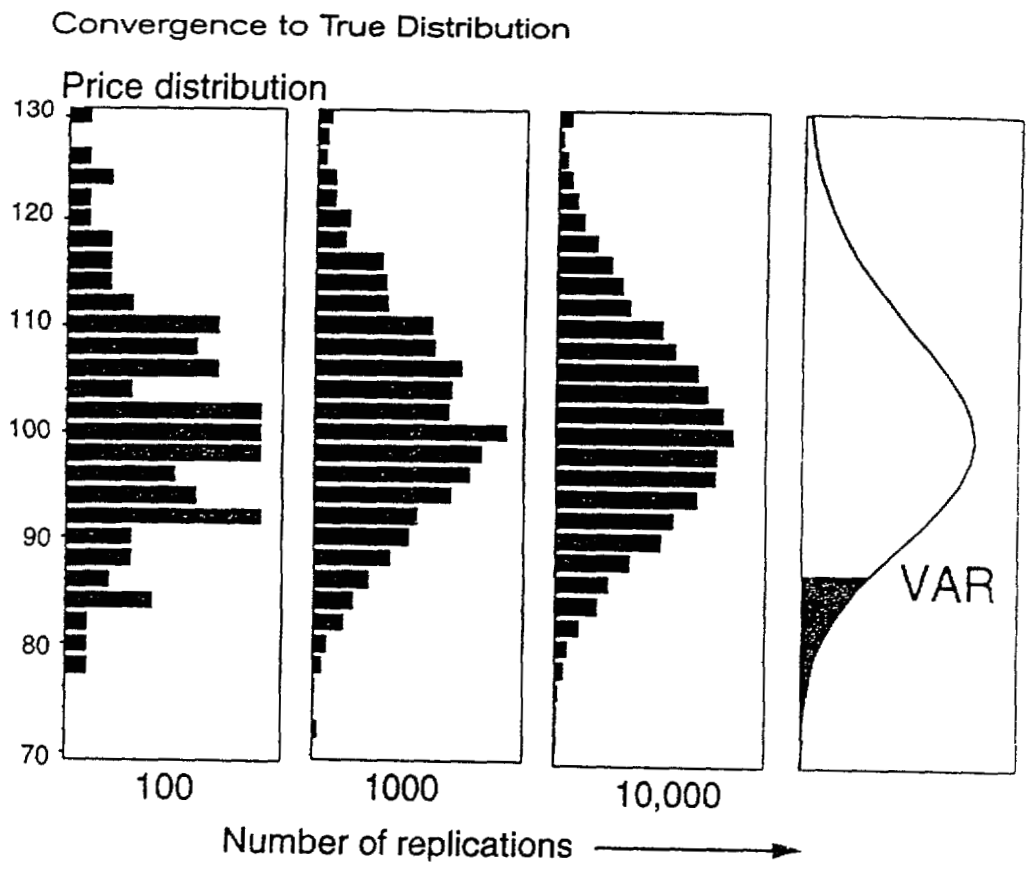


Simulating a Price Path

Step t	Previous Price S_{t+t-1}	Random Variable ϵ_t	Increment ΔS	Current Price S_{t+t}
1	100.00	0.199	0.00199	100.20
2	100.20	1.665	0.01665	101.87
3	101.87	−0.445	−0.00446	101.41
4	101.41	−0.667	−0.00668	100.74
. . .				
100	92.47	1.153	−0.01153	91.06

Simulating Price Paths




Convergence to True Distribution
Price distribution
130
120
110
100
90
80
70
VAR
100
1000
10,000
Number of replications

GENERATION OF RATE AND VOLATILITY SCENARIOS

- GENERATE THE INTEREST RATE VARIANCE - COVARIANCE MATRIX
- GENERATE A RANDOM SAMPLE OFAN NX1 VECTOR OF INDEPENDENT N(O,I) RANDOM VARIABLES
- USE CHOLETSKY DECOMPOSITION OF COVARIANCE MATRIX TO CREATE NEW CORRELATED SET OF INNOVATIONS WITH SAME COVARIANCE STRUCTURE AS MARKET RATE INNOVATIONS
- THESE INNOVATIONS ARE USED TO CALCULATE ADDITIVE CHANGES IN OBSERVABLE MARKET RATES
- REVALUE PORTFOLIO FOR EACH SIMULATION RUN

CHOLETSKY DECOMPOSITION

A TECHNIQUE TO PRESERVE THE CORRELATION STRUCTURE WHEN DRAWING RANDOMLY FROM SEVERAL NORMAL VARIABLES.

EXAMPLE

	ASSET 1	ASSET 2
NUMBER OF STANDARD DEVIATIONS	-1.2580	0.7875

CORRELATION

-1	-1.2580	1.2580
0	-1.2580	0.7875
1	-1.2580	-1.2580
0.9	-1.2580	-0.7889

GLOBAL LIMITS

FEW INSTITUTIONS ARE CAPABLE OF INTEGRATING ALL THEIR EXPOSURES ESPECIALLY WHEN CONSIDERING RELATIVELY CIRCUMSTANCES.

TWO APPROACHES CAN BE CONSIDERED

1. CORRELATION MATRIX

   THE CORRELATION MATRIX (OR VARIANCE/COVARIANCE MATRIX) AMONG SEVERAL ASSETS CAN IN THEORY BE USED TO DESCRIBE A PORTFOLIO RISK.

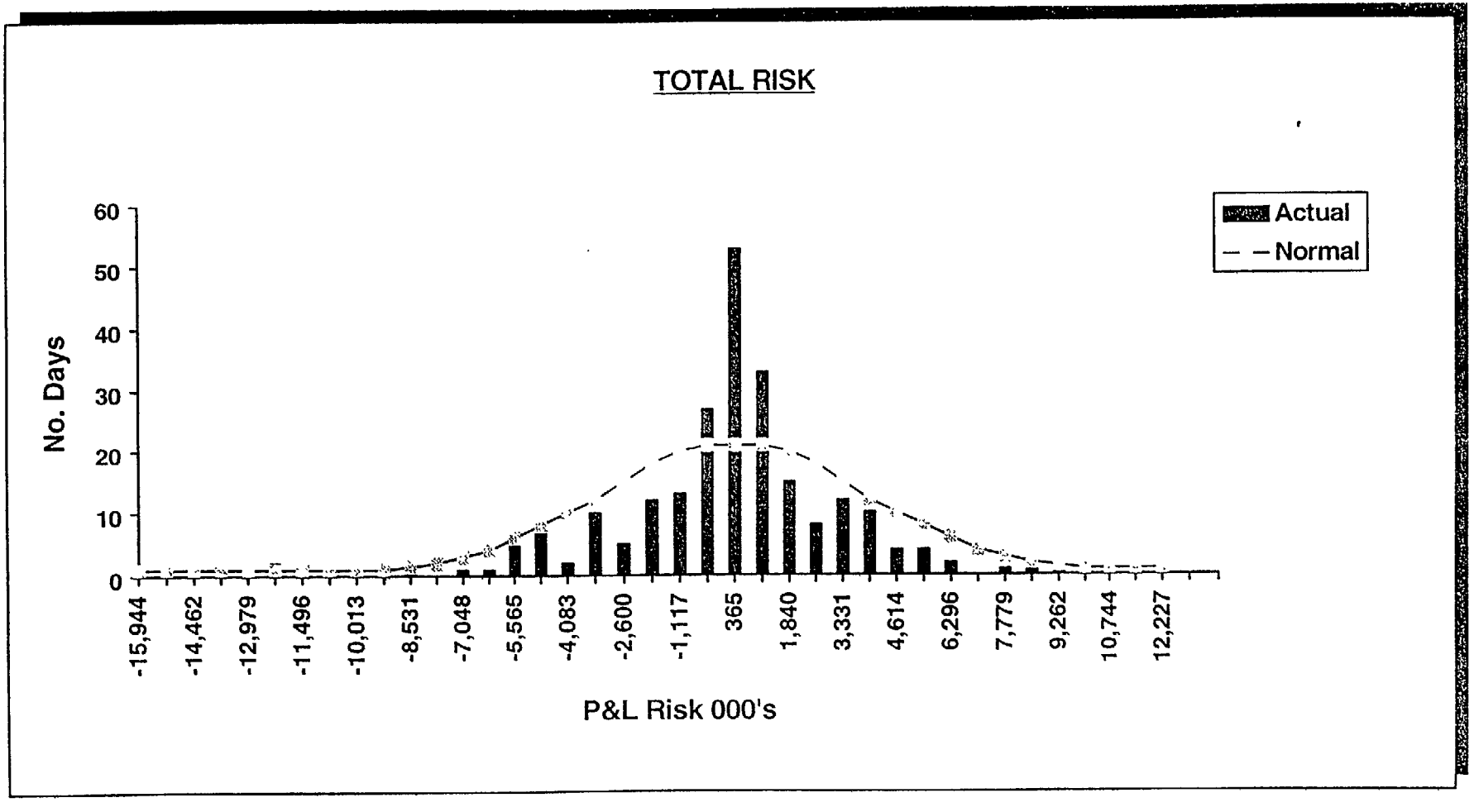
   HOWEVER:
   - LINEAR CORRELATIONS MAY NOT DESCRIBE ACCURATELY THE MUTUAL OFTEN NON LINEAR DEPENDENCY AMONG MANY ASSETS.
   - THE MATRIX CAN BE TOO LARGE TO HANDLE.

   SIMPLIFICATION:
   TRY TO REDUCE THE PORTFOLIO RISK DOWN TO A SMALL NUMBER OF EXPLANATORY FACTORS.

2. BACKTESTING (OR SIMULATION)

   COLLECT DATA ON THE JOINT VARIATIONS OF THE RELEVANT ASSET PRICES OVER TIME AND APPLY

TRADING MANAGER



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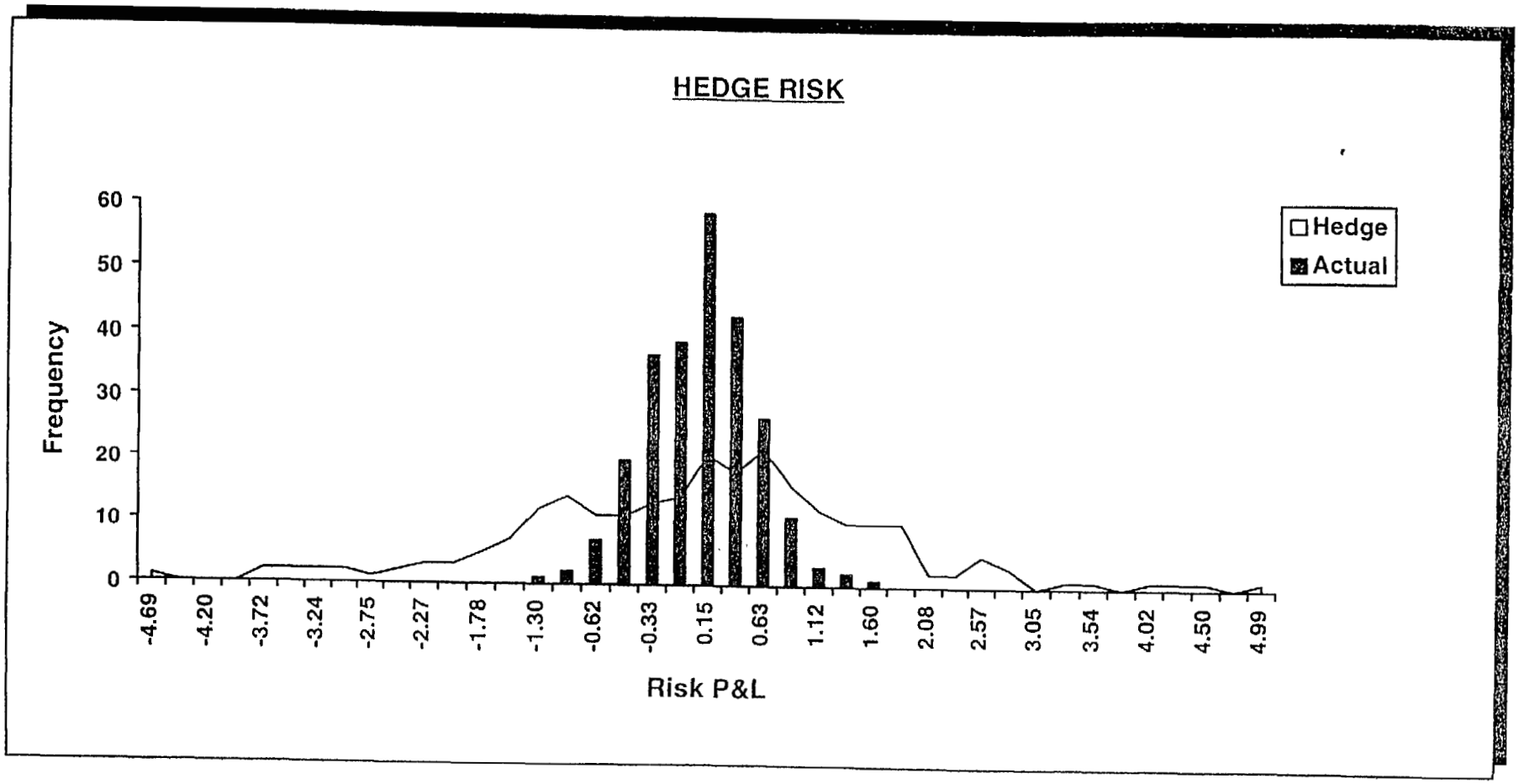
HEDGE MAKER



VALUE AT RISK METHODOLOGIES

- VARIANCE - COVARIANCE
- MONTE CARLO SIMULATION
- HISTORICAL SIMULATION

ALL METHODOLOGIES FOLLOW SAME FOUR STEPS

- ESTIMATE DISTRIBUTION FOR HORIZON PERIOD'S MARKET
- ESTIMATE IMPACT OF HORIZON PERIOD'S MARKET ON TODAY'S POSITION (DISTRIBUTION OF RESULTS)
- AGGREGATE RISKS OF SEPARATE POSITIONS (DISTRIBUTION OF PORTFOLIO RESULTS)
- DETERMINE VALUE AT RISK OF PORTFOLIO DISTRIBUTION

VALUE AT RISK (VAR)
VARIANCE/COVARIANCE METHODOLOGY

- PRINCIPAL ASSUMPTION:
  - DISTRIBUTIONS OF PORTFOLIO RETURNS ARE NORMALLY DISTRIBUTED.
    - SUM OF NORMAL DISTRIBUTIONS IS ITSELF A NORMAL DISTRIBUTION.
    - RISK CALCULATION AT CHOSEN CONFIDENCE INTERVAL IS SIMPLY A MATTER OF CHOOSING THE RIGHT STANDARD DEVIATION.
    - CHANGING HORIZON IS NO PROBLEM (√TIME).

- ADVANTAGES
  - ANALYTICAL AND PARAMETRIC APPROACH - STRAIGHTFORWARD
  - BASED ON SIMPLE PROBABILITY THEORY
  - ATTEMPT TO CREATE INDUSTRY STANDARD

- ISSUES
  - MARKETS ARE NOT NORMAL
  - WHAT ABOUT EXTREME CASES
  - IMPRECISION OF GRIDDING AND MAPPING TECHNIQUES
  - INABILITY TO HANDLE OPTIONS

VALUE AT RISK (VAR)
MONTE CARLO SIMULATION METHODOLOGY

- PRINCIPAL ASSUMPTION
  LAW OF LARGE NUMBERS
  - MANY NEAR-RANDOM SCENARIOS PROVIDE UNBIASED SAMPLE OF HORIZON MARKET
  - CALCULATE VAR BY PARAMETRIC AND NON-PARAMETRIC APPROACHES

- ADVANTAGES
  - EASILY HANDLES NON-LINEAR INSTRUMENTS (OPTIONS)
  - LARGE SAMPLE SIZE GIVES STATISTICALLY ACCURATE ESTIMATE OF RISK
  - EASY TO HANDLE NON-NORMAL DISTRIBUTIONS
  - CAN IDENTIFY EXTREME SCENARIOS AND PROBABILTIES

- ISSUES
  - VERY COMPUTER INTENSIVE
  - DOES MANAGEMENT UNDERSTAND
  - WIDE DEGREE OF CHOICE

VALUE AT RISK (VAR)
HISTORICAL SIMULATION METHODOLOGY

- PRINCIPAL ASSUMPTION
  STATIONARITY OF MARKET PRICE DISTRIBUTIONS
  - "OF THE 100 SETS OF DAILY PRICE CHANGES JUST EXPERIENCED, ONE OF THEM WILL OCCUR TONIGHT"

- ADVANTAGES
  - EASILY HANDLES NON-LINEAR RISKS
  - NO ASSUMPTIONS ABOUT DISTRIBUTIONS
  - COMPUTATIONALLY EFFICIENT
  - VERY CLEAR AND TRANSPARENT

- ISSUES
  - SLOW DECAY OF EXTREME EVENTS
  - WHAT TYPE OF HISTORICAL DATA
    - WINDOW
    - LENGTH
    - WEIGHTING
  - DATA INTEGRITY
  - EXTENDING TO LONGER TIME HORIZON

VAR CASE STUDY 1

You are presented with a portfolio of three assets. The relevant weightings and market data are as shown.

	WEIGHTING	VOLATILITY
ASSET 1	30%	25%
ASSET 2	25%	27%
ASSET 3	45%	30%

CORRELATION

1,2	0.60
1,3	0.50
2,3	0.30

VALUE OF PORTFOLIO $5,000,000

Determine the VAR of this portfolio at a 95% and at a 99% confidence interval. Do this on both a diversified and undiversified basis.

→ Look at page 16-17

*Formula

VAR Case Study 1 - Solution

We first consider the market information

Market Information

	Weighting	Volatility
Asset 1	30%	25%
Asset 2	25%	27%
Asset 3	45%	30%

Portolio Value: £ 5,000,000

Correlations

	Asset 1	Asset 2	Asset 3
Asset 1	1	0.6	0.5
Asset 2	0.6	1	0.3
Asset 3	0.5	0.3	1

Confidence Interval 95.0%

Number of standard deviations 1.6449 (We use the function NORMSINV to calculate this)

We rewrite the volatilities in matrix form as we are only going to do matrix calculations. We also need to adjust the volatilities by the number of standard deviations.

Volatility Matrix

25%		
	27%	
		30%

Adjusted Volatity matrix = Adjusted for Std Dev =

41.12%	0.00%	0.00%
0.00%	44.41%	0.00%
0.00%	0.00%	49.35%

We first build up our variance covariance matrix (VCV). We do this in two stages ((VC) x V).

VC Matrix

41.12%	24.67%	20.56%
26.65%	44.41%	13.32%
24.67%	14.80%	49.35%

Variance covariance matrix = Adjusted for Std. Dev. =

16.91%	10.96%	10.15%
10.96%	19.72%	6.57%
10.15%	6.57%	24.35%

We rewrite the weightings as a matrix and the transpose of it.

Weighting Matrix'

30%	25%	45%

Weighting matrix

30%
25%
45%

5,073 @ 30?
2,740 @ 25?
4,5675 @ 45?
+
12,387.

We can now multiply to get W'VCV and then W'VCVW

W'VCV Matrix

12.38%	11.18%	15.64%

3.71 + 2.795 + 7.038 = 13.55%

W'VCVW

V = 36.81?

The diversified VaR is the square root of this.

VaR 36.81% (Diversified) × £ 5,000,000 =

= £ 1,840,357

VC matrix
41.12
X
30%
12,347

44.41
X 25%
11.10%

49.35
X 45%
22.2

For the undiversified VaR, we need only calculate W'VW and add up the cells.

45.64% (Undiversified) X £5,000,000

= £2,282,234

W'VW Matrix

12.34% + 11.10% + 22.21% =

The above gives the solutions for a 95% confidence interval. If we use a 99% interval, then the solution is:

{ use the entire same exercise over again!

VaR 52.06% (Diversified)

X £5mil = £2,602,847

64.56% (Undiversified)

X £5mil = £3,227,799

INDUSTRIAL FINANCE CORPORA/TION OF THAILAND

FOUR DAY RISK MANAGEMENT SEMINAR

DAY FOUR
MAY 20, 2000

ANALYZING MARKET RISKS OF DERIVATIVES

PRESENTED BY

A. WILLIAM BODINE, Ph.D.

BANGKOK, THAILAND

DELOITTE TOUCHE TOHMATSU

POSITION RISKS

PROBLEM DESCRIPTION

THE PRICES OF DERIVATIVE INSTRUMENTS MAY VARY AS A RESULT OF CHANGES IN A NUMBER OF MARKET FACTORS.

AMONG THESE:

- THE MARKET SENTIMENT
- THE PRICES OF U/ASSETS
- THE VOLATILITIES OF THESE PRICES
- THE LEVELS OF SHORT TERM INTEREST RATES
- THE PASSAGE OF TIME

IT IS IMPORTANT TO:

- ASSESS THE RISKS REGULARLY
- DEFINE EXPOSURE LIMITS
- DESIGN EFFICIENT METHODS FOR CONTROLLING THE RISKS WITHIN THESE LIMITS

POSITION RISKS

AN APPROACH TO THE CONTROL OF POSITION RISKS

1 EVALUATE THE SENSITIVITIES OF INDIVIDUAL DERIVATIVE INSTRUMENTS TO CHANGES IN MAJOR MARKET FACTORS:

MARKET SENTIMENT	→	BASIS PREM/DISC.
U/ASSET PRICE	→	DELTA, GAMMA
VOLATILITY	→	VEGA
S.T. INTEREST RATE	→	RHO
YIELD	→	PHI
TIME	→	THETA

2 CALCULATE GLOBAL SENSITIVITIES OF PORTFOLIO BASED ON INDIVIDUAL SENSITIVITIES AND CORRELATIONS AMONG MARKET FACTORS. EXTEND THE ANALYSIS TO EXTREME CHANGES OF MARKET CONDITIONS (BY SIMULATION, IF NECESSARY)

3 DEFINE GLOBAL LIMITS TO POSITION RISKS FOR AVERAGE AS WELL AS EXTREME MARKET FLUCTUATIONS ALTERNATIVELY, OR IN ADDITION, DESIGN METHODOLOGY FOR ASSESSING OPTIMAL EXPOSURE AS A FUNCTION OF EXPECTATIONS AND CAPACITY TO TAKE RISK.

AN APPROACH TO THE CONTROL OF POSITION RISKS (CONTD.)

4 DEVELOP CONTROL MECHANISMS TO MAINTAIN EXPOSURE WITHIN LIMITS OR TO STEER IT TOWARDS ITS OPTIMAL PROFILE.

5 DEVELOP PROCEDURES AND SYSTEMS TO CARRY OUT SYSTEMATICALLY THE PREVIOUS 4 STEPS ON A ROUTINE BASIS

REMARKS

THE OBJECTIVE OF POSITION RISK CONTROL IS NOT TO REDUCE SUCH RISKS AS MUCH AS POSSIBLE BUT TO KEEP THEM IN BALANCE WITH CORRESPONDING PROFIT EXPECTATIONS AND WITHIN THE RISK CAPACITY OF THE FIRM.

BASIS RISK

RISK INCURRED ON A PORTFOLIO CONTAINING SECURITIES AND FUTURES (OR OPTIONS) ON SUCH SECURITIES WHEN AN UNEXPECTED BASIS MOVEMENT TAKES PLACE

NOTE: THE GRADUAL REDUCTION OF THE BASIS TO ZERO AT FUTURES EXPIRY DATE SHOULD NOT BE REGARDED AS A RISK IN AS MUCH AS IT IS PREDICTABLE.

TWO EFFECTS OF BASIS FLUCTUATIONS MAY BE OF CONCERN:

- TRADERS SHOULD BE MORE CONCERNED ABOUT SHORT TERM BASIS FLUCTUATIONS AS THEY AFFECT THEIR PORTFOLIO P/L FROM DAY TO DAY

- HEDGERS SHOULD BE MORE CONCERNED WITH THE ULTIMATE BASIS RISK AT THE TIME THEY LIFT A HEDGE AS IT IMPACTS THE EFFICIENCY OF THE HEDGE STRATEGY

BUCKETING IN AN OPTION MODEL CONTEXT

EXAMPLE : BLACK, DERMAN, TOY MODEL

- INPUTS: ZERO YIELD CURVE
  ZERO YIELD VOLATILITY CURVE

- DETERMINE KEY RATES AND KEY VOLATILITIES ON CURVE

- SHIFT KEY RATES, CALCULATE NEW ZERO CURVE, REVALUE ENTIRE PORTFOLIO OF CASH FLOWS. GIVES DOLLAR KEY RATE DELTA

- SHIFT KEY RATES TWICE AS MUCH, RECALCULATE NEW ZERO CURVE, REVALUE ENTIRE PORTFOLIO OF CASH FLOWS. GIVES DOLLAR KEY RATE GAMMA

- SHIFT KEY VOLATILITIES, CALCULATE NEW VOLATILITY CURVE, REVALUE ENTIRE PORTFOLIO OF CASH FLOWS. GIVES DOLLAR KEY VOLATILITY VEGAS

RATE AND VOLATILITY BUCKETING REPORT

	KEY RATE	KEY RATE VOLATILITIES	DELTA	GAMMA	VEGA
1-MO	4.0	16%	565	200	500
3-MO	4.5	18%	890	400	-400
6-MO	5.0	19%	-700	150	500
1-YEAR	5.25	18%	2200	560	-1000
2-YEAR	5.50	17%	5650	2100	2000
3-YEAR	6.00	16%	8000	1000	-3000
5-YEAR	6.50	14%	-6250	450	2000
7-YEAR	7.00	13%	-500	100	500
10-YEAR	7.75	12%	2100	2000	1000
		TOTAL	11,955	6,960	2,100

TOTAL SENSITIVITIES OF A PORTFOLIO

1. ALL OPTIONS ON SAME ASSET

ADD MONETARY VALUES OF SENSITIVITIES OF INDIVIDUAL OPTIONS.

MARKS & SPENCER = 402p

SERIES	POSITION	PREMIUM	DELTA	GAMMA	VEGA	THETA
JUL 390 CALL	+30	23	0.65	0.04	0.32	-0.20
JUL 420 PUT	+20	23	-0.60	0.03	0.30	-0.18
OCT 420 CALL	-20	19½	0.40	0.02	0.50	-0.08

CALCULATION OF PORTFOLIO SENSITIVITIES

		DELTA
30 x 0.65	=	19.5p
20 x -0.60	=	-12.0p
-20 x 0.40	=	-8.0p
TOTAL	=	-0.5p

		GAMMA
30 x 0.04	=	1.2p
20 x 0.03	=	0.6p
-20 x 0.02	=	-0.4p
TOTAL	=	1.4p

		VEGA
30 x 0.32	=	9.6p
20 x 0.30	=	6.0p
-20 x 0.50	=	-10.0p
TOTAL	=	5.6p

		THETA
30 x-0.20	=	-6p
20 x -0.18	=	-3.6p
-20 x -0.08	=	+1.6p
TOTAL	=	-8p

ASSUMING 1000 SHARES PER OPTION

STERLING DELTA = £-5 (A LOSS OF £5 PER 1p RISE IN STOCK)
STERLING GAMMA = +£14 (A CHANGE IN STERLING DELTA OF £14 PER 1p CHANGE IN STOCK)
STERLING VEGA = £56 (A GAIN OF £56 PER 1% RISE IN VOLATILITY)
STERLING THETA = £-80 (A LOSS OF £80 FOR EACH DAY)

TOTAL SENSITIVITIES OF A PORTFOLIO

2. OPTIONS ON DIFFERENT U/ASSETS

U/ASSETS MUST BE GROUPED INTO FAMILIES IDENTIFIED BY AN INDEX AND REGRESSED AGAINST THIS INDEX.

THE REGRESSION COEFFICIENTS AND THE STOCK PRICES CAN BE USED AS WEIGHTING FACTORS TO CALCULATE THE TOTAL SENSITIVITIES TO CHANGES IN THE INDEX

FOR EXAMPLE, LET

βP = REGRESSION COEFFICIENT OF STOCK PRICES/INDEX

$\beta\sigma$ = REGRESSION COEFFICIENT OF STOCK VOLATILITIES/INDEX VOLATILITY

AND CONSIDER THE FOLLOWING PORTFOLIO OF UK STOCKS:

STOCK	PRICE	βP	£Δ	VOLATILITY	$\beta\sigma$	£K
M & S	402	1.0	+47	26	1.2	+56
SHELL	700	0.9	+310	22	1.1	+450
ULV	989	1.2	+190	20	1.0	+230

CALCULATE THE PORTFOLIO SENSITIVITIES TO VARIATIONS OF +1% OF THE INDEX PRICE AND +1% OF THE INDEX VOLATILITY

CALCULATIONS

1% CHANGE IN MARKET INDEX

IMPLIED STOCK PRICE CHANGE	STERLING DELTA
4.02P	+£188.94
6.30P	+£1,953.00
11.87P	+£2,255.30
	+£4,397.24

1% CHANGE IN MARKET VOLATILITY

IMPLIED STOCK VOLATILITY CHANGE	STERLING VEGA
0.312%	+£17.47
0.242%	+£108.90
0.200%	+£46.00
	+£172.37

AVERAGE DAILY SCENARIO - AN EXERCISE

CALCULATE THE DAILY STANDARD DEVIATION (DSD) OF A PORTFOLIO BASED ON THE FOLLOWING DAILY STANDARD DEVIATIONS AND SENSITIVITIES

DAILY VARIATIONS		SENSITIVITY			
(A1) PRICE	1.00%	(B1) DELTA/1%	=	£4397
(A2) VOLATILITY	5.00%	(B2) KAPPA/1%	=	£172
(A3) RATES	0.10% ABS	(B3) RHO/1% ABS	=	£5000

STEP 1 MARKET RISK

ASSUMING INDEPENDENT VARIATIONS FOR PRICE, VOLATILITY AND RATES, THE TOTAL MARKET RISK DSD IS THE SQUARE ROOT OF THE SUM OF THE SQUARES OF THE INDIVIDUAL COMPONENTS:

$(1.0 \times 4397)^2 = 19{,}333{,}609$

$(5.0 \times 172)^2 = 739{,}600$

$(0.10 \times 5000)^2 = 250{,}000$

MARKET RISK $DSD^2 = 20{,}323{,}209$

MARKET RISK DSD = 4,508

EXERCISE (CONTD.)

STEP 2 SPECIFIC RISK

- WHEN THE PORTFOLIO IS MADE OF POSITIONS IN SEVERAL RELATED SECURITIES, THE PREVIOUS CALCULATION INDICATES THE RISK RELATIVE TO OVERALL MARKET FACTORS ASSUMING EACH SECURITY MOVES ACCORDING TO ITS BETA

- IT REMAINS TO EVALUATE THE SPECIFIC RISKS ASSOCIATED WITH EACH SECURITY USING:

$$(\text{TOTAL DSD})^2 = (\text{MARKET DSD})^2 + (\text{SPECIFIC DSD})^2$$

WHERE MARKET DSD = βP x INDEX DSD

FOR EXAMPLE WITH:

M & S TOTAL DSD	=	$26\% \sqrt{256}$
M & S βP	=	1.0
FTSE TOTAL DSD	=	$16\% \sqrt{256}$

$$(26)^2/256 = (1.0)^2 \times (16)^2/256 + (\text{SPECIFIC DSD})^2$$

THEN, SPECIFIC DSD = 20.5%

- SIMILAR CALCULATIONS FOR SPECIFIC VOLATILITY RISK

EXERCISE

- THE TOTAL PORTFOLIO DSD IS OBTAINED BY SUMMING THE VARIOUS COMPONENTS
- INDEPENDENT COMPONENTS ARE SUMMED BY TAKING THE SQUARE ROOT OF THE SUM OF THE SQUARES
- BY DEFINITION MARKET AND SPECIFIC RISKS ARE INDEPENDENT
- WE ASSUME PRICE VOLATILITY AND RATE RISKS ARE ALSO INDEPENDENT

FOR EXAMPLE

	MARKET RISK	SPECIFIC RISK	TOTAL
PRICE	4397 (19,337)	2491 (6205)	5054 (25,539)
VOLATILITY	860 (740)	633 (400)	1068 (1140)
RATE	500 (250)	0 (0)	500 (250)
TOTAL	4508 (20,323)	2570 (6605)	5189 (26,927)

( ) = DSD^2 ALL FIGURES IN £ THOUSANDS

AVERAGE DAILY SCENARIOS - QUESTIONS

1 HOW SHOULD THE DSD OF THE PORTFOLIO BE COMPARED WITH DAILY P/L FLUCTUATIONS?

2 IS IT IMPORTANT TO SET A LIMIT ON THE DSD OF A PORTFOLIO AND, IF SO, HOW SHOULD IT BE DEFINED?

3 IS IT POSSIBLE TO RELATE DSD TO TOTAL MARGIN?

4 WOULD A LIMIT ON THE DSD BE SUFFICIENT TO CONTROL POSITION RISK?

DAILY RISK EXERCISE I

BUDGETED P/L = 10,000,000

WILL ACCEPT 99.5% CONFIDENCE OF MAKING MONEY

$$\text{STANDARD DEVIATION} = \frac{10{,}000{,}000}{3}$$

$$= 3{,}333{,}333$$

$$\text{DAILY P/L} = \frac{10{,}000{,}000}{256} = 39{,}062$$

$$\text{DAILY S.D.} = \frac{3{,}333{,}333}{16} = 208{,}333$$

THE RULE OF 5 : 1

DAILY RISK EXERCISE II

1. RATIO OF DAILY RISK TO DAILY P/L MUST NEVER EXCEED 5/1

2. DAILY RISK MUST NEVER EXCEED $200,000

3. A TARGET RATIO SHOULD BE $2^1/_2$ /1

4. NO NEW TRADE SHOULD BE DONE AT A REWARD/RISK RATIO WORSE THAN 3/1

WORSE CASE SCENARIO

THE MAIN PURPOSE OF DEFINING A WORSE CASE SCENARIO IS TO ENSURE THAT THE EFFECTS OF MAJOR MARKET MOVEMENTS HAVE BEEN CONSIDERED

THE MAIN DIFFICULTIES ARE THAT:

- THE EFFECTS OF MAJOR MARKET MOVEMENTS ARE NOT LINEAR AND NOT ADDITIVE
- THE CORRELATIONS AMONG CRITICAL FACTORS ARE HARD TO ESTIMATE
- WHATEVER THE DEFINITION OF A WORSE SCENARIO IT IS DIFFICULT TO ASSESS THE LIKELIHOOD OF EVEN MORE ADVERSE SCENARIOS

WORSE CASE SCENARIOS

(1) P/L DEVIATIONS FROM SPOT UP TO PLUS OR MINUS 8 DAILY STANDARD DEVIATIONS, EQUAL TO ONE HALF YEAR S.D.

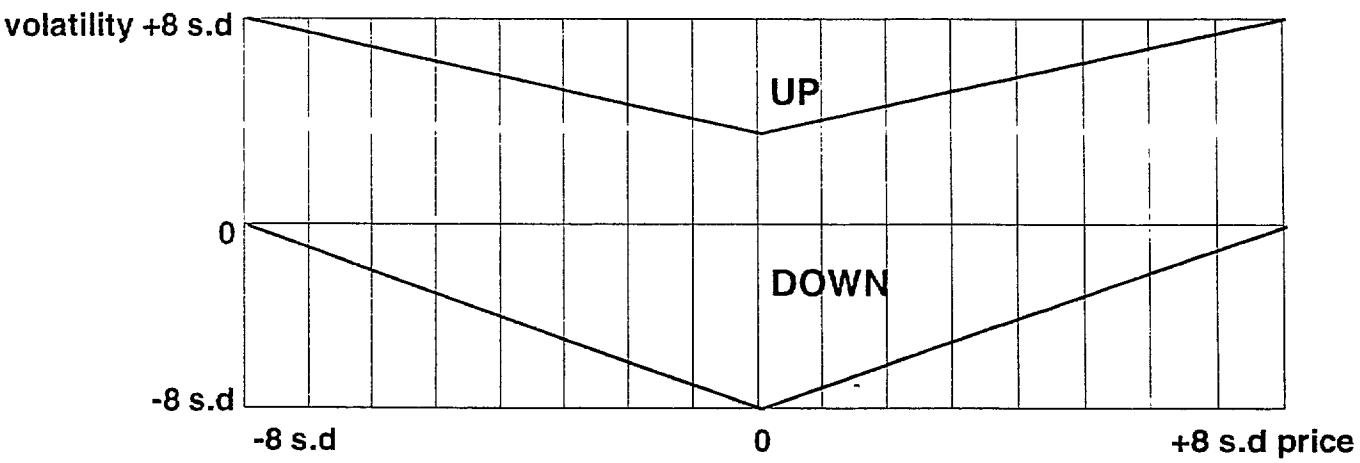
(2) DOWN SCENARIO FROM DOWN 8 VOLATILITY STANDARD DEVIATIONS FOR NO PRICE CHANGE TO NO CHANGE IF PRICES MOVE ±8 DAILY STANDARD DEVIATIONS.

(3) UP SCENARIO FROM 4 VOL STANDARD DEVIATIONS UP FOR NO PRICE CHANGE TO INCREASE OF 8 VOL STANDARD DEVIATIONS IF PRICES MOVE ±8 DAILY STANDARD DEVIATIONS.

(4) ALL CALCULATIONS OVER ONE WEEK DURATION.

(5) WORSE P+L DOWN MOVE IS THE SCENARIO RISK.

(6) FOR MULTIPLE ASSET PORTFOLIOS ASSUME CORRELATION AND BETAS DO NOT CHANGE.



Combined price and volatility worse case scenarios

RECOMMENDATION

SET LIMITS EQUAL TO HALF THE YEARLY RISK FORECAST FOR WORSE CASE SCENARIOS AS SHOWN ABOVE

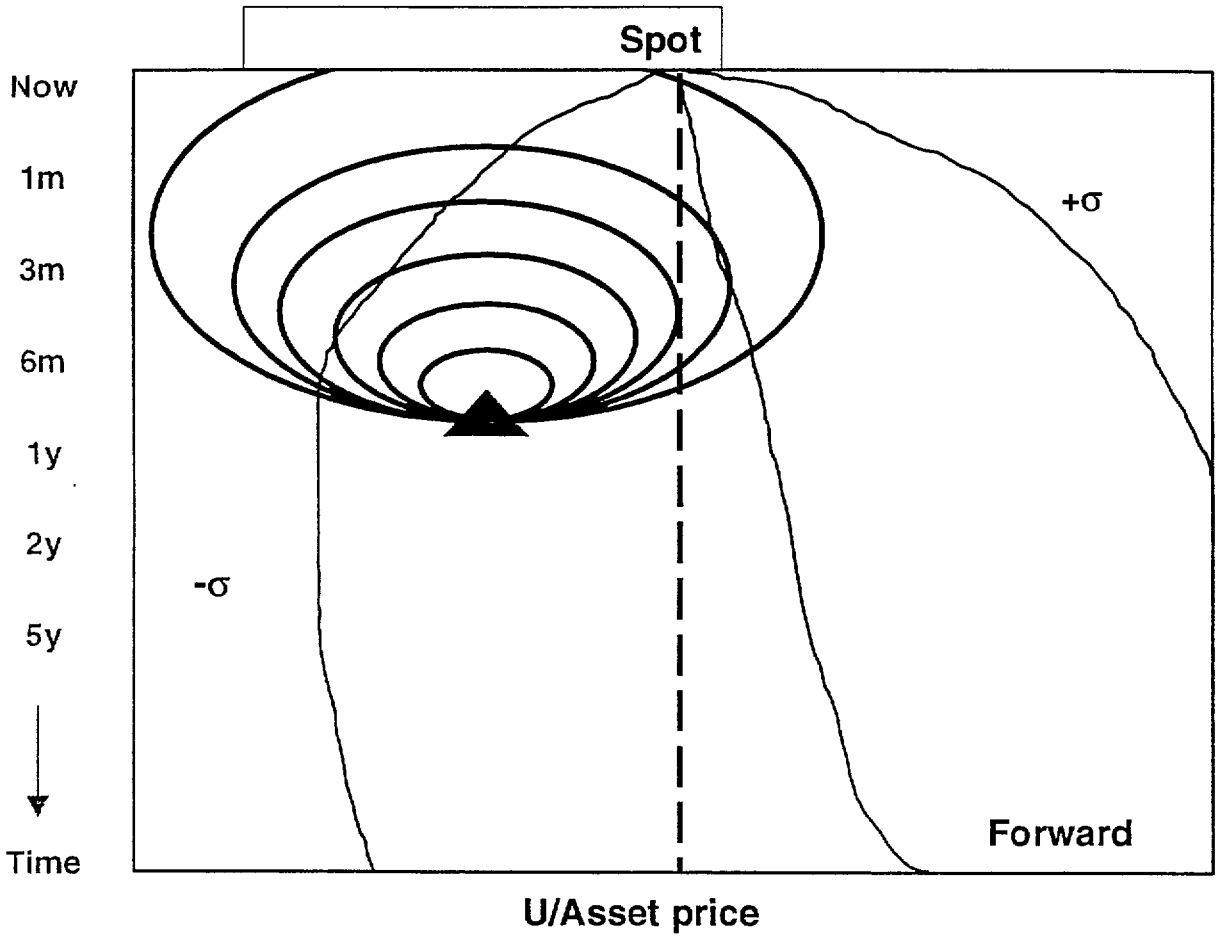
EXAMPLE

VOLATILITY	PRICE: -8S.D	PRICE: 0	PRICE: +8S.D
+8S.D	-6,000,000		-7,000,000
+4S.D		-500,000	
0	-4,000,000	+52,000	-5,000,000
-8S.D	-1,250,000	+2,125,000	-2,750,000

WORSE CASE SCENARIO = -$7mm

IDENTIFYING FORTHCOMING RISKS

GAMMA MAP

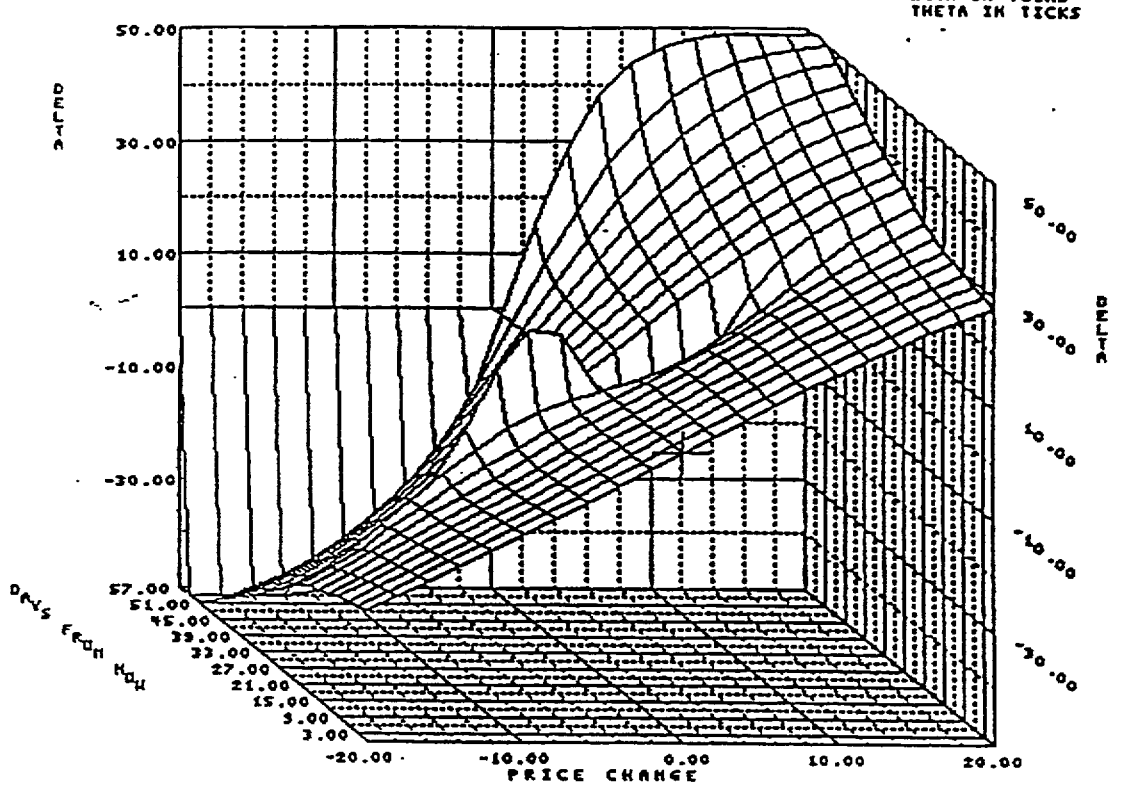


Each option is positioned according to price and maturity and leaves a pattern of gamma levels on the map (expressed for example as a number of futures per u/asset price unit).

ISCOUNT
ORPORATION
F
EW YORK
UTURES

FITZ DELTA TOTAL

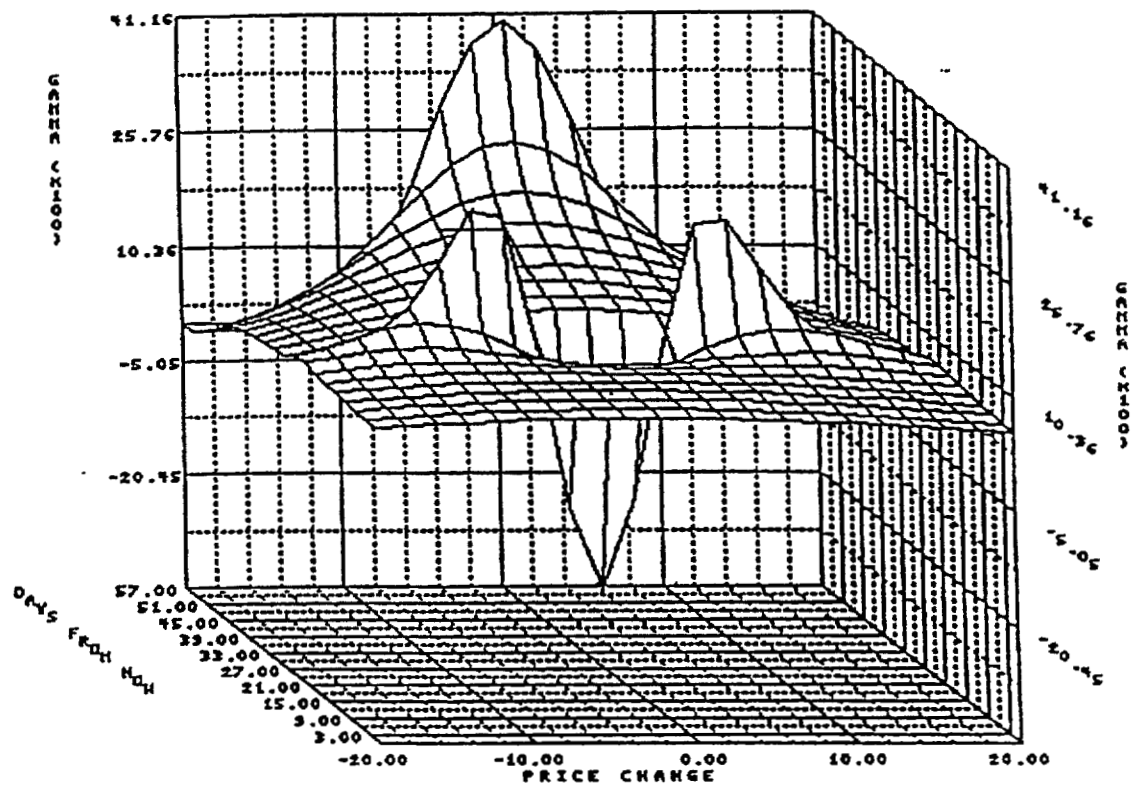
PRICE CHANGE	0.00
DAYS FROM NOW	0
P/L IN TICKS	267
DELTA	1.4
GAMMA (X100)	7.4
ZETA IN TICKS	5821
THETA IN TICKS	-854



)ISCOUNT
)ORPORATION
)F
EW YORK
UTURES

FITZ GAMMA TOTAL

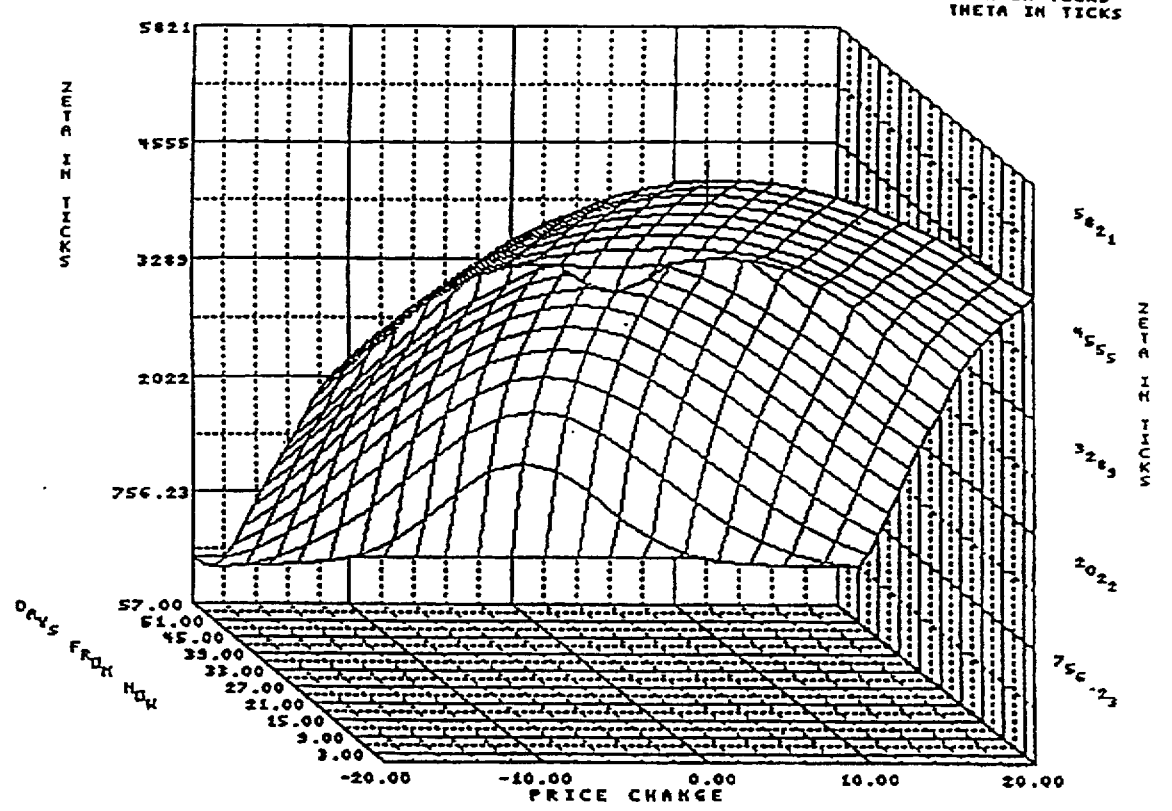
PRICE CHANGE	-4.00
DAYS FROM NOW	45
P/L IN TICKS	-51184
DELTA	-13.3
GAMMA (*100)	16.7
ZETA IN TICKS	2467
THETA IN TICKS	-1356



DISCOUNT CORPORATION OF NEW YORK FUTURES

FITZ ZETA TOTAL

PRICE CHANGE
DAYS FROM NOW
P/L IN TICKS
DELTA
GAMMA (X100)
ZETA IN TICKS
THETA IN TICKS



EXAMPLES OF MIDDLE OFFICE DAILY REPORTS

- POSITION LIMITS
- EXPECTED P & L
- AVERAGE DAILY VARIATION
- WORSE CASE SCENARIO
- COUNTERPARTY RISK

BOOK XYZ RISK ANALYSIS

Delta Equiv	Cum. P&L	Arb P&L	Avrg. STDS	Avrg. %DVol	MBL Up	MBL Down	Worst %SFA	Worst %DVol	Worst Up	Worst Down	Worst Risk	New P&L	DRate +50bp	Currency Risk
33326	1025	33	1.16	0.07%	-9	-32	8.50%	6.67%	705	755	-688	337	473	10
	Fair P&L :	992		MBL Avrg. Risk : -32				MFI Price Risk : 0			SFA PRR : -688			
								MFI P+Vol Risk : 0						

STOCK INDEX SENSITIVITY SUMMARY

dRised	Delta	Kappa	Rho	Theta	Slip	dFair	UdCurr	RdCurr	FArb dP&L	OArb dP&L	UdP&L	U+RdP&L
-2	1	-32	-3	-20	-4	-59	34	-46	87	-1	59	13
-2	1	-32	-3	-20	-4	-59	34	-46	87	-1	59	13

BOOK XYZ PROFIT & LOSS

	O/Type		Strike	Maturity		ULy/Posn		Delta	Gamma	Kappa	Equ. Delta	Cost	MTM -1	MTM	Daily P&L	Cum. P&L
O	C/A		1377.63	26/03/92	S	0.193	X	100	1	6	0	230.00	283.00	304.00	-5	-117
L	P/A		1700.00	06/04/92	B	126.500		-49	31	296		182.00	66.95	55.96	-139	-1594
L	P/A		1923.86	09/04/92	B	269.788	X	-100	0	0		186.61	259.09	240.28	-507	5226
L	P/E		1650.00	21/04/92	B	50.000		-32	21	293		61.50	44.35	36.86	-37	-123
L	C/A		1750.00	24/04/92	S	50.000		46	23	332		155.00	49.97	57.19	-36	489
O	P/A		1600.00	04/08/92	B	4.188		-27	14	375		77.25	51.36	45.48	-47	-254
O	C/A		1600.00	04/08/92	S	2.382		76	12	376	575	139.42	187.00	200.44	-40	-132
O	C/A		1600.00	04/08/92	S	6.304		76	12	376	1522	124.00	187.00	200.44	-54	-306
O	C/A		1600.00	04/08/92	S	8.275		76	12	376	1998	205.00	187.00	200.44	-67	23
L	P/A		1700.00	08/10/92	B	50.000		-43	16	522		140.00	105.46	96.32	-46	-218
O	P/A		1500.00	19/10/92	B	7.500		-17	9	334		32.50	34.30	30.37	-20	-11
O	P/A		1400.00	14/01/93	B	20.000		-11	5	277		15.00	23.09	20.34	-55	107
O	P/A		1672.00	15/01/93	B	16.720		-38	13	573		70.00	104.26	95.89	-84	259
O	P/A		1660.00	15/01/93	B	8.300		-36	13	563		70.00	98.85	90.88	-40	104
O	P/A		1664.00	15/01/93	B	33.310		-37	13	566		71.00	100.61	92.54	-161	431
O	P/E		1500.00	02/04/93	B	15.850		-16	6	444		67.00	43.83	40.09	-37	-269
O	P/A		1790.00	08/04/93	B	23.370		-53	15	702		250.00	176.12	165.20	-164	-1272
O	C/A		1500.00	15/04/93	S	9.111		84	6	450	1448	354.83	360.30	375.62	-86	-47
O	C/A		1500.00	15/04/93	S	7.900		84	6	450	1256	274.00	360.30	375.62	-77	-508
O	C/E	LBK	1322.68	01/06/93	S	0.307		83	4	583	53	584.50	529.69	544.17	-9	26
O	C/E		3187.50	03/09/93	S	14.728		6	2	255	890	100.00	10.83	11.62	-6	707
O	C/A		1450.00	18/11/94	S	1.605		87	3	584	203	455.00	562.80	578.85	-16	-124
O	C/E		4000.00	26/05/95	S	78.440		12	3	630	9746	15.65	36.05	37.95	-90	-1059
O	C/E		4000.00	30/05/95	S	16.410		12	3	633	2048	10.00	36.29	38.20	-19	-282
O	C/E		4000.00	30/05/95	S	8.205		12	3	633	1024	10.00	36.29	38.20	-10	-141
O	C/E	SPR	1635.00	07/05/97	S	14.862		56	-1	-468	6491	573.07	545.27	556.06	-113	179
L	F			20/03/92	S	169.000		101				1693.02	1693.50	1704.00	-177	468
						168.721			107373	44	27256	-1649	-896	1056	-2144	1561
						104.861			66733	27	16940	-1025	-564	656	-1362	970

BOOK XYZ INPUTS

	O/Type		Strike	Maturity	T-Date		Posn		Delta	Gamma	PLevel	Rlsed P&L	%Vol.	%Yield	%Rate
O	C/A		1377.63	26/03/92	26/09/90	S	2.150	X	100	1	1683.58	-101	19.657	0.000	9.703
L	P/A		1700.00	06/04/92	10/04/91	B	126.500		-49	31	1683.58		20.057	0.000	9.683
L	P/A		1923.86	09/04/92	09/04/90	B	269.788	X	-100	0	1683.58	3778	20.229	0.000	9.678
L	P/E		1650.00	21/04/92	16/08/91	B	50.000		-32	21	1683.58		20.629	0.000	9.662
L	C/A		1750.00	24/04/92	29/05/91	S	50.000		46	23	1683.58		20.743	0.000	9.659
O	P/A		1600.00	04/08/92	08/10/91	B	80.000		-27	14	1683.58		22.319	0.000	9.569
O	C/A		1600.00	04/08/92	11/10/91	S	30.000		76	12	1683.58	51	22.319	0.000	9.569
O	C/A		1600.00	04/08/92	28/10/91	S	40.000		76	12	1683.58		22.319	0.000	9.569
O	C/A		1600.00	04/08/92	29/08/91	S	50.000		76	12	1683.58		22.319	0.000	9.569
L	P/A		1700.00	08/10/92	25/10/91	B	50.000		-43	16	1683.58		22.617	0.000	9.438
O	P/A		1500.00	19/10/92	11/11/91	B	50.000		-17	9	1683.58		22.662	0.000	9.425
O	P/A		1400.00	14/01/93	14/01/92	B	200.000		-11	5	1683.58		23.037	0.000	9.380
O	P/A		1672.00	15/01/93	15/01/92	B	100.000		-38	13	1683.58		23.043	0.000	9.379
O	P/A		1660.00	15/01/93	16/01/92	B	50.000		-36	13	1683.58		23.043	0.000	9.379
O	P/A		1664.00	15/01/93	16/01/92	B	200.000		-37	13	1683.58		23.043	0.000	9.379
O	P/E		1500.00	02/04/93	09/04/91	B	100.000		-16	6	1683.58		23.186	0.000	9.120
O	P/A		1790.00	08/04/93	10/04/91	B	150.000		-53	15	1683.58		23.193	0.000	9.097
O	C/A		1500.00	15/04/93	05/04/91	S	56.000		84	6	1683.58	70	23.198	0.000	9.089
O	C/A		1500.00	15/04/93	30/10/91	S	50.000		84	6	1683.58		23.198	0.000	9.089
O	C/E	LBK	1322.68	01/06/93	30/05/90	S	6.500		83	4	1683.58		23.253	0.000	8.977
O	C/E		3187.50	03/09/93	03/08/90	S	80.000		6	2	1683.58		23.361	0.000	8.830
O	C/A		1450.00	18/11/94	08/11/91	S	10.000		87	3	1683.58		23.753	0.000	8.438
O	C/E		4000.00	26/05/95	22/05/91	S	475.000		12	3	1683.58		23.876	0.000	8.323
O	C/E		4000.00	30/05/95	22/05/91	S	100.000		12	3	1683.58		23.878	0.000	8.322
O	C/E		4000.00	30/05/95	22/05/91	S	50.000		12	3	1683.58		23.878	0.000	8.322
O	C/E	SPR	1635.00	07/05/97	10/07/91	S	105.000		56	-1	1683.58		24.181	0.000	8.116
L	F			20/03/92		S	169.000		101		1704.00	653	24.500	0.000	9.700

BOOK XYZ SENSITIVITY ANALYSIS

	O/Type		Strike	Maturity	ULy/Posn	Delta	Kappa	Rho	Theta	dFair	Market	Fair	Arb P&L	Arb dPL
O	C/A		1377.63	26/03/92 S	0.193	-4	0	0	0	-3	304.00	328.08	5	-2
L	P/A		1700.00	06/04/92 B	126.500	-122	-10	0	-5	-139	55.96	55.96	0	0
L	P/A		1923.86	09/04/92 B	269.788	-507	0	0	0	-507	240.28	240.28	0	0
L	P/E		1650.00	21/04/92 B	50.000	-32	-4	0	-1	-37	36.86	36.86	0	0
L	C/A		1750.00	24/04/92 S	50.000	-41	4	0	4	-36	57.19	57.19	0	0
O	P/A		1600.00	04/08/92 B	4.188	-43	-3	0	-2	-47	45.48	45.48	0	0
O	C/A		1600.00	04/08/92 S	2.382	-42	1	0	2	-40	200.44	200.44	0	0
O	C/A		1600.00	04/08/92 S	6.304	-56	2	0	3	-54	200.44	200.44	0	0
O	C/A		1600.00	04/08/92 S	8.275	-70	2	0	4	-67	200.44	200.44	0	0
L	P/A		1700.00	08/10/92 B	50.000	-42	-3	-1	-1	-46	96.32	96.32	0	0
O	P/A		1500.00	19/10/92 B	7.500	-17	-2	0	-1	-20	30.37	30.37	0	0
O	P/A		1400.00	14/01/93 B	20.000	-43	-6	-1	-2	-55	20.34	20.34	0	0
O	P/A		1672.00	15/01/93 B	16.720	-73	-6	-2	-1	-84	95.89	95.89	0	0
O	P/A		1660.00	15/01/93 B	8.300	-35	-3	-1	-1	-40	90.88	90.88	0	0
O	P/A		1664.00	15/01/93 B	33.310	-142	-12	-5	-3	-161	92.54	92.54	0	0
O	P/E		1500.00	02/04/93 B	15.850	-31	-4	-1	-1	-37	40.09	40.09	0	0
O	P/A		1790.00	08/04/93 B	23.370	-153	-10	-5	-1	-164	165.20	165.20	0	0
O	C/A		1500.00	15/04/93 S	9.111	-88	2	-2	3	-86	375.62	375.62	0	0
O	C/A		1500.00	15/04/93 S	7.900	-79	2	-2	3	-77	375.62	375.62	0	0
O	C/E	LBK	1322.68	01/06/93 S	0.307	-10	0	0	0	-9	544.17	544.17	0	0
O	C/E		3187.50	03/09/93 S	14.728	-9	2	0	1	-6	11.62	11.62	0	0
O	C/A		1450.00	18/11/94 S	1.605	-16	0	0	0	-16	578.85	578.85	0	0
O	C/E		4000.00	26/05/95 S	78.440	-109	13	-1	7	-90	37.95	37.95	0	0
O	C/E		4000.00	30/05/95 S	16.410	-23	3	0	1	-19	38.20	38.20	0	0
O	C/E		4000.00	30/05/95 S	8.205	-12	1	0	1	-10	38.20	38.20	0	0
O	C/E	SPR	1635.00	07/05/97 S	14.862	-111	-1	-1	1	-113	556.06	556.06	0	0
L	F			20/03/92 S	169.000	-316		0		-316	1704.00	1706.85	48	139
						-2228	-31	-23	12	-2281			48	139

DEM : STOCK_INDEX Sensitivity Analysis for Book OTC on 27/01/92

Underlying	Future Contracts	KAPPA (USD)	DP&L Now (USD)	DP&L + 7 (USD)	DP&L + 7 V up (USD)	DP&L + 7 V down (USD)	7 Day Diff (USD)
1540.48	-208	403.46k	755.00k	669.09k	1.29m	44.25k	44.25k
1550.02	-201	404.60k	631.94k	522.28k	1.15m	-104.15k	-104.15k
1559.56	-172	405.35k	516.86k	413.01k	1.04m	-214.43k	-214.43k
1569.10	-134	405.86k	427.44k	327.04k	955.12k	-301.03k	-301.03k
1578.64	-111	405.98k	358.02k	256.43k	884.56k	-371.70k	-371.70k
1588.18	-110	405.40k	295.89k	192.00k	819.10k	-435.09k	-435.09k
1597.72	-118	404.45k	227.99k	123.28k	748.79k	-502.24k	-502.24k
1607.26	-105	403.08k	156.29k	49.53k	672.84k	-573.77k	-573.77k
1616.80	-73	401.45k	103.45k	-4.36k	616.34k	-625.06k	-625.06k
1626.34	-44	399.46k	69.82k	-39.07k	578.48k	-656.62k	-656.62k
1635.88	-34	394.91k	51.31k	-57.11k	553.76k	-667.99k	-667.99k
1645.42	-42	386.92k	29.22k	-74.36k	525.10k	-673.83k	-673.83k
1654.96	-40	378.44k	2.08k	-97.61k	489.74k	-684.95k	-684.95k
1664.50	-18	369.41k	-18.37k	-113.21k	461.21k	-687.62k	-687.62k
1674.04	15	359.87k	-19.41k	-108.86k	451.90k	-669.61k	-669.61k
1683.58>	37>	349.84k>	0.00>	-84.68k>	461.69k>	-631.05k>	-631.05k
1693.12	33	346.53k	24.48k	-59.81k	481.24k	-600.87k	-600.87k
1702.66	16	342.90k	38.60k	-46.25k	489.00k	-581.50k	-581.50k
1712.20	10	338.96k	43.34k	-42.00k	486.97k	-570.97k	-570.97k
1721.74	23	334.72k	49.98k	-34.97k	487.27k	-557.20k	-557.20k
1731.28	48	330.19k	70.57k	-15.43k	499.66k	-530.51k	-530.51k
1740.82	66	365.21k	106.43k	19.01k	580.26k	-542.25k	-542.25k
1750.36	75	366.42k	149.03k	19.32k	581.11k	-542.48k	-542.48k
1759.90	78	367.42k	195.59k	84.73k	646.75k	-477.29k	-477.29k
1769.44	82	340.43k	241.63k	147.93k	672.68k	-376.82k	-376.82k
1778.98	101	339.67k	292.43k	205.83k	728.38k	-316.72k	-316.72k
1788.52	133	338.64k	361.56k	250.72k	770.65k	-269.22k	-269.22k
1798.06	151	333.48k	450.12k	334.62k	846.27k	-177.03k	-177.03k
1807.60	148	325.74k	540.11k	425.27k	925.08k	-74.53k	-74.53k
1817.14	139	317.71k	625.36k	510.27k	997.80k	22.75k	22.75k
1826.68	134	309.47k	704.64k	591.23k	1.07m	116.31k	116.31k

WHAT IS RISK MANAGEMENT?

1) UNDERSTANDING HOW THE PORTFOLIO VALUE CHANGES WITH MOVEMENTS IN UNDERLYING FACTORS

2) QUANTIFY HOW LIQUID HEDGE INSTRUMENTS MOVE WITH THE DEFINING UNDERLYING FACTORS

3) BY USING STATISTICAL ANALYSIS DEFINE 'COMFORT' LEVELS BASED ON MARKET DATA

4) CONSTRUCT HEDGE TO BRING PORTFOLIO WITHIN 'COMFORT' LEVELS

5) EARN PROFIT FROM 'SENSIBLE' RISK TAKING

IMPORTANCE OF THE PORTFOLIO

1) RECOGNISE THAT MODELS ARE IMPERFECT

2) RECOGNISE THAT FORECASTS ARE IMPERFECT

3) RECOGNISE THAT THE BEST HEDGE OF AN OPTION IS ANOTHER OPTION

4) RECOGNISE THAT HEDGING A 'NET' RISK REDUCES THE ABOVE PROBLEMS AND ALLOWS NATURAL OFFSETS TO LOCK-IN BID/OFFER SPREAD

5) RECOGNISE THAT A PORTFOLIO FOSTERS THE ABILITY TO DO TWO-WAY BUSINESS AND CAPTURE BID/OFFER SPREADS WITHOUT OUTRIGHT RISK

THE PORTFOLIO (1)

DEFINING THE PORTFOLIO/EXAMPLE IN SINGLE CURRENCY

	CALL/PUT	STRIKE	MATURITY	K.O.	INT.R.	D.R.	σ
1.	X	X	X	X	X	X	X
2.	X	X	X	X	X	X	X
3.	X	X	X	X	X	X	X

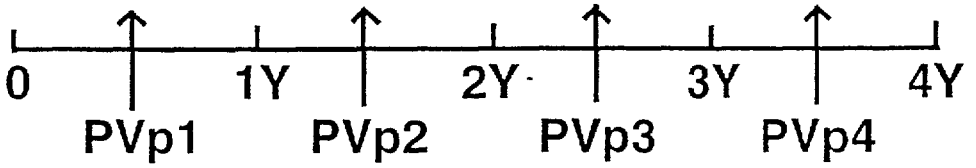
MODEL APPLICABLE TO EACH OPTION HAS INPUTS:

- SPOT UNDERLYING S
- INTEREST RATE I(t)
- ASSET YIELD D(t)
- VOLATILITY σ(t)

PVp = F(S, I(t), D(t), σ(t))

t = TIME TO EXPIRY (IE TERM STRUCTURE)

BUCKETING



RISK ANALYSIS

DAR (DOLLARS AT RISK)

HOW MUCH MONEY DO WE MAKE OR LOSE IF THE FACTORS MOVE?

1) HOW ARE MOVES CORRELATED?

- HISTORICAL STUDIES
- MONTE-CARLOS

2) HOW BIG A MOVE DO WE EXPECT?

- DAILY MARKET MOVE
- 3σ (INTERNATIONAL REGULATORS)
- 8σ
- MELT DOWN

3) EXPECTED RETURN .V. RISK + CAPITAL USAGE

RISK MANAGEMENT

- NEW CONCENTRATION ON GAMMA AND VEGA RISK CONTROL

- IMPORTANCE OF FORWARD IDENTIFICATION OR MAJOR RISKS

- USE OF RISK ASSESSMENT TO GUIDE TRADING DECISIONS

- NEW CONCERN WITH CORRELATION RISK

INDUSTRIAL FINANCE CORPORATION OF THAILAND

FOUR DAY RISK MANAGEMENT SEMINAR

DAY FOUR
MAY 20, 2000

ANALYZING MARKET RISKS IN TREASURY PORTFOLIOS

PRESENTED BY

A. WILLIAM BODINE, Ph.D.

BANGKOK, THAILAND

DELOITTE TOUCHE TOHMATSU

BASICS OF FIXED INTEREST RATE RISK

- OVERALL INTEREST RATE RISK
- YIELD CURVE SHAPE RISK
- QUALITY SPREAD RISK

DURATION

- HOW TO COMBINE COUPON AND MATURITY EFFECT ON BOND VOLATILITY INTO A SINGLE MEASURE?

- BY CONSIDERING THE AVERAGE LIFE OR DURATION OF THE BOND.

- THE LONGER THE DURATION THE MORE RESPONSIVE A BOND TO A CHANGE IN YIELDS.

DURATION

FUNDAMENTAL MEASURE OF INTEREST RATE RISK.

DURATION IS THE SUM OF THE TIME-WEIGHTED CONTRIBUTIONS OF INDIVIDUAL PERIOD CASH FLOWS TO VALUE.

$$\text{DURATION} = \sum_{t=1}^{T} \frac{PV(C_t)}{P} \times t$$

$PV(C_t)$ = PRESENT VALUE CASH FLOW IN PERIOD T (DISCOUNTED USING INTERNAL RATE OF RETURN)

P = PRESENT VALUE

T = NUMBER OF PERIODS TO MATURITY

DURATION OF ZERO COUPON BOND

5 YEAR ZERO COUPON BOND PRICED AT $68.06 TO YIELD 8%

PERIOD	1	2	3	4	5
CASH FLOW	0	0	0	0	100
PV CASH FLOW	0	0	0	0	100
AS % PRICE					
CASH FLOW	0	0	0	0	100

DURATION OR AVERAGE LIFE OF ZERO COUPON BOND IS EQUAL TO ITS MATURITY

$$D = \frac{[0x1] \times [0x2] + [0x3] + [0x4] + [100x5]}{100}$$

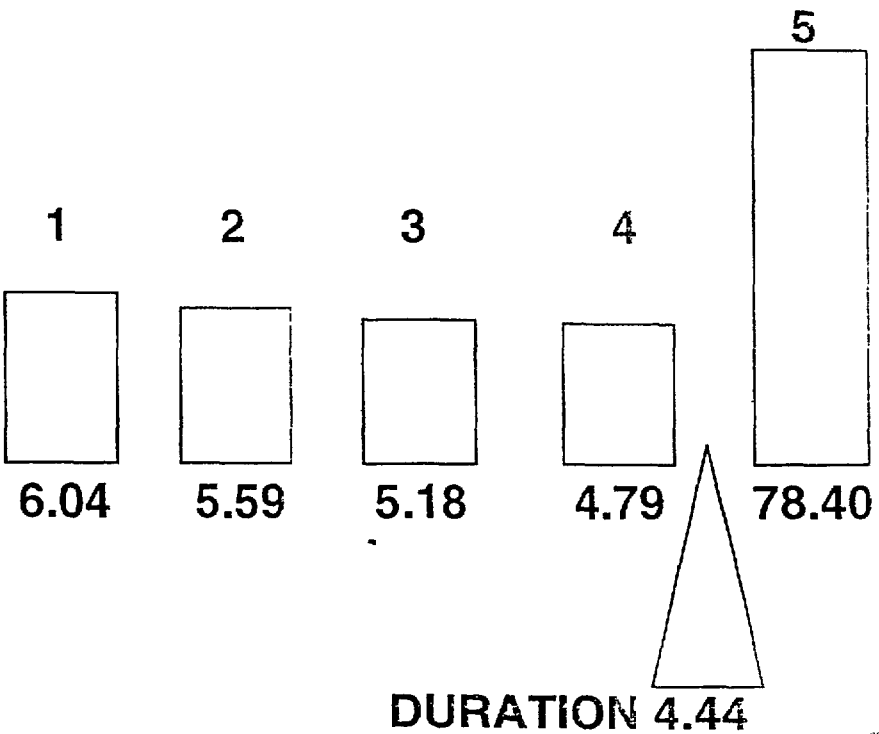
D = 5 YEARS

WHAT IS THE EFFECT ON DURATION OF COUPONS?

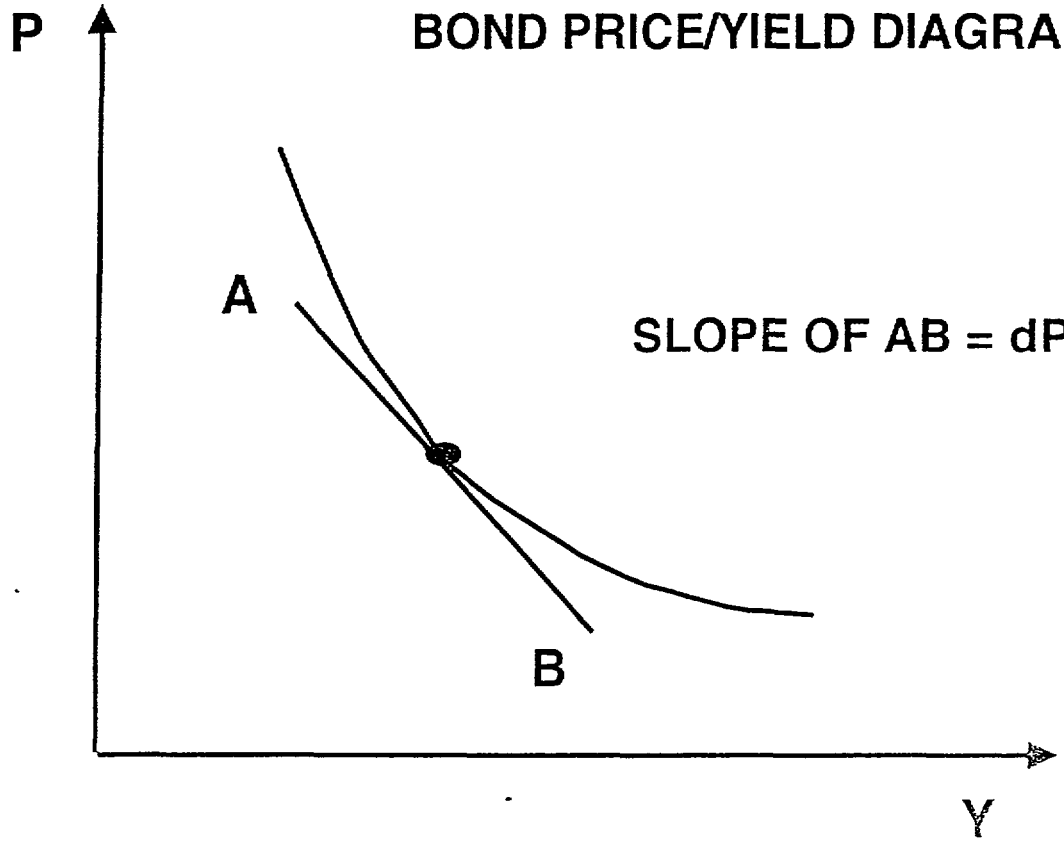
DURATION

6 PERCENT ANNUAL COUPON 5 YEAR BOND PRICED AT $92 TO YIELD 8%

PERIOD	1	2	3	4	5
CASH FLOW	6	6	6	6	106
PV (CASH FLOW)	5.56	5.14	4.76	4.41	72.14
PV CASH FLOW AS % PRICE	6.04	5.59	5.18	4.79	78.40



RELATIONSHIP OF DURATION TO dP/dY



DURATION = PERCENTAGE RESPONSE OF PRICE TO GIVEN PERCENTAGE INCREASE IN (1 + YIELD)

$$D = dP/P \Big/ \frac{dY}{1+Y}$$

$$\frac{dP}{dY} = \frac{P.D}{1+Y}$$

MODIFIED DURATION OR VOLATILITY

$$\text{MODIFIED DURATION} = \frac{\text{DURATION}}{1 + \text{YIELD}}$$

$$dP = -\text{PRICE} \times \text{MODIFIED DURATION} \times dY$$

PRICE VALUE OF ONE BASIS POINT

CHANGE IN ABSOLUTE VALUE OF BOND IF YIELD CHANGES BY ONE BASIS POINT

YIELD VALUE OF A PRICE CHANGE

CHANGE IN YIELD REQUIRED TO CHANGE PRICE BY SPECIFIED AMOUNT, FOR EXAMPLE 1/32ND

1 P182 Govt

Screen Printed

YIELD ANALYSIS CUSIP 912827Q88

US TREASURY N/B T 7 ¼ 08/15/04 105-19+ /105-21+ (5.97 /96) BGN @12:51

PRICE 105-21+ SETTLEMENT DATE 6/16/1999

YIELD CALCULATIONS	MATURITY 8/15/2004
STREET CONVENTION	5.956
TREASURY CONVENTION	5.953
TRUE YIELD	5.952
EQUIVALENT 1/YEAR COMPOUND	6.044
JAPANESE YIELD (SIMPLE)	5.821
PROCEEDS/MMKT EQUIVALENT	
REPO EQUIVALENT	6.670
EFFECTIVE @5.956 RATE(%)	5.956
TAXED: INC 39.60% CG 28.00%	3.598*

ISSUE PRICE = 99.440. BOND PURCHASED WITH PREMIUM.

SENSITIVITY ANALYSIS		
DURATION(YEARS)		4.327
ADJ/MOD DURATION		4.202
RISK		4.542
CONVEXITY		0.219
DOLLAR VALUE OF A	0.01	0.04542
YIELD VALUE OF A	0 1/32	0.00688

CASHFLOW ANALYSIS

To 8/15/2004 WORKOUT . 1000M FACE

PAYMENT INVOICE	
PRINCIPAL [RND(Y/N) N]	1056718.75
121 DAYS ACCRUED INT	24233.43
TOTAL	1080952.18
INCOME	
REDEMPTION VALUE	1000000.00
COUPON PAYMENT	398750.00
INTEREST @5.956%	65003.63
TOTAL	1463753.63
RETURN	
GROSS PROFIT	382801.45
RETURN (SIMPLE INT)	5.956

FURTHER ANALYSIS

HIT 1 <GO> COST OF CARRY
HIT 2 <GO> PRICE/YIELD TABLE
HIT 3 <GO> TOTAL RETURN

Bloomberg

COMPLEXITIES

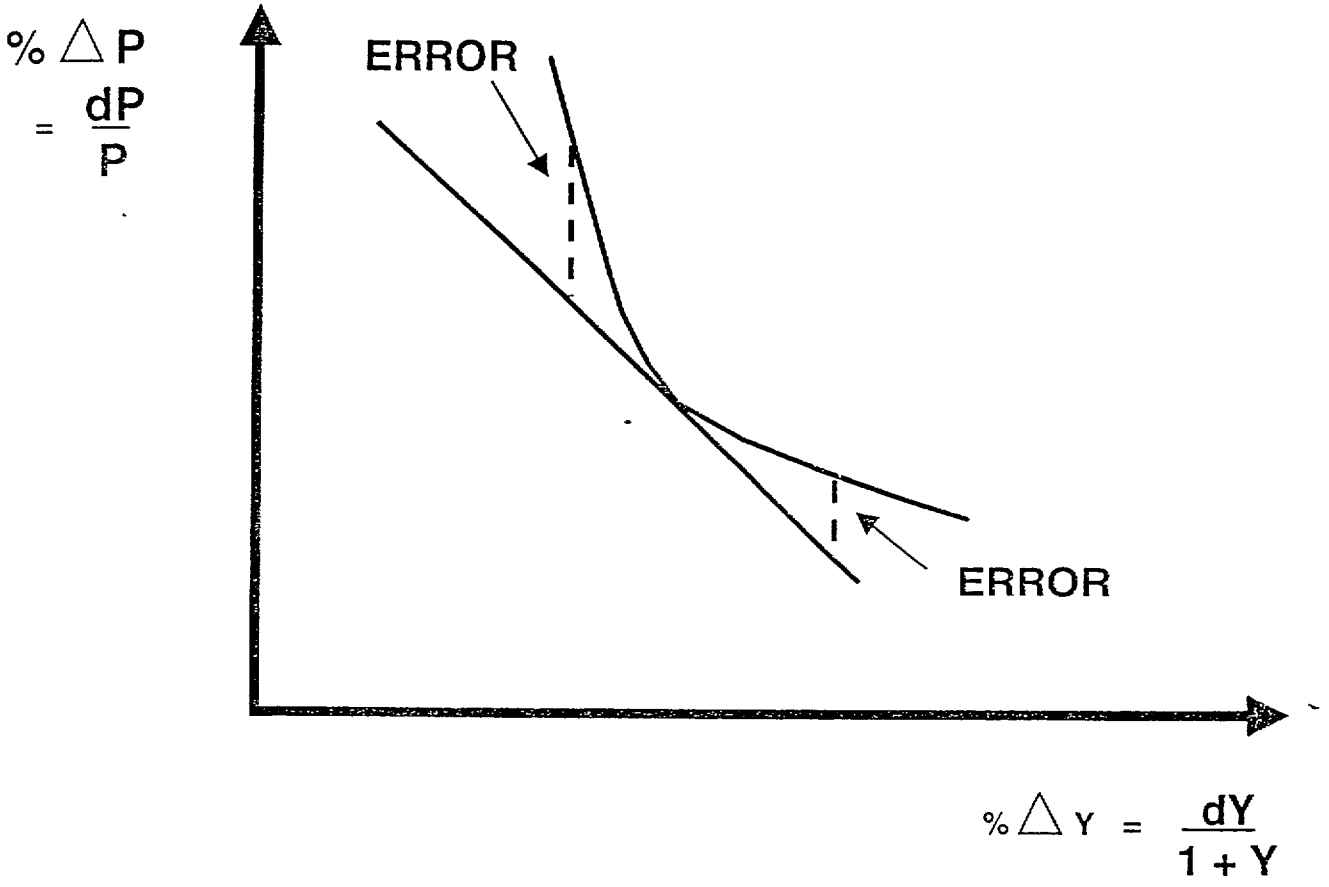
- DURATION IS NOT CONSTANT

- SPECIFIC DURATION PORTFOLIO CAN BE ACHIEVED IN MANY WAYS

- IMPROVEMENTS IN CONVEXITY INVARIABLY INCREASE EXPOSURE TO YIELD CURVE RISKS

CONVEXITY

THE MORE CONVEX THE RELATIONSHIP BETWEEN dP/P (%PRICE CHANGES) AND dY/1 + Y (% YIELD CHANGES) THE BIGGER THE ERROR FROM USING SIMPLE DURATION TO MEASURE RISK.



BUT REMEMBER MORE CONVEXITY CAN BE A GOOD THING

TAYLOR'S EXPANSION OF THE PRICE : YIELD FUNCTION (I)

$$P = \sum_{t=1}^{N} \frac{Ct}{(1+Y)^t}$$

$$\frac{dP}{dY} = -\sum_{t=1}^{N} \frac{Ct \,.\, t}{(1+Y)^{t+1}} \qquad \frac{d^2P}{dY^2} = \sum_{t=1}^{N} \frac{Ct \,.\, t(t+1)}{(1+Y)^{t+2}}$$

$$\Delta P = \left[\frac{dP}{dY}\Delta Y\right] + \left[\frac{1}{2!}\frac{d^2P}{dY^2}(\Delta Y)^2\right] + \left[\frac{1}{3!}\frac{d^3P}{dY^3}(\Delta Y)^3\right] + \ldots\ldots\ldots\ldots$$

TAYLOR'S EXPANSION OF THE PRICE : YIELD FUNCTION (II)

$$\text{Modified Duration} = -\frac{dP / dY}{P}$$

$$\text{Convexity} = \frac{d^2P / dY^2}{P}$$

$$\frac{\Delta P}{P} = \left[-(MD)\Delta Y\right] + \left[\frac{1}{2}(\text{CONVEXITY})(\Delta Y)^2\right] + \text{RESIDUAL}$$

$$\Delta P = -\left[P(MD)\Delta Y\right] + \left[\frac{P}{2}(\text{CONVEXITY})(\Delta Y)^2\right] + \text{RESIDUAL}$$

EXAMPLE

3 Year Eurobond 10% Coupon Yield = 10%

$$\frac{dP}{dY} = -\left[\frac{10}{(1.10)^2} + \frac{10(2)}{(1.10)^3} + \frac{110(3)}{(1.10)^4}\right] = 248.685$$

$$\text{Duration} = \frac{dP}{dY}\left[\frac{1+Y}{P}\right] = 248.685\left[\frac{1.10}{100}\right] = 2.736$$

$$\text{Modified Duration} = \frac{2.736}{1.10} = 2.487$$

$$\frac{d^2P}{dY^2} = \left[\frac{10(1)(2)}{(1.10)^3} + \frac{10(2)(3)}{(1.10)^4} + \frac{110(3)(4)}{(1.10)^5}\right] = 875.623$$

$$\text{Convexity} = \frac{d^2P/dY^2}{P} = \frac{875.623}{100} = 8.756$$

EXAMPLE (Contd.)

ASSUME A 10 BP YIELD CHANGE

	ACTUAL PRICE CHANGE	DURATION IMPLIED PRICE CHANGE	DURATION & CONVEXITY IMPLIED PRICE CHANGE
10 BP UP	-0.2483	-0.2487	-0.2483
10 BP DOWN	+0.2491	+0.2487	+0.2491

<HELP> for explanation. P182 Govt PDA

POSITION DURATION MANAGEMENT Page 1 of 3

Mode: A Cash,Hedge,AGGREG. Settle 7/ 5/96
"MACRO" Portfolio? N Recompute Fut/Opt Hedge N

Buy 40 518 646.98
Sel .00

Tkr Cpn Mty <Key>	Price	CnvYld	ModDur	Cvx	Val01	M	Par	1000MV	BPV
T 8 1/8 08/19	111-28+	7.07	10.71	1.80	.1232	Buy	10000	11 504	12321
T11 1/4 02/15	143-25	7.00	9.14	1.27	.1354	Buy	13000	19 258	17604
T 9 3/8 02/06	118-10+	6.75	6.39	.55	.0780	Buy	8000	9 757	6238
CASH			.00	.00					0
SUB-TOTAL		6.96	8.93	1.25				40 519	36164

Futures/Options	Price	Proxy Issue	Num Contr	
				n/a
				n/a
				n/a
				n/a
				n/a
				n/a
CB TOTAL	Mod. Duration =	8.93		40 519 36164

<HELP> for explanation. P182 Govt PDA

POSITION DURATION MANAGEMENT Page 2 of 3

Settle 7/ 5/96 Parallel Shift Horizon 7/ 5/96

Issue	Price	CnvYld	Mkt Val ($1000)	-10 B.P. New Px	-10 B.P. $ P&L	+10 B.P. New Px	+10 B.P. $ P&L
T 8 1/8 08/19	111-28+	7.07	11504	113.133	124252	110.669	-122187
T11 1/4 02/15	143-25	7.00	19258	145.145	177272	142.436	-174826
T 9 3/8 02/06	118-10+	6.75	9757	119.111	62650	117.552	-62116
CASH					0		0
SUB-TOTAL		6.96	40519	$	364174	$	-359128

Futures/Options	Proxy	Num Contr		
TOTAL			$	364174 $ -359128

CB Mod. Duration = 8.93

<HELP> for explanation. P182 Govt PDA
Aggregate Mode... Change to "CASH or HEDGE MODE", if appropriate.

POSITION DURATION MANAGEMENT Page 1 of 3

Mode:A Cash,Hedge,AGGREG. Settle 7/ 5/96
"MACRO" Portfolio? N Recompute Fut/Opt Hedge N

Buy 40 518 646.98
Sel -38 658 321.30

Tkr Cpn Mty <Key>	Price	CnvYld	ModDur	Cvx	Val01	M	Par	1000MV	BPV
T 8 1/8 08/19	111-28+	7.07	10.71	1.80	.1232	Buy	10000	11 504	12321
T11 1/4 02/15	143-25	7.00	9.14	1.27	.1354	Buy	13000	19 258	17604
T 9 3/8 02/06	118-10+	6.75	6.39	.55	.0780	Buy	8000	9 757	6238
T10 5/8 08/15	137-18	7.02	9.35	1.33	.1325	Sel	-27286	-38 658	-36164
CASH			.00	.00					0
AGGREGATE		5.69	.00	-.58				1 860	0

Futures/Options	Price	Proxy Issue	Num Contr	
				n/a
				n/a
				n/a
				n/a
				n/a
				n/a

CB TOTAL Mod. Duration = .00 1 860 0

<HELP> for explanation. P182 Govt PDA
Aggregate Mode... Change to "CASH or HEDGE MODE", if appropriate.

POSITION DURATION MANAGEMENT Page 1 of 3

Mode:A Cash,Hedge,AGGREG. Settle 7/ 5/96
"MACRO" Portfolio? N Recompute Fut/Opt Hedge N

Buy 40 518 646.98
Sel -39 855 321.70

Tkr Cpn Mty <Key>	Price	CnvYld	ModDur	Cvx	Val01	M	Par	1000MV	BPV
T 8 1/8 08/19	111-28+	7.07	10.71	1.80	.1232	Buy	10000	11 504	12321
T11 1/4 02/15	143-25	7.00	9.14	1.27	.1354	Buy	13000	19 258	17604
T 9 3/8 02/06	118-10+	6.75	6.39	.55	.0780	Buy	8000	9 757	6238
T10 5/8 08/15	137-18	7.02	9.35	1.33	.1325	Sel	-26210	-37 134	-34738
T 8 3/8 08/08-03	108-24	6.80	5.24	.35	.0587	Sel	-2430	-2 721	-1426
CASH			.00	.00					0
AGGREGATE		4.21	.00	.00				663	0

Futures/Options	Price	Proxy Issue	Num Contr	
				n/a
				n/a
				n/a
				n/a
				n/a
				n/a

CB TOTAL Mod. Duration = .00 663 0

<HELP> for explanation. P182 Govt PDA

POSITION DURATION MANAGEMENT

Settle 7/ 5/96 Parallel Shift Horizon 7/ 5/96

Issue	Price	CnvYld	Mkt Val ($1000)	-10 B.P. New Px	-10 B.P. $ P&L	+10 B.P. New Px	+10 B.P. $ P&L
T 8 1/8 08/19	111-28+	7.07	11504	113.133	124252	110.669	-122187
T11 1/4 02/15	143-25	7.00	19258	145.145	177272	142.436	-174826
T 9 3/8 02/06	118-10+	6.75	9757	119.111	62650	117.552	-62116
T10 5/8 08/15	137-18	7.02	-38658	138.897	-364231	136.247	359079
CASH					0		0
SUB-TOTAL		5.69	1860	$	-58	$	-50
Futures/Options		Proxy	Num Contr				
TOTAL				$	-58	$	-50

CB Mod. Duration = .00

<HELP> for explanation. P182 Govt PDA

POSITION DURATION MANAGEMENT Page 2 of 3

Settle 7/ 5/96 Parallel Shift Horizon 7/ 5/96

Issue	Price	CnvYld	Mkt Val ($1000)	-10 B.P. New Px	-10 B.P. $ P&L	+10 B.P. New Px	+10 B.P. $ P&L
T 8 1/8 08/19	111-28+	7.07	11504	113.133	124252	110.669	-122187
T11 1/4 02/15	143-25	7.00	19258	145.145	177272	142.436	-174826
T 9 3/8 02/06	118-10+	6.75	9757	119.111	62650	117.552	-62116
T10 5/8 08/15	137-18	7.02	-37134	138.897	-349868	136.247	344919
T 8 3/8 08/08-03	108-24	6.80	-2721	109.339	-14304	108.165	14208
CASH					0		0
SUB-TOTAL		4.21	663	$	1	$	-1
Futures/Options		Proxy	Num Contr				
TOTAL				$	1	$	-1

CB Mod. Duration = .00

<HELP> for explanation. P182 Govt PDA

POSITION DURATION MANAGEMENT Page 2 of 3

Settle 7/ 5/96 Parallel Shift Horizon 7/ 5/96

Issue	Price	CnvYld	Mkt Val ($1000)	-100 B.P. New Px	-100 B.P. $ P&L	100 B.P. New Px	100 B.P. $ P&L
T 8 1/8 08/19	111-28+	7.07	11504	125.316	1342568	100.538	-1135303
T11 1/4 02/15	143-25	7.00	19258	158.317	1889607	131.131	-1644468
T 9 3/8 02/06	118-10+	6.75	9757	126.471	651393	110.854	-597947
T10 5/8 08/15	137-18	7.02	-38658	151.815	-3888977	125-06+	3372438
CASH					0		0
SUB-TOTAL		5.69	1860	$	-5409	$	-5280
Futures/Options		Proxy	Num Contr				
TOTAL				$	-5409	$	-5280

CB Mod. Duration = .00

<HELP> for explanation. P182 Govt PDA

NO FIELDS ENTERED.

POSITION DURATION MANAGEMENT Page 2 of 3

Settle 7/ 5/96 Parallel Shift Horizon 7/ 5/96

Issue	Price	CnvYld	Mkt Val ($1000)	-100 B.P. New Px	-100 B.P. $ P&L	100 B.P. New Px	100 B.P. $ P&L
T 8 1/8 08/19	111-28+	7.07	11504	125.316	1342568	100.538	-1135303
T11 1/4 02/15	143-25	7.00	19258	158.317	1889607	131.131	-1644468
T 9 3/8 02/06	118-10+	6.75	9757	126.471	651393	110.854	-597947
T10 5/8 08/15	137-18	7.02	-37134	151.815	-3735618	125-06+	3239448
T 8 3/8 08/08-03	108-24	6.80	-2721	114.819	-147479	103.076	137881
CASH					0		0
SUB-TOTAL		4.21	663	$	471	$	-388
Futures/Options		Proxy	Num Contr				
TOTAL				$	471	$	-388

CB Mod. Duration = .00

EUROBONDS AND CORPORATE BONDS

- ANALYSIS AS FOR TREASURY BONDS

- DEFAULT RISK: HISTORICAL ASSESSMENT OF DEFAULT LOSSES VERSUS RETURN PREMIUM

- QUALITY SPREAD : VOLATILITY OF QUALITY SPREAD

  : HISTORICAL RELATIONSHIP OF QUALITY SPREAD AND TREASURY YIELDS

METHODS FOR REPRESENTING RISKS

1. DURATION AND CONVEXITY OF CASH FLOWS

2. SENSITIVITY TO ZERO COUPON RATE CHANGES

3. SENSITIVITY TO FORWARD RATE CHANGES

4. SENSITIVITY TO GENERIC INSTRUMENT RATE CHANGES

CONSTRUCTING THE DISCOUNT FUNCTION

NB: All sources of data should come from the same credit risk class e.g. Government securities.

RISK FREE CURVE:

Bills

Bonds

SWAPS CURVE:

Money market rates

Short term interest rate futures

Par swaps

FRA's

FORWARD CURVE ANALYSIS
United States

BASE CURVE DEFAULTS - BGN

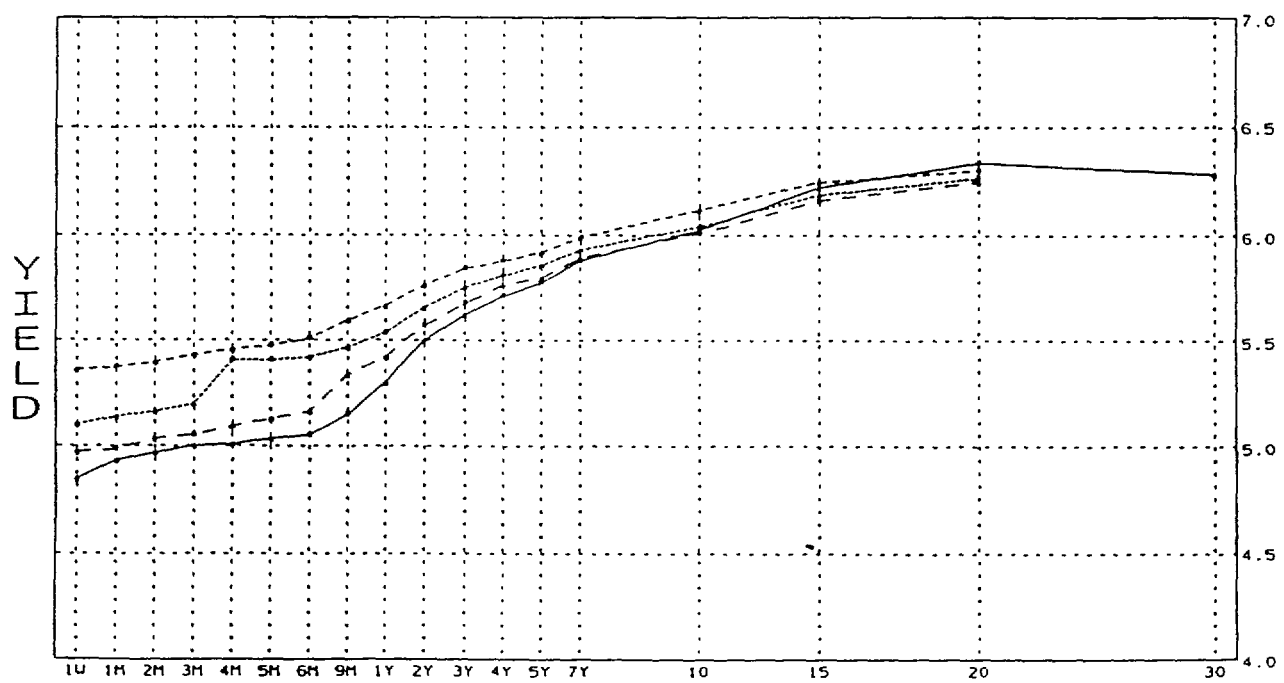
Curve Dated: 3/12/99
Settlement Date: 3/16/99
Coupon/Spot: S
Bid/Ask/Mid: M
FMC # [redacted] or SWYC #23

1 [redacted] Graph
2 [redacted] Update Curve
3 [redacted] Forwards Analysis

	TERM	SPOT	6/16/99	P	9/16/99	P	3/16/00	P
	1 Wk	4.8478	4.9817	R	5.1163	R	5.3599	R
D	1 Mo	4.9375	4.9921	O	5.1399	O	5.3814	O
E R	2 Mo	4.9687	5.0360	J	5.1651	J	5.4063	J
P A	3 Mo	5.0000	5.0634	E	5.2005	E	5.4330	E
O T	4 Mo	5.0138	5.1003	C	5.4107	C	5.4597	C
S E	5 Mo	5.0400	5.1306	T	5.4107	T	5.4855	T
I S	6 Mo	5.0641	5.1650	E	5.4208	E	5.5138	E
T	9 Mo	5.1537	5.3474	D	5.4749	D	5.5921	D
	1 Yr	5.3113	5.4245		5.5442		5.6678	
	2 Yr	5.4974	5.5786		5.6650		5.7671	
S R	3 Yr	5.6179	5.6801		5.7512		5.8408	
W A	4 Yr	5.7172	5.7547		5.8096		5.8755	
A T	5 Yr	5.7729	5.8012		5.8504		5.9105	
P E	7 Yr	5.8732	5.8882		5.9321		5.9905	
S	10Yr	6.0117	6.0031		6.0447		6.1059	
	15Yr	6.2193	6.1558		6.1888		6.2377	
	20Yr	6.3354	6.2332		6.2602		6.2998	
	30Yr	6.2816	n/a		n/a		n/a	

〈HELP〉 for explanation. DL17 M-Mkt FWCV

FORWARD CURVE ANALYSIS
United States



Graph Curves: [X] SPOT [X] 6/16/99 [X] 9/16/99 [X] 3/16/00

SWAP ZERO COUPON PRICING MODEL

Maturity	Par Yield	Zero Coupon Yield	Discount Factor
1	10.00	10.00	0.90909091
2	10.50	10.52637876	0.81859317
3	11.00	11.07613010	0.72968916

SWAP ZERO COUPON PRICING MODEL

MATURITY	CASH FLOW	DISCOUNT FACTOR	PRESENT VALUE	INTEREST RATE SENSITIVITY 25BP
0	(100.000)	1.000000	(100.000)	
1	7.000	0.90909091	6.363	0.0144
2	7.000	0.81859317	5.730	0.0258
3	107.000	0.72968916	78.076	0.5248
			(9.830)	0.5650

SENSITIVITY OF FRA TO ZERO RATE CHANGES

TWO PERIOD/THREE PERIOD FRA : BORROW AT 10.50% $10,000,000

MOVEMENT	2-PERIOD PV (Δ)	3-PERIOD PV(Δ)	TOTAL Δ
+10.BP	-$14,792.55	+$21,737.97	+$6,945.42
+5 BP	-$7,401.29	+$10,878.77	+$3,477.48
-5 BP	+$7,411.35	-$10,898.37	-$3,487.02
-10 BP	+$14,832.76	-$21,816.39	-$6,983.63

RELATIVE SENSITIVITIES

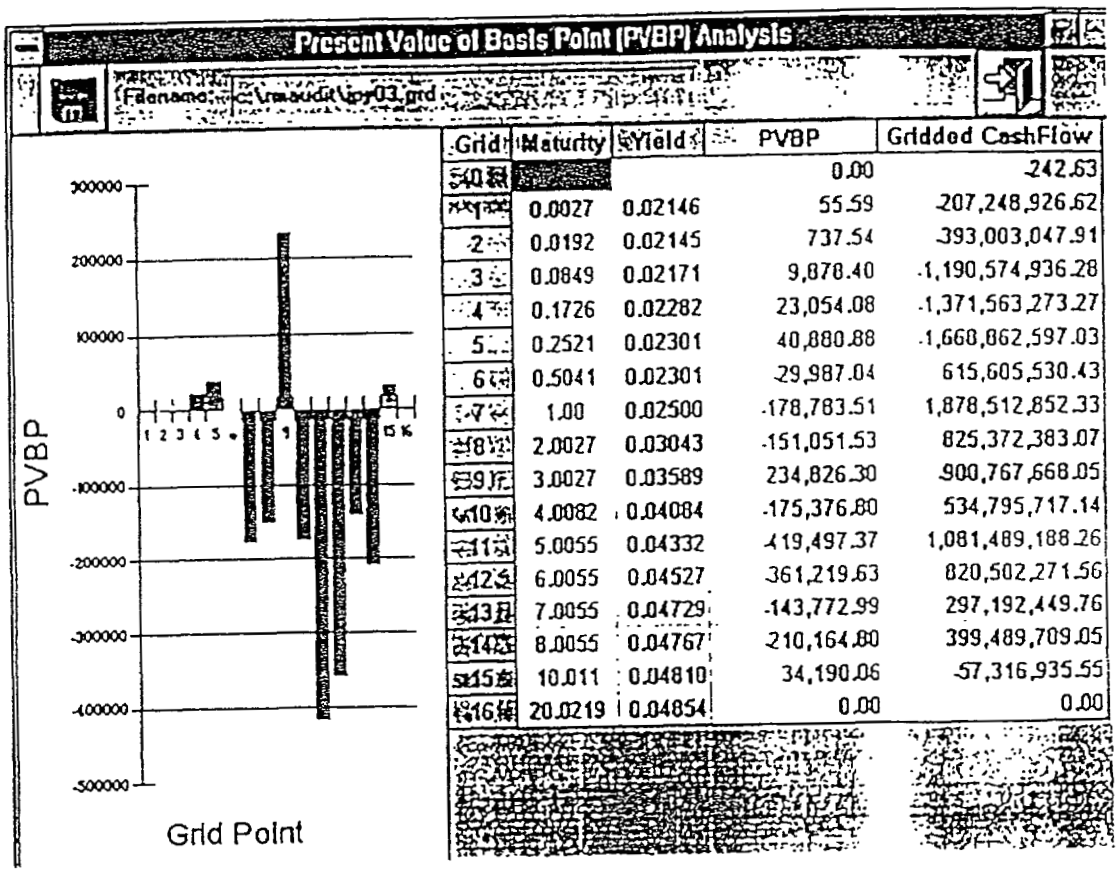
DEPOSIT:	$1,000,000 @ 10%
1 ON 2 FRA:	$1,000,000 STRUCK AT 10%
2 ON 3 FRA:	$1,000,000 STRUCK AT 10%
SWAP:	RECEIVE FIXED @ 10% FOR 3 YEARS ON $1,000,000

RELATIVE SENSITIVITIES (CONT'D)

(TO A 1 B.P. CHANGE IN THE ZERO RATES)

MATURITY (YEARS)	DEPO	1 ON 2 FRA	2 ON 3 FRA	SWAP
1	-90.90	+82.64		-8.26
2	-	-162.92	+148.11	-14.81
3	-		-216.75	-216.75
TOTALS	-90.90	-80.28	-68.64	-239.82

Worked Example 5:
VaR and PVBP Portfolio Risk Management



Grid	Maturity	Yield	PVBP	Gridded CashFlow
0			0.00	-242.63
1	0.0027	0.02146	55.59	-207,248,926.62
2	0.0192	0.02145	737.54	-393,003,047.91
3	0.0849	0.02171	9,878.40	-1,190,574,936.28
4	0.1726	0.02282	23,054.08	-1,371,563,273.27
5	0.2521	0.02301	40,880.88	-1,668,862,597.03
6	0.5041	0.02301	-29,987.04	615,605,530.43
7	1.00	0.02500	-178,783.51	1,878,512,852.33
8	2.0027	0.03043	-151,051.53	825,372,383.07
9	3.0027	0.03589	234,826.30	-900,767,668.05
10	4.0082	0.04084	-175,376.80	534,795,717.14
11	5.0055	0.04332	-419,497.37	1,081,489,188.26
12	6.0055	0.04527	-361,219.63	820,502,271.56
13	7.0055	0.04729	-143,772.99	297,192,449.76
14	8.0055	0.04767	-210,164.80	399,489,709.05
15	10.011	0.04810	34,190.06	-57,316,935.55
16	20.0219	0.04854	0.00	0.00

EQUITY RISK ANALYSIS

MARKET MODEL

- ALL SHARE RETURNS MOVE MORE OR LESS TOGETHER

- ONLY COMMON FACTOR IS WHOLE MARKET

- CAN DERIVE SINGLE-INDEX MODEL CALLED MARKET MODEL

- CAPITAL ASSET PRICING MODEL IS A SINGLE INDEX MODEL

THE MARKET MODEL

THE SIMPLEST FORM OF THE MARKET MODEL IS A SINGLE FACTOR LINEAR REGRESSION MODEL.

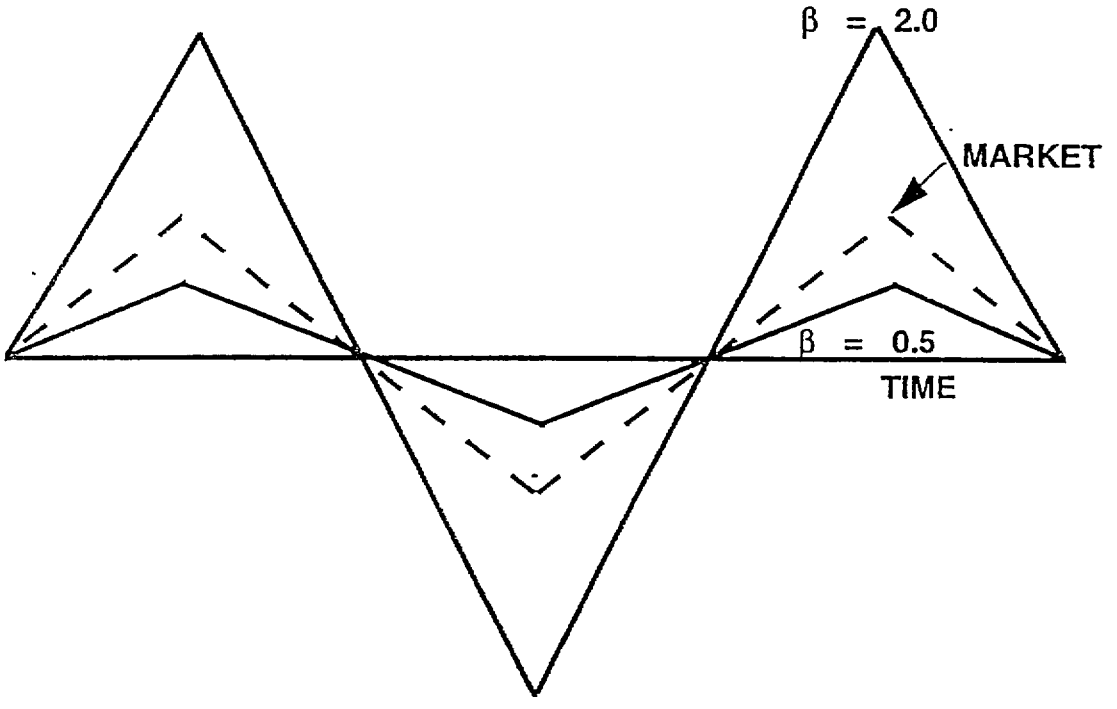
$$R_{jt} = A_j + B_j R_{mt} + e_{jt}$$

where R_{jt} = return on individual stock in period t

R_{mt} = return on market in period t

BETA AND CYCLICALITY

THE BETA OF A STOCK IS A MEASURE OF HOW IT IS EXPECTED TO MOVE RELATIVE TO THE MARKET AS A WHOLE



HIGH BETA STOCKS ARE AGGRESSIVE

LOW BETA STOCKS ARE DEFENSIVE

<HELP> for explanation. DL17 Equity BETA
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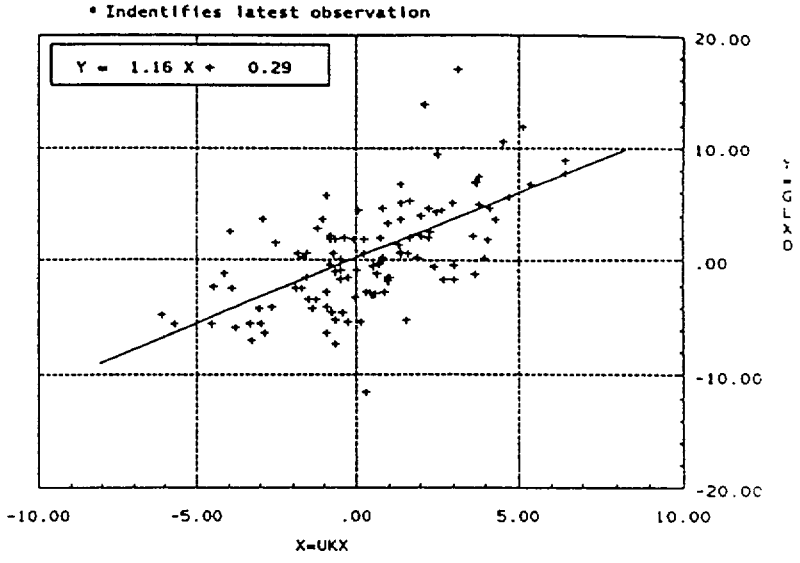
HISTORICAL BETA

GLXO LN GLAXO WELLCOME PLC

Relative Index UKX FTSE 100 INDEX

Period W
Range 1/ 3/97 To 3/ 5/99
Market T Trade

ADJ BETA	1.11
RAW BETA	1.16
Alpha (Intercept)	.29
R2 (Correlation)	.39
Std Dev of Error	3.70
Std Error of Beta	.14
Number of Points	113



Adj beta = (0.67) * Raw Beta
+ (0.33) * 1.0

<HELP> for explanation. DL17 Equity BETA

HISTORICAL BETA

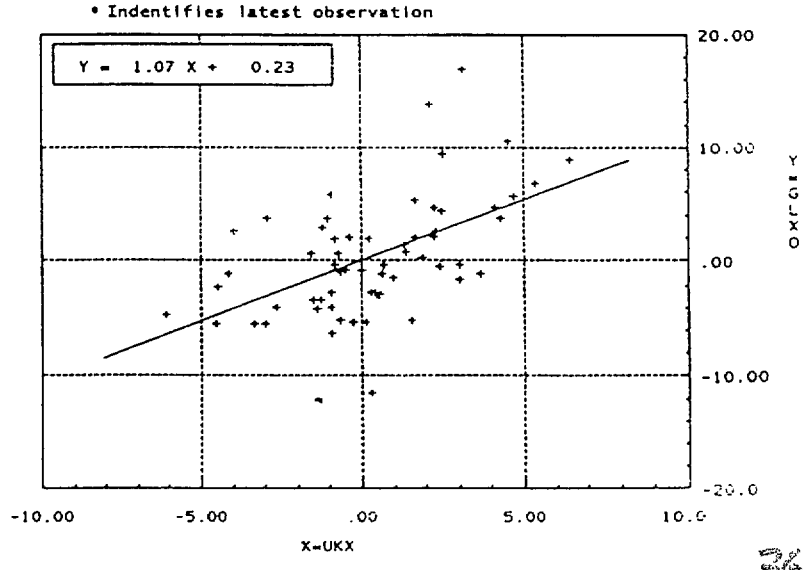
Number of points may be insufficient for an accurate beta.

GLXO LN GLAXO WELLCOME PLC

Relative Index UKX FTSE 100 INDEX

Period W
Range 1/ 2/98 To 3/ 5/99
Market T Trade

ADJ BETA	1.05
RAW BETA	1.07
Alpha (Intercept)	.23
R2 (Correlation)	.29
Std Dev of Error	4.34
Std Error of Beta	.22
Number of Points	61



Adj beta = (0.67) * Raw Beta
+ (0.33) * 1.0

RISK

$$S^2 = \beta^2 S^2_M + S^2_\varepsilon$$

TOTAL RISK	MARKET RISK	NON-MARKET RISK
	SYSTEMATIC RISK	NON-SYSTEMATIC RISK
	NON-SPECIFIC RISK	SPECIFIC RISK
	BETA RISK	RESIDUAL RISK
	NON-DIVERSIFIABLE	DIVERSIFIABLE
	CANNOT BE AVOIDED	CAN BE AVOIDED

- AN INDIVIDUAL STOCK'S RISK IS <u>ALSO</u> MEASURED BY BETA SINCE INVESTORS HOLD DIVERSIFIED PORTFOLIOS

MEASUREMENT OF PORTFOLIO RISK AND RETURN

STOCK	FUND HOLDING	BETA	SPECIFIC RISK	TOTAL RISK
A	5,000,000	1.25	10.0	22.4
B	10,000,000	2.00	20.0	37.7
C	10,000,000	0.60	15.0	17.8

R_F = 5% R_M = 11% S_M = 16%

PORTFOLIO BETA = $\frac{(5 \times 1.25) + (10 \times 2.00) + (10 \times 0.60)}{25}$ = 1.29

PORTFOLIO EXPECTED RETURN = 5% + 1.29 (11% - 5%) = 12.74%

PORTFOLIO MARKET RISK = $\beta_P S_M$ = (1.29) (16) = 20.64%

PORTFOLIO SPECIFIC RISK

PORTFOLIO VARIANCE $= \left(\frac{5}{25}\right)^2 (10)^2 + \left(\frac{10}{25}\right)^2 (20)^2 + \left(\frac{10}{25}\right)^2 (15)^2 = 104$

PORTFOLIO RISK $= \sqrt{104} = 10.2\%$

TOTAL PORTFOLIO RISK

PORTFOLIO VARIANCE $= \beta_P^2 \; S_M^2 + S_E^2$

$= (1.29)^2 \; (16)^2 + (10.2)^2$

$= 530.05$

PORTFOLIO RISK $= \sqrt{530.05} = 23.0\%$

<HELP> for explanation, <MENU> for similar functions. DL17 Equity HEDG
ENTER ALL VALUES AND HIT <GO>.

Equity Hedge Screen

DEPENDENT VARIABLE		INDEPENDENT VARIABLE	
GLXO LN		Z A Index	
GLAXO WELLCOME PLC		FTSE 100 Indx NEW Mar99	
Latest Price	1953.000	Latest Price	6350
Shares held	10000	Contract Size	10
Market Value	195,300.00	Contract Value	63,500.00
Currency	GBP	Currency	GBP
		Cross Rate	1.00
Beta	1.151	Dates:	3/14/97 to 3/ 5/99
t-Test	8.1962	Alpha	0.00193
# Points	104	r-squared	0.3971
Frequency	W Weekly		

Market Value X Beta = Risk-adjusted market value
195,300 1.151 224,846.19
divided by
Contract Value = Number of Contracts
63,500.00 3.54

Bloomberg

CORRELATION RISKS

TWO ASSETS : RETURN ON A = 15% RETURN ON B = 15%
VOLATILITY OF A= 10% VOLATILITY OF B = 10%

PORTFOLIO RETURN = $(½)(15) + ½(15)$	PORTFOLIO VARIANCE = $(½)^2(10)^2 + (½)^2(10)^2 + 2(½)(½)(10)(10)\rho$

CORRELATION	RETURN	RISK
1.00	15%	10.00%
0.50	15%	8.66%
0.00	15%	7.07%
-0.50	15%	5.00%
-1.00	15%	0.00%

INDUSTRIAL FINANCE CORPORATION OF THAILAND

FOUR DAY RISK MANAGEMENT SEMINAR

DAY FOUR
MAY 20, 2000

EXPERT PANEL DISCUSSION ON RISK MANEGEMENT TOOL APPLICATIONS

PRESENTED BY

FREDERICK J. ZAMON
A. WILLIAM BODINE, Ph.D.

BANGKOK, THAILAND

DELOITTE TOUCHE TOHMATSU

EXPERT PANEL DISCUSSION ON RISK MANAGEMENT TOOL APPLICATIONS

- **REVIEW OF RISK MANAGEMENT TOOLS**

  SEE HANDOUT: RISK MANAGEMENT MEASURES

- **DISCUSSION OF RISK MANAGEMENT ROAD MAP**

  SEE HANDOUT: RISK MANAGEMENT ROAD MAP

- **DISCUSSION QUESTIONS:**

  WHAT EXISTING DATA DO YOU SEE IN YOUR AREA FOR THESE ACTIVITIES?

  RISK IDENTIFICATION
  RISK MEASUREMENT
  RISK MANAGEMENT

  WHAT OPPORTUNITIES DO YOU SEE IN YOUR AREA WITH THE NEW QUANTITATIVE TOOLS?

  RISK IDENTIFICATION
  RISK MEASUREMENT
  RISK MANAGEMENT

  WHAT RESOURCE REQUIREMENTS ARE NEEDED IN YOUR AREA FOR IMPLEMENTING AND UTILIZING QUANTITATIVE RISK MANAGEMENT TOOLS?

Date:_____

IFCT RISK MANAGEMENT ROAD MAP
Discussion Outline

Activities:	Risk Measurement Tools & Applications			Scheduling Priority			
	Identification	Measurement	Management	2Q	3Q	4Q	1Q
Funding							
Treasury							
Customer							
Relationship Manager							
Corporate Analysis							
Credit Analysis							
Loan Disbursement							
Accounting							
Investment							
Info Technology							
A & L Management							
Senior Management							

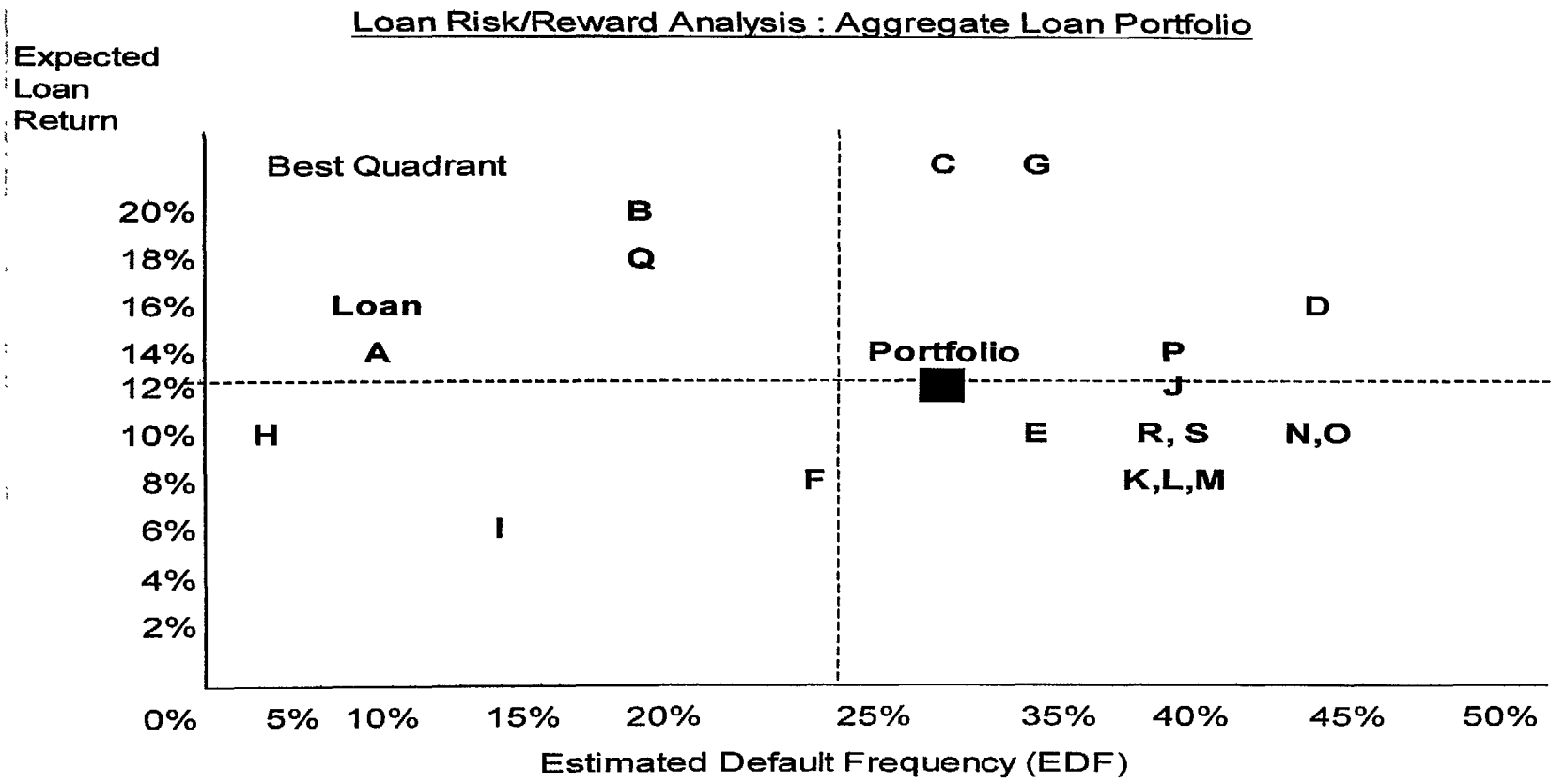
Prepared By: Deloitte Touche Tohmatsu (Zamon & Bodine)

IFCT Credit and Market Risk Management

Executive Briefing

Strategic Use of Risk Measurement Data

Application of Credit Risk Measures in Loan Portfolio Analysis

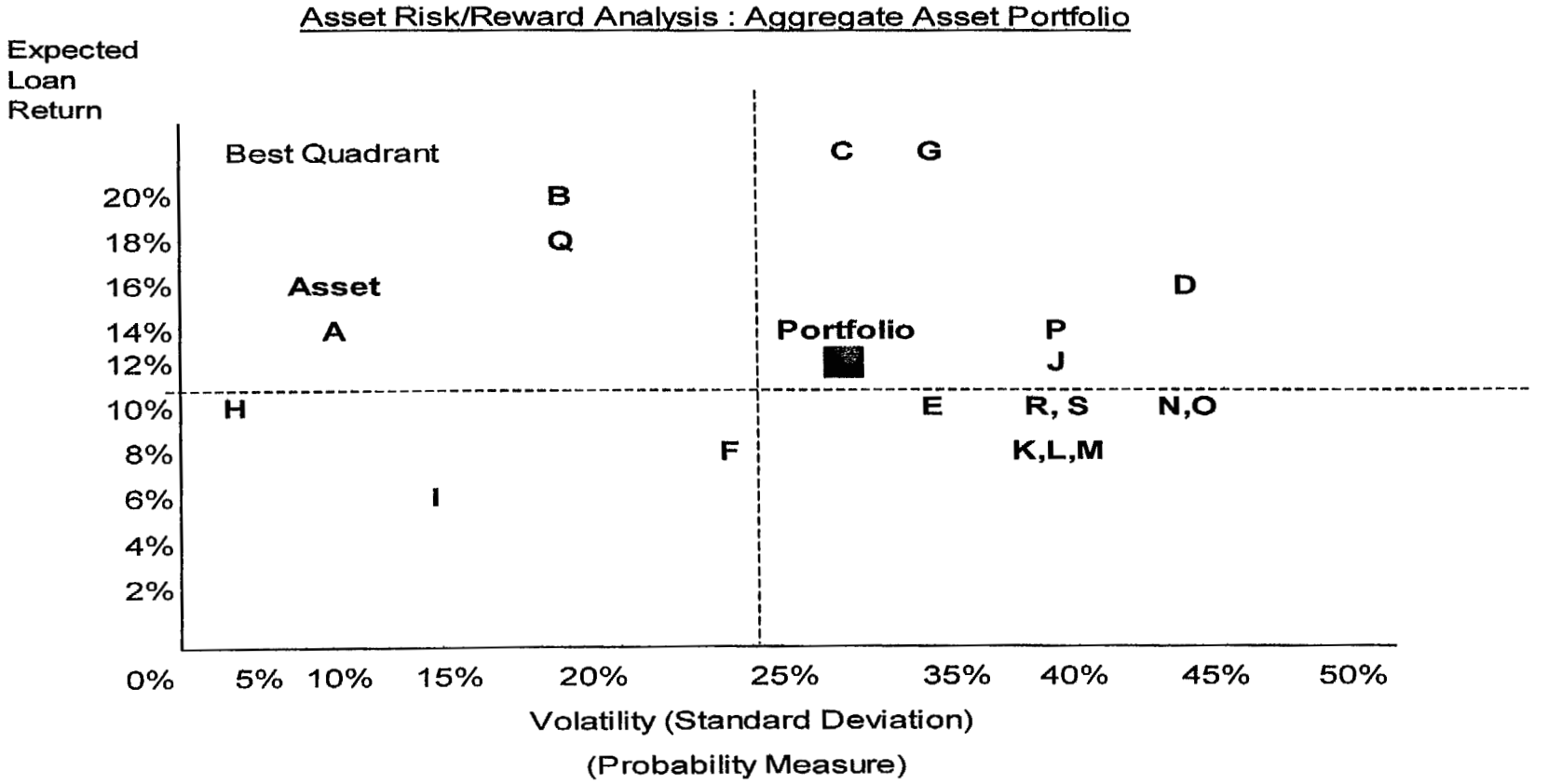


Deloitte Touche Tohmatsu

Executive Briefing

Strategic Use of Risk Measurement Data

Application of Market Risk Measures in Asset Portfolio Analysis



Credit and Market Risk Management Project Plan

Project Task	Fans	Front Office			Coaches		Regular Line-Up						Special Teams				
	Business End Users	Business Sponsor	IS Sponsor	Business Driver	Business Project Lead	Project Manager	Business Sys. Analyst	Data Modeler	Data Base Analyst	Data Staging Designer	Educator	E/U Appl'n Developer	Tech/Security Architect	Tech Support Specialist	Data Staging Programmer	Data Steward	QA Analyst
PROJECT DEFINITION																	
Assess Credit & Market Risk Mgmt. Readiness		○	○	○	●	●	◗	◗	◗	◗			◗				
Develop Preliminary Project Scope		○	○	○	●	●	◗	◗	◗	◗			◗				
Build Business Justification	◗	◗	◗	●	●	○	◗										
PROJECT PLANNING & MANAGEMENT																	
Establish Project Identity				◗	●	●											
Identify Project Resources		○	○	○	●	●											
Prepare Draft Project Plan				◗	◗	●	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗
Conduct Project Team Kick-Off & Planning		□	□	○	○	●	○	○	○	○	○	○	○	○	○	○	○
Revise Project Plan				◗	◗	●	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗
Develop Project Communication Plan		◗	◗	◗	○	●	◗	◗	◗	◗	▲	◗	◗	▲	◗	▲	▲
Develop Program to Measure Success		○	○	○	●	○											
Develop Process to Manage Scope				○	○	●											
Ongoing Project Management					○	●											
USER REQUIREMENT DEFINITION																	
Identify and Prepare Interview Team						●	○	○									
Select Interviewees		◗	◗	◗	●	●											
Schedule Interviews					○	●											
Conduct User Kick-Off & Prepare Interviewees	○	○	○	○	○	●	○	○									
Conduct Business User Interviews	○	○		○	○	▲	●	▲				▲					
Conduct IS Data Discovery Interviews						▲	●	●	○	○		▲			○		
Analyze Interview Findings					○	○	●										
Document Findings and Review	◗			◗	○	○	●	○				▲					
Publish Requirements Deliverables	□	□	□	□	○	○	●	○	□	□	□	□	□	□	□	□	□
Prioritize and Revise Project Scope	◗	◗	◗	○	●	●	◗	◗				◗					
User Acceptance/Project Review	▲	□	□	○	●	○	○	○	○	○	▲	○	▲	▲	○	▲	▲

LEGEND:

Primary Responsibility for the Task =	●
Involved in the Task =	○
Provides Input to the Task =	◗
Informed Task Results =	□
Optional Involvement in the Task =	▲

Credit and Market Risk Management

Project Task	Fans	Front Office	Coaches	Regular Line-Up	Special Teams
PHYSICAL DATABASE DESIGN					
PHYSICAL DATABASE IMPLEMENTATION					
DATA STAGING DESIGN & DEVELOPMENT					
POPULATE & VALIDATE DATABASE					
PERFORMANCE TUNING					
END USER (E/U) APPLICATION SPECIFICATION					
END USER (E/U) APPLICATION DEVELOPMENT					
DEPLOYMENT PLANNING					
COMPLETE SYSTEM TEST					
DEPLOYMENT (ALPHA, BETA & PROD'N)					

LEGEND:

Primary Responsibility for the Task =	●
Involved in the Task =	○
Provides Input to the Task =	◗
Informed Task Results =	▢
Optional Involvement in the Task =	▲

Date:_____

IFCT RISK MANAGEMENT ROAD MAP
Discussion Outline

Activities:	Risk Measurement Tools & Applications: Identification	Measurement	Management	Scheduling Priority: 2Q	3Q	4Q	1Q
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Treasury							
Customer							
Relationship Manager							
Corporate Analysis							
Credit Analysis							
Loan Disbursement							
Accounting							
Investment							
Info Technology							
A & L Management							
Senior Management							

Prepared By: Deloitte Touche Tohmatsu (Zamon & Bodine)

Other Deliverables

IFCT Risk Management Training Outline

Day One - General Risk Management Framework: 9:00 AM to 12:00 PM

- Current Situation Review: (a) Credit Risk Management; and (b) Capital Market Risk Management
- Financial Markets Framework: See Diagram
- Credit Risk Management vs. Capital Market Risk Management

  (a) Information & Reporting Requirements
  (b) Risk Measures
  (c) Risk Management Methods

- Related Risk Elements:

  (a) Operational Risks
  (b) Legal Risks

- Risk Management Cycles:

  (a) Credit Risk Management
  (b) Capital Market Risk Management

- Objectives of Risk Management Systems:

  (a) Credit Risk Management
  (b) Capital Market Risk Management

- Management Responsibilities at Various Levels:

  (a) Board – Establishes Policies & Guidelines
  (b) Chief Executive – Responsible for Implementation & Execution
  (c) Senior Managers – Directly Responsible for Day-to-Day Management

- Management Issues & Challenges:

  (a) Examining Relevant Historical Data
  (b) Creating an Independent Risk Management Unit
  (c) Analyzing Sources of Return Performance
  (d) Comparing Relative Performance Measures
  (e) Producing Fully Integrated Risk Management Reports & Forward Maps

- Regulator Issues & Concerns:

  (a) Cascade Effect of A Default
  (b) Lack of Transparency in Market Data
  (c) Destabilization of Markets
  (d) Ensuring Capital Adequacy

Day One – Case Study Examples of General Framework Issues: 1:00 PM to 5:00 PM

- Credit Risk Management Case Analysis: Group Study (45 Minutes)
- Capital Market Risk Management Case Study: Group Study (45 Minutes)
- Open Discussion & Review: Credit Risk Case and Capital Market Risk Case
- Instructor Led Examples for Open Discussion:

  (a) Credit Risk Management Case
  (b) Capital Market Risk Management Case

Day Two – Credit Risk Management & Operational Issues: 9:00 AM to 12:00 PM

- Nature of Available Credits In Thai Market for IFCT
- Credit Risks Associated with IFCT's Available Credits

  (a) Conversion Risk (i.e. "Getting Your Money Back!")

    1. Inventories
    2. Receivables

  (b) Management Risk:

    1. Skills
    2. Strategy
    3. Plans
    4. Continuity of Key Personnel

  (c) Market & Competition:

    1. External factors
    2. Competition
    3. Events

- Industry Models & Historical Common Size Ratio Analysis

  (a) Hotel Industry
  (b) Food & Beverage Industry
  (c) Basic Metals
  (d) Transportation

- Credit Risk Analysis System:

  (a) Factor Review
  (b) Customer Analysis
  (c) Transaction Analysis
  (d) Weightings

Day Two - Credit Risk Management & Operational Issues: 1:00 PM to 5:00 PM

- Case Studies:

  (a) Characteristics of Different Businesses
  (b) Comparative Credit Analysis
  (c) Comparative Return Analysis
  (d) Loan Scoring

- The Three Key Analytical Factors:

  (a) Return – Expected Reward & Time Value of Money
  (b) Risk – Historical Loss Factors
  (c) Cost – Loan Administration & Technology Support Costs

- Aggregate Loan Portfolio Analysis:

  (a) Individual Loan Analysis of Risk/Reward
  (b) Plotting of Loans in Risk/Reward Matrix
  (c) Aggregate Loan Portfolio Risk/Reward Analysis
  (d) Risk/Reward Quadrant Analysis

- Summary & Conclusions

  (a) Q & A
  (b) Open Discussion

Day Three – Capital Market Risk Management & Operational Issues: 9:00 AM to 12:00 PM

- Balance Sheet Dynamics & Analysis:

  (a) IFCT Balance Sheet Analysis
  (b) Impact of Loan Credit Quality on Equity Account
  (c) Funding Advantage & Impact on Cost-of-Capital and Returns
  (d) Risks Inherent in Funding Sources
  (e) Linkage between Asset & Liability Management

- Social Commitment in IFCT Lending Activities:

  (a) Advantages
  (b) Disadvantages
  (c) Certainty vs. Uncertainty

- Capital Market Risk Exposures:

  (a) Interest Rate Risk
  (b) Currency Risks (i.e. Baht loans supported by Yankee Dollar Bonds)
  (c) IFCT Equity Risks: Market Risk vs. Specific Risk

Day Three – Capital Market Risk Management & Operational Issues: 9:00 AM to 12:00 PM

- Risk & Reward Analysis:

  (a) A Gambler's Experiment
  (b) Properties of Expectations
  (c) Normal Distributions
  (d) Risk
  (e) Asset Returns
  (f) Sample Estimates

- Examples & Lessons of Financial Disasters:

  (a) Baring's Collapse
  (b) Metallgesellschaft
  (c) Orange County
  (d) Daiwa's Lost Billion
  (e) Lessons

Day Three – Capital Market Risk Management & Operational Issues: 1:00 PM to 5:00 PM

- Measuring of Capital Market Risk:

  (a) Value at Risk (VAR) Defined
  (b) Expected Maximum Loss, Time Horizons & Confidence Levels
  (c) VAR for General Distributions
  (d) VAR for Parametric Distributions
  (e) Conversion of VAR Parameters
  (f) Verifying VAR
  (g) Model Verification Based on Failure Rates
  (h) Measurement Errors
  (i) Estimation Error in Means & Variances
  (j) Estimation error in Sample Quantiles
  (k) Comparison of Methods

- Approaches to Measuring VAR:

  (a) Delta-Normal Method
  (b) Delta vs. Full Valuation
  (c) Delta-Gamma Approximations
  (d) Historical-Simulation Method
  (e) Stress Testing
  (f) Structured Monte Carlo Method

- Risk Adjusted Return on Capital:

  (a) Measuring Risk
  (b) Developing a Risk Adjustment Matrix
  (c) VAR vs. Score Card Method

Day Three - Capital Market Risk Management & Operational Issues: 1:00 PM to 5:00 PM

- Case Studies:

  (a) Interest Rate Case
  (b) Currency Case
  (c) Risk Adjusted Return of Capital

Day Four – Linking Credit Risk & Capital Market Risk Management: 9:00 AM to 12:00 PM

- A Financial Markets Perspective: See Diagram
- Developed Market vs. Emerging Market Model
- Fundamental Characteristics of the Thai Credit & Capital Markets
- Recent IFCT Challenges & Opportunities
- Related Issues: Bankruptcy Law Changes & Tax Treatment of Loan Losses
- New Lending Directions:

  (a) Market Characteristics of Small & Medium Size Enterprises
  (b) Credit Characteristics of Small & Medium Size Enterprises
  (c) Evaluating the Credit Risks of Small & Medium Size Enterprises
  (d) Business & Industry Model References
  (e) Loan Portfolio Modeling
  (f) Risk/Reward Analysis

Day Four – Linking Credit Risk & Capital Market Risk Management: 1:00 PM to 5:00 PM

- Information & Reporting Systems
- Case Studies – Role Play Discussions:

  (a) Loan Officer view
  (b) Credit Review view
  (c) Loan Portfolio view
  (d) Asset & Liability Manager view

- Open Discussion: Q & A

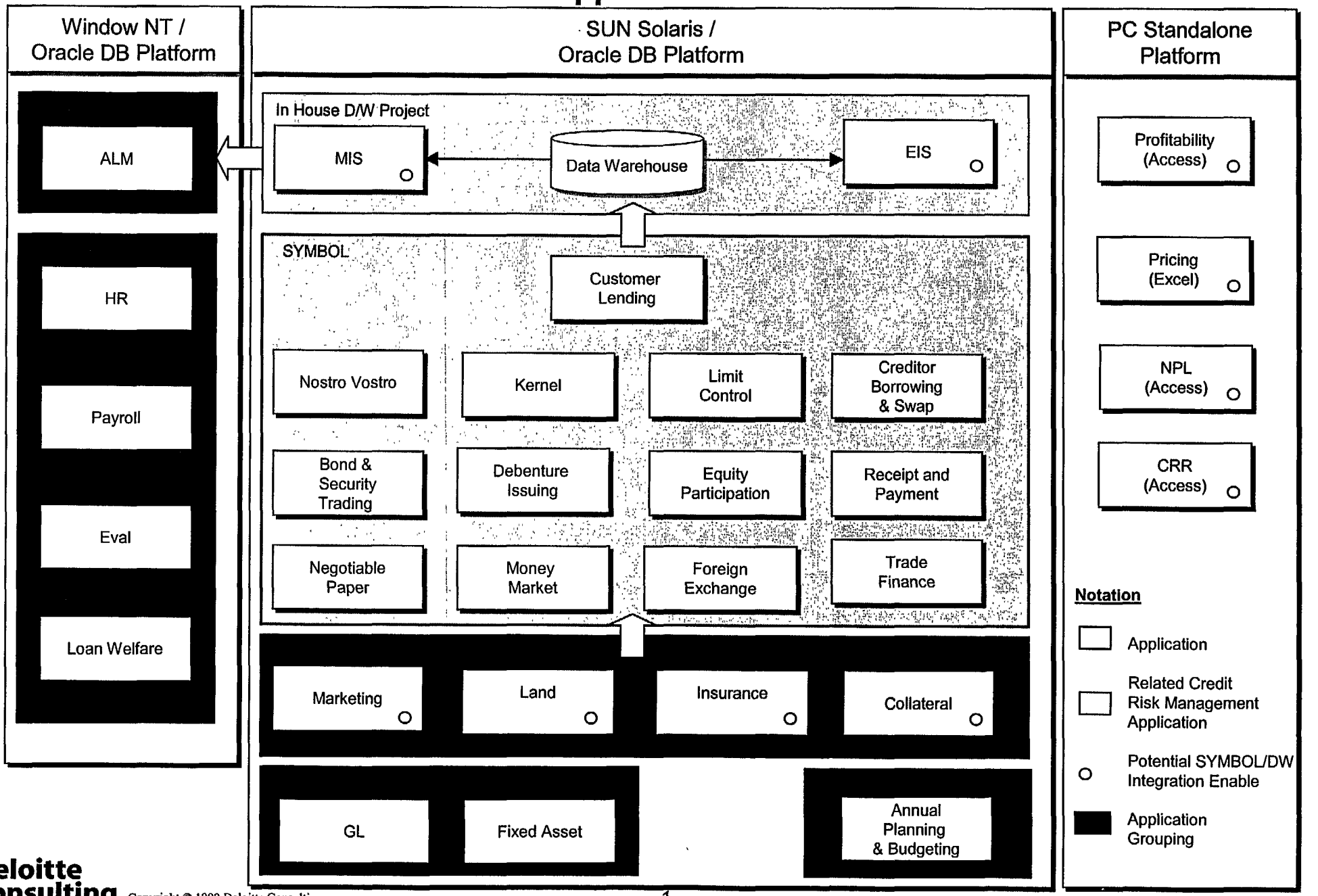
Credit and Market Risk Management Project Plan

	Fans	Front Office			Coaches		Regular Line-Up						Special Teams				
Project Task	Business End Users	Business Sponsor	IS Sponsor	Business Driver	Business Project Lead	Project Manager	Business Sys. Analyst	Data Modeler	Data Base Analyst	Data Staging Designer	Educator	E/U Appl'n Developer	Tech/Security Architect	Tech Support Specialist	Data Staging Programmer	Data Steward	QA Analyst
PROJECT DEFINITION																	
Assess Credit & Market Risk Mgmt. Readiness		○	○	○	●	●	◗	◗	◗	◗			◗				
Develop Preliminary Project Scope		○	○	○	●	●	◗	◗	◗	◗			◗				
Build Business Justification	◗	◗	◗	●	●	○	◗										
PROJECT PLANNING & MANAGEMENT																	
Establish Project Identity				◗	●	●											
Identify Project Resources		○	○	○	●	●											
Prepare Draft Project Plan				◗	◗	●	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗
Conduct Project Team Kick-Off & Planning		❐	❐	○	○	●	○	○	○	○	○	○	○	○	○	○	○
Revise Project Plan				◗	◗	●	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗	◗
Develop Project Communication Plan		◗	◗	◗	○	●	◗	◗	◗	◗	▲	◗	◗	▲	◗	▲	▲
Develop Program to Measure Success		○	○	○	●	○											
Develop Process to Manage Scope				○	○	●											
Ongoing Project Management					○	●											
USER REQUIREMENT DEFINITION																	
Identify and Prepare Interview Team						●	○	○									
Select Interviewees		◗	◗	◗	●	●											
Schedule Interviews					○	●											
Conduct User Kick-Off & Prepare Interviewees	○	○	○	○	○	●	○	○									
Conduct Business User Interviews	○	○		○	○	▲	●	▲				▲					
Conduct IS Data Discovery Interviews						▲	●	●	○	○		▲			○		
Analyze Interview Findings					○	○	●										
Document Findings and Review	◗			◗	○	○	●	○				▲					
Publish Requirements Deliverables	❐	❐	❐	❐	○	○	●	○	❐	❐	❐	❐	❐	❐	❐	❐	❐
Prioritize and Revise Project Scope	◗	◗	◗	○	●	●	◗	◗				◗					
User Acceptance/Project Review	▲	❐	❐	○	●	○	○	○	○	○	▲	○	▲	▲	○	▲	▲

LEGEND:

Primary Responsibility for the Task =	●
Involved in the Task =	○
Provides Input to the Task =	◗
Informed Task Results =	❐
Optional Involvement in the Task =	▲

IFCT As-Is Application Architecture



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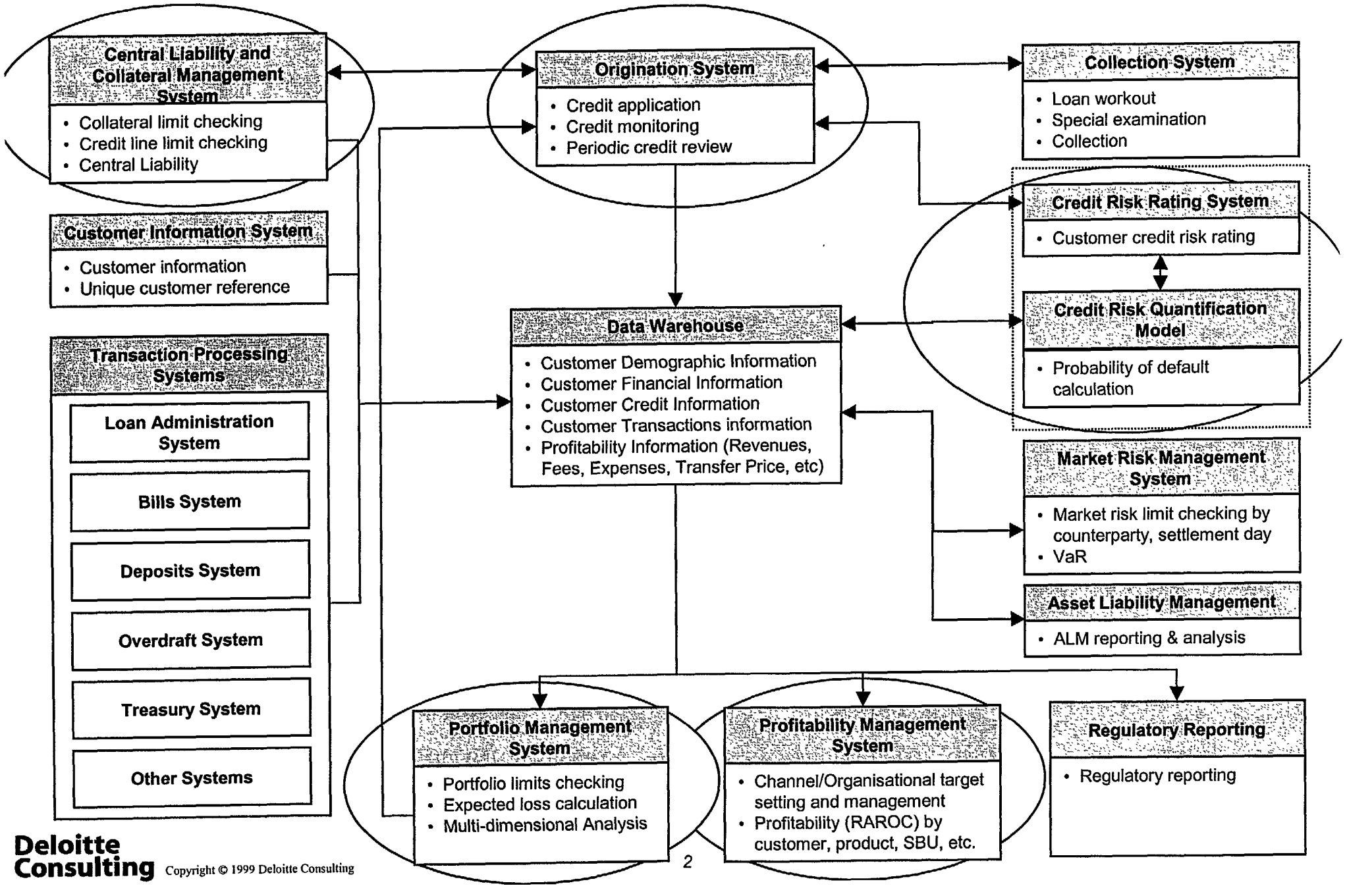
Best Practice Risk Management Application Architecture (Logical View)



Deloitte Consulting

Major Risk Management Application Gaps

- **Credit Risk Rating System and Credit Risk Quantification Model**: Risk rating, to be successful, must be based on a stable underlying credit process, and technology should be used to support this stability as much as possible. Most "best practice" risk rating users employ some sort of financial model to do calculations of probabilities of default or "rating equivalents" to S&P/Moody's etc. These models require "clean" and "consistent" data.

- **Central Liability and Collateral Management System:** Collateral always requires close monitoring, and there should be controls to ensure that loan funds are not released when collateral has not been received first. In the modern theory, the disaggregation of "expected loss" to look at "probability of default" and "loss in the event of default" separately requires a particularly strong collateral monitoring function.

- **Origination System:** Consistent credit processes can be implemented and enforced through a credit origination system. Currently available applications allow timely monitoring and control over the progress of credit processes. A loan origination system can serve as a knowledge management system to ensure knowledge is easily available to all personnel involved in the credit process.

- **Profitability Management System:** A profitability management system is needed so that risk and reward can be managed concurrently. Profitability management can be enhanced with the calculation of RAROC.

- **Portfolio Management System:** A portfolio management system should provide MIS and EIS information on credit quality, credit process, and business management. Modern technology can be implemented to enable multi-dimensional analysis on an ad-hoc basis for further analysis apart from regular reporting.

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Other Considerations

- **Transaction Processing System (SYMBOL)**: IFCT's transaction processing system is on the critical path for the implementation of the DW and other related applications. Timely rollout of the SYMBOL system is important to the overall implementation schedule.
- **Data Warehouse:** Detailed data analysis is required to ensure the data warehouse will have required data for the related applications (e.g. RAROC calculation in profitability management system, VaR calculation, expected loss calculation in portfolio management system).

Window NT & Oracle Application Description

	Application	Description	Tools
1	ALM	Risk Management Software Package 'Sendero' for Asset & Liability Management	Developer/2000
2	HR	In-house developed Human Resource Application	Developer/2000
3	Payroll	'Payroll System' software package	Developer/2000
4	EVAL	In-house performance evaluation application	Developer/2000
5	Loan Welfare	In-house developed loan welfare application	Developer/2000

Sun Solaris & Oracle Application Description (SYMBOL Package)

Application	Description	Tools
1. Trade Finance	The module supports Import/Export Letter of Credit, Documentary Collections, Trust Receipt Loans, Bills Acceptance, Shipping Guarantees operations.	Developer/2000
2. Customer Lending	The module support credit application, security details, repayment, guarantee issuing, invoicing, receipt processing and loan settlement.	Developer/2000
3. Nostro Vostro	The module maintains actual and projected cash activities for the bank's multicurrency nostro and vostro account,offset accounts and margin accounts maintenance with support functional areas from front office dealers, back office operation/settlement, generate account entries, and summarised information.	Developer/2000
4. Limit Control	The module provides risk management facilities , counterparty credit risk, settlement risk measurement, liquidity risk profile, position risk monitoring and global risk profile; maintain and consolidates multiple limits exposure across various SYMBOL modules.	Developer/2000

Sun Solaris & Oracle Application Description (SYMBOL Package)

	Application	Description	Tools
5.	Foreign Exchange	The module processes foreign exchange contract types including spot, forward, swap transaction from front office dealers, back office operation/settlement , generate accounting entries and MIS	Developer/2000
6.	Money Market	The module processes multi-currency money market instruments including : Fixed Deports taken/place, Call/Notice Deposits placed and accepted and term deports/placement and supports front officer dealers, back office operation/settlement, generate accounting entries and MIS	Developer/2000
7.	Kernel	The module maintain centralized information and common program/routines utilized by each SYMBOL modules, including static data especially customer information.	Developer/2000
8.	Negotiable Paper	The module maintain market prices of securities, support deal capture, verification and confirmation of deals, settlement , deal matching and summarized reports.	Developer/2000
9.	Bond & Security Trading	The module processes marketable securities including discount paper, fixed/floating rate bonds, equities and commodities	Developer/2000

Sun Solaris & Oracle Application Description (SYMBOL Package)

Application	Description	Tools
10. Reception Payment	The module processes reception payment.	Developer/2000
11. Equity Participation	The module maintain equity participation information.	Developer/2000
12. Debenture Issuing	The funding module processes debenture issuing.	Developer/2000
13. Creditor Borrowing & Swap	The funding module process creditor borrowing and swap.	Developer/2000

Sun Solaris & Oracle Application Description (Non-SYMBOL Package)

Application	Description	Tools
1. EIS	Funding and Lending Executive Information System	Developer/2000, Seagate Report Writer
2. MIS	Funding and Lending Management Information System	Developer/2000, Oracle Discoverer
3. Collateral	Customer collateral Security information	Developer/2000
4. GL	Oracle Finance General Ledger Module	Developer/2000
5. Fixed Asset	Oracle Finance Fixed Asset Module	Developer/2000
6. Annual Planning & Budgeting	Internal application uses for annual planning and budgeting	Developer/2000
7. Inventory	In house developed Inventory Application	Developer/2000
8. Marketing	Information of walk-in prospect and progress of TL, RM, customer visit before loan origination	Developer/2000
9. Land	Land title deed information as collateral security for customer landing	Developer/2000
10. Insurance	Insurance coverage for collateral security information system	Developer/2000

PC Standalone Application Description

	Application	Description	Tools
1	Pricing	Risk-based customer pricing worksheet based on customer rating, quality of project and quality of collateral	Excel
2	Profitability	Profitability report by customer, RM, Department and Organization	Visual Basic
3	NPL	Customer debt status and outstanding aging	MS Access
4	CRR	Credit risk rating calculation and print-out for customer loan consideration, no information storing function	Visual Basic

May 22, 2000

Memorandum to: Jirapol Pobukadee - Vice President
Policy & Planning Department
IFCT

From: Frederick J. Zamon
A. William Bodine, Ph.D.

Subject: **Preliminary Implementation Action Plan for IFCT Risk Management**

Hardware & Software Recommendation

- IFCT has confirmed their decision to have a modern, scalable computer system and infrastructure which appears to meet international standards for risk management requirements. Deloitte's own IT (Hong Kong based) specialists (Alvin Ng and Pensiri Dudsdeemaytha) have also conveyed their preliminary recommendations with respect to system requirements for risk management, views which were also presented in writing to senior executives at IFCT.

- Currently, no credit or market risk management module is built into IFCT's system. It is our recommendation that IFCT seek appropriate software (guided by Deloitte's IT specialists) and evaluate its application and effectiveness in IFCT's environment.

Action Plan & "Next Steps" for Implementing Modern Risk Management Methods

Assuming initial risk management focus is on loan assets, these are our suggested first steps:

1. Based on the Risk Management Measurement Check-List (copy attached), select the appropriate measures for risk identification, measurement and control in each area of IFCT's business activities. Obviously, this will require detailed follow-up discussions with course participants involved in Day Four's "Expert Panel" exercise.

2. Select a Default Frequency Model and begin testing its application on existing loans in Corporate, Project and SME lending areas.

3. Select a Portfolio Management Risk/Reward Model which allows for plotting of each loan on a Risk/Reward basis and also include a capability to aggregate the portfolio's assets.

4. Use the Default Frequency Model and a Portfolio Management Risk/Reward Model to construct distribution curves in order to identify standard deviations (i.e. confidence levels). This work should also include correlation analysis in order to construct a variance/covariance matrix.

5 From these first four steps, initial VAR calculations can be made. Then, with VAR, CAR can be calculated. And, finally, RORAC can be determined.

Additional Suggestions & Resource Information

1. We suggest that a copy of Risk Management & Analysis by Carole Alexander (a Wiley publication) be purchased and read carefully by a few selected highly technically competent individuals. This work we believe is the finest piece available on the most sophisticated aspects of VAR and related issues, including IT.

2. We suggest that regular reviews of the following Internet sites for the latest writings on VAR, CAR and RORAC:

   www.RMAHQ.org – This is Robert Morris Associates website.

   www.FRBSF.org – This is the Federal Reserve Bank of San Francisco's index of
   Economic Research.

   www.Research.FRBCHI.org – This is the Federal Reserve Bank of Chicago's academic working papers.

3. We suggest that regular participation in local, regional and international conferences be scheduled to add perspective to IFCT's risk management work and to keep abreast of new developments in an evolving discipline.

4. We suggest that the Credit & Market Risk Management activity be given highest level project standing and that high level work plan and implementation schedule be established. The attached form (i.e. Project Planning & Responsibility Schedule) be tailored to IFCT's Risk Management Project and that it be directed from the Senior Executive level in IFCT. Otherwise, it runs the risk of becoming simply another task (albeit important and high priority) assigned to the Policy & Planning Department.

Closing Note

We wish to express our appreciation for the opportunity to fulfill the important initial tasks on IFCT's Risk Management project, namely: (1) the senior executive briefing; (2) the staff risk management seminar; (3) recommendations of future training programs; and (4) our preliminary recommendations for "next steps" implementation contained in this memorandum.

We also appreciate the most positive response we have received on our efforts to serve your needs at this time. The Deloitte team stands ready to respond to future requests for assistance.

Attachments

Risk Management Measurement Check-List

Statistical Measures Used in Risk Management

Statistical Measures:	IFCT Use	Functional Area/Activity	Training Need
• Correlation			
• Regression			
• Standard Deviation			
• Variance			
• Covariance			
• R2			

Credit Risk Measures

Credit Risk Measures:

- Credit Provision
- Credit Risk Capital
- Default Frequency Model
- Credit Return-on-Risk Adjusted Capital

Credit Portfolio Risk Measures:

- Volatility
- Market Value-at-Risk
- Capital-at-Risk
- Risk/Reward Map
- Covariance Matrix
- Risk Adjusted Return-on-Capital
- Attribution Analysis
- Monte Carlo Simulation
- Historical Simulation
- Stress Testing
- Back Testing
- Factor Model

Market Risk Measures

Bond Return Measures:

- Yield
- Yield to Maturity

Bond Risk Measures:

- Duration
- Convexity
- Value-at-Risk
- Price Simulations

Risk Management Measurement Check-List - continued

General Bond Measures:	IFCT Use	Functional Area/Activity	Training Need
• Bond Valuation			
• Yield Curve			
• Zero Coupon Yield Curve			
• Risk Decomposition			
Equity Return Measures:			
• Annual Rate of Return			
• Average Annual Rate			
• Annual Compound Rate			
Equity Risk Measures:			
• Volatility			
• Beta			
• Market Value-at-Risk			
• Capital-at-Risk			
• Risk Adjusted Return-on-Capital			
Market Portfolio Risk Measures:			
• Volatility			
• Beta			
• Market Value-at-Risk			
• Capital-at-Risk			
• Risk/Return Map			
• Covariance Matrix			
• Risk Adjusted Return-on-Capital			
• Attribution Analysis			
• Monte Carlo Simulation			
• Historical Simulation			
• Stress Testing			
• Back Testing			
• Factor Model			
Derivative Risk Measures:			
• VAR of Linear Contracts			
• VAR of Non-Linear Contracts			
• Duration Approximation & Continuous Compounding			
• Black-Scholes Model			
• Dynamic Replication of Call Option			
• Dynamic Replication of Put Option			
• Delta-Gamma Approximation for Long Call			

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Industrial Finance Corporation of Thailand
PROJECT PLANNING AND RESPONSIBILITY SCHEDULE

PROJECT NAME:						
Project Responsibility:						
Number and Task Description	**Primary**	**Secondary**	**Begin Date**	**End Date**	**Comments**	**Priority**

NOTES: 1. Tasks can become Projects with more defined Tasks under them.
2. Use initials for primary/secondary responsibility.
3. A person with primary responsibility on one task may be secondary on another.
4. Ending dates are estimates until actually complete.
5. Comments can be used for updates, to show actual completion date, etc.

10h

Memorandum

Date: May 23, 2000

To: Visut Sattabudsutthi
Jirapol Pobukadee

Cc: Viloetta Kozlowski
Wm. Bodine, Ph.D.

From: Fred Zamon

Subject: Lending to SME's

In our initial meeting with Kun Anothai he requested that we address the issue of lending to SME's in Thailand. Specifically he expressed our opinion about:

A) The tools currently in use at IFCT for analyzing SME risk whether or not they are used efficiently.
B) How these tools be modified, if at all, to best manage exposure to the changing portfolio of assets.

In this memorandum, I present findings and recommendations relating to these two points. As noted below, the focus of the Credit and Market Risk Training Project prohibited a thorough analysis of the issues and complete identification of the challenges and related solutions surrounding lending to SME's in Thailand. However, as we were aware of the importance of SME initiatives to Senior Management, I have attempted to address these concerns below. There is no doubt that it has the attention of top Management at IFCT, as evidenced by review of the 1998 and 1999 Annual Reports, and research papers put forth by the Bank and the World Bank. Should Deloitte Emerging Markets be able to assist in further defining SME lending, we would be happy to assist.

This memorandum assumes knowledge of IFCT's charter, ownership, and mission as a development institution in Thailand. It assumes knowledge of IFCT's mandate to increase lending to SME's as a matter of Government policy, and it assumes knowledge of the official definition of an SME as put forth by the Bank of Thailand.

Methodology

The basis for this memorandum was a series of interviews with various IFCT personnel involved with policy and planning, research, and SME lending, auditing, and back office operations. Preparation also included reading appropriate portions of the above referenced Annual Reports and World Bank publications.

Constraints

The main constraint in preparing this memorandum lies in the fact that answers to the above questions were not the priority of the Credit and Market Risk Management Training Project (the Project). Hence, this analysis has been extracted from responses to questions primarily intended to facilitate the Project. A secondary constraint was the time allocated to the

Project, and its "scope of work" as a whole, which covered a corporate-wide view of credit and market risk management rather than just the SME portfolio.

The findings and recommendations below are strictly those of the writer. I accept all responsibility for any errors committed in extracting information used to record the findings and recommendations below.

Findings and Recommendations

The findings and recommendations focus on the importance of the tools of fundamental credit analysis on the one hand, and the use of statistical analysis on the other hand, when assessing SME lending and credit risk measurement.

Impact of the IFCT Charter

One of the most significant aspects of IFCT's Charter that may affect SME lending includes a provision prohibiting IFCT from taking deposits. In a modern, "global" economy,[1] the income (reward) offsetting risk incurred from lending to SME's is derived from two sources: First, interest earned on loans, and second, fees earned on client transactions such as payments and other non-credit based services, combined with interest earned on related demand and time deposits.

In the case of SME's, the ability to take demand deposits extends to owners, employees, and extended family that participate in the operations of the SME. The inability of IFCT to provide such services may be at once a substantial disincentive to the client and an impediment to IFCT's ability to monitor SME cash flows, on the one hand, and, on the other hand, achieve an acceptable return on capital.

One solution to this situation, if indeed it affects IFCT SME lending, is to change the Charter. Alternatively, IFCT may seek additional compensation from appropriate Thai Government ministries to "make it whole" for foregoing the rewards of the depository function of a free-market financial intermediary.

Concern for the Justification of SME Lending

Increasing lending to the SME sector of the Thai economy appears to be justified largely based on the "success" of SME's as engines of job creation, export earnings, and survivability during times of economic stress experienced in Japan, Taiwan, and the United States. While not denying the total validity of the thought process, the logic needs further analysis based on the financial support structures in Japan, Taiwan, and the United States and respective cultural attitudes toward credit in these countries. Increasing lending to SME's in Thailand must be subjected to the same analysis, and in particular, the behavior of SME's toward repaying legitimate debt to creditors subsequent to the events of 1997.

Measuring the Efficiency of IFCT Tools

[1] The definition of a "global" economy is in dispute. The only attribute that seems to follow whatever definition is used is that a "global" economy is one subject to free market forces in the process of allocating resources, the consequences of which are not always pleasant.

Measuring the efficiency in processes and credit risk analysis tools used by IFCT when originating, evaluating, approving, disbursing, and administering SME loans is an entire project worthy of Senior Management support and resource allocation.

In the case of strengthening SME loan administration, it is recommended that a Methods-Time-Management study be designed and implemented to measure the efficiency of processing SME loans, from the time of origination through repayment. Defining fixed and variable costs associated with processing SME loans appears to be within existing capacity of IFCT, since administrative costs associated with its general lending activities are already being calculated in the Finance Department. Depending upon how detailed Senior Management believes necessary, a Business Process Reengineering (BPR) focus may be appropriate.

Measuring the efficiency of risk rating SME loans based on the Booz, Allen, & Hamilton risk rating methodology is an important component that was not completed for two reasons:

- First, the proprietary nature of the methodology required that the specifics of the tool not be disclosed to this consultant.
- Second, the methodology of its use in the credit approval process, as compared with the use of this tool for approving larger credits, could not be examined.

Therefore, it is not possible to specifically recommend changes to existing IFCT processes, either back office or credit risk related, to best manage exposure to the changing portfolio of assets. However, an approach for managing this changing exposure can be suggested.

Managing Exposure of the Changing Asset Portfolio

"Credit Scoring," defined as a system that uses statistical methods to predict the creditworthiness of loan applicants and existing loan accounts, can be developed for SME's. Unfortunately, the "statistical" method normally requires a minimum of five years of information to build a confidence level sufficient for "credit scoring." "Credit scoring", then, may be premature for the Thai IFCT market.

The Booz, Allen, & Hamilton methodology (the Method), as described in interviews, appears to have the requisite evaluation criteria to be a strong analytical tool for SME's. The numeric weightings and factors used to calculate borrower credit risk ratings however need adjustment for SME's. In any case, the Method should be re-evaluated at least quarterly, with revisions, at least annually, based on the changing market environment for all credits rated by the Method.

Criteria for re-evaluating the factors should be based on an historical analysis of an aggregate SME portfolio by industry. Such analysis should include "comparative balance sheet percentages and financial statement ratios" by industry. This fundamental analysis is well within IFCT capability.

Credit risk can be compared to inherent industry risk to generate a risk/return ratio appropriate for SME's. Parties involved in this exercise should include at least Senior Management of Policy and Planning, the various IFCT Departments concerned with credit, Finance Department, Information Technology, and the Audit Department.

Priorities can be established for industry analyses by using SME client exposures and targeted industries consistent with IFCT's risk tolerance and strategic market objectives.

IFCT client data, grouped by industry, together with a larger industry database obtained from the BoT, and other sources, such as the "Default Filter" software available through the Deloitte, Touche offices in Thailand, will be useful in developing "hurdle rates" that can be used to "automate" the credit approval process.

These "hurdle rates" and percentages can be assimilated into an SME credit evaluation system based on what is called "formula lending." In this methodology, a combination of fundamental credit judgement based on an adjusted Method, together with thoughtful industry analysis, can define an efficient origination, evaluation, and approval process for SME;s.

Other Critical Considerations in SME Lending

Lending to SME's most always involves an inability to distinguish the owner's business assets from the owner's personal assets, whether or not there is a legal distinction. Therefore, guarantees from the owner and related individuals may be required. The requirement for collateral to support SME facilities is an important consideration in every loan.

In this regard, a thorough review of existing Thai statutes concerning collateral, guarantees, and bankruptcy actions is critical in constructing origination and approval formulas for lending to SME's. Clearly, SME motivation to repay debt will be enhanced if personal wealth is also at risk.

Summary

Definitive evaluation of existing operations processes and credit risk analysis tools for SME lending by IFCT was over-shadowed by the primary objectives of the Credit and Market Risk Management Training Project scope of work. However, the basic tools of credit analysis appear adequate if adjusted by industry analysis and the design of a "formula lending" solution using relevant common size and income statement ratios for establishing a relevant set of "hurdle" measures for lending to SMEs. Since it is difficult to distinguish the owner's business assets from the owner's personal assets, even if legally distinct, when lending to SME's, it is important to consider personal guarantees and other collateral considerations to provide to motivation for repayment.