

2024

FRM® STUDY GUIDE

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FRM® | Financial Risk Manager

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2024 FINANCIAL RISK MANAGER (FRM) EXAM STUDY GUIDE

Topic Outline, Readings, and Test Weightings

The Study Guide sets forth primary topics and sub-topics covered in the FRM Exams Part I and Part II. The topics were selected by the FRM Committee as essential for today's risk managers to master. The topics and their respective weightings are reviewed yearly to ensure the Exams are timely and relevant. The Study Guide also contains a full listing of all the readings that are recommended as preparation for the FRM Exams Part I and Part II.

Key concepts appear as bullet points at the beginning of each section and are intended to help candidates identify the major themes and knowledge areas associated with that section.

FRM Exam Approach

The FRM Exams are practice oriented. The questions are based on both theory, as set forth in the readings, and real-world applications. Candidates are expected to understand risk management concepts and approaches, as well as how they would apply to a risk manager's day-to-day activities. It is rare that a risk manager will be faced with an issue that can immediately be slotted into one category. In the real world, a risk manager must be able to identify any number of risk-related issues and deal with them effectively.

As such, the Exams are comprehensive in nature, testing a candidate on a number of risk management concepts and approaches.

Readings

Questions for the FRM Exams are related to and supported by the readings listed under each topic outline. These readings were selected by the FRM Committee to assist candidates in their review of the subjects covered by the Exams. It is strongly suggested that candidates review these readings in depth prior to sitting for each Exam. All of the readings listed in the FRM Study Guide are available through GARP. Further information can be found on the GARP website.

FRM Exam Preparation Providers

Some candidates may want to review more formally the materials with FRM Exam Preparation Providers (EPPs). A list of EPPs that have registered with GARP can be found on the GARP website. GARP does not endorse any EPP, but merely lists them as a service to FRM candidates.

On the following pages, an asterisk after a reading indicates that the reading is freely available on the GARP website.

FRM EXAM PART I

FOUNDATIONS OF RISK MANAGEMENT

QUANTITATIVE ANALYSIS

FINANCIAL MARKETS AND PRODUCTS

VALUATION AND RISK MODELS

FOUNDATIONS OF RISK MANAGEMENT

PART I EXAM WEIGHT | 20%

Topics and Readings

This area focuses on foundational concepts of risk management and how risk management can add value to an organization. The broad knowledge points covered in Foundations of Risk Management include the following:

- Basic risk types, measurement, and management tools
- Creating value with risk management
- Risk governance and corporate governance
- Credit risk transfer mechanisms
- The Capital Asset Pricing Model (CAPM)
- Risk-adjusted performance measurement
- Multifactor models
- Data aggregation and risk reporting
- Financial disasters and risk management failures
- Ethics and the GARP Code of Conduct
- Enterprise risk management (ERM)

A proprietary book for FRM candidates has been created to cover these broad knowledge points. While detailed learning objectives associated with these readings are presented in the 2024 FRM Learning Objectives document, a brief summary of how to relate these readings to the knowledge points follows.

Chapters 1 and 2 explore different risk types, how risks can arise in an organization, and how firms manage financial risks. Chapter 3 describes the role of corporate governance in risk management, including the role of the board of directors and other areas of an organization. The concept of risk appetite and how it is translated into a risk appetite framework and communicated throughout an organization is presented as well in this chapter.

Chapter 4 presents an overview of credit risk transfer mechanisms, including credit derivatives and securitization, and discusses issues with the securitization of subprime mortgages. Chapter 5 presents Modern Portfolio Theory (MPT) and the CAPM, one of the foundational developments in risk-adjusted pricing and valuation. Chapter 6 explains how the Arbitrage Pricing Theory (APT) and factor models can be used to model returns on investment assets.

Data is the lifeblood of many large financial organizations, and aggregating and reporting risk data have become increasingly important. Chapter 7 addresses this topic. Chapter 8 introduces enterprise risk management (ERM), a commonly used method for assessing and managing risk in an organizational context, and discusses its future trends.

As it is always important to learn from historical experience, Chapter 9 describes various financial disasters from the past, and Chapter 10 focuses on the financial crisis of 2007-2009.

To help ensure ethical standards are upheld in the risk management profession, Chapter 11 contains GARP's Code of Conduct, which applies to all candidates and those who complete FRM Certification.

Readings for Foundations of Risk Management

All Foundations of Risk Management curated readings are contained in GARP's proprietary Foundations of Risk Management book. The contents of this book are as follows:

- Chapter 1. The Building Blocks of Risk Management
- Chapter 2. How Do Firms Manage Financial Risk?
- Chapter 3. The Governance of Risk Management
- Chapter 4. Credit Risk Transfer Mechanisms
- Chapter 5. Modern Portfolio Theory and Capital Asset Pricing Model
- Chapter 6. The Arbitrage Pricing Theory and Multifactor Models of Risk and Return
- Chapter 7. Principles for Effective Data Aggregation and Risk Reporting
- Chapter 8. Enterprise Risk Management and Future Trends
- Chapter 9. Learning from Financial Disasters
- Chapter 10. Anatomy of the Great Financial Crisis of 2007-2009
- Chapter 11. GARP Code of Conduct*

* This reading is freely available on the GARP website

QUANTITATIVE ANALYSIS

PART I EXAM WEIGHT | 20%

Topics and Readings

This area focuses on basic probability and statistics, regression and time series analysis, and various quantitative techniques useful in risk management. The broad knowledge points covered in Quantitative Analysis include the following:

- Discrete and continuous probability distributions
- Estimating the parameters of distributions
- Population and sample statistics
- Bayesian analysis
- Statistical inference and hypothesis testing
- Measures of correlation
- Linear regression with single and multiple regressors
- Time series analysis and forecasting
- Simulation methods
- Machine learning

A proprietary book for FRM candidates has been created to cover these broad knowledge points. While detailed learning objectives associated with these readings are presented in the 2024 FRM Learning Objectives document, a brief summary of how to relate these readings to the knowledge points follows.

Chapters 1 through 6 introduce fundamental concepts related to probability, statistics, probability distributions, Bayesian analysis, hypothesis testing, and confidence intervals.

Regression analysis is an important statistical tool used to investigate relationships between variables. Chapters 7 and 8 give a general introduction to single and multivariate linear regression analysis. Chapter 9 examines model specification and explores how potential deficiencies in model specification can be identified through conducting standard specification checks, which include the use of residual diagnostics and tests of statistical hypotheses.

Time series data occur frequently in finance. The next two chapters describe methods for analyzing time series data in order to estimate statistics, extract meaningful data characteristics, and produce forecasts of future values. Chapter 10 focuses on modeling stationary time series, while Chapter 11 discusses the modeling of non-stationary time series.

Dependence and variation are important subjects in risk management. Chapter 12 introduces volatility, correlation, and returns, as well as the properties of these three measures in the context of both normally and non-normally distributed variables.

Simulation methods are used to value and analyze complex financial instruments and portfolios. Chapter 13 introduces two

closely related simulation methods, Monte Carlo simulation and bootstrapping, and outlines some of their applications. It also explains the advantages and disadvantages of using simulations and the techniques employed to reduce Monte Carlo sampling error.

The last two chapters introduce machine learning as an alternative approach to traditional model-building techniques tackled in the previous chapters and highlight its growing applications in finance. Chapter 14 details the various ways data can be prepared for machine learning applications and distinguishes among the types of machine learning models, while Chapter 15 presents several leading supervised machine learning models used for classification and prediction problems.

Readings for Quantitative Analysis

All Quantitative Analysis readings are contained in GARP's proprietary Quantitative Analysis book. The contents of this book are as follows:

- Chapter 1. Fundamentals of Probability
- Chapter 2. Random Variables
- Chapter 3. Common Univariate Random Variables
- Chapter 4. Multivariate Random Variables
- Chapter 5. Sample Moments
- Chapter 6. Hypothesis Testing
- Chapter 7. Linear Regression
- Chapter 8. Regression with Multiple Explanatory Variables
- Chapter 9. Regression Diagnostics
- Chapter 10. Stationary Time Series
- Chapter 11. Non-stationary Time Series
- Chapter 12. Measuring Returns, Volatility, and Correlation
- Chapter 13. Simulation and Bootstrapping
- Chapter 14. Machine Learning Methods
- Chapter 15. Machine Learning and Prediction

FINANCIAL MARKETS AND PRODUCTS

PART I EXAM WEIGHT | 30%

Topics and Readings

This area focuses on financial products and the markets in which they trade, more specifically, the following knowledge areas:

- Structure and functions of financial institutions
- Structure and mechanics of over-the-counter (OTC) and exchange markets
- Structure, mechanics, and valuation of forwards, futures, swaps, and options
- Hedging with derivatives
- Interest rates and measures of interest rate sensitivity
- Foreign exchange risk
- Corporate bonds
- Mortgage-backed securities (MBS)

To cover these broad knowledge points, a proprietary book has been created exclusively for FRM candidates. While detailed learning objectives associated with these readings are presented in the 2024 FRM Learning Objectives document, a brief summary of how to relate these readings to the knowledge points follows.

The first chapter describes the structure of commercial and investment banking, the way banks are regulated, the nature of risks they face, the role of capital in providing cushion against losses, and the securitization process for MBS. Chapter 2 explains the risks and regulations faced by insurance companies, their capital requirements, and performance ratios, as well as the types and key characteristics of pension funds. Chapter 3 introduces mutual funds, exchange-traded funds, and hedge funds, and describes various hedge fund strategies and performance measures.

Financial derivatives play a key role in risk management. Chapter 4 describes options, forwards, and futures along with the derivatives markets and the risks faced by market participants. The exchange-traded and OTC markets are explained in Chapter 5. Chapter 6 describes the structures and operations of central counterparties (CCPs), and the types of risks faced by CCPs. Chapters 7 and 8 explain the mechanics of futures markets and how futures are used for hedging. Chapter 9 describes the foreign exchange markets and explains methods for estimating foreign exchange risk, multicurrency hedging strategies using options, the determination of exchange rates, and the covered interest rate parity theorem.

Chapters 10 and 11 provide deeper coverage of financial forwards and futures, including their pricing and the determination of no-arbitrage values for commodity forwards and futures. The following four chapters (12 through 15) examine options and their use in risk management, including the properties of different options, option market mechanics, multi-option and hedging strategies, and different exotic options.

Interest rates and two important classes of fixed income securities are covered in the next three chapters. Chapter 16 describes properties of interest rates and explains bond valuation, duration, and convexity, the pricing of forward rate agreements, and the theories of term structure. Chapter 17 describes corporate bonds, their types and characteristics, and credit ratings. Chapter 18 defines mortgages, explains the valuation of MBS pools, prepayment modeling, and calculations of mortgage pool metrics.

The last two chapters examine two additional derivative instruments. Chapter 19 describes interest rates and Treasury bonds in relation to forward and futures prices, along with the use of interest rate futures in hedging. The mechanics, types, and the pricing of swaps contracts used for hedging are described in Chapter 20.

Readings for Financial Markets and Products

All Financial Markets and Products readings are contained in GARP's proprietary Financial Markets and Products book. The contents of this book are as follows:

- Chapter 1. Banks
- Chapter 2. Insurance Companies and Pension Plans
- Chapter 3. Fund Management
- Chapter 4. Introduction to Derivatives
- Chapter 5. Exchanges and OTC Markets
- Chapter 6. Central Clearing
- Chapter 7. Futures Markets
- Chapter 8. Using Futures for Hedging
- Chapter 9. Foreign Exchange Markets
- Chapter 10. Pricing Financial Forwards and Futures
- Chapter 11. Commodity Forwards and Futures
- Chapter 12. Options Markets
- Chapter 13. Properties of Options
- Chapter 14. Trading Strategies
- Chapter 15. Exotic Options
- Chapter 16. Properties of Interest Rates
- Chapter 17. Corporate Bonds
- Chapter 18. Mortgages and Mortgage-Backed Securities
- Chapter 19. Interest Rate Futures
- Chapter 20. Swaps

VALUATION AND RISK MODELS

PART I EXAM WEIGHT | 30%

Topics and Readings

This area focuses on valuation techniques and risk models. The broad knowledge points covered in Valuation and Risk Models include the following:

- Value-at-risk (VaR)
- Expected shortfall (ES)
- Estimating volatility and correlation
- Economic and regulatory capital
- Stress testing and scenario analysis
- Option valuation
- Fixed-income valuation
- Hedging
- Country and sovereign risk models and management
- External and internal credit ratings
- Expected and unexpected losses
- Operational risk

To cover these broad knowledge points, a proprietary book has been created exclusively for FRM candidates. While detailed learning objectives associated with these readings are presented in the 2024 FRM Learning Objectives document, a brief summary of how to relate these readings to the knowledge points follows.

The first three chapters introduce financial risk measures and models. Chapter 1 examines measures of financial risk and describes measurement frameworks such as the mean-variance approach, VaR, and ES. Chapter 2 covers VaR and ES estimation approaches and applications. Chapter 3 discusses the calculation and monitoring of volatility used in the VaR and ES models.

The next three chapters introduce credit risk. Chapter 4 describes credit ratings and presents a review of external and internal rating methodologies, along with their relative strengths and weaknesses. Chapter 5 explains specific sources of country risk and the use of external ratings in assessing sovereign default risk. Chapter 6 covers the basics of credit risk, specifically expected loss (EL) and unexpected loss (UL), for both individual assets and portfolios, and describes default risk models such as the Gaussian copula model, the Vasicek model, and CreditMetrics.

Chapter 7 introduces aspects of operational risk and discusses various approaches for determining capital for operational risk. Stress testing, its importance, applications, and practices are explained in Chapter 8.

Chapters 9 through 13 focus on risk management for fixed-income securities. Chapters 9 through 11 cover the various tools of fixed-income valuation, while Chapters 12 and 13 explain risk metrics and hedging.

The last three chapters discuss key elements of option pricing and option sensitivities. Chapters 14 and 15 cover option valuation using binomial trees and the Black-Scholes-Merton model. Chapter 16 presents applications of options for hedging and risk management.

Readings for Valuation and Risk Models

All Valuation and Risk Models readings are contained in GARP's proprietary Valuation and Risk Models book. The contents of this book are as follows:

- Chapter 1. Measures of Financial Risk
- Chapter 2. Calculating and Applying VaR
- Chapter 3. Measuring and Monitoring Volatility
- Chapter 4. External and Internal Credit Ratings
- Chapter 5. Country Risk: Determinants, Measures, and Implications
- Chapter 6. Measuring Credit Risk
- Chapter 7. Operational Risk
- Chapter 8. Stress Testing
- Chapter 9. Pricing Conventions, Discounting, and Arbitrage
- Chapter 10. Interest Rates
- Chapter 11. Bond Yields and Return Calculations
- Chapter 12. Applying Duration, Convexity, and DV01
- Chapter 13. Modeling Non-Parallel Term Structure Shifts and Hedging
- Chapter 14. Binomial Trees
- Chapter 15. The Black-Scholes-Merton Model
- Chapter 16. Option Sensitivity Measures: The "Greeks"

FRM EXAM PART II

MARKET RISK MEASUREMENT AND MANAGEMENT

CREDIT RISK MEASUREMENT AND MANAGEMENT

OPERATIONAL RISK AND RESILIENCE

LIQUIDITY AND TREASURY RISK MEASUREMENT AND MANAGEMENT

RISK MANAGEMENT AND INVESTMENT MANAGEMENT

CURRENT ISSUES IN FINANCIAL MARKETS

MARKET RISK MEASUREMENT AND MANAGEMENT

PART II EXAM WEIGHT | 20%

Topics and Readings

This area focuses on market risk measurement and management techniques. The broad knowledge points covered in Market Risk Measurement and Management include the following:

- VaR and other risk measures
  - Parametric and non-parametric methods of estimation
  - VaR mapping
  - Backtesting VaR
  - Expected shortfall (ES) and other coherent risk measures
  - Extreme Value Theory (EVT)
- Modeling dependence: correlations and copulas
- Term structure models of interest rates
- Volatility: smiles and term structures
- Fundamental Review of the Trading Book (FRTB)

To cover these broad knowledge points, a set of curated readings is listed on the following page. While detailed learning objectives associated with these readings are presented in the 2024 FRM Learning Objectives document, a brief summary of how to relate these readings to the knowledge points follows.

The importance of VaR and other common risk measures in assessing risk cannot be overstated. Reading 1 presents both parametric and non-parametric estimation techniques for VaR and ES. Backtesting as a form of model validation, and the use of VaR and VaR mapping as a tool to address portfolio risk factors, is presented in the two chapters of Reading 2. Reading 3 completes the risk measures coverage by showing the uses and applications of VaR and ES in a trading book context while addressing some academic literature associated with market risk management.

Modern risk management requires an understanding of correlation risk. Reading 4 explains the basics of correlation risk and explores the empirical properties, models, and modeling approaches related to correlation risk. The first chapter covers the basics of correlation risk and how it is related to credit risk, market risk, systemic risk, and concentration risk. The second chapter explores how correlations behave in different economic states as well as mean reversion and autocorrelation. The third chapter explains the purpose and uses of copula functions.

The five chapters in Reading 5 are all associated with term structure models and their impact on pricing and hedging fixed-income products and interest rate derivatives. Various regression hedges are explained in the first chapter. Term structure models that deal with drifts, mean reversions, negative short-term rates, and time-dependent volatilities are all reviewed in subsequent chapters. Specific term structure models such as the Ho-Lee, Vasicek, Cox-Ingersoll-Ross, and lognormal models are discussed in this reading.

Reading 6 covers very specific concepts related to the shapes of volatility smiles.

A discussion on the fundamental review of trading book capital requirements is covered in Reading 7.

Readings for Market Risk Measurement and Management

1. **Kevin Dowd, *Measuring Market Risk, 2nd Edition* (West Sussex, UK: John Wiley & Sons, 2005).**
   - Chapter 3. Estimating Market Risk Measures: An Introduction and Overview
   - Chapter 4. Non-parametric Approaches
   - Chapter 7: Parametric Approaches (II): Extreme Value

2. **Philippe Jorion, *Value at Risk: The New Benchmark for Managing Financial Risk, 3rd Edition* (New York, NY: McGraw-Hill, 2007).**
   - Chapter 6. Backtesting VaR
   - Chapter 11. VaR Mapping

3. **"Messages from the academic literature on risk measurement for the trading book," Basel Committee on Banking Supervision, Working Paper No. 19, January 2011.**

4. **Gunter Meissner, *Correlation Risk Modeling and Management, 2nd Edition* (Risk Books, 2019).**
   - Chapter 1. Correlation Basics: Definitions, Applications, and Terminology
   - Chapter 2. Empirical Properties of Correlation: How Do Correlations Behave in the Real World?
   - Chapter 5. "Financial Correlation Modeling—Bottom-Up Approaches (pages 126-134 only)

5. **Bruce Tuckman and Angel Serrat, *Fixed Income Securities: Tools for Today's Markets, 3rd Edition* (Hoboken, NJ: John Wiley & Sons, 2011).**
   - Chapter 6. Empirical Approaches to Risk Metrics and Hedging
   - Chapter 7. The Science of Term Structure Models
   - Chapter 8. The Evolution of Short Rates and the Shape of the Term Structure
   - Chapter 9. The Art of Term Structure Models: Drift
   - Chapter 10. The Art of Term Structure Models: Volatility and Distribution

6. **John C. Hull, *Options, Futures, and Other Derivatives, 10th Edition* (New York, NY: Pearson, 2017).**
   - Chapter 20. Volatility Smiles

7. **John C. Hull, *Risk Management and Financial Institutions, 5th Edition* (Hoboken, NJ: John Wiley & Sons, 2018).**
   - Chapter 18. Fundamental Review of the Trading Book

CREDIT RISK MEASUREMENT AND MANAGEMENT

PART II EXAM WEIGHT | 20%

Topics and Readings

This area focuses on a candidate's understanding of credit risk management, with some attention given to structured finance and credit products such as collateralized debt obligations and credit derivatives. The broad areas of knowledge covered in readings related to Credit Risk Measurement and Management include the following:

- Credit analysis
- Default risk: quantitative methodologies
- Expected and unexpected loss
- Credit VaR
- Counterparty risk
- Credit derivatives
- Structured finance and securitization

To cover these broad knowledge points, a set of curated readings is listed beginning on the following page. While detailed learning objectives associated with these readings are presented in the 2024 FRM Learning Objectives document, a brief summary of how to relate these readings to the knowledge points follows.

Reading 8 includes two chapters that introduce the key themes of credit risk management. The first chapter discusses the components of credit risk, types of credit risk analysis, and credit risk measurements. The second chapter describes governance and explains the responsibilities of risk management in an organization. Reading 9 describes the tools and methods of credit analysis. It explains the components of credit risk management capability and discusses elements of an effective lending or financing policy.

Reading 10 covers measurement of credit risk, especially expected loss and unexpected loss, and the effect of correlation on portfolio unexpected loss. It describes a framework for calculating economic capital for credit risk and explores the challenges of quantifying credit risk.

The next three readings discuss key features of a good rating system and the relationship between ratings and the probability of default. Reading 11 includes two chapters. The first chapter describes different approaches to credit risk modeling and assessment, including the judgmental approaches, empirical models, and financial models to predict default. The second chapter presents the role of ratings in supporting credit risk management and rating assignment methodologies. Reading 12 defines and compares the risk management and scoring models of retail and corporate credit risk. Reading 13 describes measures of sovereign default risk and explains components of a sovereign rating.

Quantitative methodologies of estimating credit risk are covered in two chapters of Reading 14. The first chapter describes default intensity models, explains credit spread risk, and defines the relationship between a default probability and a hazard rate. The second chapter introduces credit value at risk and the tools for measuring it.

Reading 15 includes two chapters that provide a deeper coverage of portfolio and structured credit risk. The first chapter defines default correlation for credit portfolios, assesses the impact of correlation on credit VaR, and describes the use of the single factor model to measure portfolio credit risk. The second chapter describes common types of structured products and the mechanics of a securitization and explains how default sensitivities for tranches are measured.

Reading 16 extends discussions on quantitative methodologies of estimating credit risk and explains the distinction between reduced form and structural default correlation models. Assessment of credit derivatives is covered, and the various credit risk mitigants and their role in credit analysis are examined.

Counterparty risk is discussed in seven chapters that form Reading 17. The first chapter introduces derivatives and explains how derivative transactions create counterparty credit risk. The next four chapters identify ways of managing and mitigating counterparty risk and describe the effects of netting, close-out, collateral on credit exposure, and central clearing. The sixth chapter describes the determination of credit exposure, the pricing of exposure profiles for derivative contracts, and the impact of collateral on funding, while the last chapter covers the analysis of credit value adjustment (CVA) and debt value adjustment (DVA), and the concept of wrong-way risk.

Reading 18 describes stress tests on CVA and counterparty credit risk (CCR).

Finally, Reading 19 describes special purpose vehicles (SPVs), explains performance analysis tools for securitized structures, and describes the various prepayment forecasting methodologies.

Readings for Credit Risk Measurement and Management

8. **Sylvain Bouteille and Diane Coogan-Pushner, *The Handbook of Credit Risk Management: Originating, Assessing, and Managing Credit Exposures, 2nd Edition* (Hoboken, NJ: John Wiley & Sons, 2022).**
    - Chapter 1. Fundamentals of Credit Risk
    - Chapter 2. Governance

9. **Hennie van Greuning and Sonja Brajovic Bratanovic, *Analyzing Banking Risk, Fourth Edition* (World Bank Group, 2020).**
    - Chapter 7. Credit Risk Management

10. **Gerhard Schroeck, *Risk Management and Value Creation in Financial Institutions* (New York, NY: John Wiley & Sons, 2002).**
    - Chapter 5. Capital Structure in Banks (pages 170-186 only)

11. **Michalis Doumpos, Christos Lemonakis, Dimitrios Niklis, and Constantin Zopounidis, *Analytical Techniques in the Assessment of Credit Risk: An Overview of Methodologies and Applications* (Springer, 2019).**
    - Chapter 1. Introduction to Credit Risk Modeling and Assessment
    - Chapter 2. Credit Scoring and Rating

12. **Michel Crouhy, Dan Galai and Robert Mark, *The Essentials of Risk Management*, 2nd Edition (New York, NY: McGraw-Hill, 2014).**
    - Chapter 9. Credit Scoring and Retail Credit Risk Management

13. **Aswath Damodaran, *Country Risk: Determinants, Measures, and Implications – The 2022 Edition* (2022)**

14. **John C. Hull, *Risk Management and Financial Institutions, Sixth Edition* (John Wiley & Sons, 2023).**
    - Chapter 17. Estimating Default Probabilities
    - Chapter 19. Credit Value at Risk

15. **Allan Malz, *Financial Risk Management: Models, History, and Institutions* (Hoboken, NJ: John Wiley & Sons, 2011).**
    - Chapter 8. Portfolio Credit Risk (Sections 8.1, 8.2, 8.3 only)
    - Chapter 9. Structured Credit Risk

16. **John C. Hull, *Options, Futures, and Other Derivatives, 11th Edition* (Pearson, 2022).**
    - Chapter 24. Credit Risk
    - Chapter 25. Credit Derivatives

17. **Jon Gregory, *The xVA Challenge: Counterparty Credit Risk, Funding, Collateral, and Capital* (West Sussex, UK: John Wiley & Sons, 2020).**
    - Chapter 2. Derivatives
    - Chapter 3. Counterparty Risk and Beyond
    - Chapter 6. Netting, Close-out and Related Aspects
    - Chapter 7. Margin (Collateral) and Settlement
    - Chapter 8. Central Clearing
    - Chapter 11. Future Value and Exposure
    - Chapter 17. CVA

18. ***Stress Testing: Approaches, Methods, and Applications*, edited by Akhtar Siddique and Iftekhar Hasan (London, UK: Risk Books, 2013).**
    - Chapter 4. The Evolution of Stress Testing Counterparty Exposures

19. **Moorad Choudhry, *Structured Credit Products: Credit Derivatives & Synthetic Securitisation, 2nd Edition* (New York, NY: John Wiley & Sons, 2010).**
    - Chapter 12. An Introduction to Securitisation

OPERATIONAL RISK AND RESILIENCE

PART II EXAM WEIGHT | 20%

Topics and Readings

This area focuses on methods to measure and manage operational risk as well as methods to manage risk across an organization, including risk governance, stress testing, and regulatory compliance. The broad knowledge points covered in Operational Risk and Resilience include the following:

- Governance of operational risk management frameworks
- Identification, classification, and reporting of operational risks
- Measurement and assessment of operational risks
- Mitigation of operational risks
- Cyber-resilience and operational resilience
- Risks related to money laundering, financing of terrorism, financial crime, and fraud
- Third-party outsourcing risk
- Model risk and model validation
- Stress testing banks
- Risk-adjusted return on capital (RAROC)
- Economic capital frameworks and capital planning
- Regulation and the Basel Accords

To cover these broad knowledge points, a set of proprietary and curated readings is listed beginning on the following page. While detailed learning objectives associated with these readings are presented in the 2024 FRM Learning Objectives, a brief summary of how to relate these readings to the knowledge points follows.

This area is divided into two sections. The first section, Reading 20, provides a proprietary holistic overview of operational risk and resilience. Chapter 1 introduces operational risk management frameworks and operational resilience, while Chapter 2 goes deeper into the governance of a framework. Chapter 3 describes different approaches for the identification and classification of operational risks, while Chapter 4 explains approaches and metrics firms can use to measure and assess operational risk and establish a strong level of operational resilience. Chapter 5 presents methods firms can use to mitigate operational risk, including a discussion of risk control frameworks. To round out this section, Chapter 6 describes best practices and challenges in risk reporting and Chapter 7 addresses some integrated risk management topics with an emphasis on stress testing.

The second section presents a series of focus areas to explore best practices more deeply in managing some key types of operational risk. In some of these focus areas, the discussion is complemented by case studies describing historical events and valuable lessons that risk managers can learn in managing each type of risk. Readings 21 and 22 focus on cyber risk management and current practices in cyber-resilience, while Readings 23 and 24 provide insights into managing financial crime and fraud risk. In the next focus area, Readings 25 and 26 present best practices in managing risk related to third-party vendors and case studies on investor protection and compliance risks. Readings 27 and 28 follow with a discussion of model risk. Important

concepts presented in this area include best practices for identifying and mitigating model risk as well as model validation. The next focus area covers stress testing and capital planning. Reading 29 continues the discussion of stress testing by comparing different stress testing approaches. Reading 30 introduces capital planning and RAROC, while readings 31 and 32 extend the discussion by presenting best practices in capital planning and recommended practices for stress testing at larger banks. Finally, readings 33 through 36 provide a detailed overview of the Basel regulations including their historical evolution and more recent recommendations. For the interested candidate, the full Basel regulation documents are presented as optional readings.

Readings for Operational Risk and Resilience

20. Global Association of Risk Professionals, *Operational Risk and Resilience* (New York, NY: Pearson, 2022).

- Chapter 1. Introduction to Operational Risk and Resilience
- Chapter 2. Risk Governance
- Chapter 3. Risk Identification
- Chapter 4. Risk Measurement and Assessment
- Chapter 5. Risk Mitigation
- Chapter 6. Risk Reporting
- Chapter 7. Integrated Risk Management

21. "Cyber-resilience: Range of practices," Basel Committee on Banking Supervision Publication, December 2018.

22. Global Association of Risk Professionals, *Operational Risk and Resilience* (New York, NY: Pearson, 2022).

- Chapter 9. Case Study: Cyberthreats and Information Security Risks

23. "Sound Management of Risks related to Money Laundering and Financing of Terrorism," Basel Committee on Banking Supervision, revised July 2020. (through p.16, para. 83)

24. Global Association of Risk Professionals, *Operational Risk and Resilience* (New York, NY: Pearson, 2022).

- Chapter 11. Case Study: Financial Crime and Fraud

25. "Guidance on Managing Outsourcing Risk," Board of Governors of the Federal Reserve System, December 2013.

26. Global Association of Risk Professionals, *Operational Risk and Resilience* (New York, NY: Pearson, 2022).

- Chapter 13. Case Study: Third-party Risk Management
- Chapter 14. Case Study: Investor Protection and Compliance Risks in Investment Activities

27. "Supervisory Guidance on Model Risk Management," Federal Deposit Insurance Corporation, June 7, 2017.

28. Global Association of Risk Professionals, *Operational Risk and Resilience* (New York, NY: Pearson, 2022).

- Chapter 16. Case Study: Model Risk and Model Validation

29. Stress Testing Banks (Til Schuermann, *International Journal of Forecasting* 30, no. 3, 2014): 717–728.

30. Michel Crouhy, Dan Galai and Robert Mark, *The Essentials of Risk Management, 2nd Edition* (New York, NY: McGraw-Hill, 2014).

- Chapter 17. Risk Capital Attribution and Risk-Adjusted Performance Measurement

31. **"Range of practices and issues in economic capital frameworks," Basel Committee on Banking Supervision Publication, March 2009.**

32. **"Capital Planning at Large Bank Holding Companies: Supervisory Expectations and Range of Current Practice," Board of Governors of the Federal Reserve System, August 2013.**

33. **Mark Carey, "Capital Regulation Before the Global Financial Crisis," GARP Risk Institute, April 2019.**

34. **Mark Carey, "Solvency, Liquidity and Other Regulation After the Global Financial Crisis," GARP Risk Institute, April 2019.**

35. **"High-level summary of Basel III reforms," Basel Committee on Banking Supervision Publication, December 2017.**

36. **"Basel III: Finalising post-crisis reforms," Basel Committee on Banking Supervision Publication, December 2017, pp. 128-136**

Optional Regulatory Readings for Reference

Candidates are expected to understand the objective and general structure of important international regulatory frameworks and general application of the various approaches for calculating minimum capital requirements, as described in the readings above. Candidates interested in the complete regulatory framework can review the following:

"Revisions to the Principles for the Sound Management of Operational Risk," Basel Committee on Banking Supervision Publication, March 2021.

"Principles for Operational Resilience," Basel Committee on Banking Supervision Publication, March 2021.

"Basel II: International Convergence of Capital Measurement and Capital Standards: A Revised Framework - Comprehensive Version," Basel Committee on Banking Supervision Publication, June 2006.*

"Basel III: A global regulatory framework for more resilient banks and banking systems—revised version," Basel Committee on Banking Supervision Publication, June 2011.*

"Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools," Basel Committee on Banking Supervision Publication, January 2013.*

"Revisions to the Basel II market risk framework—updated as of 31 December 2010," Basel Committee on Banking Supervision Publication, February 2011.*

"Basel III: The net stable funding ratio." Basel Committee on Banking Supervision Publication, October 2014.*

"Minimum capital requirements for market risk," Basel Committee on Banking Supervision Publication, January 2016.*

"Basel III: Finalising post-crisis reforms," Basel Committee on Banking Supervision Publication, December 2017.*

* This reading is freely available on the GARP website

LIQUIDITY AND TREASURY RISK MEASUREMENT AND MANAGEMENT

PART II EXAM WEIGHT | 15%

Topics and Readings

This area focuses on methods to measure and manage liquidity and treasury risk. The broad knowledge points covered in the Liquidity and Treasury Risk Management section include the following:

- Liquidity risk principles and metrics
- Liquidity portfolio management
- Cash flow modeling, liquidity stress testing, and reporting
- Contingency funding plan
- Funding models
- Funds transfer pricing
- Cross-currency funding
- Balance sheet management
- Asset liquidity

To cover these broad knowledge points, a set of curated readings is listed beginning on the following page. While detailed learning objectives associated with these readings are presented in the 2024 FRM Learning Objectives, a brief summary of how to relate these readings to the knowledge points follows.

Readings 37, 38, and 39 discuss potential sources of liquidity risk, quantitative liquidity metrics, and institutional liquidity risk management methods. Readings 41, 42, 44, 45, and 46 take this discussion further and present the major components of a holistic liquidity risk management framework, including the development and monitoring of internal liquidity metrics, cash flow modeling, liquidity stress testing, contingency funding planning, managing intraday liquidity, and liquidity risk reporting. Reading 43 addresses liquidity from a dealer bank perspective by explaining potential warning signs that a bank could be failing, potential systemic liquidity risks, and possible policy responses to address these scenarios.

Readings 40, 47, and 52 provide more detail on day-to-day techniques that banks use to manage liquidity and treasury risk, including asset-liability management, liquidity portfolio management, determining funding sources to address liquidity mismatches, and managing deposit accounts and liabilities. Reading 48 explains the market for repurchase agreements.

Transfer pricing, a more technical aspect of liquidity and treasury risk management, is covered in Reading 49, while Readings 50 and 51 provide an international perspective to liquidity risk management by presenting topics such as cross-currency funding and violations of covered interest rate parity.

Finally, Reading 53 addresses liquidity risk from the perspective of an asset manager by providing insights on how to measure and manage the risks of illiquid assets.

Readings for Liquidity and Treasury Risk Measurement and Management

37. John C. Hull, *Risk Management and Financial Institutions, 5th Edition* (Hoboken, NJ: John Wiley & Sons, 2018).

- Chapter 24. Liquidity Risk

38. Allan Malz, *Financial Risk Management: Models, History, and Institutions* (Hoboken, NJ: John Wiley & Sons, 2011).

- Chapter 12. Liquidity and Leverage

39. Shyam Venkat, Stephen Baird, *Liquidity Risk Management: A Practitioner's Perspective* (Hoboken, NJ: John Wiley & Sons, 2016).

- Chapter 6. Early Warning Indicators

40. Peter Rose, Sylvia Hudgins, *Bank Management & Financial Services, 9th Edition* (New York, NY: McGraw-Hill, 2013).

- Chapter 10. The Investment Function in Financial-Services Management
- Chapter 11. Liquidity and Reserves Management: Strategies and Policies

41. Shyam Venkat, Stephen Baird, *Liquidity Risk Management* (Hoboken, NJ: John Wiley & Sons, 2016).

- Chapter 4. Intraday Liquidity Risk Management

42. Antonio Castagna, Francesco Fede, *Measuring and Managing Liquidity Risk* (United Kingdom: John Wiley & Sons, 2013).

- Chapter 6. Monitoring Liquidity

43. Darrell Duffie, (2010), "The Failure Mechanics of Dealer Banks," Journal of Economic Perspectives, 24(1), 51-72.

44. Shyam Venkat, Stephen Baird, *Liquidity Risk Management* (Hoboken, NJ: John Wiley & Sons, 2016).

- Chapter 3. Liquidity Stress Testing

45. Moorad Choudhry, *The Principles of Banking* (Singapore: John Wiley & Sons, 2012).

- Chapter 14. Liquidity Risk Reporting and Stress Testing

46. Shyam Venkat, Stephen Baird, *Liquidity Risk Management* (Hoboken, NJ: John Wiley & Sons, 2016).

- Chapter 7. Contingency Funding Planning

47. Peter Rose, Sylvia Hudgins, *Bank Management & Financial Services, 9th Edition* (New York, NY: McGraw-Hill, 2013).

- Chapter 12. Managing and Pricing Deposit Services
- Chapter 13. Managing Nondeposit Liabilities

48. **Bruce Tuckman and Angel Serrat, *Fixed Income Securities: Tools for Today's Markets, 3rd Edition* (Hoboken, NJ: John Wiley & Sons, 2011).**
    - Chapter 12. Repurchase Agreements and Financing

49. **Joel Grant, (2011), "Liquidity Transfer Pricing: A Guide to Better Practice," Occasional Paper, Financial Stability Board, Bank for International Settlements.**

50. **Patrick McGuire, Goetz von Peter, (2009), "The US Dollar Shortage in Global Banking and the International Policy Response," BIS Working Paper #291, Bank for International Settlements.**

51. **Claudio Borio, Robert McCauley, Patrick McGuire, Vladyslav Sushko, "Covered Interest Parity Lost: Understanding the Cross-Currency Basis," BIS Quarterly Review, Third Quarter 2016.**

52. **Peter Rose, Sylvia Hudgins, *Bank Management & Financial Services, 9th Edition* (New York, NY: McGraw-Hill, 2013).**
    - Chapter 7. Risk Management for Changing Interest Rates: Asset-Liability Management and Duration Techniques

53. **Andrew Ang, *Asset Management: A Systematic Approach to Factor Investing* (New York, NY: Oxford University Press, 2014).**
    - Chapter 13. Illiquid Assets

RISK MANAGEMENT AND INVESTMENT MANAGEMENT

PART II EXAM WEIGHT | 15%

Topics and Readings

This area focuses on risk management techniques applied to the investment management process. The broad knowledge points covered in Risk Management and Investment Management include the following:

- Factor theory
- Portfolio construction
- Portfolio risk measures
- Risk budgeting
- Risk monitoring and performance measurement
- Portfolio-based performance analysis
- Hedge funds

To cover these broad knowledge points, a set of curated readings is listed beginning on the following page. While detailed learning objectives associated with these readings are presented in the 2024 FRM Learning Objectives document, a brief summary of how to relate these readings to the knowledge points follows.

Reading 54 introduces the factor theory of investing, in which asset and portfolio returns and risk premiums are explained by their exposure to specific factors. The first chapter describes the theory of factor risk by starting with the basic single-factor risk premium theory — the CAPM — and then examining multifactor models. The second chapter explains factors that drive risk premiums and compares two types of factors: fundamental-based factors and investment-style factors. The third chapter explores how the sets of factors used to construct a benchmark can affect portfolio alpha.

Reading 55 introduces ways to construct an optimal portfolio given investment constraints.

VaR is an important tool in portfolio management, as it explicitly accounts for leverage and portfolio diversification while providing a single measure of portfolio risk. The first chapter of Reading 56 explains how managers can measure and manage portfolio VaR. The second chapter details some benefits of using VaR in investment management and introduces the process of risk budgeting.

As risk capital is a scarce resource, controls should exist to ensure that risk capital is used in a manner consistent with the firm's risk budget. Reading 57 explains how managers can develop a risk plan, provides tools for risk budgeting, and introduces guidelines for monitoring portfolio risk.

Standardized measurements are helpful for investors in comparing the performance of asset managers. Reading 58 introduces various measures to evaluate portfolio manager performance.

Hedge funds are private investment vehicles that are not open to the general investing public. Reading 59 gives a general introduction to hedge fund styles and Reading 60 describes the process of performing due diligence on funds and fund managers.

Finally, Reading 61 analyzes the predictability of investment fraud through U.S. Securities and Exchange Commission (SEC) filings and explains the efficacy of mandatory disclosures in avoiding fraud.

Readings for Risk Management and Investment Management

54. Andrew Ang, *Asset Management: A Systematic Approach to Factor Investing* (New York, NY: Oxford University Press, 2014).

- Chapter 6. Factor Theory
- Chapter 7. Factors
- Chapter 10. Alpha (and the Low-Risk Anomaly)

55. Richard Grinold and Ronald Kahn, *Active Portfolio Management: A Quantitative Approach for Producing Superior Returns and Controlling Risk, 2nd Edition* (New York, NY: McGraw-Hill, 2000).

- Chapter 14. Portfolio Construction

56. Philippe Jorion, *Value-at-Risk: The New Benchmark for Managing Financial Risk, 3rd Edition* (New York, NY: McGraw Hill, 2007).

- Chapter 7. Portfolio Risk: Analytical Methods
- Chapter 17. VaR and Risk Budgeting in Investment Management

57. Robert Litterman and the Quantitative Resources Group, *Modern Investment Management: An Equilibrium Approach* (Hoboken, NJ: John Wiley & Sons, 2003).

- Chapter 17. Risk Monitoring and Performance Measurement

58. Zvi Bodie, Alex Kane, and Alan J. Marcus, *Investments, 12th Edition* (New York, NY: McGraw- Hill, 2020).

- Chapter 24. Portfolio Performance Evaluation

59. G. Constantinides, M. Harris and R. Stulz, eds., *Handbook of the Economics of Finance, Volume 2B* (Oxford, UK: Elsevier, 2013).

- Chapter 17. Hedge Funds

60. Kevin R. Mirabile, *Hedge Fund Investing: A Practical Approach to Understanding Investor Motivation, Manager Profits, and Fund Performance, 2nd Edition* (Hoboken, NJ: John Wiley & Sons, 2016).

- Chapter 12. Performing Due Diligence on Specific Managers and Funds

61. Stephen G. Dimmock and William C. Gerken: *Finding Bernie Madoff: Predicting Fraud by Investment Managers*, (2012).

CURRENT ISSUES IN FINANCIAL MARKETS

PART II EXAM WEIGHT | 10%

Topics and Readings

This area focuses on current issues that have a strong impact on financial markets. The broad knowledge points covered in Current Issues in Financial Markets include the following:

- 2023 Bank Failures
- Artificial Intelligence (AI)
- Climate Risk
- Blockchain, Cryptocurrency, and Decentralized Finance
- Digital Resilience

To cover these broad knowledge points, a set of curated readings is listed on the following page. While detailed learning objectives associated with these readings are presented in the 2024 FRM Learning Objectives document, a brief summary of how to relate these readings to the knowledge points follows.

Readings 62 and 63 both explore recent bank failures and their causes. Reading 62, "Review of the Federal Reserve's Supervision and Regulation of Silicon Valley Bank" (through page 66), Board of Governors of the Federal Reserve System, is a critical analysis of the failure of Silicon Valley Bank which highlights the bank's risk management deficiencies as well as the shortfalls of its regulatory supervisors. Reading 63, "The Credit Suisse CoCo Wipeout: Facts, Misperceptions, and Lessons for Financial Regulation," Swiss Finance Institute Number 23-32 explores the rescue of Credit Suisse engineered by Swiss regulators and the implications of the regulators' decision to write down the contingent convertible bonds (CoCos) issued by Credit Suisse as part of this rescue.

Reading 64 describes how banking institutions utilize AI-based systems and processes, and covers advantages, disadvantages and difficulties related to AI implementation and usage.

Reading 65 presents considerations for establishing a risk-based governance and testing framework for complex AI/ML models and promotes the control of model risk through a discussion on the use of current technologies, approaches, and platforms that support the formation of responsible, explainable, and ultimately trustworthy AI.

Reading 66 presents a framework designed to equip organizations and individuals with approaches to minimize anticipated negative impacts of AI systems as well as identify opportunities to maximize positive impacts. It addresses challenges for AI risk management, identifies the audience and representative actors across the AI lifecycle, discusses AI trustworthiness, and describes core functions to help organizations manage the risks of AI systems.

The projected increase in the frequency and severity of disasters due to climate change is a potential threat to financial stability. Reading 67 explores how climate-related financial risks can arise and impact banks individually and the banking

system as a whole. Reading 68 provides an overview of conceptual issues related to climate-related financial risk measurement and methodologies, as well as practical implementation by banks and supervisors. Reading 69 lists the Basel Committee principles for effectively managing and supervising climate-related risks by banks.

Reading 70 discusses the crypto ecosystem, examining its components including unbacked cryptocurrencies, stablecoins, and decentralized finance (DeFi). The reading outlines some of the risks arising from the growing use of these technologies.

An increasingly important factor in the stability of financial systems is their ability to be digitally resilient. Reading 71 presents some approaches and policy tools that financial regulators can use to respond to the risks in the area of digital resilience.

Readings for Current Issues in Financial Markets:

62. **"Review of the Federal Reserve's Supervision and Regulation of Silicon Valley Bank" (through page 66), Board of Governors of the Federal Reserve System.**

63. **"The Credit Suisse CoCo Wipeout: Facts, Misperceptions, and Lessons for Financial Regulation," Journal of Applied Corporate Finance, June 2023.**

64. **"Artificial Intelligence and Bank Supervision," Federal Reserve Bank of Richmond, Second Quarter 2023.**

65. **"Financial Risk Management and Explainable, Trustworthy, Responsible AI," Fritz-Morgenthal S, Hein B and Papenbrock J (2022) Frontiers in Artificial Intelligence.**

66. **"Artificial Intelligence Risk Management Framework," National Institute of Standards and Technology.**

67. **"Climate-related risk drivers and their transmission channels," Basel Committee on Banking Supervision Publication, April 2021.**

68. **"Climate-related financial risks – measurement methodologies," Basel Committee on Banking Supervision Publication, April 2021.**

69. **"Principles for the effective management and supervision of climate-related financial risks," Basel Committee on Banking Supervision Publication, June 2022.**

70. **"The Crypto Ecosystem: Key Elements and Risks," Basel Committee on Banking Supervision Publication, July 2023.**

71. **"Digital Resilience and Financial Stability. The Quest for Policy Tools in The Financial Sector" (April 13, 2023). Jose Ramon Martinez, Banco de Espana.**

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