

ERM – Enterprise Risk Management Exam
Spring 2014

Important Exam Information:

Exam Date and Time	The exam duration is 4 hours consisting of a general exam and case study. Candidates are expected to select one of the case studies and spend about 1 hr in the exam. 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	UPDATED 2/5/14: 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.
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.
Past Exams	Past Exams from 2012 - present are available on SOA website.
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.

1. Topic: Risk Categories and Identification
Learning Objectives
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: <ul style="list-style-type: none">a) Explain risk concepts and be able to apply risk definitions to different entitiesb) Explain risk taxonomy and its application to different frameworksc) 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
<ul style="list-style-type: none">• Financial Enterprise Risk Management, Sweeting<ul style="list-style-type: none">○ Ch. 1 An Introduction to Enterprise Risk Management○ Ch. 7 Definitions of Risk○ Ch. 8 Risk Identification• Value-at- Risk: The New Benchmark for Managing Financial Risk, Jorion, 3rd Edition<ul style="list-style-type: none">○ Ch. 13 Liquidity Risk○ Ch. 19 Operational Risk Management (excluding 19.5)• ERM-100-12: A Common Risk Classification System for the Actuarial Profession - Kelliher, Wilmot, Vij and Klumpes (background only)• ERM-107-12: Strategic Risk Management Practice, Andersen and Schroder, 2010, Ch. 7: Strategic Risk Analyses

2. Topic: Risk Modeling and Aggregation of Risks
Learning Objectives
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: <ul style="list-style-type: none">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 analysisb) Evaluate how risks are correlated, and give examples of risks that are positively correlated and risks that are negatively correlatedc) Analyze and evaluate risk aggregation techniques, including use of correlation, integrated risk distributions and copulasd) Apply and analyze scenario and stress testing in the risk measurement processe) Evaluate the theory and applications of extreme value theory in the measuring and modeling of riskf) Analyze the importance of tails of distributions, tail correlations, and low frequency / high severity eventsg) Analyze and evaluate model and parameter riskh) 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
<ul style="list-style-type: none">• Financial Enterprise Risk Management, Sweeting<ul style="list-style-type: none">○ Ch. 12 Extreme Value Theory○ Ch. 14 Quantifying Particular Risks○ Ch. 15.5 Unquantifiable Risks• Value-at- Risk: The New Benchmark for Managing Financial Risk, Jorion, 3rd Edition<ul style="list-style-type: none">○ Ch. 5 Computing VaR○ Ch. 7 Portfolio Risk: Analytical Methods○ Ch. 9 Forecasting Risk Correlations, (only Section 9.3 Modelling Correlations, pp. 232-236)○ Ch. 12 Monte Carlo Methods○ Ch. 14 Stress testing○ Ch. 19 Operational Risk Management (excluding 19.5)• ERM-101-12: Measurement and Modeling of Dependencies in Economic Capital, Ch. 4-5• ERM-103-12: Basel Committee - Developments in Modelling Risk Aggregation, pp. 76-87• ERM-104-12: Study Note on Parameter Risk, Venter and Sahasrabuddhe

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- ERM-106-12: Economic Capital-Practical Considerations, Milliman
- ERM-602-12: *Investment Management for Insurers*, Babel and Fabozzi, Ch. 11, The Four Faces of an Interest Model
- [ASOP 46: Risk Evaluation in Enterprise Risk Management](#), ASB Final, through p. 14
- [Risk Appetite: Linkage with Strategic Planning Report](#)
- [Modeling Tail Behavior with Extreme Value Theory](#), Risk Management, Sept 2009
- [SOA Monograph- A New Approach to Managing Operational Risk](#), Ch. 8

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3. Topic: Risk Measures
Learning Objectives
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: <ul style="list-style-type: none">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 processb) Analyze and evaluate the properties of risk measures (e.g., Delta, volatility, duration, VaR, TVaR, etc.) and their limitationsc) 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 applicationd) Define and evaluate credit risk. Explain how to incorporate best practices in credit risk measurement, modeling, and management
Resources
<ul style="list-style-type: none">• Financial Enterprise Risk Management, Sweeting<ul style="list-style-type: none">○ Ch. 9 Some Useful Statistics (Background only)○ Ch. 15.5 Unquantifiable Risks• Value-at-Risk: The New Benchmark for Managing Financial Risk, Jorion, 3rd Edition<ul style="list-style-type: none">○ Ch. 5 Computing VaR○ Ch. 7 Portfolio Risk: Analytical Methods○ Ch. 9 Forecasting Risk and Correlations○ Ch. 12 Monte Carlo Methods○ Ch. 13 Liquidity Risk○ Ch. 18 Credit Risk Management (excluding Appendices)○ Ch. 19 Operational Risk Management (excluding 19.5)• ERM-102-12: Value-at-Risk: Evolution, Deficiencies, and Alternatives• ERM-105-12: Coherent Measures of Risk – An Exposition for the Lay Actuary, Meyers, Glenn• ERM-109-12: Asset/Liability Management of Financial Institutions, Tilman, 2003, Ch. 9: Measuring and Marking Counterparty Risk, Canabarro, E. & Duffie, D.• Summary of “Variance of the CTE Estimator,” Risk Management, Aug 2008• ASOP23: Data Quality, pp. 1-8

4. Topic: Risk Management Tools and Techniques
Learning Objectives
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: <ul style="list-style-type: none">a) Evaluate the rationale for managing risk and demonstrate the selection of the appropriate risk retention level and hedging of riskb) Demonstrate and analyze applicability of risk optimization techniques and the impact on an organization's value of an ERM strategyc) Demonstrate means for transferring risk to a third party, and estimate the costs and benefits of doing sod) Demonstrate means for reducing risk without transferring ite) 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 itf) 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 risksg) Analyze the practicalities of market risk hedging, including dynamic hedgingh) Define credit risk as related to derivatives, define credit risk as related to reinsurance ceded, define counterparty risk and demonstrate the use of comprehensive due diligence and aggregate counterparty exposure limitsi) 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 entitiesj) Analyze the application of Asset Liability Management and Liability Driven Investment principles to Investment Policy and Asset Allocationk) Analyze methods of managing other risks (operational, strategic, legal, and insurance) both pre-event and post-eventl) Apply best practices in risk measurement, modeling and management of various financial and non-financial risks faced by an entity
Resources
<ul style="list-style-type: none">• Financial Enterprise Risk Management, Sweeting<ul style="list-style-type: none">○ Ch. 16 Responses to Risk• Value-at- Risk: The New Benchmark for Managing Financial Risk, Jorion, 3rd Edition<ul style="list-style-type: none">○ Ch. 7 Portfolio Risk: Analytical Methods

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- Ch. 18 Credit Risk Management (excluding Appendices)
- Ch. 19 Operational Risk Management (excluding 19.5)
- ERM-107-12: Strategic Risk Management Practice, Andersen and Schroder, 2010, Ch. 7: Strategic Risk Analyses
- ERM-108-12: Life, Health and Annuity Reinsurance, Tiller, 3rd Edition, 2005, Ch. 5: Advanced Methods of Reinsurance
- ERM-109-12: Asset/Liability Management of Financial Institutions, Tilman, 2003 , Ch. 9: Measuring and Marking Counterparty Risk, by E. Canabarro & D. Duffie
- ERM-110-12: Derivatives: Practice and Principles, Recommendations 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-114-13: Introduction to Reinsurance, Rudolpho Wehrhahn (excluding all Annexes)
- ERM-115-13: Creating an Understanding of Special Purpose Vehicles, PWC
- [ASOP 46: Risk Evaluation in Enterprise Risk Management](#), ASB Final, through p. 14
- [SOA Monograph- A New Approach to Managing Operational Risk](#), Ch. 8
- [Risk Appetite: Linkage with Strategic Planning Report](#)

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5. Topic: Economic Capital
Learning Objectives
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: <ol style="list-style-type: none">Describe the concept of economic measures of value and demonstrate their uses in the risk management and corporate decision-making processesDefine the basic elements and explain the uses of economic capitalExplain the challenges and limits of economic capital calculations and explain how economic capital may differ from external requirements of rating agencies and regulatorsApply risk measures and demonstrate how to use them in economic capital assessment. Contrast and understand regulatory, accounting, statutory and economic capitalPropose techniques for allocating /appropriating the cost of risks/capital/hedge strategy to business units in order to gauge performance (risk adjusted performance measures)Develop an economic capital model for a representative financial firm
Resources
<ul style="list-style-type: none">ERM-101-12: Measurement and Modelling of Dependencies in Economic Capital, Ch 3ERM-106-12: Economic Capital – Practical Considerations, MillimanERM-112-12: Revisiting the Role of Insurance Company ALM within a Risk Management FrameworkERM-116-13: Risk Management and the Rating Process for Insurance Companies, AM BestASOP 46: Risk Evaluation in Enterprise Risk Management, ASB Final, through p. 14Risk Appetite: Linkage with Strategic Planning ReportSOA 2012 Annual Meeting – Session 53 – Assumption Setting Best Practices, Towers Watson (Steiner slides only)

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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-309-13: Risk Assessment Framework for Federal Regulated Private Pension Plans, OSFI
- ERM-310-13: The Ten Fundamentals of Pension Fund Risk Management, Northfield
- ERM-311-13: Russell Investments: Strategies for Hedging Interest Rate Risk in a Cash Balance Plan
- ERM-312-13: Clear Path: Pension Plan De-Risking, North America, April 2012 pg 11-15, 19-21
- ERM-313-13: Clear Path: Pension Plan De-Risking, North America, April 2013 pg 12-13
- ERM-314-13: Financial Economics and Actuarial Practice
- ERM-606-12: Fixed Income Securities, Tuckman, 2nd Edition, Ch. 7:Key Rate and Bucket Exposures
- ERM-607-12: Creating Value in Pension Plans, or Gentlemen Prefer Bonds (also coded V-C111-07)
- [Quantifying Defined Contribution Risk](#), Lalani, JRMS Newsletter, March 2009

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INDIVIDUAL LIFE AND ANNUITIES

- ERM-308-12: Integrated Risk Management, Doherty - Ch. 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–Ch. 10-14
- [How Fair Value Measurement Changes Risk Management Behavior in the Insurance Industry](#)
- [Building an Economic Scenario Generator](#)

GROUP AND HEALTH

- 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)
- ERM-507-12: ERM for Health Insurance from an Actuarial Perspective– A Discussion Paper
- ERM-508-13: Pricing Long Term Care by Mark Litow and Allen Schmitz, pp.9-22
- ERM-509-13: PPACA MLR Regulations
- ERM-510-13: PPACA Rate Restrictions
- ERM-511-13: PPACA 3R's Programme Description
- ERM-512-13: Economics and Financing, Getzen, Sections 5.4 & 5.5
- ERM-513-13: Extending the Insurance ERM Criteria to the Health Insurance Sector, S&P
- [Enterprise Risk Management](#), Health Watch, January 2006, Health Section SOA
- [A Health Insurance Solvency Case Study](#), Health Section News, No 38, 2000 , pp.1 & 20-25

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INVESTMENT

- Value-at- Risk: The New Benchmark for Managing Financial Risk, Jorion, 3rd Edition
 - Ch. 8, Multivariate Models
 - Ch. 11, VAR Mapping
 - Ch. 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-603-12: The Handbook of Fixed Income Securities, Fabozzi, 7th Edition, Ch. 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, Ch. 10: Strategic Asset Allocation in the Presence of Uncertain Liabilities
- ERM-606-12: Fixed Income Securities, Tuckman, 2nd Edition, Ch. 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

- ERM-702-12: IAA Note on ERM for Capital and Solvency Purposes in the Insurance Industry, pp.9–38
- ERM-705-12: P&C RAROC: A Catalyst for the Improved Capital Management in the Property and Casualty Insurance Industry
- ERM-706-13: Solvency II Reserving Risk and Risk Margins
- ERM-707-13: Catastrophe Reinsurance Pricing
- ERM-708-13: Natural Catastrophe Loss Modeling
- [We're Going to Need a Bigger Boat](#), CAS, Part 1 pp.15-16, Aug 2010 (Ingram/Underwood)
- [Riding the Waves of the Cycle](#), CAS, Part 2, pp.26–27, Nov 2010 (Ingram and Underwood)
- [Evolution of Risk Management](#) by Robert Wolf Part 2: The Birth, Death and Resurrection of Dynamic Financial Analysis
- [ERM for Strategic Management](#) - Status Report, Venter
- [Human Dynamics of Insurance Cycles and Implications for Insurers](#)
- [Regulatory Capital Standards for Property and Casualty Insurers under US, Canadian and Proposed Solvency II \(Standard\) Formulas](#)
- [Research Paper: Considerations on the Quantification of Variability in P&C Insurance Policy Liabilities](#), CIA

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GENERAL CORPORATE ERM

- ERM-308-12: Integrated Risk Management, Doherty - Ch. 7, Why is Risk Costly for Firms
- ERM-402-12: Countering the Biggest Risk of All (also coded FE-C159-09)
- ERM-513-13: Extending the Insurance ERM Criteria to the Health Insurance Sector, S&P
- ERM-802-12: Enterprise Risk Management for Non-Financial Companies—From Risk Control and Compliance to Creating Shareholder Value
- ERM-803-13: Risk Measurement, Risk Management and Capital Adequacy in Financial Conglomerates
- ERM-804-13: Refined Methodology for Assessing an Insurer's Risk Appetite, S&P
- ERM-805-13: Mergers & Acquisitions, Toole & Herget, Sections 2.2, 2.3.4, 2.6 - 2.6.3, 3.4, 4 - 4.3
- [ERM for Strategic Management](#) - Status Report, Venter