ACTEX Study Manual for
Enterprise Risk Management

Fall 2017 Edition

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## Table of Contents

### Section A: Risk Categories and Identification

#### Learning Objective

The candidate will understand the types of risks faced by an entity and be able to identify and analyze these risks.

#### Learning Outcomes

The candidate will be able to:

- a) Explain risk concepts and be able to apply risk definitions to different entities.
- b) Explain risk taxonomy and its application to different frameworks.
- c) Identify and assess the potential impact of risks faced by an entity, including but not limited to market risk, currency risk, credit risk, counterparty risk, spread risk, liquidity risk, interest rate risk, equity risk, hazard/insurance risk, inflationary risk, environmental risk, pricing risk, product risk, legal risk, operational risk, project risk and strategic risk.

#### Resources

  o Ch. 8 Risk Identification A-1

  o Ch. 13 Liquidity Risk A-5

  o Ch. 7: Strategic Risk Analyses A-9

- ERM-117-14: AAA Practice Note: Insurance Enterprise Risk Management Practices (pp. 4-26) A-15

- ERM-127-17: Outline of the Reading Is Forthcoming A-21

- ERM-702-12: Governance and an ERM framework A-23
# Section B: Risk Modeling and Aggregation of Risks

## Learning Objective
The candidate will understand the concepts of risk modeling and be able to evaluate and understand the importance of risk models.

## Learning Outcomes
The candidate will be able to:

- **a)** Demonstrate how each of the financial and non-financial risks faced by an entity can be amenable to quantitative analysis including an explanation of the advantages and disadvantages of various techniques such as Value at Risk (VaR), stochastic analysis, scenario analysis.
- **b)** Evaluate how risks are correlated, and give examples of risks that are positively correlated and risks that are negatively correlated.
- **c)** Analyze and evaluate risk aggregation techniques, including use of correlation, integrated risk distributions and copulas.
- **d)** Apply and analyze scenario and stress testing in the risk measurement process.
- **e)** Evaluate the theory and applications of extreme value theory in the measuring and modeling of risk.
- **f)** Analyze the importance of tails of distributions, tail correlations, and low frequency / high severity events.
- **g)** Analyze and evaluate model and parameter risk.
- **h)** Construct approaches to managing various risks and evaluate how an entity makes decisions about techniques to model, measure and aggregate risks including but not limited to stochastic processes.

## Resources

- **Financial Enterprise Risk Management**, Sweeting
  - Ch. 12 Extreme Value Theory  B-1
  - Ch. 14 Quantifying Particular Risks  B-3
  - Ch. 15.5 Unquantifiable Risks  B-21

  - Ch. 5 Computing VaR Sections 5.1-5.3 including appendices  B-23
  - Ch. 7 Portfolio Risk: Analytical Methods  B-25
  - Ch. 9 Forecasting Risk Correlations Section 9.3 Modelling Correlations  B-29
  - Ch. 12 Monte Carlo Methods  B-33

  - Ch. 4-5

- **ERM-103-12: Basel Committee – Aggregation Methods**
  - pp. 72 -89  B-41

- **ERM-104-12: Study Note on Parameter Risk, Venter and Sahasrabuddhe**  B-47
• ERM-106-12: Economic Capital-Practical Considerations, Milliman
  B-51

• ERM-117-14: AAA Practice Note: Insurance Enterprise Risk Management Practices
  (pp. 4-26)
  A-15

• ERM-118-14: Model Validation Principles Applied to Risk and Capital Models in the
  Insurance Industry
  B-59

• ERM-119-14: Aggregation of Risks and Allocation of Capital (Sections 4-7)
  B-63

• ERM-120-14: IAA Note on Stress Testing and Scenario Analysis (pp. 1-6 and 14-17)
  B-67

• ERM-124-15: Counterparty Credit Risk: Ch. 2, Defining Counterparty Credit Risk
  B-69

• ERM-602-12: Investment Management for Insurers, Babbel and Fabozzi
  ○ Ch. 11, The Four Faces of an Interest Model
  B-73

• Risk Appetite: Linkage with Strategic Planning Report
  B-77

• Modeling Tail Behavior with Extreme Value Theory, Risk Management, Sept 2009
  B-85

• SOA Monograph- A New Approach to Managing Operational Risk, Ch. 8
  B-89

• Summary of “Variance of the CTE Estimator,” Risk Management, Aug 2008
  B-95
## Section C: Risk Measures

### Learning Objective
The candidate will understand how the risks faced by an entity can be quantified and the use of metrics to measure risk.

### Learning Outcomes
The candidate will be able to:

a) Apply and construct risk metrics to quantify major types of risk exposure such as market risk, credit risk, liquidity risk, operational risk, regulatory risk etc., and tolerances in the context of an integrated risk management process.

b) Analyze and evaluate the properties of risk measures (e.g., Delta, volatility, duration, VaR, TVaR, etc.) and their limitations.

c) Analyze quantitative financial market data and insurance data (including asset prices, credit spreads and defaults, interest rates, incidence, causes and losses) using modern statistical methods. Construct measures from insurance data and contrast the methods with respect to scope, coverage and application.

d) Analyze risks that are not easily quantifiable, such as operational and liquidity risks.

### Resources
  - Ch. 15.5 Unquantifiable Risks  B-21
  - Ch. 5 Computing VaR  Sections 5.1-5.3  B-23
  - Ch. 7 Portfolio Risk: Analytical Methods  B-25
  - Ch. 9 Forecasting Risk and Correlations  B-29
  - Ch. 12 Monte Carlo Methods  B-33
  - Ch. 13 Liquidity Risk  C-1
  - Ch. 18 Credit Risk Management (excluding Appendices)  C-5
- ERM-102-12: Value-at-Risk: Evolution, Deficiencies, and Alternatives  C-11
- ERM-105-12: Coherent Measures of Risk – An Exposition for the Lay Actuary  C-15
- ERM-702-12: ERM for Capital and Solvency Purposes in the Insurance Industry  A-9
- Summary of “Variance of the CTE Estimator,” Risk Management, Aug 2008  B-95
- ASOP 23: Data Quality, pp. 1-8  C-17
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<td>The candidate will understand the approaches for managing risks and how an entity makes decisions about appropriate techniques.</td>
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<td><strong>Learning Outcomes</strong></td>
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<tr>
<td>The candidate will be able to:</td>
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<tr>
<td>a) Demonstrate and analyze applicability of risk optimization techniques and the impact of an ERM strategy on an organization’s value. Analyze the risk and return trade-offs that result from changes in the organization’s risk profile.</td>
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<td>b) Demonstrate means for transferring risk to a third party, and estimate the costs and benefits of doing so.</td>
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<td>c) Demonstrate means for reducing risk without transferring it.</td>
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<td>d) Demonstrate how derivatives, synthetic securities, and financial contracting may be used to reduce risk or to assign it to the party most able to bear it.</td>
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<td>e) Develop an appropriate choice of a risk mitigation strategy for a given situation (e.g., reinsurance, derivatives, financial contracting), which balances benefits with inherent costs, including exposure to credit risk, basis risk, moral hazard and other risks.</td>
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<td>f) Analyze the practicalities of market risk hedging, including dynamic hedging.</td>
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<td>g) Demonstrate the use of tools and techniques for analyzing and managing credit and counterparty risk.</td>
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<td>h) Analyze funding and portfolio management strategies to control equity and interest rate risk, including key rate risks. Contrast the various risk measures and be able to apply these risk measures to various entities. Explain the concepts of immunization including modern refinements and practical limitations.</td>
</tr>
<tr>
<td>i) Analyze the application of Asset Liability Management and Liability Driven Investment principles to Investment Policy and Asset Allocation.</td>
</tr>
<tr>
<td>j) Demonstrate risk management strategies for other key risks (for example, operational, strategic, legal, and insurance risks).</td>
</tr>
<tr>
<td>k) Apply best practices in risk measurement, modeling and management of various financial and non-financial risks faced by an entity.</td>
</tr>
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**Resources**

  - Ch. 16 Responses to Risk  
  - D-1
  - Ch. 7 Portfolio Risk: Analytical Methods  
  - B-25  
  - Ch. 18 Credit Risk Management (excluding Appendices)  
  - C-5
- ERM-107-12: *Strategic Risk Management Practice*, Andersen and Schroder,  
  - Ch. 7: Strategic Risk Analyses  
  - A-9
- ERM-110-12: Derivatives: Practice and Principles Recommendations
  o Pp. 9-24 & Section III
  
- ERM-111-12: Key Rate Durations: Measures of Interest Rate Risks
  
- ERM-112-12: Revisiting the Role of Insurance Company ALM within a Risk Management Framework
  
- ERM-115-13: Creating an Understanding of Special Purpose Vehicles, PWC
  
- ERM-117-14: AAA Practice Note: Insurance Enterprise Risk Management Practices
  
- ERM-122-16: Chapter 1 of Captives and the Management of Risk, Kate Westover
  
- ERM-128-17: The Breadth and Scope of the Global Reinsurance Market
  
- ERM-702-12: ERM for Capital and Solvency Purposes in the Insurance Industry
  
- SOA 2012 Annual Meeting – Session 53 – Assumption Setting Best Practices
  
- SOA Monograph- A New Approach to Managing Operational Risk
  o Ch. 8
  
- Risk Appetite: Linkage with Strategic Planning Report
Section E: Capital Management

Learning Objective
The candidate will understand the concept of economic capital, risk measures in economic capital assessment and techniques to allocate the cost of risks within business units.

Learning Outcomes
The candidate will be able to:

a) Describe the concept of economic measures of value and capital requirements (for example, EVA, embedded value, economic capital, regulatory measures, and accounting measures) and demonstrate their uses in the risk management and corporate decision-making processes.

b) Define the basic elements and explain the uses of economic capital. Explain the challenges and limits of economic capital calculations and explain how economic capital may differ from external requirements of rating agencies and regulators.

c) Apply risk measures and demonstrate how to use them in economic capital assessment. Contrast regulatory, accounting, statutory and economic capital.

d) Propose techniques for allocating/appropriating the cost of risks/capital/hedge strategy to business units in order to gauge performance (risk adjusted performance measures).

e) Develop an economic capital model for a representative financial firm.

Resources

- ERM-101-12: Measurement and Modeling of Dependencies in Economic Capital
  - Ch 4, 5
- ERM-106-12: Economic Capital – Practical Considerations, Milliman
- ERM-112-12: Revisiting the Role of Insurance Company ALM within a Risk Management Framework
- ERM-119-14: Aggregation of Risks and Allocation of Capital (Sections 4-7)
- ERM-123-14: S&P Enterprise Risk Management Criteria (Paragraphs 1-71, 86-88)
- ERM-501-12: Risk Based Capital–General Overview
- Risk Appetite: Linkage with Strategic Planning Report
- SOA 2012 Annual Meeting – Session 53 – Assumption Setting
- ERM-126-15 ORSA – An International Requirement, Sections 3.1 and 4.1
Thank you for purchasing the Actex ERM Study Manual for the Fall 2017 Exam.

Actuaries have practiced risk management for centuries. Yet it was not until recently that the actuarial profession (and indeed, the financial services industry) began to focus on risk in the context of the entire enterprise. Commercial banks started the shift a decade or so before the insurance industry, although some of their early efforts would be more aptly described as management of portfolio risk rather than enterprise risk.

The Society of Actuaries introduced the ERM exam into its syllabus in 2012. The syllabus has undergone considerable change over the last two years. This is reflective of the changes in the practice and new emerging research in what is a relatively young field. In addition, the financial crisis of 2008-2009 has spurred numerous changes in the regulatory and rating agencies perspective on risk management. The SOA has endeavored to include current publications and research in place of older papers as appropriate.

One consequence of the dynamic state of the practice and the multitude of papers included in the syllabus is a considerable amount of overlap and duplication in content. In some cases the duplication serves to fill in background for the principle subject of the paper, and in other cases it is simply the result of a different author offering his or her own perspective. In producing these study guides we have reduced some duplication but more often tended towards keeping close to the content as presented by each author.

These study guides attempt to capture the key essence of the syllabus in a considerably compressed form. They are not, however, a substitute for the original syllabus material. We recommend you start with a thorough reading of the each syllabus resource before reading the corresponding guide. Our intent is for the guides serve as an efficient means of subsequent review and overview of the entire syllabus.

Finally, I welcome any comments, observations or recommendations for improvement to this Manual.

Good speed with your preparation for the exam.

Zafar Rashid
FSA, MAAA, CERA
**Sweeting – *Financial Enterprise Risk Management:*
Chapter 8 – Risk Identification

Reviewer’s note: *Written with a decidedly British style, the author’s nomenclature takes some getting used to. The style is wordy and somewhat disorganized when compared to other references.*

I. **8.1 Introduction**
   A. Goal is to decide of all risks that could, which are now affecting or will affect the organization
   B. Risk ID includes determining the way the risks will be analyzed – quantitative vs. qualitative
   C. Part of a well-defined process to ID and record as many risks as possible

II. **Four broad areas to risk ID:**
   A. 8.2 Risk identification tools – common tools include:
      1. 8.2.1 SWOT analysis – strengths, weaknesses, opportunities, threats
         a. Often used for strategic planning, it can also be used to identify risks
         b. Strengths and weaknesses are internal while opportunities and threats are external
            i. Ensures both internal and external aspects of RM are considered
         c. Best to consider strengths if they can be used to take advantage of an opportunity or counter a weakness; weaknesses only if they result in exposure to a threat
      2. 8.2.1 Risk check lists
         a. Lists of risks used as a reference for identifying risks
            i. Includes both experiential knowledge – that which has been obtained through experiences – and documented (aka historical) knowledge – that which has been documented by some external source
               (a) Experiential – test for relevance and applicability
               (b) Documented – test for caveats
      3. 8.2.3 Risk prompt lists – similar to check lists, but focused on categories of risks to be considered
         a. Typically political, economic, social and technological, but sometimes also environmental, legal and industry
      4. 8.2.4 Risk taxonomy – midpoint of the two preceding – more detailed than prompt list but not as specific as a check list
         a. Contains a full list and description of risks that may be faced
      5. 8.2.5 Risk trigger questions – lists of situations/events that have led to risk historically in the organization
      6. 8.2.6 Case studies – useful in risk ID
         a. Suggest specific risks – especially if organization in case study has parallels to the organization
         b. Suggests where similar risks might occur in the future
         c. Shows context in which risks can develop and the links among risks
      7. 8.2.7 Risk-focused process analysis
         a. Construct flow charts for every process and analyzing points where risks occur
            i. Detailed description of each broad process, including who, what, where failure can occur as well as links between processes
B. 8.3 Risk ID techniques – many approaches
   1. 8.3.1 Brainstorming – unrestrained/unstructured group discussion
      a. Need experienced facilitator
      b. No censoring initially
      c. Disadvantages
         i. Can lead to freeloading – not everyone contributing
         ii. Need to have entire group present at same location
            (a) Convergent thinking – group think - could occur
         iii. Lack of completeness
   2. 8.3.2 Independent group analysis – avoids group think
      a. Participants write ideas in silence w/o collaborating
      b. Facilitator aggregates ideas and then leads discussion to determine the exact nature of the various
         risks and the extent they are truly distinct
         i. Also draws out relevance of each risk
      c. Finally, risks are ranked by importance – at first independently and then aggregate results are
         tallied to get objective ranking
      d. Disadvantage is group may be biased if one discipline is overrepresented
   3. 8.3.3 Surveys by email or snail mail – ensures wide participation
      a. List of questions about the organization/industry is circulated
      b. Allows for views of larger group to ensure a wide range of risks is covered and avoids
         participants influencing each other
      c. Weaknesses:
         i. Responses may change based on how questions are interpreted
         ii. Some may not respond – low response invalidates the exercise or biases the results
         iii. Form of survey means responses must be multiple choice to be quantifiable or may be
             difficult to analyze if free text is allowed
            (a) Hard to ensure if a single risk is described in different ways or are there multiple risks
      d. Need to test with a pilot survey
   4. 8.3.4 Gap analysis – a type of survey
      a. Goal is to find desired and actual risk levels – not necessarily from the same folks
   5. 8.3.5 Delphi technique – another survey
      a. Experts are asked to comment on risks anonymously and independently
      b. More time is allotted for analysis and more flexible results are permitted
         i. Take full advantage of the experts’ knowledge
      c. Based on initial survey results, other surveys are created and distributed
         i. Process continues until consensus/stalemate is reached on nature and importance of risks
   6. 8.3.6 Interviews – advantage of structure and independence, but also clarity as issues can be cleared up immediately
      a. Form of questions is an issue along with the time it takes to interview
         i. Can use multiple interviewers but must ensure consistency
7. 8.3.7 Working groups – once the above techniques ID relevant risks, working groups can investigate more thoroughly their nature
   a. Small groups of individuals who are familiar with the risk
   b. Can go beyond ID to analysis
C. 8.4 Assessment of risk nature – quantifiable vs. unquantifiable
   1. Should be part of ID process
   2. Will model quantifiable risks
   3. Unquantifiables can be analyzed by group that IDs them
D. 8.5 Risk register – central repository that details all risks faced by an organization
   1. Constantly updated
   2. Should include:
      a. Unique identifier
      b. Category
      c. Date assessed
      d. Clear description
      e. Nature – quantifiable vs. unquantifiable
      f. Likelihood
      g. Severity
      h. Period of exposure
      i. Current status
      j. Details of scenarios where risk is likely to occur
      k. Details of risks linked to this one
      l. Risk responses implemented
      m. Cost of responses
      n. Details of residual risks
      o. Timetable and process for review of the risk
      p. Risk owner
      q. Author of entry

Reviewer’s note: This resource is well-organized and complete; it provides both background and detailed information.

I. Intro - Liquidity Risk
   A. VAR models assume a frozen portfolio that will transact at market price – which is adequate in assessing risk but not if you want the worst possible loss in a liquidation
   B. Liquidity risk – Has two components funding liquidity risk (financing collapses due to creditor demands) and asset liquidity risk (forced liquidation creates unfavorable prices)

II. 13.1 DEFINING LIQUIDITY RISK
   A. LR arises from the assets side of the BS through large positions in times of forced liquidations and the liability side when investors/creditors demand redemption/refuse to refinance existing positions and/or mark to market haircuts
      1. Must understand ALM, market microstructure that affects clearings and optimal trade execution to minimize trading costs
   B. 13.1.1 Asset Liquidity Risk – aka market/product liability risk
      1. Risk that liquidation value differs from current mark to market – function of size and price
      2. Asset liquidity is measured by a price-quantity function – aka market-impact effect
         a. Deep markets – positions can be sold with little market price impact
         b. Thin markets – any transactions quickly affect prices
         c. Figure 13-1 illustrates that p-q function
            i. Tight markets have narrow bid-ask spread
            ii. This spread is constant to a point – the normal market size or depth
            iii. Transaction cost is half the spread
            iv. As q increases from normal, bid-ask widens, net price decreases and transaction costs increase as a %
               (a) Could be linear or another shape
      3. Liquidity also depends on prevailing market conditions, e.g. when fear of default pushes traders into treasuries and out of corporates
      4. Traditional control mechanism for liquidity risk is limits on position size
   C. 13.1.2 Funding Liquidity Risk
      1. Cash flow/funding liquidity risk is the inability to meet payment obligations to creditors/investors, which could force unwanted liquidation of the portfolio
      2. FLR arises from the liability side of the BS due to common practice of leveraging/borrowing with assets pledged as collateral
         a. Assets in excess of Liabilities are pledged (haircut) to provide lenders a buffer
         b. Collateral is constantly being marked to market and if value falls below the liability, lender will require an additional variation margin to be advanced by borrower
            i. A borrower without enough cash to cover margin call, must liquidate other assets
            ii. Lender can raise margin requirements as well, which happens in times of crisis
3. Also get FLR if timing of payments are mismatched – owe before you receive proceeds
4. Cash on hand is first defense against FLR, then a line of credit
   a. Raising new equity or debt is next, but hard in hard times
5. Need to anticipate that lenders will raise margin requirements or call debt at the time when the institution appears vulnerable and take protective measures such as:
   a. Hedge funds impose a minimum time period for fund to hold a client’s assets (lockup period) or longer redemption notice before withdrawing funds
   b. Commercial banks borrow short (deposits) and lend long (mortgages), necessitating deposit insurance to prevent a run on the bank

III. 13.2 ASSESSING ASSET LIQUIDITY RISK
   A. Mid-market trading values do not reflect the value of assets in a large portfolio liquidation scenario, but to manage risk, we must be able to assess this potential
      1. One way is to ensure in VAR measures that the liquidation horizon is stretched beyond the time required for orderly liquidation
         a. Could also increase volatility assumption in the VAR calculation
   B. 13.2.1 Effect of Bid-Ask Spreads
      1. Bid-ask reflects three costs:
         a. Order processing costs – should decrease with volume
         b. Asymmetric information costs – informed traders may know more than market makers, who increase the spread to protect themselves
         c. Inventory carrying costs – cost of maintaining open positions, this increases directly with price volatility/interest rates and inversely with trading activity
      2. If it were fixed, could derive a liquidity-adjusted VAR by adding a term
         a. \( LVAR = VAR + L_1 = (W \alpha \sigma) + 1/2(WS) \); W is initial wealth, S is spread
      3. If spread is uncertain:
         a. \( LVAR = VAR + L_2 = (W \alpha \sigma) + 1/2[W(S+\alpha \sigma_S)] \), \( S/\sigma_S \) is mean/std. dev. of the distribution of spread
         b. Assumes worst market loss and spread increase happens simultaneously as volatility and spreads are positively correlated
   C. 13.2.2 Incorporating Liquidity in Valuation
      1. If position is to be sold, the second term above is a certain loss (bid price is less than mid-market price
         a. Can also mark to bid/ask for long/short positions
         b. Could also add a reserve to reflect illiquidity and/or model risk
   D. 13.2.3 Effect of Price Impact
      1. Not enough to focus on bid-ask to capture all transactions costs since quantity traded also affects prices
         a. If the price quantity function is linear, then can lower impact by 4/5 by spreading sales uniformly over 5 days vs. immediately over 1 day
b. But leaves the company exposed to price variation for longer period, increasing volatility so that
   must also be accounted for
   i. \( \text{LVAR} = \alpha \sqrt{V(W)} + C(W) \); \( V \) is portfolio variance

E. 13.2.4 Trading Strategies
1. Execution strategies are not limited to immediate vs. uniform liquidation
2. Because of increased volatility of taking more time, an optimized strategy (by Almgren and Chriss) of
   algorithmic trading involves selling more than the uniform strategy on day one
   a. Optimal half life (the time to liquidate half the portfolio) depends on price impact and volatility
3. Tradeoff is between price impact of dumping shares too quickly and being exposed longer to normal
   price fluctuations

IV. 13.3 ASSESSING FUNDING LIQUIDITY RISK
A. Involves examining asset-liability structure and potential demands on cash and other liquidity sources
B. Counterparty Risk Management Policy Group (established in the wake of Long Term Capital
   Management crisis) provides guidance in managing market, counterparty credit and liquidity risk
   1. Evaluate funding risk by comparing cash at hand with what it could need meet obligations
      a. Cash liquidity is the ratio of cash equivalent over potential decline in the value of relevant
         positions – those that create cash-flow needs
   2. Example shows the difference in VAR from two way vs. one way MTM swaps
      a. Two way means positive MTMs can used to offset negatives, while one way, only the negatives
         are settled, increasing VAR
C. Box 13.2 How Rating Agencies Assess Liquidity Risk
   1. S&P uses a stress scenario where the subject’s rating is lowered and collateral calls take place
      a. Size of worst collateral is estimated by the sum of all positions with negative market values since
         positives on one position cannot be applied to protect negatives from other positions

V. 13.4 LESSONS FROM LTCM – which was a hedge fund created to take advantage of relative value or
   convergence arbitrage trades
A. 13.4.1 LTCM’s Leverage – because these strategies generate tiny profits, leverage is needed to get high
   returns – 25:1 on the balance sheet of 125 billion with another 1.25 trillion gross off balance sheet
   1. LTCM represented over 2% of global swap market, even though positions netted to much less
B. 13.4.2 LTCM’s “Bulletproofing”
   1. LTCM leveraged its balance sheet through sale – repurchase agreements (repos) with banks
      a. Repo agreements involve selling assets in exchange for cash (loan) and a promise to repurchase
         them at a fixed price in the future
      b. Typically value of the assets exceeds the cash – haircut
   2. LTCM was able to obtain financing with near zero haircuts because it was viewed as safe – also it
      swaps were two way mark to market
   3. LTCM protect itself against liquidity squeeze by requiring a three-year lockup from its investors
      a. It also secured a 900 million credit line from Chase and other banks
   4. LTCM had some protection for funding liquidity, but was still exposed to market and asset liquidity
      risks
13.4.3 LTCM's Downfall

1. Strategy worked well early on (40+ percent returns)
2. In 2Q 1998, Russia restructured its bomb payments – i.e. defaulted – and immediately credit spreads, risk premiums and liquidity spreads jumped up sharply while stock markets dove
   a. By August, fund lost half its value, increasing leverage from 28:1 to 55:1
   b. Capital was needed but was not forthcoming and further losses occurred in September
   c. Bear Stearns, LTCM's prime broker, was subject to a margin call and they passed on increased collateral requirements to LTCM, depleting its liquid resources
3. The squeeze was between funding risk, as reserves dwindled, and asset risk, as its large positions prohibited liquidation
   a. Lenders faced significant potential exposure because the small haircuts they required or more than offset for potential losses due to liquidating collateral
4. This potential disruption led the New York Federal Reserve to organize a bailout wears 14 banks invested 3.6 billion in return for 90% of the firm, costing original investors 92% of their investment

13.4.4 LTCM's Liquidity

1. LTCM failed because it could not manage its risks – its trades were undiversified and portfolio optimization did not manage risk
   a. All its trade types were subject to increased liquidity risk and many were exposed to increased default risk
   b. In fact, a single risk factor – changes in credit spreads – explained most of its return volatility, suggesting little diversification across risk factors
   c. Additionally LTCM suffered both asset and funding liquidity risk – it protected itself against withdrawal but did not foresee inability to raise new capital or organize an orderly liquidation of the portfolio
2. The situation raise questions about the soundness of brokers' risk management systems, which led to acceleration of the integration of credit and market risk management

VI. 13.5 CONCLUSIONS

A. Traditional VAR measures account for the worse change in Mark to market values over the horizon but not the cost of liquidation, which depend on price – impact function and the size of the positions – so a liquidity-adjusted VAR hybrid can be calculated that combines price volatility with liquidation costs
B. Bid ask spreads are less important than traditional VAR measures – what matters more are large price drops when liquidating large positions
C. An alternative to LVAR is to value positions at the conservative bid/ask quote and add a reserve for liquidity
D. Funding liquidity risk by contrast arises when financing for the portfolio cannot be maintained – again VAR can be altered to estimate the risk of running out of cash
E. Both sides of the balance sheet affect liquidity risk
F. LVAR may be difficult to measure but we know the following:
   1. Bid ask spreads are positively correlated with volatility
   2. Illiquid assets will generate greater execution costs as volatility increases
      a. Can mitigate liquidity risk by taking offsetting positions in assets that benefit from increased volatility – those with positive vega
I. Introduction
   A. A look at the variety of analytical tools that can be adapted for RM purposes
      1. Start with simple trend analytics and then add the spectrum of uncertainty

II. 7.1 Environmental Scanning in a Predictable World
   A. Since 90% of drops in shareholder value are attributed to strategic and operational risks, it is critical that a firm be observant and sensitive to changes in the risk environment
      1. Difficult to see and interpret future events; e.g. the PC was a major technology change, but not appreciated or understood long after its initial use
      2. No one foresaw the mortgage meltdown from the weak signals (reviewer’s note: except the one guy in that Michael Lewis book)
         a. But signals were there – excess liquidity, low interest rates, big deficits, (reviewer adds: relaxed lending standards, record cash out re-financings)
   B. Environmental scanning involves:
      1. Formal search – firm is structured to seek information as part of normal processes
      2. Conditional viewing – firm tracks *pre-selected information* to identify evolving issues
      3. Informal search – the corporation actively looks for information through unfocused and unstructured efforts to understand *specific developments*
      4. Undirected viewing – the firm scans diverse sources of information *without specific informational needs in mind* to sense new trends
   C. Company must balance these four modes – e.g. too much undirected viewing is costly and unfocused; too much formal search and conditional viewing is too narrow
      1. Generally, complexity and volatility suggests more undirected viewing
      2. Formal search and conditional viewing are part of centralized planning
      3. Informal search and undirected viewing often occur at decentralized functions, close to operations, suppliers and customers
      4. Both centralized and decentralized approaches are necessary
   D. No standardized way to do this, but it makes sense to begin with the general environment and then the industry and finally, the company
      1. General environmental risks
         a. Exogenous factors completely outside the control of management that affect all players across industries and sectors, albeit differently
            i. Organized into categories (Box 7.1 Drivers of change in non-life insurance)
               (a) Political
               (b) Economic
               (c) Social
(d) Technology
(e) Environmental
(f) Legal

b. Industry risks
i. Factors identified at the industry level where competitive conditions may influence corporate exposures, while corporate actions may affect industry developments
   (a) Typical frameworks include Porter’s 5 forces model and national diamond model, competitive analyses and mapping of strategic groups
   (b) Conventional industry analysis considers conditions that are specific to the particular business environment
      (i) New product development
      (ii) Process innovation
      (iii) Changing customer needs
      (iv) Industry regulation

ii. Competitor analysis is often used to determine possible strategic moves and their expected consequences (Box 7.2 Industry threats and opportunities in non-life insurance)
   (a) Porter’s 5-forces analyzes profitability of an industry based on:
      (i) Threat of new entrants
      (ii) Power of buyers
      (iii) Power of suppliers
      (iv) Threat of substitute products
      (v) Intensity of competition

c. Company risks
i. Risk factors that are endogenous to the organization as they are caused by internal processes, technological systems and actions
   (a) Includes things like operational disruption, technological breakdown, misreporting, fraud, inability to observe and react to market changes
   (b) Common tools include the McKinsey 7S model, value chain analysis, VRIO and analysis of core competencies (Box 7.3 Assessing company risks)
      (i) Lays out strengths and weaknesses

d. The above tools are used to assess the strategic position of the company in terms of developments in external market conditions and internal organizational capabilities - focus is on current perceptions
i. Going a step further requires developing a common risk vocabulary to help emphasize RM and facilitate internal communication in handling risk
   (a) Many ways to handle this – breakdowns of broad categories and finer sub-categories
   (b) Analogous to developing a strategic management vocabulary to help facilitate a common understanding of strategy
      (i) Strategic analysis is typically SWOT – strengths, weaknesses, opportunities, threats – note first two are internal, last two are external
         [a] SWOT can identify risk factors
         [b] But SWOT does not explicitly state their relative importance
(ii) Risk map is the RM equivalent of SWOT; SWOT is an input to the RM initial assessment process – supplemented by assessments of operational risk factors and hazards

[a] After identifying all risk factors, the exposures should be evaluated based on two dimensions, likelihood and economic impact to determine which risks are most economically material

[b] Often these dimensions are determined through qualitative judgment

[c] Risk map is a two dimensional representation (impact/likelihood) of these judgments – increasing severity risks are located in the top right of the graph – i.e. high impact, high likelihood

[d] Further analyze those high severity risks by breaking them down into immediate vs. longer term timing

[e] Immediate risks are handled tactically and operationally – they need ongoing attention

[f] Longer term risks are handled strategically – they need lesser but regular attention

(iii) The foregoing assumes independence of risks

[a] Next level of granularity is the influence matrix, where each risk is listed vertically and the relative impact of the risk on other risks is then listed horizontally

[i] Scale of 0-2

[ii] Totaling across indicates how influential each risk factor is on the other risk factors – tells you which risks to prioritize and which will affect others as they are handled

[iii] Totaling down indicates how each risk factor is impacted by the other risk factors – tells you which risks must be dealt with alone (low score) because they are not influenced by handling other risks

III. 7.2 Scenario Planning – A Simple Technique in an Unpredictable World

A. The above tools and approaches are static in nature – and that is problematic in today’s world – narrow focus leads to blind spots

1. Examples:
   a. Brent Spar: Shell Oil wanted to sink an offshore oil container to dispose of it and despite receiving government approval, environmentalists caused a huge public relations issue which forced the company to abandon those plans – at great economic and reputational cost
   b. Nokia: Nokia made a deal to produce phones in Romania in exchange for government concessions, but then closed a plant in Germany, for which they had received concessions years earlier, angering the Germans, who demanded paybacks, and worrying Romanians, who were concerned they might be victims of the strategy in the future

B. Corporations should therefore acknowledge uncertainty and explore the important uncertainties to challenge conventional wisdom about the future business environment

1. Most predictable surprises escape notice due to insufficient attention or lack of resources committed
   a. Information gathering is too narrowly-focused
   b. Not enough challenging of what is known, perceived or unknown
C. Scenario planning can help evaluate weak signals and challenge current beliefs
   1. Analogous to financial deterministic scenarios and Monte Carlo techniques
   2. However, it is a qualitative tool in the strategic RM context
      a. Difficult to estimate strategic risks due to lack of data
      b. Statistical models are built on very restrictive assumptions
      c. Sophisticated models may suggest precision that doesn’t really exist
   3. But also consider that qualitative scenario analysis may be seen as pure guesswork
      a. But getting folks to think about these situations, organize them and discuss their implications on
         the effectiveness of current strategies, while exploring new ones may be beneficial

D. Five steps in the SP process:
   1. Identify key environmental risk factors
      a. From SWOT, risk mapping or influence matrix
         i. Adding further uncertainties
      b. Typically deals with exogenous factors
   2. Elaborate some of the major themes that may characterize plausible alternative developments in
      future competitive market conditions
   3. Elaborate on major themes outlined previously and describe a few alternative environmental
      scenarios that arise as the consequence of different assumptions about the risk factors and the relevant
      underpinning themes
   4. Evaluate the consequences of key strategic risk factors within the themes that shape the alternative
      scenarios in view of essential strategic concerns and assess the capacity for corporate responsiveness
   5. Formulate new strategic alternatives, if required, and evaluate them given the different scenarios
      a. They should be flexible to allow the firm to react no matter how the future unfolds

E. SP is nothing but plausible stories based on competing assumptions about the future
   1. It can be a powerful tool that helps managers evaluate the robustness of strategic alternatives
      a. Gives management a way to evaluate strategic alternatives when operating in an uncertain
         business environment
      b. Provides needed structure when thinking about the appropriate corporate response capabilities in
         the event of unexpected events

IV. 7.3 Adding Complexity and Uncertainty
   A. The foregoing assumes that it is possible to identify important risk factors and extrapolate them
   B. Sometimes, the interactions between various risk events are so complex and unpredictable that the
      outcomes are literally unknown
      1. Company cannot expect to be capable of designing a foolproof set of contingency plans
         a. Existence of contingency plans may lead to false sense of security and an inability to consider
            anything outside the plan
      2. Planned responses to anticipated risks are insufficient in complex environments
         a. Organization must be able to handle the unexpected in a flexible manner
            i. Success depends on alertness and adaptable mindsets of management
               (a) Examples of organizations that successfully deal with unexpected include fire & rescue,
                   nuclear power plants and submarines – high reliability organizations
V. 7.4 Dealing with the Unknown

A. Companies can’t plan for what they do not know – but they can develop a portfolio of strategic options that will be useful when uncertain events occur

1. This real options approach will be useful in analyzing corporate actions when strategic exposures are influenced by unknown factors
   a. Yes, the real options will be based on current perceptions, but they can be a basis for trial-and-error experimentation in the event of changing environment
      i. These systematic experiments will lead to better alternatives

2. Trial-and-error process involves moving toward the best outcome identified in planning, but constantly reviewing and revising if necessary as information becomes available
   a. This process is a cyclical learning model used in TQM; plan-do-act-check
      i. Key principles:
         (a) Failure is a learning opportunity
         (b) Experiment early to get new actionable information ASAP
         (c) Organize so frequent, rapid and multiple experiments are carried out and new information is shared
         (d) Multiple methods of experimenting should be adopted and integrated to create variation and enhance learning
            i. Can happen anywhere – central planning and decentralized management initiatives

B. Box 7.12 A real options perspective to learning and selection

1. Two ways to create real options:
   a. Structure pre-planned trials on alternative ways of approaching a strategic challenge, where outcomes form the basis for selecting
   b. Provide managers the leeway to undertake autonomous initiatives in response to evolving events

C. During planning, the corporation can design a series of experiments in a systematic search for products/processes that might work should the unknowable occur

1. Then as the changes are observed, informal and spontaneous initiatives can be undertaken by management
2. Again, balancing the systematic and the informal is important
   a. Might have to choose one approach over the other – e.g. if time is of the essence, the informal will dominate; if complexity is high, then systematic is better

VI. Handling the Different Images of Risk

A. Complexity and dynamism of business suggests foresight is critical, yet difficult to achieve

1. Scanning, sensing, interpreting and responding – all are important
   a. Host of tools and approaches in Figure 7.5
   b. As said before, the tools can help assess the external/internal framework and determine the vital risk factors
      i. Then move into scenario planning and real options development
         (a) Idea is to challenge deeply rooted preconceptions and better prepare the company to respond to the unknown

2. However, pre-planned responses are not enough – the whole company must be tuned into changes and responses
VII. Conclusion

A. Chapter dealt with conventional tools from strategic planning and how to complement them with RM tools
B. Static tools are inadequate, however, in dealing with the unknown – except that they may cloud thinking outside the known, which is bad
C. This is where scenario planning and developing a portfolio of real options comes into play
D. In the end, it is operational flexibility and alertness to the environment that build a successful organization