

ERM – Enterprise Risk Management Exam

Spring 2021

Important Exam Information:

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 readings for the selected extension. These questions may also draw on material from the core reading. Questions in both the core and the extension may be based on the case study.
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.
Syllabus Readings	Readings listed in this syllabus may include study notes, online readings and textbooks. Candidates are responsible for all readings in their entirety, including sections such as Appendices, unless it is stated otherwise in the syllabus.
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 are applicable to all candidates and which parts apply to each 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) Describe different definitions and concepts of risk.b) Discuss risk taxonomy, including an awareness of how individual risks might be categorized in different ways.c) Identify and analyze specific risks faced by an organization, including but not limited to: financial, environmental, operational, legal, reputational and strategic risks.
Resources
<ul style="list-style-type: none">• <i>Financial Enterprise Risk Management</i>, Sweeting, Paul, 2nd Edition, 2017<ul style="list-style-type: none">○ Ch. 8: Risk Identification• <i>Value at Risk: The New Benchmark for Managing Financial Risk</i>, Jorion, Philippe, 3rd Edition, 2007<ul style="list-style-type: none">○ Ch. 13: Liquidity Risk (excluding section 13.4)○ Ch. 18: Credit Risk Management (excluding Appendices)• ERM-107-12: Strategic Risk Management Practice, Andersen and Schroder, 2010, Ch. 7: Strategic Risk Analyses• ERM-130-18: AAA Model Governance Practice Note• ERM-133-19: Emerging Risks and Enterprise Risk Management, pp. 2-6• ERM-135-20: Risk Management and the Rating Process for Insurance Companies• ERM-136-20: Managing Liquidity Risk: Industry Practices and Recommendations for CROs (excluding Ch. 4)• ERM-137-20: ORSA and the Regulator by AAA• ERM-702-12: IAA Note on ERM for Capital and Solvency Purposes in the Insurance Industry, pp.9-38• Embedding Cyber Risk in Risk Management: An Insurer's Perspective, pp. 12-15 of Cybersecurity: Impact on Insurance Business and Operations• Risk Appetite: Linkage with Strategic Planning Report• National Risk Management A Practical ERM Approach for Federal Governments, CAS, CIA and SOA, Mar 2018, pp. 11-22

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:

- a) Demonstrate how each of the financial and non-financial risks faced by an organization can be amenable to quantitative analysis
- b) Demonstrate organization-wide risk aggregation techniques that illustrate the concept of risk diversification by incorporating the use of correlation
- c) Evaluate and select appropriate copulas as part of the process of modelling multivariate risks
- d) Demonstrate the use of scenario analysis and stress testing in the measurement of current and emerging risks
- e) Demonstrate the importance of the tails of distributions, tail correlations, and low frequency / high severity events, and the use of extreme value theory to analyze these situations
- f) Demonstrate an understanding of model and parameter risk
- g) Evaluate and select appropriate models to handle diverse risks, including models that use a stochastic approach

Resources

- *Financial Enterprise Risk Management*, Sweeting, Paul, 2nd Edition, 2017
 - Ch. 14: Quantifying Particular Risks
- *Value at Risk: The New Benchmark for Managing Financial Risk*, Jorion, Philippe, 3rd Edition, 2007
 - Ch. 7: Portfolio Risk: Analytical Methods
 - Ch. 9: Forecasting Risk Correlations (section 9.3 only)
 - Ch. 12: Monte Carlo Methods
 - Ch. 18: Credit Risk Management (excluding Appendices)
- 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. 72-89 (excluding section G.2)
- ERM-104-12: Study Note on Parameter Risk, Venter and Sahasrabuddhe (excluding section 3)
- ERM-106-12: Economic Capital-Practical Considerations, Milliman
- ERM-107-12: Strategic Risk Management Practice, Andersen and Schroder, 2010, Ch. 7: Strategic Risk Analyses
- ERM-110-12: Derivatives: Practice and Principles, Recommendations 9-24 & Section III
- ERM-119-14: Aggregation of Risks and Allocation of Capital (sections 4-7, excluding section 6.3)

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- ERM-120-14: IAA Note on Stress Testing and Scenario Analysis (pp. 1-6, 14-17 & 19-25)
- ERM-124-15: Counterparty Credit Risk: The New Challenge for Global Financial Markets, Ch.2: Defining Counterparty Credit Risk
- ERM-135-20: Risk Management and the Rating Process for Insurance Companies
- ERM-137-20: ORSA and the Regulator
- ERM-138-20: Quantitative Enterprise Risk Management, Hardy, Ch. 6: Extreme Value Theories
- ERM-139-20: Quantitative Enterprise Risk Management, Hardy, Ch. 7: Copulas
- ERM-140-20: Risk Adjustments for Insurance Contracts under IFRS 17: Chapter 3: Risk Adjustment Techniques & Chapter 7: Validation of Risk Adjustments
- ERM-141-20: Ch. 9: Risk Management, section 5 of Managing Investment Portfolios, Maginn and Tuttle, 3rd Edition, 2007
- [Risk Appetite: Linkage with Strategic Planning Report](#)
- [Modeling Tail Behavior with Extreme Value Theory](#), Risk Management, Sep 2009
- [A New Approach for Managing Operational Risk](#), Ch. 8
- [Economic Scenario Generators: A Practical Guide](#), pp. 7-17 (pp. 97-112 background only)
- [Embedding Cyber Risk in Risk Management: An Insurer's Perspective](#), pp. 12-15 of Cybersecurity: Impact on Insurance Business and Operations
- [Parameter Uncertainty](#), CAS, CIA and SOA, 2017

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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:

- a) Determine risk exposures using common risk measures (e.g., VaR and TVaR) and compare the properties and limitations of such measures
- b) Analyze quantitative financial and non-financial data using appropriate statistical methods to assist in quantifying risk
- c) Analyze risks that are not easily quantifiable, such as liquidity, operational, and environmental risks.

Resources

- *Financial Enterprise Risk Management*, Sweeting, Paul, 2nd Edition, 2017
 - Ch. 9: Some Useful Statistics (background only)
 - Ch. 14: Quantifying Particular Risks
- *Value at Risk: The New Benchmark for Managing Financial Risk*, Jorion, Philippe, 3rd Edition, 2007
 - Ch. 7: Portfolio Risk: Analytical Methods
 - Ch. 9: Forecasting Risk and Correlations
 - Ch. 12: Monte Carlo Methods
 - Ch. 13: Liquidity Risk (excluding section 13.4)
 - Ch. 18: Credit Risk Management (excluding Appendices)
- ERM-102-12: Value at Risk: Evolution, Deficiencies, and Alternatives
- ERM-106-12: Economic Capital – Practical Considerations, Milliman
- ERM-112-12: Revisiting the Role of Insurance Company ALM within a Risk Management Framework
- ERM-133-19: Emerging Risks and Enterprise Risk Management, pp. 2-6
- ERM-135-20: Risk Management and the Rating Process for Insurance Companies
- ERM-136-20: Managing Liquidity Risk: Industry Practices and Recommendations for CROs (excluding Ch. 4)
- ERM-137-20: ORSA and the Regulator
- ERM-140-20: Risk Adjustments for Insurance Contracts under IFRS 17: Chapter 3: Risk Adjustment Techniques & Chapter 7: Validation of Risk Adjustments
- ERM-141-20: Ch. 9: Risk Management, section 5 of *Managing Investment Portfolios*, Maginn and Tuttle, 3rd Edition, 2007
- ERM-142-20: Data Quality is the Biggest Challenge

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- ERM-702-12: IAA Note on ERM for Capital and Solvency Purposes in the Insurance Industry, pp.9-38
- [A New Approach to Managing Operational Risk](#), Ch.8
- [Embedding Cyber Risk in Risk Management: An Insurer's Perspective](#), pp. 12-15 of Cybersecurity: Impact on Insurance Business and Operations

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:

- a) Demonstrate risk optimization and analyze the risk and return trade-offs that result from changes in the organization's risk profile
- b) Demonstrate application of the following responses to risk, including consideration of their costs and benefits: avoidance, acceptance, reduction without transfer, and transfer to a third party
- c) Demonstrate the use of controls for retained and residual risks
- d) Demonstrate how derivatives, synthetic securities, and financial contracting may be used to reduce risk within a static or dynamic hedging program
- e) Determine an appropriate choice of mitigation strategy for a given situation, which balances benefits with inherent costs (including exposure to moral hazard, credit, basis and other risks)
- f) Demonstrate the use of tools and techniques for identifying and managing credit and counterparty risk
- g) Analyze how ALM and other risk management principles can be used to establish investment policy and strategy, including asset allocation
- h) Demonstrate possible risk management strategies for non-financial risks
- i) Choose appropriate techniques to measure, model and manage various financial and non-financial risks faced by an organization

Resources

- *Financial Enterprise Risk Management*, Sweeting, Paul, 2nd Edition, 2017
 - Ch. 16: Responses to Risk
- *Value at Risk: The New Benchmark for Managing Financial Risk*, Jorion, Philippe, 3rd Edition, 2007
 - Ch. 7: Portfolio Risk: Analytical Methods
 - Ch. 18: Credit Risk Management (excluding Appendices)
- ERM-102-12: Value-at-Risk: Evolution, Deficiencies and Alternatives
- ERM-107-12: Strategic Risk Management Practice, Andersen and Schroder, 2010, Ch. 7: Strategic Risk Analyses
- ERM-110-12: Derivatives: Practice and Principles, Recommendations 9-24 & Section III
- 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-120-14: IAA Note on Stress Testing and Scenario Analysis (pp. 1-6, 14-17 & 19-25)
- ERM-122-16: Chapter 1 of *Captives and the Management of Risk*, 3rd Edition, Kate Westover

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- ERM-124-15: Counterparty Credit Risk: The New Challenge for Global Financial Markets, Ch.2: Defining Counterparty Credit Risk
- ERM-128-17: The Breadth and Scope of the Global Reinsurance Market and the Critical Role Such Market Plays in Supporting Insurance in the United States (III, IV & VI)
- ERM-129-18: AAA PBR Checklist - Assumptions Setting (section C)
- ERM-130-18: AAA Model Governance Practice Note
- ERM-131-18: Leveraging COSO Across the Three Lines of Defenses
- ERM-135-20: Risk Management and the Rating Process for Insurance Companies
- ERM-136-20: Managing Liquidity Risk: Industry Practices and Recommendations for CROs (excluding Ch. 4)
- ERM-137-20: ORSA and the Regulator
- ERM-143-20: Internal Controls Toolkit, Doxey, Ch. 1, pp. 11-17 & 27-35
- ERM-144-20: Ch. 13: Asset Liability Management Techniques and Practices for Insurance Companies, IAA Risk Book
- ERM-702-12: IAA Note on ERM for Capital and Solvency Purposes in the Insurance Industry, pp.9-38
- [Risk Appetite: Linkage with Strategic Planning Report](#)
- [End to End Assumption Documentation Practices](#), Product Matters, Jul 2016
- [Embedding Cyber Risk in Risk Management: An Insurer's Perspective](#), pp. 12-15 of Cybersecurity: Impact on Insurance Business and Operations

5. Topic: Capital Management
Learning Objectives
The candidate will understand the concept of economic capital, risk measures in capital assessment and techniques to allocate the cost of risks within business units.
Learning Outcomes
The Candidate will be able to: <ul style="list-style-type: none">a) Demonstrate a conceptual understanding of economic measures of value and capital requirements (e.g., EVA, embedded value, economic capital, regulatory measures, and accounting measures) and their uses in decision-making processesb) Apply risk measures and demonstrate how to use them in value and capital assessmentc) Propose techniques of attributing the “cost” of risk/capital/hedge strategies to business units in order to gauge performance (e.g. returns on marginal capital)d) Demonstrate the ability to develop a capital model for a hypothetical organization
Resources
<ul style="list-style-type: none">• ERM-101-12: Measurement and Modelling of Dependencies in Economic Capital, Ch. 3• 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, excluding section 6.3)• ERM-134-19: Group Insurance, Skwire, 2016, Ch. 39: Risk Based Capital Formulas• ERM-135-20: Risk Management and the Rating Process for Insurance Companies• ERM-137-20: ORSA and the Regulator• Risk Appetite: Linkage with Strategic Planning Report

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-321-14: LDI Evolution: Implementing Dynamic Asset Allocation Strategies that Respond to Changes in Funded Status
- ERM-327-17: Pension Funding Strategy
- ERM-330-17: Liability Relative Investing I
- ERM-332-20: Longevity Risk Management
- ERM-333-21: Green DB: Eliminate Wasteful Practices and Make Your DB Plan Sustainable
- ERM-621-21: Liability Driven Investment Explained
- [ASOP 51: Assessment and Disclosure of Risk Associated with Measuring Pension Obligations and Determining Pension Plan Contributions](#)
- [Pension Risk Transfer](#), 2014, pp. 1-46 (pp. 7-10 background only)
- [Corporate Pension Risk Management and Corporate Finance: Bridging the Gap between Theory and Practice in Pension Risk Management](#), Aug 2015
- [Embedded Options in Pension Plans](#), 2014, pp. 6-18 & 28-60
- [Quantifying Defined Contribution Risk](#), Risk Management, Mar 2009

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INDIVIDUAL LIFE AND ANNUITIES

- ERM-331-17: Quantifying the Mortality-Longevity Offset
- ERM-401-12: Mapping of Life Insurance Risks
- ERM-405-14: Secondary Guarantee Universal Life - Practical Considerations (excluding sections 1, 2, and 7 Introduction, Overview and Principle-based Reserve Sections)
- ERM-408-14: The Captive Triangle: Where Life Insurers' Reserve and Capital Requirements Disappear, pp. 1-11
- ERM-409-14: A Brief Primer on Financial Reinsurance
- ERM-410-14: Coinsurance and its Variants
- ERM-412-17: Surrenders in the Life Insurance Industry, sections 1-4
- ERM-413-17: Hedging for Liabilities in Life Insurance Companies
- ERM-414-17: A Tale of Two Formulas
- ERM-415-17: Strategic Risk Management in Insurance: Navigating the Rough Waters Ahead
- ERM-418-19: Low Interest Rates and the Implications on Life Insurers
- ERM-420-20: Variable Annuity Volatility Management: An Era of Risk Control, pp. 1-27
- ERM-421-20: The Specter of Antiselection
- ERM-422-20: Mortality Improvement: Understanding the Past and Framing the Future
- [Life Insurance for the Digital Age: An End-to-End View](#), Product Matters, Nov 2017
- [How Fair Value Measurement Changes Risk Management Behavior in the Insurance Industry](#), Jan 2013
- [Modeling of Policyholder Behavior for Life Insurance and Annuity Products](#), 2014, pp. 7-15 & 68-80
- [Hybrid Annuities: A Growth Story](#), Product Matters, Oct 2014

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GROUP AND HEALTH

- Group Insurance, Skwire 7th Edition, Ch. 42: Enterprise Risk Management for Group Health Insurers
- ERM-513-13: Extending the Insurance ERM Criteria to the Health Insurance Sector
- ERM-517-15: The Cost of Waiting, Nov/Dec 2014 Contingencies
- ERM-521-17: Risk Transfer Formula for Individual and Small Group Markets under the Affordable Care Act
- ERM-522-17: Risk Selection Threatens Quality of Care for Certain Patients: Lessons from Europe’s Health Insurance Exchanges
- ERM-523-18: Why are Many Co-Ops Failing?
- ERM-524-18: Life, Health and Annuity Reinsurance, Ch. 18
- ERM-526-19: The Risk of Pricing New Insurance Products: The Case of Long-Term Care
- ERM-528-20: Assessing the Health-Care Risk: The Clinical-VaR, a Key Indicator for Sound Management
- ERM-529-20: RBC Calculation Examples
- ERM-531-21: Top Health Industry Issues of 2020: Will Digital Start to Show an ROI
- ERM-532-21: Shared Savings Model Risk in the MSSP Program
- ERM-533-21: Building a Successful Value-Based Payer Contracting Strategy
- ERM-534-21: What is Value-Based Healthcare?
- [ASOP 46: Risk Evaluation in Enterprise Risk Management](#)
- [ASOP 47: Risk Treatment in Enterprise Risk Management](#)
- [ASOP 55: Capital Adequacy Assessment](#)
- [ASOP 56: Modeling](#) (excluding Appendices)
- [Risk & Mitigation for Health Insurance Companies](#), 2012
- [Time to Update your Trend Process?](#), Health Watch, Feb 2018
- [Large Group Medical Insurance Reserves, Liabilities, and Actuarial Assets](#), AAA Public Policy Practice Note, Aug 2013

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INVESTMENT

- *Value at Risk: The New Benchmark for Managing Financial Risk*, Jorion, Philippe, 3rd Edition, 2007
 - Ch. 8: Multivariate Models
 - Ch. 11: VAR Mapping
 - Ch. 17: VAR and Risk Budgeting in Investment Management (excluding sections 17.3 and 17.4)
- *The Top Ten Operational Risks: A Survival Guide for Investment Management Firms and Hedge Funds*, Miller and Lawton, 2010
- ERM-613-17: Managing Investment Portfolios, Maginn and Tuttle, 3rd Edition Ch. 6, sections 4 & 5 only
- ERM-615-19: The Devil is in the Tails: Actuarial Mathematics and the Subprime Mortgage Crisis
- ERM-617-19: Chapters 17 (pp. 365-377), 19 (pp. 397-425) and 29 (pp. 670-686) of *Options, Futures and other Derivatives*, Hull, John, 10th Edition, 2018
- ERM-618-20: Chapter 9, section 6 of *Managing Investment Portfolios*, Maginn, John L. and Tuttle, Donald L., 3rd Edition, 2007
- ERM-619-20: Correlation: Pitfalls and Alternatives
- ERM-620-21: The Evolution of LDI and Role of a Completion Manager
- ERM-621-21: Liability Driven Investment Explained

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GENERAL INSURANCE

- ERM-708-13: Natural Catastrophe Loss Modeling
- ERM-711-16: Risk Appetite for a General Insurance Undertaking (excluding Appendices)
- ERM-712-16: Catastrophe Modelling: Guidance for Non-Catastrophe Modellers
- ERM-714-18: U.S. Property-Casualty: Underwriting Cycle Modeling and Risk Benchmarks, section 2, pp. 92-103
- ERM-719-21: Top 10 Trends in Property and Casualty Insurance: 2020
- ERM-721-21: Understanding BCAR for U.S. Property/Casualty Insurers (excluding Appendices)
- ERM-723-20: Issues Paper on Climate Change Risks to the Insurance Sector, sections 2, 3 & 4, Annex A1.1, A1.2 & A1.3
- ERM-724-21: Failures and Near Misses in Insurance: Overview of the Causes and Early Identification, sections 1, 2, 5 & 6 only
- [CIA Research Paper on Quantification of Variability in P&C Liabilities](#), Nov 2012
- [Risk-Adjusted Performance Measurement for P&C Insurers](#), CAS, Oct 2010 (excluding Appendix B)
- [The Actuary & Enterprise Risk Management: Integrating Reserve Variability](#), CAS, E-Forum, Summer 2016

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GENERAL CORPORATE ERM

- ERM-414-17: A Tale of Two Formulas
- ERM-723-20: Issues Paper on Climate Change Risks to the Insurance Sector, sections 2, 3 & 4, Annex A1.1, A1.2 & A1.3
- ERM-811-15: Agency Theory and Asymmetric Information
- ERM-812-15: Valuation for Mergers and Acquisitions, Ch. 1
- ERM-813-15: Financial Structure, Capital Structure (Capitalization), and Leverage Explained
- ERM-814-15: Cognitive Bias and their Implications on the Financial Market
- ERM-817-17: Speech by SEC Staff: The Role of Compliance and Ethics in Risk Management
- ERM-819-19: Exchange Rate Risk Measurement and Management
- ERM-820-19: CRO Forum Concept Paper on a Proposed Categorisation Methodology of Cyber Risk, Jun 2016
- ERM-822-20: Non-Financial Risk Convergence and Integration
- ERM-823-21: The Role of Human Resource Management in Risk Management
- ERM-824-21: Strategic Crisis Management: A Basis for Renewal and Crisis Prevention
- ERM:825-21: Understanding and Managing the IT Risk Landscape (excluding Section 3.7 & Appendices)
- ERM-826-21: Machine Decisions: Governance of AI and Big Data Analytics
- ERM-827-21: SEC Staff Accounting Bulletin: No. 99 – Materiality (excluding footnotes)
- [Incentive Compensation/Risk Management – Integration Incentive Alignment and Risk Mitigation](#), Beal et al.
- [A New Approach for Managing Operational Risk](#), Jul 2010, sections 5-7, 9 & 10
- [Regulatory Risk and North American Insurance Organizations](#), Aug 2014, sections 6.1-6.14 & 7
- [Risk Aggregation and Diversification](#), Apr 2016 (excluding Appendices)
- [Integration of Risk Management into Strategic Planning](#), Apr 2016
- [Four Ways to Improve the Relationship Between Enterprise Risk Management and Audit](#), Oct 2016