

**ERM Exam
Fall 2012/Spring 2013**

Important Exam Information:

Exam Date and Time

The exam duration is 4 hrs in one session. A read-through time of 15 minutes will be given prior to the start of the exam.

Reading Extensions

At registration, candidates must select from one of six reading extensions. The readings for each extension appear at the end of this document. The study note package includes all extensions. Seventy-five percent of the exam points will come from the core readings and will be common for all candidates. The remaining twenty-five percent will be based on the case study and the selected extension. These questions may also draw on material from the core reading.

Exam Registration

Candidates may register online or with an application.

Order Study Notes

Study notes are part of the required syllabus and are not available electronically but may be purchased through the online store.

Courseware

This document will guide candidates through the syllabus material and reinforce learning that is expected from each topic. It is not intended to duplicate or replace the study material, but rather to enhance it. Courseware is required reading and is in the Study Note package as ERM-50-12.

Introductory Study Note

The Introductory Study Note has a complete listing of all study notes as well as errata and other important information.

Case Study

This case study will also be provided with the examination. Candidates will not be allowed to bring their copy of the case study into the examination room. There is a single case study. However, within the case study are instructions as to which parts relate to which reading extension.

Updates

Candidates should be sure to check the Updates page on the exam home page periodically for additional corrections or notices.

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The five topics that follow are the core learning objectives and readings for this examination. All candidates are responsible for this material

Topic: Risk Categories and Identification

Learning Objective:

1. 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 analyze risks faced by an entity, including but not limited to market risk, currency risk, credit risk, spread risk, liquidity risk, interest rate risk, equity risk, hazard/insurance risk, inflationary risk, environmental risk, pricing risk, product risk, operational risk, project risk and strategic risk

RESOURCES

Financial Enterprise Risk Management, Sweeting, 2011
Chapter 1, An Introduction to Enterprise Risk Management
Chapter 7, Definitions of Risk
Chapter 8, Risk Identification

ERM-100-12: A Common Risk Classification System for the Actuarial Profession - Kelliher, Wilmot, Vij and Klumpkes (Background only)

Topic: Risk Modelling and Aggregation of Risks

Learning Objective:

2. 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 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

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- 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 analyse 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, 2011
Chapter 10.4, Copulas (Pages 195 to 219)
Chapter 12, Extreme Value Theory
Chapter 14, Quantifying Particular Risks
Chapter 15.5, Unquantifiable Risks

Value-at-Risk, Third Edition, The New Benchmark for Managing Financial Risk, Jorion, 2007
Chapter 5, Computing VaR pages 129 – 134
Chapter 9.3, Modelling Correlations
Chapter 14, Stress testing

ERM-101-12: Measurement and Modeling of Dependencies in Economic Capital
Pages 22 (Section 5.6 Copulas) to 81

ERM-102-12: Value-at-Risk: Evolution, Deficiencies, and Alternatives

ERM-103-12: Basel Committee - Developments in Modelling Risk Aggregation Pages 76 -87

ERM-104-12: Study Note on Parameter Risk, Venter and Sahasrabudde

ERM-602-12: *Investment Management for Insurers*, Babbel and Fabozzi, Chapter 11, The Four Faces of an Interest Model

ASOP 46, Risk Evaluation in Enterprise Risk Management – ASB Final Version-September 2012
http://www.actuarialstandardsboard.org/pdf/asop046_165.pdf

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Topic: Risk Measures

Learning Objective:

3. 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, 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 data and construct measures from insurance data using modern statistical methods (including asset prices, credit spreads and defaults, interest rates, incidence, causes and losses). Contrast the available range of methods with respect to scope, coverage and application
- d) Describe and evaluate risk management techniques in terms of best practice that can be used to deal with financial and non-financial risks
- e) Define and evaluate credit risk. Explain how to incorporate best practices in credit risk measurement, modeling, and management

RESOURCES:

Financial Enterprise Risk Management, Sweeting, 2011
Chapter 9, Some Useful Statistics (Background only)

Value-at- Risk, Third Edition, The New Benchmark for Managing Financial Risk, Jorion, 2007
Chapter 5, Computing VaR
Chapter 7, Portfolio Risk: Analytical Methods
Chapter 9, Forecasting Risk and Correlations
Chapter 12, Monte Carlo Methods
Chapter 13, Liquidity Risk
Chapter 18, Credit Risk Management(excluding Appendices)
Chapter 19, Operational Risk Management (excluding 19.5)

ERM-101-12: Measurement and Modeling of Dependencies in Economic Capital, Pages 22 (Section 5.6, Copulas) to 81

ERM-102-12: Value-at-Risk: Evolution, Deficiencies, and Alternatives

ERM-105-12: Coherent Measures of Risk – An Exposition for the Lay Actuary –Glenn Meyers

ERM-106-12: Economic Capital-Practical Considerations-Milliman

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Topic: Risk Management Tools and Techniques

Learning Objective:

4. The candidate will understand the approaches for managing risks and how an entity makes decisions about appropriate techniques.

Learning Outcomes:

The candidate will be able to:

- a) Evaluate the rationale for managing risk and demonstrate the selection of the appropriate risk retention level and hedging of risk
- b) Demonstrate and analyze applicability of risk optimization techniques and the impact on an organization's value of an ERM strategy
- c) Demonstrate means for transferring risk to a third party, and estimate the costs and benefits of doing so
- d) Demonstrate means for reducing risk without transferring it
- e) 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
- f) Develop an appropriate choice of hedging 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
- g) Analyze the practicalities of market risk hedging, including dynamic hedging
- h) Define credit risk as related to derivatives, define credit risk as related to reinsurance ceded, define counter-party risk and demonstrate the use of comprehensive due diligence and aggregate counter-party exposure limits
- i) Analyze funding and portfolio management strategies to control equity and interest rate risk, including key rate risks. Explain the concepts of immunization including modern refinements and practical limitations. Contrast the various risk measures and be able to apply these risk measures to various entities
- j) Analyze the application of Asset Liability Management and Liability Driven Investment principles to Investment Policy and Asset Allocation
- k) Analyze methods of managing of other risks (operational, strategic, legal, and insurance) both pre-event and post-event

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RESOURCES

Financial Enterprise Risk Management, Sweeting, 2011
Chapter 16, Responses to Risk

ERM-107-12: Strategic Risk Management Practice, Andersen and Schroder, 2010
Chapter 1, The Strategic Nature of Corporate Risk Management
Chapter 7, Strategic Risk Analyses

ERM-108-12: Tiller, Life, Health and Annuity Reinsurance, 3rd Edition, 2005
Chapter 5, Advanced Methods of Reinsurance
Chapter 17, Special Purpose Reinsurance Companies

ERM-109-12: Tilman, Asset/Liability Management of Financial Institutions, 2003
Chapter 9, Measuring and Marking Counterparty Risk, by E. Canabarro & D. Duffie

ERM-110-12: Derivatives: Practice and Principles, Recommendations 9-24 and 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

Topic: Economic Capital

Learning Objective:

5. 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 demonstrate their uses in the risk management and corporate decision-making processes
- b) Define the basic elements and explain the uses of economic capital
- c) Explain the challenges and limits of economic capital calculations and explain how economic capital may differ from external requirements of rating agencies and regulators
- d) Apply risk measures and demonstrate how to use them in economic capital assessment. Contrast and understand regulatory, accounting, statutory and economic capital
- e) Propose techniques for allocating /appropriating the cost of risks/capital/hedge strategy to business units in order to gauge performance (risk adjusted performance measures)

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- f) Develop an economic capital model for a representative financial firm

RESOURCES

Financial Enterprise Risk Management, Sweeting 2011
Chapter 18 Economic Capital

ERM-106-12: Economic Capital-Practical Considerations-Milliman

ERM-101-12: Measurement and Modelling of Dependencies in Economic Capital Pages 9 to 22

ERM-102-12: Value-at-Risk: Evolution, Deficiencies and Alternatives

ERM-113-12: A Principles-Based Reserves and Capital Standard

Modeling Tail Behavior with Extreme Value Theory, Risk Management, Sept 2009

<http://www.soa.org/library/newsletters/risk-management-newsletter/2009/september/jrm-2009-iss17.aspx>

Summary of “Variance of the CTE Estimator,” Risk Management, August 2008

<http://www.soa.org/library/newsletters/risk-management-newsletter/2008/august/rmn-2008-iss13.aspx>

Regulatory Capital Standards for Property and Casualty Insurers under US, Canadian and Proposed Solvency II (Standard) Formulas

<http://www.soa.org/files/research/research-2010-08-regulatory-cap.pdf>

SOA Monograph- A New Approach to Managing Operational Risk -Chapter 8

<http://www.soa.org/Research/Research-Projects/Risk-Management/research-new-approach.aspx>

ASOP 46, Risk Evaluation in Enterprise Risk Management – ASB Final Version-September 2012

http://www.actuarialstandardsboard.org/pdf/asop046_165.pdf

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READING EXTENSIONS

The following are the resources for the six extensions. They apply risk management across the set of learning objectives for this examination. Candidates are responsible only for the readings in the extension for which they registered.

RETIREMENT BENEFITS

- ERM-301-12: Pension Investing and Corporate Risk Management (also coded R-C112-07)
- ERM-302-12: Jim Moore Discusses Liability Driven Investment Strategies and Concepts (also coded R-C148-10)
- ERM-303-12: Plan Sponsor Guide to Liability-Driven Investing (also coded R-C149-10)
- ERM-304-12: Mind the Gap: Using Derivatives Overlays to Hedge Pension Duration (also coded R-C150-10)
- ERM-305-12: Risk Management for Pension Funds
- ERM-306-12: The Intersection of Pensions and Enterprise Risk Management
- ERM-307-12: Pensions Risk in an ERM Context
- ERM-308-12: *Integrated Risk Management*, Doherty - Chapter 7, Why is Risk Costly for Firms
- ERM-606-12: *Fixed Income Securities*, Tuckman, Second Edition, Chapter 7, Key Rate and Bucket Exposures

Financial Economics and Actuarial Practice

<http://www.soa.org/library/journals/north-american-actuarial-journal/2004/july/naaj0403-6.aspx>

INDIVIDUAL LIFE AND ANNUITIES

- ERM-308-12: *Integrated Risk Management*, Doherty - Chapter 7, Why is Risk Costly for Firms
- ERM-401-12: Mapping of Life Insurance Risks (also coded FE-C106-07)
- ERM-402-12: Countering the Biggest Risk of All (also coded FE-C159-09)
- ERM-403-12: Deciphering the Liquidity and Credit Crunch 2007–2008 (also coded FE-C174-10)
- ERM-404-12: *Variable Annuities*, Kalberer, Section 3–Chapters 10–14

Implementing Risk Appetite for Variable Annuities <http://www.soa.org/library/monographs/other-monographs/2011/november/mono-2011-m-as11-1-jacobi.aspx>

AAA Monograph, Fair Valuation of Insurance Liabilities: Principles and Methods

http://www.actuary.org/pdf/finreport/fairval_sept02.pdf

Building an Economic Scenario Generator <http://www.soa.org/library/proceedings/record-of-the-society-of-actuaries/2000-09/2003/may/ras03v29n162ts.aspx>

GROUP AND HEALTH

Financial Enterprise Risk Management, Sweeting, Sections 14.10, 16.10

- ERM-501-12: Risk Based Capital–General Overview
- ERM-502-12: Healthcare Reform's Minimum Medical Loss Ratios
- ERM-503-12: Hedging with Derivatives in Traditional Insurance Products (also coded FE-C130-07)
- ERM-504-12: Mapping of Health Company Risks (also coded GH-C113-07)

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- ERM-505-12: Health Industry RBC Results for 2010
- ERM-506-12: ERM Practice As Applied to Health Insurers, Self Insured Plans and Health Finance Professionals, Pages 4-13, 21-32
- ERM-507-12: ERM for Health Insurance from an Actuarial Perspective– A Discussion Paper
- ERM-508-13: Pricing Long Term Care, pp. 9-22
- ERM-509-13: PPACA MLR Regulations

Enterprise Risk Management, *Health Watch*, January 2006, Health Section SOA
<http://www.soa.org/library/newsletters/health-watch-newsletter/2006/january/hsn0601.aspx>

Risk-Based Capital for Health Entities, *Record*, Volume 28 No 2
<http://www.soa.org/library/proceedings/record-of-the-society-of-actuaries/2000-09/2002/january/rsa02v28n240pd.aspx>

A Health Insurance Solvency Case Study, *Health Section News*, No 38, 2000 - Pages 1, 20-25
<http://www.soa.org/library/newsletters/health-section-news/2000/august/hsn-2000-iss38-howard.aspx>

INVESTMENT

- Value at Risk*, Jorion, Chapter 8, Multivariate Models
- Value at Risk*, Jorion, Chapter 11, VAR Mapping
- Value at Risk*, Jorion, Chapter 17, VAR and Risk Budgeting in Investment Management

- ERM-304-12: Mind the Gap Using Derivative Overlays to Hedge Pension Duration (also coded V-C185-11 and R-C150-10)
- ERM-601-12: Managing Your Advisor (also coded V-C138-09)
- ERM-602-12: *Investment Management for Insurers*, Babbel and Fabozzi, Chapter 11, The Four Faces of an Interest Model
- ERM-603-12: *The Handbook of Fixed Income Securities*, Fabozzi, Seventh Edition, Chapter 47, Bond Immunization: An Asset Liability Optimization Strategy
- ERM-604-12: Impact of Skewness and Fat Tails on Asset Allocation Decision
- ERM-605-12: *Modern Investment Management*, Litterman, Chapter 10, Strategic Asset Allocation in the Presence of Uncertain Liabilities
- ERM-606-12: *Fixed Income Securities*, Tuckman, Second Edition, Chapter 7, Key Rate and Bucket Exposures
- ERM-607-12: Creating Value in Pension Plans, or Gentlemen Prefer Bonds, (also coded V-C111-07)

GENERAL INSURANCE

- GTO/924/34-12: P&C RAROC: A Catalyst for the Improved Capital Management in the Property and Casualty Insurance Industry

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CAS, We're Going to Need a Bigger Boat, Part 1 Pages 15–16 Aug 2010 (Ingram/Underwood)
<http://www.casact.org/newsletter/index.cfm?fa=viewart&id=6023>

CAS, Riding the Waves of the Cycle, Part 2 Pages 26–27 Nov 2010 (Ingram and Underwood)
<http://www.casact.org/newsletter/index.cfm?fa=viewart&id=6075>

Evolution of Risk Management by Robert Wolf Part 2: The Birth, Death and Resurrection of Dynamic Financial Analysis
<http://www.soa.org/Library/Newsletters/The-Actuary-Magazine/2008/October/act-2008-vol5-iss5-wolf.aspx>

ERM for Strategic Management—Status Report, Venter
<http://www.soa.org/library/monographs/other-monographs/2008/april/mono-2008-m-as08-1-venter.aspx>

Human Dynamics of Insurance Cycles and Implications for Insurers
<http://www.soa.org/library/monographs/other-monographs/2010/april/mono-2010-m-as10-1-ingram.aspx>

GENERAL CORPORATE ERM

- ERM-305-12: Risk Management for Pension Funds
- ERM-401-12: Mapping of Life Insurance Risks (also coded FE-C106-07)
- ERM-402-12: Countering the Biggest Risk of All (also coded FE-C159-09)
- ERM-504-12: Mapping of Health Company Risks (also coded GH-C113-07)
- ERM-601-12: Managing Your Advisor (also coded V-C138-09)
- ERM-705-12: P&C RAROC: A Catalyst for the Improved Capital Management in the Property and Casualty Insurance Industry
- ERM-801-12: *Strategic Risk Management*, Andersen & Schroder, Chapter 3, Managing Market-Related Business Exposures
- ERM-802-12: Enterprise Risk Management for Non-Financial Companies—From Risk Control and Compliance to Creating Shareholder Value

ERM for Strategic Management—Status Report, Venter
<http://www.soa.org/library/monographs/other-monographs/2008/april/mono-2008-m-as08-1-venter.aspx>