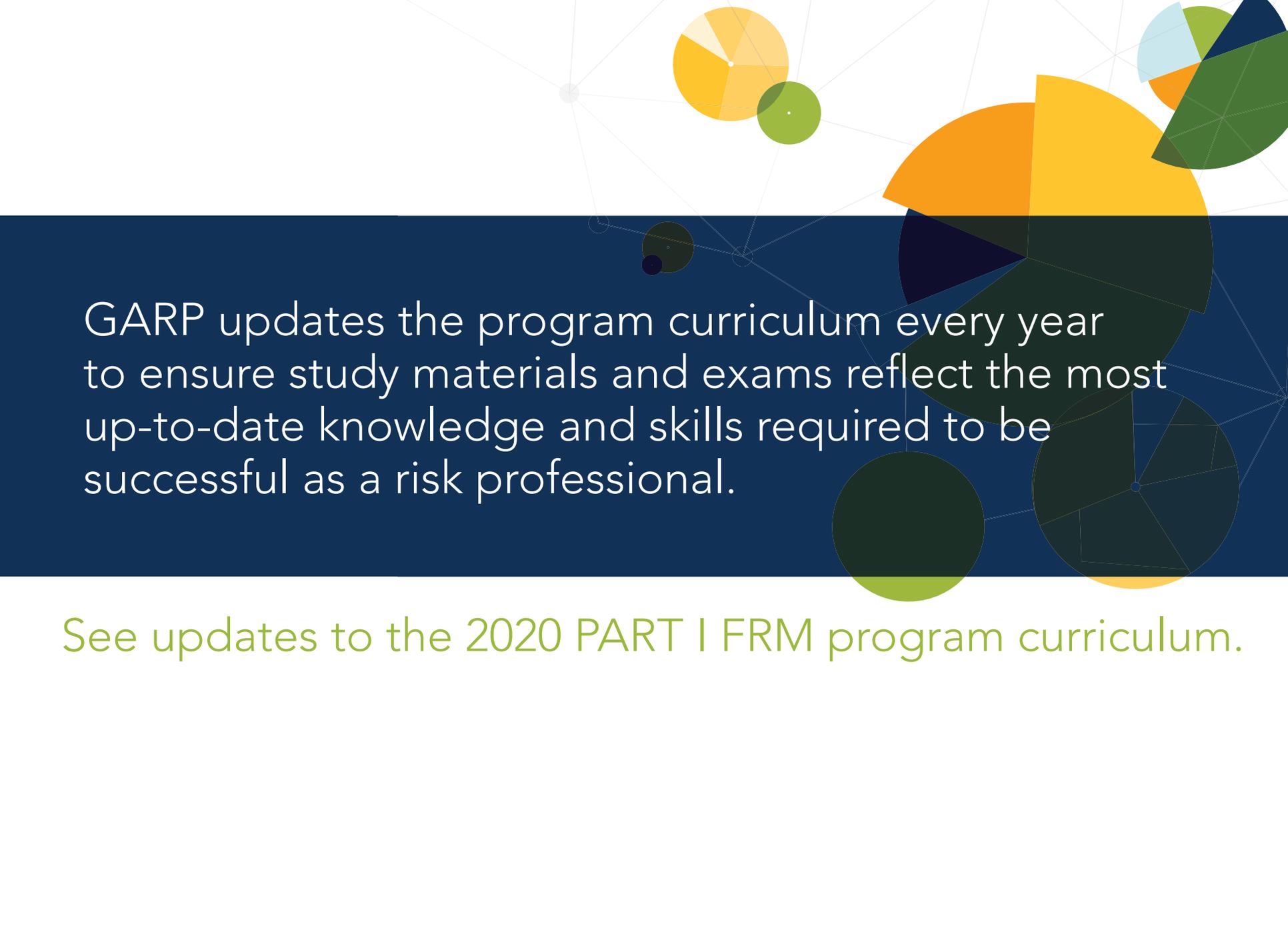# PART I FRM

2020 CURRICULUM UPDATES

WILEY

GARP updates the program curriculum every year to ensure study materials and exams reflect the most up-to-date knowledge and skills required to be successful as a risk professional.

See updates to the 2020 PART I FRM program curriculum.

2019	2020
FRM-1	**FRM-1**
Michel Crouhy, Dan Galai, and Robert Mark, The Essentials of Risk Management, 2nd Edition (New York: McGraw-Hill, 2014). Chapter 1. Risk Management: A Helicopter View (Including Appendix 1.1)	**Michel Crouhy, Dan Galai, and Robert Mark, The Essentials of Risk Management, 2nd Edition (New York: McGraw-Hill, 2014). Chapter 1. Risk Management: A Helicopter View (Including Appendix 1.1)**

2019 FRM-1

- Explain the concept of risk and compare risk management with risk taking.
- Describe the risk management process and identify problems and challenges that can arise in the risk management process.
- Evaluate and apply tools and procedures used to measure and manage risk, including quantitative measures, qualitative assessment, and enterprise risk management.
- Distinguish between expected loss and unexpected loss, and provide examples of each.
- Interpret the relationship between risk and reward and explain how conflicts of interest can impact risk management.
- Describe and differentiate between the key classes of risks, explain how each type of risk can arise, and assess the potential impact of each type of risk on an organization.

2020 FRM-1

- Explain the concept of risk and compare risk management with risk taking.
- ⚠ NEW: Describe elements, or building blocks, of the risk management process and identify problems and challenges that can arise in the risk management process.
- Evaluate and apply tools and procedures used to measure and manage risk, including quantitative measures, qualitative assessment, and enterprise risk management.
- Distinguish between expected loss and unexpected loss, and provide examples of each.
- Interpret the relationship between risk and reward and explain how conflicts of interest can impact risk management.
- Describe and differentiate between the key classes of risks, explain how each type of risk can arise, and assess the potential impact of each type of risk on an organization.
- ⚠ NEW: Explain how risk factors can interact with each other and describe challenges in aggregating risk exposures.

2019	2020
FRM-2	**FRM-2**
Michel Crouhy, Dan Galai, and Robert Mark, The Essentials of Risk Management, 2nd Edition (New York: McGraw-Hill, 2014). Chapter 2. Corporate Risk Management: A Primer	**Michel Crouhy, Dan Galai, and Robert Mark, The Essentials of Risk Management, 2nd Edition (New York: McGraw-Hill, 2014). Chapter 2. Corporate Risk Management: A Primer**

2019 — FRM-2

- Evaluate some advantages and disadvantages of hedging risk exposures.
- Explain considerations and procedures in determining a firm's risk appetite and its business objectives.
- Explain how a company can determine whether to hedge specific risk factors, including the role of the board of directors and the process of mapping risks.
- Apply appropriate methods to hedge operational and financial risks, including pricing, foreign currency and interest rate risk.
- Assess the impact of risk management instruments.

2020 — FRM-2

- [!] NEW: Compare different strategies a firm can use to manage its risk exposures and explain situations in which a firm would want to use each strategy.
- [!] NEW: Explain the relationship between risk appetite and a firm's risk management decisions.
- [!] NEW: Evaluate some advantages and disadvantages of hedging risk exposures, and explain challenges that can arise when implementing a hedging strategy.
- Apply appropriate methods to hedge operational and financial risks, including pricing, foreign currency, and interest rate risk.
- [!] NEW: Assess the impact of risk management tools and instruments, including risk limits and derivatives.

2019	2020
FRM-3	**FRM-3**
Michel Crouhy, Dan Galai, and Robert Mark, **The Essentials of Risk Management, 2nd Edition** **(New York: McGraw-Hill, 2014).** **Chapter 4. Corporate Governance and Risk Management**	**Michel Crouhy, Dan Galai, and Robert Mark,** **The Essentials of Risk Management, 2nd Edition** **(New York: McGraw-Hill, 2014).** **Chapter 4. Corporate Governance and Risk Management**

2019 — FRM-3

- Compare and contrast best practices in corporate governance with those of risk management.
- Assess the role and responsibilities of the board of directors in risk governance.
- Evaluate the relationship between a firm's risk appetite and its business strategy, including the role of incentives.
- Distinguish the different mechanisms for transmitting risk governance throughout an organization.
- Illustrate the interdependence of functional units within a firm as it relates to risk management.
- Assess the role and responsibilities of a firm's audit committee.

2020 — FRM-3

- **!** NEW: Explain changes in corporate risk governance that occurred as a result of the 2007 — 2009 financial crisis.
- Compare and contrast best practices in corporate governance with those of risk management.
- Assess the role and responsibilities of the board of directors in risk governance.
- Evaluate the relationship between a firm's risk appetite and its business strategy, including the role of incentives.
- Illustrate the interdependence of functional units within a firm as it relates to risk management.
- Assess the role and responsibilities of a firm's audit committee.

James Lam, Enterprise Risk Management: From Incentives to Controls, 2nd Edition (Hoboken, NJ: John Wiley & Sons, 2014). Chapter 4. What is ERM?	**James Lam, Enterprise Risk Management: From Incentives to Controls, 2nd Edition (Hoboken, NJ: John Wiley & Sons, 2014). Chapter 4. What is ERM?**

2019	2020
• Describe enterprise risk management (ERM) and compare and contrast differing definitions of ERM.	⚠ • NEW: Compare different types of credit derivatives, explain how each one transfers credit risk, and describe their advantages and disadvantages.
• Compare the benefits and costs of ERM and describe the motivations for a firm to adopt an ERM initiative.	⚠ • NEW: Explain different traditional approaches or mechanisms that firms can use to help mitigate credit risk.
• Describe the role and responsibilities of a chief risk officer (CRO) and assess how the CRO should interact with other senior management.	⚠ • NEW: Evaluate the role of credit derivatives in the 2007 — 2009 financial crisis, and explain changes in the credit derivative market that occurred as a result of the crisis.
• Distinguish between components of an ERM program	⚠ • NEW: Explain the process of securitization, describe a special purpose vehicle (SPV), and assess the risk of different business models that banks can use for securitized products.

FRM-5

FRM-5

René Stulz, Risk Management, Governance, Culture and Risk Taking in Banks, FRBNY Economic Policy Review, (August 2016): 43-59.

Elton, Gruber, Brown and Goetzmann, Modern Portfolio Theory and Investment Analysis, 9th Edition, Chapter 13. Amenc and Le Sourd, Portfolio Theory and Performance Analysis. Chapter 4.

- Assess methods that banks can use to determine their optimal level of risk exposure, and explain how the optimal level of risk can differ across banks

- Describe implications for a bank if it takes too little or too much risk compared to its optimal level

- Explain ways in which risk management can add or destroy value for a bank

- Describe structural challenges and limitations to effective risk management, including the use of VaR in setting limits.

- Assess the potential impact of a bank's governance, incentive structure and risk culture on its risk profile and its performance

- **!** NEW: Explain modern portfolio theory and interpret the Markowitz efficient frontier.

- Understand the derivation and components of the CAPM.

- Describe the assumptions underlying the CAPM.

- Interpret the capital market line.

- Apply the CAPM in calculating the expected return on an asset.

- Interpret beta and calculate the beta of a single asset or portfolio.

- Calculate, compare, and interpret the following performance measures: the Sharpe performance index, the Treynor performance index, the Jensen performance index, the tracking error, information ratio, and Sortino ratio.

2019

FRM-6

Steve Allen, Financial Risk Management: A Practitioner's Guide to Managing Market and Credit Risk, 2nd Edition (New York: John Wiley & Sons, 2013). Chapter 4. Financial Disasters

- Analyze the key factors that led to and derive the lessons learned from the following risk management case studies: Chase Manhattan and their involvement with Drysdale Securities, Kidder Peabody, Barings, Allied Irish Bank, Union Bank of Switzerland, Société Générale, Long Term Capital Management, Metallgesellschaft, Bankers Trust, JPMorgan, Citigroup, and Enron

2020

FRM-6

Zvi Bodie, Alex Kane, and Alan J. Marcus, Investments, 10th Edition (New York: McGraw-Hill, 2013). Chapter 10. Arbitrage Pricing Theory and Multifactor Models of Risk and Return

- **!** NEW: Explain the arbitrage pricing theory (APT), describe its assumptions, and compare the APT to the CAPM.
- Describe the inputs (including factor betas) to a multifactor model.
- Calculate the expected return of an asset using a single-factor and a multifactor model.
- **!** NEW: Explain models that account for correlations between asset returns in a multi-asset portfolio.
- Explain how to construct a portfolio to hedge exposure to multiple factors.
- Describe and apply the Fama-French three factor model in estimating asset returns.

2019

FRM-7

Markus K. Brunnermeir, 2009.
Deciphering the Liquidity and Credit Crunch 2007—2008,
Journal of Economic Perspectives 23:1, 77—100

- Describe the key factors the led to the housing bubble.
- Explain the banking industry trends leading up to the liquidity squeeze and assess the triggers for the liquidity crisis.
- Explain the purposes and uses of credit default swaps.
- Describe how securitized and structured products were used by investor groups and describe the consequences of their increased use.
- Describe how the financial crisis triggered a series of worldwide financial and economic consequences.
- Distinguish between funding liquidity and market liquidity and explain how the evaporation of liquidity can lead to a financial crisis.
- Analyze how an increase in counterparty credit risk can generate additional funding needs and possible systemic risk

2020

FRM-7

Principles for Effective Data Aggregation
and Risk Reporting,
(Basel Committee on Banking
Supervision Publication, January 2013).

- Explain the potential benefits of having effective risk data aggregation and reporting.
- **!** NEW: Describe the impact of data quality on model risk and the model development process.
- Describe key governance principles related to risk data aggregation and risk reporting practices.
- **!** NEW: Identify the governance framework, risk data architecture and IT infrastructure features that can contribute to effective risk data aggregation and risk reporting practices.
- Describe characteristics of a strong risk data aggregation capability and demonstrate how these characteristics interact with one another.
- Describe characteristics of effective risk reporting practices.
- Describe the role that supervisors play in the monitoring and implementation of the risk data aggregation and reporting practices.

2019

FRM-8

**Gary Gorton and Andrew Metrick, 2012.
Getting Up to Speed on the Financial Crisis:
A One-Weekend-Reader's Guide,
Journal of Economic Literature 50:1, 128—150.**

- Distinguish between triggers and vulnerabilities that led to the financial crisis and their contributions to the crisis.
- Describe the main vulnerabilities of short-term debt especially repo agreements and commercial paper.
- Assess the consequences of the Lehman failure on the global financial markets.
- Describe the historical background leading to the recent financial crisis.
- Distinguish between the two main panic periods of the financial crisis and describe the state of the markets during each.
- Assess the governmental policy responses to the financial crisis and review their short-term impact.
- Describe the global effects of the financial crisis on firms and the real economy

2020

FRM-8

**James Lam, Enterprise Risk Management:
From Incentives to Controls, 2nd Edition
(Hoboken, NJ: John Wiley & Sons, 2014).
Chapter 4. What is ERM?**

- ⚠ NEW: Describe Enterprise Risk Management (ERM) and compare an ERM program with a traditional silo-based risk management program.
- Compare the benefits and costs of ERM and describe the motivations for a firm to adopt an ERM initiative.
- ⚠ NEW: Explain best practices for the governance and implementation of an ERM program.
- ⚠ NEW: Describe important dimensions of an ERM program and relate ERM to strategic planning.
- ⚠ NEW: Describe risk culture, explain characteristics of a strong corporate risk culture, and describe challenges to the establishment of a strong risk culture at a firm.
- ⚠ NEW: Explain the role of scenario analysis in the implementation of an ERM program and describe its advantages and disadvantages.
- ⚠ NEW: Explain the use of scenario analysis in stress testing programs and in capital planning.

2019

FRM-9

René Stulz, Risk Management Failures: What are They and When Do They Happen? Fisher College of Business Working Paper Series, October 2008.

- Explain how a large financial loss may not necessarily be evidence of a risk management failure.
- Analyze and identify instances of risk management failure.
- Explain how risk management failures can arise in the following areas: measurement of known risk exposures, identification of risk exposures, communication of risks, and monitoring of risks.
- Evaluate the role of risk metrics and analyze the shortcomings of existing risk metrics.

2020

FRM-9

René Stulz, Risk Management Failures: What are They and When Do They Happen? Fisher College of Business Working Paper Series, October 2008.

- ⚠ NEW: Analyze the key factors that led to and derive the lessons learned from case studies involving the following risk factor: Interest rate risk, including the 1980s savings and loan crisis in the US
- ⚠ NEW: Analyze the key factors that led to and derive the lessons learned from case studies involving the following risk factor: Funding liquidity risk, including Lehman Brothers, Continental Illinois, and Northern Rock
- ⚠ NEW: Analyze the key factors that led to and derive the lessons learned from case studies involving the following risk factor: Implementing hedging strategies, including the Metallgesellschaft case
- ⚠ NEW: Analyze the key factors that led to and derive the lessons learned from case studies involving the following risk factor: Model risk, including the Niederhoffer case, Long Term Capital Management, and the London Whale case
- ⚠ NEW: Analyze the key factors that led to and derive the lessons learned from case studies involving the following risk factor: Rogue trading and misleading reporting, including the Barings case
- ⚠ NEW: Analyze the key factors that led to and derive the lessons learned from case studies involving the following risk factor: Financial engineering and complex derivatives, including Bankers Trust, the Orange County case, and Sachsen Landesbank
- ⚠ NEW: Analyze the key factors that led to and derive the lessons learned from case studies involving the following risk factor: Reputational risk, including the Volkswagen case
- ⚠ NEW: Analyze the key factors that led to and derive the lessons learned from case studies involving the following risk factor: Corporate governance, including the Enron case
- ⚠ NEW: Analyze the key factors that led to and derive the lessons learned from case studies involving the following risk factor: Cyber risk, including the SWIFT case

FRM-10

FRM-10

Edwin J. Elton, Martin J. Gruber,
Stephen J. Brown and William N. Goetzmann,
Modern Portfolio Theory and Investment Analysis,
9th Edition (Hoboken, NJ: John Wiley & Sons, 2014).
Chapter 13. The Standard Capital Asset Pricing Model

Edwin J. Elton, Martin J. Gruber,
Stephen J. Brown and William N. Goetzmann,
Modern Portfolio Theory and Investment Analysis,
9th Edition (Hoboken, NJ: John Wiley & Sons, 2014).
Chapter 13. The Standard Capital Asset Pricing Model

2019	2020
• Understand the derivation and components of the CAPM.	⚠ • NEW: Describe the historical background and provide an overview of the 2007 — 2009 financial crisis.
• Describe the assumptions underlying the CAPM.	⚠ • NEW: Describe the build-up to the financial crisis and the factors that played an important role.
• Interpret the capital market line.	⚠ • NEW: Explain the role of subprime mortgages and collateralized debt obligations (CDOs) in the crisis.
• Apply the CAPM in calculating the expected return on an asset.	⚠ • NEW: Compare the roles of different types of institutions in the financial crisis, including banks, financial intermediaries, mortgage brokers and lenders, and rating agencies.
• Interpret beta and calculate the beta of a single asset or portfolio.	⚠ • NEW: Describe trends in the short-term wholesale funding markets that contributed to the financial crisis, including their impact on systemic risk.
	⚠ • NEW: Describe responses taken by central banks in response to the crisis.

2019

FRM-11

Noel Amenc and Veronique Le Sourd, Portfolio Theory and Performance Analysis (West Sussex, England: John Wiley & Sons, 2003). Chapter 4. Applying the CAPM to Performance Measurement: Single-Index Performance Measurement Indicators (Section 4.2 only)

- Calculate, compare, and evaluate the Treynor measure, the Sharpe measure, and Jensen's alpha.
- Compute and interpret tracking error, the information ratio, and the Sortino ratio.

2020

FRM-11

GARP Code of Conduct

- Describe the responsibility of each GARP member with respect to professional integrity, ethical conduct, conflicts of interest, confidentiality of information and adherence to generally accepted practices in risk management.
- Describe the potential consequences of violating the GARP Code of Conduct.

2019

QA-1

Michael Miller, Mathematics and Statistics for Financial Risk Management, 2nd Edition (Hoboken, NJ: John Wiley & Sons, 2013). Chapter 2. Probabilities

- Describe and distinguish between continuous and discrete random variables.
- Define and distinguish between the probability density function, the cumulative distribution function, and the inverse cumulative distribution function.
- Calculate the probability of an event given a discrete probability function.
- Distinguish between independent and mutually exclusive events.
- Define joint probability, describe a probability matrix, and calculate joint probabilities using probability matrices.
- Define and calculate a conditional probability, and distinguish between conditional and unconditional probabilities.

2020

QA-1

Michael Miller, Mathematics and Statistics for Financial Risk Management, 2nd Edition (Hoboken, NJ: John Wiley & Sons, 2013). Chapter 2. Probabilities

- ⚠ NEW: Describe an event and an event space.
- Describe independent events and mutually exclusive events.
- ⚠ NEW: Explain the difference between independent events and conditionally independent events.
- Calculate the probability of an event for a discrete probability function.
- ⚠ NEW: Define and calculate a conditional probability.
- ⚠ NEW: Distinguish between conditional and unconditional probabilities.
- ⚠ NEW: Explain and apply Bayes' rule.

2019	2020
QA-2	**QA-2**
Michael Miller, Mathematics and Statistics for Financial Risk Management, 2nd Edition (Hoboken, NJ: John Wiley & Sons, 2013). Chapter 3. Basic Statistics	Michael Miller, Mathematics and Statistics for Financial Risk Management, 2nd Edition (Hoboken, NJ: John Wiley & Sons, 2013). Chapter 3. Basic Statistics

2019 — QA-2

- Interpret and apply the mean, standard deviation, and variance of a random variable.
- Calculate the mean, standard deviation, and variance of a discrete random variable
- Interpret and calculate the expected value of a discrete random variable.
- Calculate and interpret the covariance and correlation between two random variables.
- Calculate the mean and variance of sums of variables.
- Describe the four central moments of a statistical variable or distribution: mean, variance, skewness and kurtosis.
- Interpret the skewness and kurtosis of a statistical distribution, and interpret the concepts of coskewness and cokurtosis.
- Describe and interpret the best linear unbiased estimator.

2020 — QA-2

- ⚠ NEW: Describe and distinguish a probability mass function from a cumulative distribution function, and explain the relationship between these two.
- ⚠ NEW: Understand and apply the concept of a mathematical expectation of a random variable.
- ⚠ NEW: Describe the four common population moments.
- ⚠ NEW: Explain the differences between a probability mass function and a probability density function.
- ⚠ NEW: Characterize the quantile function and quantile-based estimators.
- ⚠ NEW: Explain the effect of a linear transformation of a random variable on the mean, variance, standard deviation, skewness, kurtosis, median, and interquartile range.

2019

QA-3

Michael Miller, Mathematics and Statistics for
Financial Risk Management, 2nd Edition
(Hoboken, NJ: John Wiley & Sons, 2013).
Chapter 4. Distributions

- Distinguish the key properties among the following distributions: uniform distribution, Bernoulli distribution, Binomial distribution, Poisson distribution, normal distribution, lognormal distribution, Chisquared distribution, Student's t, and F-distributions, and identify common occurrences of each distribution.

- Describe the central limit theorem and the implications it has when combining i.i.d. random variables.

- Describe independent and identically distributed (i.i.d) random variables and the implications of the i.i.d. assumption when combining random variables.

- Describe a mixture distribution and explain the creation and characteristics of mixture distributions.

2020

QA-3

Michael Miller, Mathematics and Statistics for
Financial Risk Management, 2nd Edition
(Hoboken, NJ: John Wiley & Sons, 2013).
Chapter 4. Distributions

- Distinguish the key properties and identify the common occurrences of the following distributions: uniform distribution, Bernoulli distribution, binomial distribution, Poisson distribution, normal distribution, lognormal distribution, Chi-squared distribution, Student's t, and F-distributions.

- Describe a mixture distribution and explain the creation and characteristics of mixture distributions.

2019

QA-4

Michael Miller, Mathematics and Statistics for Financial Risk Management, 2nd Edition (Hoboken, NJ: John Wiley & Sons, 2013). Chapter 6. Bayesian Analysis (pp. 113-124 only)

- Describe Bayes' theorem and apply this theorem in the calculation of conditional probabilities.
- Compare the Bayesian approach to the frequentist approach.
- Apply Bayes' theorem to scenarios with more than two possible outcomes and calculate posterior probabilities.

2020

QA-4

Michael Miller, Mathematics and Statistics for Financial Risk Management, 2nd Edition (Hoboken, NJ: John Wiley & Sons, 2013). Chapter 6. Bayesian Analysis (pp. 113-124 only)

- NEW: Explain how a probability matrix can be used to express a probability mass function.
- NEW: Compute the marginal and conditional distributions of a discrete bivariate random variable.
- NEW: Explain how the expectation of a function is computed for a bivariate discrete random variable.
- NEW: Define covariance and explain what it measures.
- NEW: Explain the relationship between the covariance and correlation of two random variables, and how these are related to the independence of the two variables.
- NEW: Explain the effects of applying linear transformations on the covariance and correlation between two random variables.
- NEW: Compute the variance of a weighted sum of two random variables.
- NEW: Compute the conditional expectation of a component of a bivariate random variable.
- NEW: Describe the features of an iid sequence of random variables.
- NEW: Explain how the iid property is helpful in computing the mean and variance of a sum of iid random variables.

2019

QA-5

Michael Miller, Mathematics and Statistics for Financial Risk Management, 2nd Edition (Hoboken, NJ: John Wiley & Sons, 2013). Chapter 7. Hypothesis Testing and Confidence Intervals

- Calculate and interpret the sample mean and sample variance.
- Construct and interpret a confidence interval.
- Construct an appropriate null and alternative hypothesis, and calculate an appropriate test statistic.
- Differentiate between a one-tailed and a two-tailed test and identify when to use each test.
- Interpret the results of hypothesis tests with a specific level of confidence.
- Demonstrate the process of backtesting VaR by calculating the number of exceedances.

2020

QA-5

Michael Miller, Mathematics and Statistics for Financial Risk Management, 2nd Edition (Hoboken, NJ: John Wiley & Sons, 2013). Chapter 7. Hypothesis Testing and Confidence Intervals

- NEW: Estimate the mean, variance, and standard deviation using sample data.
- NEW: Explain the difference between a population moment and a sample moment.
- NEW: Distinguish between an estimator and an estimate.
- NEW: Describe the bias of an estimator and explain what the bias measures.
- NEW: Explain what is meant by the statement that the mean estimator is BLUE.
- NEW: Describe the consistency of an estimator and explain the usefulness of this concept.
- NEW: Explain how the Law of Large Numbers (LLN) and Central Limit Theorem (CLT) apply to the sample mean.
- NEW: Estimate and interpret the skewness and kurtosis of a random variable.
- NEW: Use sample data to estimate quantiles, including the median.
- NEW: Estimate the mean of two variables and apply the CLT .
- NEW: Estimate the covariance and correlation between two random variables.
- NEW: Explain how coskewness and cokurtosis are related to skewness and kurtosis.

2019

QA-6

James Stock and Mark Watson, Introduction to Econometrics, Brief Edition (Boston: Pearson, 2008). Chapter 4. Linear Regression with One Regressor

- Explain how regression analysis in econometrics measures the relationship between dependent and independent variables.
- Interpret a population regression function, regression coefficients, parameters, slope, intercept, and the error term.
- Interpret a sample regression function, regression coefficients, parameters, slope, intercept, and the error term.
- Describe the key properties of a linear regression
- Define an ordinary least squares (OLS) regression and calculate the intercept and slope of the regression.
- Describe the method and three key assumptions of OLS for estimation of parameters.
- Summarize the benefits of using OLS estimators
- Describe the properties of OLS estimators and their sampling distributions, and explain the properties of consistent estimators in general.
- Interpret the explained sum of squares, the total sum of squares, the residual sum of squares, the standard error of the regression, and the regression R2.
- Interpret the results of an OLS regression

2020

QA-6

James Stock and Mark Watson, Introduction to Econometrics, Brief Edition (Boston: Pearson, 2008). Chapter 4. Linear Regression with One Regressor

- ❗ NEW: Construct an appropriate null hypothesis and alternative hypothesis and distinguish between the two.
- ❗ NEW: Differentiate between a one-sided and a two-sided test and identify when to use each test.
- ❗ NEW: Explain the difference between Type I and Type II errors and how these relate to the size and power of a test.
- ❗ NEW: Understand how a hypothesis test and a confidence interval are related.
- ❗ NEW: Explain what the p-value of a hypothesis test measures.
- ❗ NEW: Interpret the results of hypothesis tests with a specific level of confidence.
- ❗ NEW: Identify the steps to test a hypothesis about the difference between two population means.
- ❗ NEW: Explain the problem of multiple testing and how it can bias results.

2019

QA-7

**James Stock and Mark Watson,
Introduction to Econometrics, Brief Edition
(Boston: Pearson Education, 2008).
Chapter 5. Regression with a Single Regressor**

- Calculate, and interpret confidence intervals for regression coefficients.
- Interpret the p-value.
- Interpret hypothesis tests about regression coefficients.
- Evaluate the implications of homoskedasticity and heteroskedasticity.
- Determine the conditions under which the OLS is the best linear conditionally unbiased estimator.
- Explain the Gauss-Markov Theorem and its limitations, and alternatives to the OLS.
- Apply and interpret the t-statistic when the sample size is small.

2020

QA-7

**James Stock and Mark Watson,
Introduction to Econometrics, Brief Edition
(Boston: Pearson Education, 2008).
Chapter 5. Regression with a Single Regressor**

- [!] Describe the models which can be estimated using linear regression and differentiate them from those which cannot.
- [!] Interpret the results of an OLS regression with a single explanatory variable.
- [!] Describe the key assumptions of OLS parameter estimation.
- [!] Characterize the properties of OLS estimators and their sampling distributions.
- [!] Construct, apply, and interpret hypothesis tests and confidence intervals for a single regression coefficient in a regression.
- [!] Explain the steps needed to perform a hypothesis test in a linear regression.
- [!] Describe the relationship between a t-statistic, it's p-value, and a confidence interval.

2019	2020
QA-8	**QA-8**
James Stock and Mark Watson, Introduction to Econometrics, Brief Edition (Boston: Pearson Education, 2008). Chapter 6. Linear Regression with Multiple Regressors	**James Stock and Mark Watson, Introduction to Econometrics, Brief Edition (Boston: Pearson Education, 2008). Chapter 6. Linear Regression with Multiple Regressors**

2019

- Define and interpret omitted variable bias, and describe the methods for addressing this bias.
- Distinguish between single and multiple regression.
- Interpret the slope coefficient in a multiple regression.
- Describe homoskedasticity and heteroskedasticity in a multiple regression.
- Describe the OLS estimator in a multiple regression.
- Calculate and interpret measures of fit in multiple regression.
- Explain the assumptions of the multiple linear regression model.
- Explain the concept of imperfect and perfect multicollinearity and their implications.

2020

- ! NEW: Distinguish between the relative assumptions of single and multiple regression.
- ! NEW: Interpret regression coefficients in a multiple regression.
- ! NEW: Interpret goodness of fit measures for single and multiple regressions, including R^2 and adjusted-R^2.
- ! NEW: Construct, apply, and interpret joint hypothesis tests and confidence intervals for multiple coefficients in a regression.

2019

QA-9

James Stock and Mark Watson,
Introduction to Econometrics, Brief Edition
(Boston: Pearson Education, 2008).
Chapter 7. Hypothesis Tests and Confidence Intervals in
Multiple Regression

- Construct, apply, and interpret hypothesis tests and confidence intervals for a single coefficient in a multiple regression.
- Construct, apply, and interpret joint hypothesis tests and confidence intervals for multiple coefficients in a multiple regression.
- Interpret the F-statistic.
- Interpret tests of a single restriction involving multiple coefficients.
- Interpret confidence sets for multiple coefficients.
- Identify examples of omitted variable bias in multiple regressions.
- Interpret the R^2 and adjusted-R^2 in a multiple regression.

2020

QA-9

James Stock and Mark Watson,
Introduction to Econometrics, Brief Edition
(Boston: Pearson Education, 2008).
Chapter 7. Hypothesis Tests and Confidence Intervals in
Multiple Regression

- ! • NEW: Explain how to test whether a regression is affected by heteroskedasticity.
- ! • NEW: Describe approaches to using heteroskedastic data.
- ! • NEW: Characterize multicollinearity and its consequences; distinguish between multicollinearity and perfect collinearity.
- ! • NEW: Describe the consequences of excluding a relevant explanatory variable from a model and contrast those with the consequences of including an irrelevant regressor.
- ! • NEW: Explain two model selection procedures and how these relate to the bias-variance trade-off.
- ! • NEW: Describe the various methods of visualizing residuals and their relative strengths.
- ! • NEW: Describe methods for identifying outliers and their impact.
- ! • NEW: Determine the conditions under which OLS is the best linear unbiased estimator.

2019

QA-10

Francis X. Diebold, Elements of Forecasting, 4th Edition (Mason, Ohio: Cengage Learning, 2006).
Chapter 5. Modeling and Forecasting Trend

- Describe linear and nonlinear trends.
- Describe trend models to estimate and forecast trends.
- Compare and evaluate model selection criteria, including s2, the Akaike information criterion (AIC), and the Schwarz information criterion (SIC).
- Explain the necessary conditions for a model selection criterion to demonstrate consistency.

2020

QA-10

Francis X. Diebold, Elements of Forecasting, 4th Edition (Mason, Ohio: Cengage Learning, 2006).
Chapter 7. Characterizing Cycles
Chapter 8. Modeling Cycles: MA, AR, and ARMA Models

- Describe the requirements for a series to be covariance stationary.
- ⚠ NEW: Define the autocovariance function and the autocorrelation function.
- Define white noise, describe independent white noise and normal (Gaussian) white noise.
- ⚠ NEW: Define and describe the properties of autoregressive (AR) processes.
- ⚠ NEW: Define and describe the properties of moving average (MA) processes.
- Explain how a lag operator works.
- ⚠ NEW: Explain mean reversion and calculate a mean-reverting level.
- Define and describe the properties of autoregressive moving average (ARMA) processes.
- ⚠ NEW: Describe the application of AR, MA, and ARMA processes.
- ⚠ NEW: Describe sample autocorrelation and partial autocorrelation.
- ⚠ NEW: Describe the Box-Pierce Q-statistic and the Ljung-Box Q statistic.
- ⚠ NEW: Explain how forecasts are generated from ARMA models.
- ⚠ NEW: Describe the role of mean reversion in long-horizon forecasts.
- ⚠ NEW: Explain how seasonality is modeled in a covariance-stationary ARMA.

QA-11

QA-11

Francis X. Diebold, Elements of Forecasting, 4th Edition (Mason, Ohio: Cengage Learning, 2006).
Chapter 6. Modeling and Forecasting Seasonality

Francis X. Diebold, Elements of Forecasting, 4th Edition (Mason, Ohio: Cengage Learning, 2006).
Chapter 5. Modeling and Forecasting Trend
Chapter 6. Modeling and Forecasting Seasonality

- **Describe the sources of seasonality and how to deal with it in time series analysis**
- **Explain how to use regression analysis to model seasonality**
- **Explain how to construct an h-step-ahead point forecast**

- **Describe linear and nonlinear time trends.**
- **Explain how to use regression analysis to model seasonality.**
- ⚠ **NEW: Describe a random walk and a unit root.**
- ⚠ **NEW: Explain the challenges of modeling time series containing unit roots.**
- ⚠ **NEW: Describe how to test if a time series contains a unit root.**
- ⚠ **NEW: Explain how to construct an h-step-ahead point forecast for a time series with seasonality.**
- ⚠ **NEW: Calculate the estimated trend value and form an interval forecast for a time series.**

2019

QA-12

Francis X. Diebold, Elements of Forecasting, 4th Edition (Mason, Ohio: Cengage Learning, 2006).
Chapter 7. Characterizing Cycles

- Define covariance stationary, autocovariance function, autocorrelation function, partial autocorrelation function and autoregression.
- Describe the requirements for a series to be covariance stationary.
- Explain the implications of working with models that are not covariance stationary.
- Define white noise, describe independent white noise and normal (Gaussian) white noise.
- Explain the characteristics of the dynamic structure of white noise.
- Explain how a lag operator works.
- Describe Wold's theorem.
- Define a general linear process.
- Relate rational distributed lags to Wold's theorem.
- Calculate the sample mean and sample autocorrelation, and describe the Box-Pierce Q-statistic and the Ljung-Box Q-statistic.
- Describe sample partial autocorrelation.

2020

QA-12

John C. Hull, Risk Management and Financial Institutions, 4th Edition (Hoboken, NJ: John Wiley & Sons, 2015).
Chapter 10. Volatility
Chapter 11. Correlations and Copulas

- **!** NEW: Calculate, distinguish, and convert between simple and continuously compounded returns.
- Define and distinguish between volatility, variance rate, and implied volatility.
- **!** NEW: Describe how the first two moments may be insufficient to describe non-normal distributions.
- **!** NEW: Explain how the Jarque-Bera test is used to determine whether returns are normally distributed.
- **!** NEW: Describe the power law and its use for non-normal distributions.
- Define correlation and covariance and differentiate between correlation and dependence.
- **!** NEW: Describe properties of correlations between normally distributed variables when using a one-factor model.

2019

QA-13

- Describe the properties of the first-order moving average (MA(1)) process, and distinguish between autoregressive representation and moving average representation.
- Describe the properties of a general finite-order process of order q (MA(q)) process.
- Describe the properties of the first-order autoregressive (AR(1)) process, and define and explain the Yule-Walker equation.
- Describe the properties of a general pth order autoregressive (AR(p)) process.
- Define and describe the properties of the autoregressive moving average (ARMA) process.
- Describe the application of AR and ARMA processes.

2020

QA-13

- Describe the basic steps to conduct a Monte Carlo simulation.
- Describe ways to reduce Monte Carlo sampling error.
- ⚠ NEW: Explain the use of antithetic and control variates in reducing Monte Carlo sampling error.
- ⚠ NEW: Describe the bootstrapping method and its advantage over Monte Carlo simulation.
- Describe pseudo-random number generation and how a good simulation design alleviates the effects the choice of the seed has on the properties of the generated series.
- Describe situations where the bootstrapping method is ineffective.
- Describe the disadvantages of the simulation approach to financial problem solving.

2019

FMP-1

John C. Hull, Risk Management and
Financial Institutions, 4th edition
(Hoboken, New Jersey: John Wiley & Sons, 2015).
Chapter 2. Banks

- Identify the major risks faced by a bank.
- Evaluate the capital requirements for banks.
- Distinguish between economic capital and regulatory capital.
- Explain how deposit insurance gives rise to a moral hazard problem.
- Describe investment banking financing arrangements including private placement, public offering, best efforts, firm commitment, and Dutch auction approaches.
- Describe the potential conflicts of interest among commercial banking, securities services, and investment banking divisions of a bank and recommend solutions to the conflict of interest problems."
- Describe the distinctions between the "banking book" and the "trading book" of a bank.
- Explain the originate-to-distribute model of a bank and discuss its benefits and drawbacks.

2020

FMP-1

John C. Hull, Risk Management and
Financial Institutions, 4th edition
(Hoboken, New Jersey: John Wiley & Sons, 2015).
Chapter 2. Banks

- ⚠ NEW: Identify the major risks faced by a bank, and explain ways in which these risks can arise.
- Distinguish between economic capital and regulatory capital.
- ⚠ NEW: Summarize Basel Committee regulations for regulatory capital and their motivations.
- Explain how deposit insurance gives rise to a moral hazard problem.
- ⚠ NEW: Describe investment banking financing arrangements including private placement, public offering, best efforts, firm commitment, and Dutch auction approaches.
- ⚠ NEW: Describe the potential conflicts of interest among commercial banking, securities services, and investment banking divisions of a bank and recommend solutions to the conflict of interest problems.
- Describe the distinctions between the "banking book" and the "trading book" of a bank.
- Explain the originate-to-distribute model of a bank and discuss its benefits and drawbacks.

2019	2020
FMP-2	**FMP-2**
John C. Hull, Risk Management and Financial Institutions, 4th edition (Hoboken, New Jersey: John Wiley & Sons, 2015). Chapter 3. Insurance Companies and Pension Plans	John C. Hull, Risk Management and Financial Institutions, 4th edition (Hoboken, New Jersey: John Wiley & Sons, 2015). Chapter 3. Insurance Companies and Pension Plans

2019 — FMP-2

- Describe the key features of the various categories of insurance companies and identify the risks facing insurance companies.
- Describe the use of mortality table and calculate premium payment for a policy holder.
- Calculate and interpret loss ratio, expense ratio, combined ratio, and operating ratio for a property-casualty insurance company.
- Describe moral hazard and adverse selection risks facing insurance companies, provide examples of each, and describe how to overcome the problems.
- Distinguish between mortality risk and longevity risk and describe how to hedge these risks.
- Evaluate the capital requirements for life insurance and property-casualty insurance companies.
- Compare the guaranty system and the regulatory requirements for insurance companies with those for banks.
- Describe a defined benefit plan and a defined contribution plan for a pension fund and explain the differences between them.

2020 — FMP-2

- Describe the key features of the various categories of insurance companies and identify the risks facing insurance companies.
- Describe the use of mortality tables and calculate the premium payment for a policy holder.
- Distinguish between mortality risk and longevity risk and describe how to hedge these risks
- Describe a defined benefit plan and a defined contribution plan for a pension fund and explain the differences between them.
- ⚠ NEW: Calculate and interpret loss ratio, expense ratio, combined ratio, and operating ratio for a property-casualty insurance company.
- ⚠ NEW: Describe moral hazard and adverse selection risks facing insurance companies, provide examples of each, and describe how to overcome the problems.
- Evaluate the capital requirements for life insurance and property-casualty insurance companies.
- Compare the guaranty system and the regulatory requirements for insurance companies with those for banks.

FMP-3

FMP-3

John C. Hull, Risk Management and Financial Institutions, 4th edition (Hoboken, New Jersey: John Wiley & Sons, 2015). Chapter 4. Mutual Funds and Hedge Funds

John C. Hull, Risk Management and Financial Institutions, 4th edition (Hoboken, New Jersey: John Wiley & Sons, 2015). Chapter 4. Mutual Funds and Hedge Funds

2019	2020
• Differentiate among open-end mutual funds, closed-end mutual funds, and exchange-traded funds (ETFs).	• Differentiate among open-end mutual funds, closed-end mutual funds, and exchange-traded funds (ETFs).
• Calculate the net asset value (NAV) of an open-end mutual fund.	⚠ • NEW: Identify and describe potential undesirable trading behaviors at mutual funds.
• Distinguish between active and passive management and define alpha.	• Calculate the net asset value (NAV) of an open-end mutual fund.
• Explain the key differences between hedge funds and mutual funds.	• Explain the key differences between hedge funds and mutual funds.
• Calculate the return on a hedge fund investment and explain the incentive fee structure of a hedge fund including the terms hurdle rate, high-water mark, and clawback.	• Calculate the return on a hedge fund investment and explain the incentive fee structure of a hedge fund including the terms hurdle rate, high-water mark, and clawback.
• Describe various hedge fund strategies, including long/short equity, dedicated short, distressed securities, merger arbitrage, convertible arbitrage, fixed income arbitrage, emerging markets, global macro, and managed futures, and identify the risks faced by hedge funds.	• Describe various hedge fund strategies, including long/short equity, dedicated short, distressed securities, merger arbitrage, convertible arbitrage, fixed income arbitrage, emerging markets, global macro, and managed futures, and identify the risks faced by hedge funds.
• Describe hedge fund performance and explain the effect of measurement biases on performance measurement.	⚠ • NEW: Describe characteristics of mutual fund and hedge fund performance and explain the effect of measurement biases on performance measurement.

2019	2020
FMP-4	**FMP-4**
John C. Hull, Options, Futures, and Other Derivatives, 10th Edition (New York: Pearson, 2017). Chapter 1. Introduction	John C. Hull, Options, Futures, and Other Derivatives, 10th Edition (New York: Pearson, 2017). Chapter 1. Introduction

2019 FMP-4

- Describe the over-the-counter market, distinguish it from trading on an exchange, and evaluate its advantages and disadvantages.

- Differentiate between options, forwards, and futures contracts.

- Identify and calculate option and forward contract payoffs.

- Calculate and compare the payoffs from hedging strategies involving forward contracts and options.

- Calculate and compare the payoffs from speculative strategies involving futures and options.

- Calculate an arbitrage payoff and describe how arbitrage opportunities are temporary.

- Describe some of the risks that can arise from the use of derivatives.

- Differentiate among the broad categories of traders: hedgers, speculators, and arbitrageurs.

2020 FMP-4

- [!] NEW: Define derivatives, describe features and uses of derivatives, and compare linear and non-linear derivatives.

- [!] NEW: Describe the over-the-counter market, distinguish it from trading on an exchange, and evaluate its advantages and disadvantages.

- Differentiate between options, forwards, and futures contracts.

- Identify and calculate option and forward contract payoffs.

- Differentiate among the broad categories of traders: hedgers, speculators, and arbitrageurs.

- Calculate and compare the payoffs from hedging strategies involving forward contracts and options.

- Calculate and compare the payoffs from speculative strategies involving futures and options.

- Calculate an arbitrage payoff and describe how arbitrage opportunities are temporary.

- Describe some of the risks that can arise from the use of derivatives.

2019

FMP-5

**John Hull,
Options, Futures, and Other Derivatives, 9th Edition
(New York: Pearson, 2014).
Chapter 2. Mechanics of Futures Markets**

- Define and describe the key features of a futures contract, including the asset, the contract price and size, delivery, and limits.
- Explain the convergence of futures and spot prices.
- Describe the rationale for margin requirements and explain how they work.
- Describe the role of a clearinghouse in futures and over-the-counter market transactions.
- Describe the role of central counterparties (CCPs) and distinguish between bilateral and centralized clearing.
- Describe the role of collateralization in the over-the-counter market and compare it to the margining system.
- Identify the differences between a normal and inverted futures market.
- Describe the mechanics of the delivery process and contrast it with cash settlement.
- Explain the different market quotes.
- Evaluate the impact of different trading order types.
- Compare and contrast forward and futures contracts.

2020

FMP-5

**Jon Gregory, Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives
(West Sussex, UK: John Wiley & Sons, 2014).
Chapter 2. Exchanges, OTC Derivatives, DPCs and SPVs**

- Describe how exchanges can be used to alleviate counterparty risk.
- Explain the developments in clearing that reduce risk.
- ⚠ NEW: Describe netting and describe a netting process.
- ⚠ NEW: Describe the implementation of a margining process and explain the determinants of initial and variation margin requirements.
- ⚠ NEW: Compare exchange-traded and OTC markets and describe their uses.
- ⚠ NEW: Identify the classes of derivative securities and explain the risk associated with them.
- Identify risks associated with OTC markets and explain how these risks can be mitigated.
- ⚠ NEW: Describe the role of collateralization in the over-the-counter market and compare it to the margining system.
- ⚠ NEW: Explain the use of special purpose vehicles (SPVs) in the OTC derivatives market.

2019

FMP-6

**John C. Hull,
Options, Futures, and Other Derivatives, 10th Edition
(New York: Pearson, 2017).
Chapter 4. Interest Rates**

- Define and differentiate between short and long hedges and identify their appropriate uses.
- Describe the arguments for and against hedging and the potential impact of hedging on firm profitability.
- Define the basis and explain the various sources of basis risk, and explain how basis risks arise when hedging with futures.
- Define cross hedging, and compute and interpret the minimum variance hedge ratio and hedge effectiveness.
- Compute the optimal number of futures contracts needed to hedge an exposure, and explain and calculate the "tailing the hedge" adjustment.
- Explain how to use stock index futures contracts to change a stock portfolio's beta.
- Explain the term "rolling the hedge forward" and describe some of the risks that arise from this strategy.

2020

FMP-6

**Jon Gregory, Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives (West Sussex, UK: John Wiley & Sons, 2014).
Chapter 3. Basic Principles of Central Clearing
Chapter 14. Risks Caused by CCPs: Risks Faced by CCPs**

- Provide examples of the mechanics of a central counterparty (CCP).
- ⚠ NEW: Describe the role of CCPs and distinguish between bilateral and centralized clearing.
- Describe advantages and disadvantages of central clearing of OTC derivatives.
- ⚠ NEW: Explain regulatory initiatives for the OTC derivatives market and their impact on central clearing.
- Compare margin requirements in centrally cleared and bilateral markets, and explain how margin can mitigate risk.
- Compare and contrast bilateral markets to the use of novation and netting.
- Assess the impact of central clearing on the broader financial markets.
- Identify and explain the types of risks faced by CCPs.
- ⚠ NEW: Identify and distinguish between the risks to clearing members as well as non-members.

2019

FMP-7

John C. Hull,
Options, Futures, and Other Derivatives, 10th Edition
(New York: Pearson, 2017).
Chapter 4. Interest Rates

- Describe Treasury rates, LIBOR, and repo rates, and explain what is meant by the "risk-free" rate.
- Calculate the value of an investment using different compounding frequencies.
- Convert interest rates based on different compounding frequencies.
- Calculate the theoretical price of a bond using spot rates.
- Derive forward interest rates from a set of spot rates.
- Derive the value of the cash flows from a forward rate agreement (FRA).
- Calculate the duration, modified duration and dollar duration of a bond.
- Evaluate the limitations of duration and explain how convexity addresses some of them.
- Calculate the change in a bond's price given its duration, its convexity, and a change in interest rates.
- Compare and contrast the major theories of the term structure of interest rates.

2020

FMP-7

John C. Hull, Risk Management and
Financial Institutions, 4th edition
(Hoboken, New Jersey: John Wiley & Sons, 2015).
Chapter 2. Banks

- [!] NEW: Define and describe the key features of a futures contract, including the underlying asset, the contract price and size, trading volume, open interest, delivery, and limits.
- Explain the convergence of futures and spot prices.
- Describe the rationale for margin requirements and explain how they work.
- [!] NEW: Describe the role of an exchange in futures and over-the-counter market transactions.
- Identify the differences between a normal and inverted futures market.
- Explain the different market quotes.
- Describe the mechanics of the delivery process and contrast it with cash settlement.
- Evaluate the impact of different trading order types.
- [!] NEW: Describe the application of marking to market and hedge accounting for futures.
- Compare and contrast forward and futures contracts.

John C. Hull, **Options, Futures, and Other Derivatives, 10th Edition** **(New York: Pearson, 2017).** **Chapter 5. Determination of Forward and Futures Prices**	**John C. Hull, Risk Management and** **Financial Institutions, 4th edition** **(Hoboken, New Jersey: John Wiley & Sons, 2015).** **Chapter 3. Insurance Companies and Pension Plans**

2019 — FMP-8

- Differentiate between investment and consumption assets.
- Define short-selling and calculate the net profit of a short sale of a dividend-paying stock.
- Describe the differences between forward and futures contracts and explain the relationship between forward and spot prices.
- Calculate the forward price given the underlying asset's spot price, and describe an arbitrage argument between spot and forward prices.
- Explain the relationship between forward and futures prices.
- Calculate a forward foreign exchange rate using the interest rate parity relationship.
- Define income, storage costs, and convenience yield.
- Calculate the futures price on commodities incorporating income/storage costs and/or convenience yields.
- Calculate, using the cost-of-carry model, forward prices where the underlying asset either does or does not have interim cash flows.
- Describe the various delivery options available in the futures markets and how they can influence futures prices.
- Explain the relationship between current futures prices and expected future spot prices, including the impact of systematic and nonsystematic risk.
- Define and interpret contango and backwardation, and explain how they relate to the cost-of-carry model.

2020 — FMP-8

- Define and differentiate between short and long hedges and identify their appropriate uses.
- Describe the arguments for and against hedging and the potential impact of hedging on firm profitability.
- Define the basis and explain the various sources of basis risk, and explain how basis risks arise when hedging with futures.
- Define cross hedging, and compute and interpret the minimum variance hedge ratio and hedge effectiveness.
- Compute the optimal number of futures contracts needed to hedge an exposure, and explain and calculate the "tailing the hedge" adjustment.
- Explain how to use stock index futures contracts to change a stock portfolio's beta.
- ⚠ NEW: Explain how to create a long-term hedge using a "stack and roll" strategy and describe some of the risks that arise from this strategy.

2019	2020
FMP-9	**FMP-9**
John C. Hull, **Options, Futures, and Other Derivatives, 10th Edition** **(New York: Pearson, 2017).** **Chapter 6. Interest Rate Futures**	**Anthony Saunders and Marcia Millon Cornett,** **Financial Institutions Management:** **A Risk Management Approach, 8th Edition** **(New York: McGraw-Hill, 2014).** **Chapter 13. Foreign Exchange Risk**

2019 — FMP-9

- Identify the most commonly used day count conventions, describe the markets that each one is typically used in, and apply each to an interest calculation.
- Calculate the conversion of a discount rate to a price for a US Treasury bill.
- Differentiate between the clean and dirty price for a US Treasury bond; calculate the accrued interest and dirty price on a US Treasury bond.
- Explain and calculate a US Treasury bond futures contract conversion factor.
- Calculate the cost of delivering a bond into a Treasury bond futures contract.
- Describe the impact of the level and shape of the yield curve on the cheapest-to-deliver Treasury bond decision.
- Calculate the theoretical futures price for a Treasury bond futures contract.
- Calculate the final contract price on a Eurodollar futures contract.
- Describe and compute the Eurodollar futures contract convexity adjustment.
- Explain how Eurodollar futures can be used to extend the LIBOR zero curve.
- Calculate the duration-based hedge ratio and create a duration-based hedging strategy using interest rate futures.
- Explain the limitations of using a duration-based hedging strategy.

2020 — FMP-9

- ⚠ NEW: Explain and describe the mechanics of spot quotes, forward quotes, and futures quotes in the foreign exchange markets, and distinguish between bid and ask exchange rates.
- ⚠ NEW: Calculate bid-ask spread and explain why the bid-ask spread for spot quotes may be different from the bid-ask spread for forward quotes.
- ⚠ NEW: Compare outright (forward) and swap transactions.
- ⚠ NEW: Define, compare, and contrast transaction risk, translation risk, and economic risk.
- ⚠ NEW: Describe examples of transaction, translation, and economic risks, and explain how to hedge these risks.
- ⚠ NEW: Describe the rationale for multi-currency hedging using options.
- ⚠ NEW: Identify and explain the factors that determine exchange rates.
- Calculate and explain the effect of an appreciation/depreciation of a currency relative to a foreign currency.
- Explain the purchasing power parity theorem and use this theorem to calculate the appreciation or depreciation of a foreign currency.
- Describe the relationship between nominal and real interest rates.
- Describe how a non-arbitrage assumption in the foreign exchange markets leads to the interest rate parity theorem, and use this theorem to calculate forward foreign exchange rates.
- ⚠ NEW: Distinguish between covered and uncovered interest rate parity conditions.

2019	2020
FMP-10	**FMP-10**
John C. Hull, Options, Futures, and Other Derivatives, 10th Edition (New York: Pearson, 2017). Chapter 7. Swaps	New Edition: John C. Hull, Options, Futures, and Other Derivatives, 10th Edition (New York: Pearson, 2017). Chapter 5. Determination of Forward and Futures Prices

2019 FMP-10

- Explain the mechanics of a plain vanilla interest rate swap and compute its cash flows.
- Explain how a plain vanilla interest rate swap can be used to transform an asset or a liability and calculate the resulting cash flows.
- Explain the role of financial intermediaries in the swaps market.
- Describe the role of the confirmation in a swap transaction.
- Describe the comparative advantage argument for the existence of interest rate swaps and evaluate some of the criticisms of this argument.
- Explain how the discount rates in a plain vanilla interest rate swap are computed.
- Calculate the value of a plain vanilla interest rate swap based on two simultaneous bond positions.
- Calculate the value of a plain vanilla interest rate swap from a sequence of forward rate agreements (FRAs).
- Explain the mechanics of a currency swap and compute its cash flows.
- Explain how a currency swap can be used to transform an asset or liability and calculate the resulting cash flows.
- Calculate the value of a currency swap based on two simultaneous bond positions.
- Calculate the value of a currency swap based on a sequence of FRAs.
- Describe the credit risk exposure in a swap position.
- Identify and describe other types of swaps, including commodity, volatility and exotic swaps.

2020 FMP-10

- Differentiate between investment and consumption assets.
- ⚠ NEW: Define short-selling and calculate the net profit of a short sale of a dividend-paying stock.
- Describe the differences between forward and futures contracts and explain the relationship between forward and spot prices.
- Calculate the forward price given the underlying asset's spot price, and describe an arbitrage argument between spot and forward prices.
- ⚠ NEW: Distinguish between the forward price and the value of a forward contract.
- ⚠ NEW: Calculate the value of a forward contract on a financial asset that does or does not provide income or yield.
- Explain the relationship between forward and futures prices.
- Calculate a forward foreign exchange rate using the interest rate parity relationship.
- ⚠ NEW: Calculate the value of a stock index futures contract and explain the concept of index arbitrage.

2019	2020
FMP-11	**FMP-11**
John C. Hull, **Options, Futures, and Other Derivatives, 10th Edition** **(New York: Pearson, 2017).** **Chapter 10. Mechanics of Options Markets**	**Robert McDonald, Derivatives Markets, 3rd Ed.** **Chapter 6. Commodity Forwards and Futures** **John C. Hull, Options, Futures, and Other Derivatives, 10th Ed.** **Chapter 5. Determination of Forward and Futures Prices**

2019 FMP-11

- Describe the types, position variations, and typical underlying assets of options.
- Explain the specification of exchange-traded stock option contracts, including that of nonstandard products.
- Describe how trading, commissions, margin requirements, and exercise typically work for exchange-traded options.

2020 FMP-11

- **⚠** NEW: Explain the key differences between commodities and financial assets.
- **⚠** NEW: Define and apply commodity concepts such as storage costs, carry markets, lease rate, and convenience yield.
- **⚠** NEW: Identify factors that impact prices on agricultural commodities, metals, energy, and weather derivatives.
- Explain the basic equilibrium formula for pricing commodity forwards.
- Describe an arbitrage transaction in commodity forwards, and compute the potential arbitrage profit.
- **⚠** NEW: Define the lease rate and explain how it determines the no-arbitrage values for commodity forwards and futures.
- **⚠** NEW: Describe the cost of carry model and illustrate the impact of storage costs and convenience yields on commodity forward prices and no-arbitrage bounds.
- Compute the forward price of a commodity with storage costs.
- Compare the lease rate with the convenience yield.
- Explain how to create a synthetic commodity position, and use it to explain the relationship between the forward price and the expected future spot price.
- Explain the relationship between current futures prices and expected future spot prices, including the impact of systematic and nonsystematic risk.
- **⚠** NEW: Define and interpret normal backwardation and contango.

2019

FMP-12

John C. Hull,
Options, Futures, and Other Derivatives, 10th Edition
(New York: Pearson, 2017).
Chapter 11. Properties of Stock Options

- Identify the six factors that affect an option's price and describe how these six factors affect the price for both European and American options.
- Identify and compute upper and lower bounds for option prices on non-dividend and dividend paying stocks.
- Explain put-call parity and apply it to the valuation of European and American stock options.
- Explain the early exercise features of American call and put options.

2020

FMP-12

John C. Hull,
Options, Futures, and Other Derivatives, 10th Edition
(New York: Pearson, 2017).
Chapter 11. Properties of Stock Options

- **!** • NEW: Describe the types, position variations, payoffs and profits, and typical underlying assets of options.
- **!** • NEW: Explain the specification of exchange-traded stock option contracts, including that of nonstandard products.
- **!** • NEW: Explain how dividends and stock splits can impact the terms of a stock option.
- **!** • NEW: Describe how trading, commissions, margin requirements, and exercise typically work for exchange-traded options.
- **!** • NEW: Define and describe warrants, convertible bonds, and employee stock options.

FMP-13

FMP-13

John C. Hull,
Options, Futures, and Other Derivatives, 10th Edition
(New York: Pearson, 2017).
Chapter 12. Trading Strategies Involving Options

John C. Hull,
Options, Futures, and Other Derivatives, 10th Edition
(New York: Pearson, 2017).
Chapter 12. Trading Strategies Involving Options

- Explain the motivation to initiate a covered call or a protective put strategy.
- Describe the use and calculate the payoffs of various spread strategies.
- Describe the use and explain the payoff functions of combination strategies.

- ! • NEW: Identify the six factors that affect an option's price.
- ! • NEW: Identify and compute upper and lower bounds for option prices on non-dividend and dividend paying stocks.
- ! • NEW: Explain put-call parity and apply it to the valuation of European and American stock options, with dividends and without dividends, and express it in terms of forward prices.
- ! • NEW: Explain and assess potential rationales for using the early exercise features of American call and put options.

FMP-14

FMP-14

John C. Hull,
Options, Futures, and Other Derivatives, 10th Edition
(New York: Pearson, 2017).
Chapter 26. Exotic Options

New Edition: John C. Hull,
Options, Futures, and Other Derivatives, 10th Edition
(New York: Pearson, 2017).
Chapter 12. Trading Strategies Involving Options

- Define and contrast exotic derivatives and plain vanilla derivatives.
- Describe some of the factors that drive the development of exotic products.
- Explain how any derivative can be converted into a zero-cost product.
- Describe how standard American options can be transformed into nonstandard American options.
- Identify and describe the characteristics and pay-off structure of the following exotic options: gap, forward start, compound, chooser, barrier, binary, lookback, shout, Asian, exchange, rainbow, and basket options.
- Describe and contrast volatility and variance swaps.
- Explain the basic premise of static option replication and how it can be applied to hedging exotic options.

- Explain the motivation to initiate a covered call or a protective put strategy.
- ⚠ NEW: Describe principal protected notes (PPNs) and explain necessary conditions to create a PPN.
- Describe the use and calculate the payoffs of various spread strategies.
- Describe the use and explain the payoff functions of combination strategies.

2019	2020
FMP-15	**FMP-15**
Robert McDonald, Derivatives Markets, 3rd Edition (Boston: Addison-Wesley, 2013) Chapter 6. Commodity Forwards and Futures	**John C. Hull, Options, Futures, and Other Derivatives, 10th Edition (New York: Pearson, 2017). Chapter 26. Exotic Options**

2019 FMP-15

- Apply commodity concepts such as storage costs, carry markets, lease rate, and convenience yield.
- Explain the basic equilibrium formula for pricing commodity forwards.
- Describe an arbitrage transaction in commodity forwards, and compute the potential arbitrage profit.
- Define the lease rate and explain how it determines the no-arbitrage values for commodity forwards and futures.
- Define carry markets, and illustrate the impact of storage costs and convenience yields on commodity forward prices and no-arbitrage bounds.
- Compute the forward price of a commodity with storage costs.
- Compare the lease rate with the convenience yield.
- Identify factors that impact gold, corn, electricity, natural gas, and oil forward prices.
- Compute a commodity spread.
- Explain how basis risk can occur when hedging commodity price exposure.
- Evaluate the differences between a strip hedge and a stack hedge and explain how these differences impact risk management.
- Provide examples of cross-hedging, specifically the process of hedging jet fuel with crude oil and using weather derivatives.
- Explain how to create a synthetic commodity position, and use it to explain the relationship between the forward price and the expected future spot price.

2020 FMP-15

- Define and contrast exotic derivatives and plain vanilla derivatives.
- ⚠ NEW: Describe some of the factors that drive the development of exotic derivative products.
- ⚠ NEW: Explain how any derivative can be converted into a zero-cost product.
- Describe how standard American options can be transformed into nonstandard American options.
- Identify and describe the characteristics and pay-off structure of the following exotic options: gap, forward start, compound, chooser, barrier, binary, lookback, Asian, exchange, and basket options.
- Describe and contrast volatility and variance swaps.
- Explain the basic premise of static option replication and how it can be applied to hedging exotic options.

2019

FMP-16

Jon Gregory, Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives (West Sussex, UK: John Wiley & Sons, 2014). Chapter 2. Exchanges, OTC Derivatives, DPCs and SPVs

- Describe how exchanges can be used to alleviate counterparty risk.
- Explain the developments in clearing that reduce risk.
- Compare exchange-traded and OTC markets and describe their uses.
- Identify the classes of derivatives securities and explain the risk associated with them.
- Identify risks associated with OTC markets and explain how these risks can be mitigated.

2020

FMP-16

John C. Hull, Options, Futures, and Other Derivatives, 10th Edition (New York: Pearson, 2017). Chapter 4. Interest Rates

- [!] NEW: Describe Treasury rates, LIBOR, Secured Overnight Financing Rate (SOFR), and repo rates and explain what is meant by the "risk-free" rate.
- Calculate the value of an investment using different compounding frequencies.
- Convert interest rates based on different compounding frequencies.
- Calculate the theoretical price of a bond using spot rates.
- [!] NEW: Calculate the duration, modified duration, and dollar duration of a bond.
- Evaluate the limitations of duration and explain how convexity addresses some of them.
- Calculate the change in a bond's price given its duration, its convexity, and a change in interest rates.
- Derive forward interest rates from a set of spot rates.
- Derive the value of the cash flows from a forward rate agreement (FRA).
- [!] NEW: Calculate zero-coupon rates using the bootstrap method.
- [!] NEW: Compare and contrast the major theories of the term structure of interest rates.

2019

FMP-17

Jon Gregory, Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives (West Sussex, UK: John Wiley & Sons, 2014). Chapter 3. Basic Principles of Central Clearing

- Provide examples of the mechanics of a central counterparty (CCP).
- Describe advantages and disadvantages of central clearing of OTC derivatives.
- Compare margin requirements in centrally cleared and bilateral markets, and explain how margin can mitigate risk.
- Compare and contrast bilateral markets to the use of novation and netting.
- Assess the impact of central clearing on the broader financial markets.

2020

FMP-17

Frank Fabozzi (editor), Steve Mann, and Adam Cohen, The Handbook of Fixed Income Securities, 8th Edition (New York: McGraw-Hill, 2012). Chapter 12. Corporate Bonds

- ⚠ NEW: Describe features of bond trading, and explain the behavior of bond yield.
- Describe a bond indenture and explain the role of the corporate trustee in a bond indenture.
- ⚠ NEW: Define high-yield bonds, and describe types of high-yield bond issuers and some of the payment features unique to high yield bonds.
- Differentiate between credit default risk and credit spread risk.
- Describe event risk and explain what may cause it in corporate bonds.
- ⚠ NEW: Describe the different classifications of bonds characterized by issuer, maturity, interest rate, and collateral.
- Describe the mechanisms by which corporate bonds can be retired before maturity.
- ⚠ NEW: Define recovery rate and default rate, differentiate between an issue default rate and a dollar default rate, and describe the relationship between recovery rates and seniority.
- Evaluate the expected return from a bond investment and identify the components of the bond's expected return.

2019

FMP-18

Jon Gregory, Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives (West Sussex, UK: John Wiley & Sons, 2014).
Chapter 14 (section 14.4 only).
Risks Caused by CCPs: Risks Faced by CCPs

- Identify and explain the types of risks faced by CCPs.
- Identify and distinguish between the risks to clearing members as well as non-members.
- Identify and evaluate lessons learned from prior CCP failures.

2020

FMP-18

Bruce Tuckman, Angel Serrat, Fixed Income Securities: Tools for Today's Markets, 3rd Edition (Hoboken, NJ: John Wiley & Sons, 2011).
Chapter 20. Mortgages and Mortgage-Backed Securities

- Describe the various types of residential mortgage products.
- Calculate a fixed rate mortgage payment, and its principal and interest components.
- Describe the mortgage prepayment option and the factors that influence prepayments.
- ⚠ NEW: Summarize the securitization process of mortgage backed securities (MBS), particularly formation of mortgage pools including specific pools and to-be-announceds (TBAs).
- ⚠ NEW: Calculate weighted average coupon, weighted average maturity, single monthly mortality rate (SMM), and conditional prepayment rate (CPR) for a mortgage pool.
- ⚠ NEW: Describe the process of trading of pass-through agency MBS.
- ⚠ NEW: Explain the mechanics of different types of agency MBS products, including collateralized mortgage obligations (CMOs), interest-only securities (IOs), and principal-only securities (POs).
- Describe a dollar roll transaction and how to value a dollar roll.
- Explain prepayment modeling and its four components: refinancing, turnover, defaults, and curtailments.
- Describe the steps in valuing an MBS using Monte Carlo simulation.
- Define Option Adjusted Spread (OAS), and explain its challenges and its uses.

2019

FMP-19

- Calculate a financial institution's overall foreign exchange exposure.
- Explain how a financial institution could alter its net position exposure to reduce foreign exchange risk.
- Calculate and explain the effect of an appreciation/depreciation of a currency relative to a foreign currency.
- Calculate a financial institution's potential dollar gain or loss exposure to a particular currency.
- Identify and describe the different types of foreign exchange trading activities.
- Identify the sources of foreign exchange trading gains and losses.
- Calculate the potential gain or loss from a foreign currency denominated investment.
- Explain balance-sheet hedging with forwards.
- Describe how a non-arbitrage assumption in the foreign exchange markets leads to the interest rate parity theorem, and use this theorem to calculate forward foreign exchange rates.
- Explain the purchasing power parity theorem and use this theorem to calculate the appreciation or depreciation of a foreign currency.
- Explain why diversification in multicurrency asset-liability positions could reduce portfolio risk.
- Describe the relationship between nominal and real interest rates.

2020

FMP-19

- Identify the most commonly used day count conventions, describe the markets that each one is typically used in, and apply each to an interest calculation.
- Calculate the conversion of a discount rate to a price for a US Treasury bill.
- Differentiate between the clean and dirty price for a US Treasury bond; calculate the accrued interest and dirty price on a US Treasury bond.
- Explain and calculate a US Treasury bond futures contract conversion factor.
- Calculate the cost of delivering a bond into a Treasury bond futures contract.
- ⚠ NEW: Describe the impact of the level and shape of the yield curve on the cheapest-to-deliver Treasury bond decision.
- Calculate the theoretical futures price for a Treasury bond futures contract.
- ⚠ NEW: Calculate the final contract price on a Eurodollar futures contract, and compare Eurodollar futures to FRAs.
- Describe and compute the Eurodollar futures contract convexity adjustment.
- Explain how Eurodollar futures can be used to extend the LIBOR zero curve.
- ⚠ NEW: Calculate the duration-based hedge ratio and create a duration-based hedging strategy using interest rate futures.
- ⚠ NEW: Explain the limitations of using a duration-based hedging strategy.

FMP-20

FMP-20

Frank Fabozzi (editor), Steve Mann, and Adam Cohen, The Handbook of Fixed Income Securities, 8th Edition (New York: McGraw-Hill, 2012). Chapter 12. Corporate Bonds

John C. Hull, Options, Futures, and Other Derivatives, 10th Edition (New York: Pearson, 2017). Chapter 7. Swaps

- Describe a bond indenture and explain the role of the corporate trustee in a bond indenture.

- Explain a bond's maturity date and how it impacts bond retirements.

- Describe the main types of interest payment classifications.

- Describe zero-coupon bonds and explain the relationship between original-issue discount and reinvestment risk.

- Distinguish among the following security types relevant for corporate bonds: mortgage bonds, collateral trust bonds, equipment trust certificates, subordinated and convertible debenture bonds, and guaranteed bonds.

- Describe the mechanisms by which corporate bonds can be retired before maturity.

- Differentiate between credit default risk and credit spread risk.

- Describe event risk and explain what may cause it in corporate bonds.

- Define high-yield bonds, and describe types of high-yield bond issuers and some of the payment features unique to high yield bonds.

- Define and differentiate between an issuer default rate and a dollar default rate.

- Define recovery rates and describe the relationship between recovery rates and seniority.

- Explain the mechanics of a plain vanilla interest rate swap and compute its cash flows.

- Explain how a plain vanilla interest rate swap can be used to transform an asset or a liability and calculate the resulting cash flows.

- Explain the role of financial intermediaries in the swaps market.

- Describe the role of the confirmation in a swap transaction.

- Describe the comparative advantage argument for the existence of interest rate swaps and evaluate some of the criticisms of this argument.

- Explain how the discount rates in a plain vanilla interest rate swap are computed.

- Calculate the value of a plain vanilla interest rate swap based on two simultaneous bond positions.

- Calculate the value of a plain vanilla interest rate swap from a sequence of forward rate agreements (FRAs).

- Explain the mechanics of a currency swap and compute its cash flows.

- Explain how a currency swap can be used to transform an asset or liability and calculate the resulting cash flows.

- Calculate the value of a currency swap based on two simultaneous bond positions.

- ⚠ NEW: Calculate the value of a currency swap based on a sequence of forward exchange rates.

- ⚠ NEW: Identify and describe other types of swaps, including commodity, volatility, credit default, and exotic swaps.

- Describe the credit risk exposure in a swap position.

2019

VRM-1

Linda Allen, Jacob Boudoukh and Anthony Saunders,
Understanding Market, Credit and Operational Risk:
The Value at Risk Approach
(Oxford: Blackwell Publishing, 2004).
Chapter 2. Quantifying Volatility in VaR Models

- Explain how asset return distributions tend to deviate from the normal distribution.
- Explain reasons for fat tails in a return distribution and describe their implications.
- Distinguish between conditional and unconditional distributions.
- Describe the implications of regime switching on quantifying volatility.
- Evaluate the various approaches for estimating VaR.
- Compare and contrast different parametric and non-parametric approaches for estimating conditional volatility.
- Calculate conditional volatility using parametric and non-parametric approaches.
- Explain the process of return aggregation in the context of volatility forecasting methods.
- Evaluate implied volatility as a predictor of future volatility and its shortcomings.
- Explain long horizon volatility/VaR and the process of mean reversion according to an AR(1) model.
- Calculate conditional volatility with and without mean reversion.
- Describe the impact of mean reversion on long horizon conditional volatility estimation

2020

VRM-1

Kevin Dowd,
Measuring Market Risk, 2nd Edition
(West Sussex, England: John Wiley & Sons, 2005).
Chapter 2. Measures of Financial Risk

- [!] NEW: Describe the mean-variance framework and the efficient frontier.
- [!] NEW: Explain the limitations of the mean-variance framework with respect to assumptions about return distributions.
- [!] NEW: Compare the normal distribution with the typical distribution of returns of risky financial assets such as equities.
- [!] NEW: Define the VaR measure of risk, describe assumptions about return distributions and holding period, and explain the limitations of VaR.
- Explain and calculate Expected Shortfall (ES), and compare and contrast VaR and ES.
- Define the properties of a coherent risk measure and explain the meaning of each property.
- Explain why VaR is not a coherent risk measure.
- Describe spectral risk measures, and explain how VaR and ES are special cases of spectral risk measures.

2019

VRM-2

- Explain and give examples of linear and non-linear derivatives.
- Describe and calculate VaR for linear derivatives.
- Describe the delta-normal approach to calculating VaR for non-linear derivatives.
- Describe the limitations of the delta-normal method.
- Explain the full revaluation method for computing VaR.
- Compare delta-normal and full revaluation approaches for computing VaR.
- Explain structured Monte Carlo, stress testing and scenario analysis methods for computing VaR. Identifying strengths and weaknesses of each approach.
- Describe the implications of correlation breakdown for scenario analysis.
- Describe worst-case scenario (WCS) analysis and compare WCS to VaR.

2020

VRM-2

- ⚠ NEW: Explain and give examples of linear and non-linear derivatives.
- Describe and calculate VaR for linear derivatives.
- ⚠ NEW: Describe and explain the historical simulation approach for computing VaR and ES.
- ⚠ NEW: Describe the delta-normal approach for calculating VaR for non-linear derivatives.
- ⚠ NEW: Describe the limitations of the delta-normal method.
- Explain the full revaluation method for computing VaR.
- ⚠ NEW: Compare delta-normal and full revaluation approaches for computing VaR.
- ⚠ NEW: Explain structured Monte Carlo and stress testing methods for computing VaR, and identify strengths and weaknesses of each approach.
- Describe the implications of correlation breakdown for scenario analysis.
- ⚠ NEW: Describe worst-case scenario (WCS) analysis and compare WCS to VaR.

2019	2020
VRM-3	**VRM-3**
Kevin Dowd, Measuring Market Risk, 2nd Edition (West Sussex, England: John Wiley & Sons, 2005). Chapter 2. Measures of Financial Risk	Kevin Dowd, Measuring Market Risk, 2nd Edition (West Sussex, England: John Wiley & Sons, 2005). Chapter 2. Measures of Financial Risk

2019

VRM-3

Kevin Dowd,
Measuring Market Risk, 2nd Edition
(West Sussex, England: John Wiley & Sons, 2005).
Chapter 2. Measures of Financial Risk

- Describe the mean-variance framework and the efficient frontier.
- Explain the limitations of the mean-variance framework with respect to assumptions about the return distributions.
- Define the Value-at-Risk (VaR) measure of risk, describe assumptions about return distributions and holding period, and explain the limitations of VaR.
- Define the properties of a coherent risk measure and explain the meaning of each property.
- Explain why VaR is not a coherent risk measure.
- Explain and calculate expected shortfall (ES), and compare and contrast VaR and ES.
- Describe spectral risk measures, and explain how VaR and ES are special cases of spectral risk measures.
- Describe how the results of scenario analysis can be interpreted as coherent risk measures.

2020

VRM-3

Kevin Dowd,
Measuring Market Risk, 2nd Edition
(West Sussex, England: John Wiley & Sons, 2005).
Chapter 2. Measures of Financial Risk

- Explain how asset return distributions tend to deviate from the normal distribution.
- Explain reasons for fat tails in a return distribution and describe their implications.
- Distinguish between conditional and unconditional distributions.
- Describe the implications of regime switching on quantifying volatility.
- Evaluate the various approaches for estimating VaR.
- ❗ NEW: Compare and contrast different parametric and non-parametric approaches for estimating conditional volatility.
- ❗ NEW: Calculate conditional volatility using parametric and non-parametric approaches.
- Evaluate implied volatility as a predictor of future volatility and its shortcomings.
- ❗ NEW: Explain long horizon volatility/VaR and the process of mean reversion according to an GARCH(1,1) model.
- Calculate conditional volatility with and without mean reversion.
- ❗ NEW: Describe the impact of mean reversion on long horizon conditional volatility estimation.
- ❗ NEW: Describe an example of updating correlation estimates.

2019	2020
VRM-4	**VRM-4**
John Hull, Options, Futures, and Other Derivatives, 9th Edition (New York: Pearson, 2014). Chapter 13. Binomial Trees	Arnaud de Servigny and Olivier Renault, Measuring and Managing Credit Risk (New York: McGraw-Hill, 2004). Chapter 2. External and Internal Ratings

2019 VRM-4

- Calculate the value of an American and a European call or put option using a one-step and two-step binomial model.
- Describe how volatility is captured in the binomial model.
- Describe how the value calculated using a binomial model converges as time periods are added.
- Explain how the binomial model can be altered to price options on: stocks with dividends, stock indices, currencies, and futures.
- Define and calculate delta of a stock option.

2020 VRM-4

- Describe external rating scales, the rating process, and the link between ratings and default.
- Describe the impact of time horizon, economic cycle, industry, and geography on external ratings.
- [!] NEW: Define and use the hazard rate to calculate unconditional default probability of a credit asset.
- [!] NEW: Define recovery rate and calculate the expected loss from a loan.
- [!] NEW: Explain and compare the through-the-cycle and at-the-point internal ratings approaches
- [!] NEW: Describe alternative methods to credit ratings produced by rating agencies.
- Compare external and internal ratings approaches.
- [!] NEW: Describe and interpret a ratings transition matrix and explain its uses.
- Explain the potential impact of ratings changes on bond and stock prices.
- [!] NEW: Explain historical failures and potential challenges to the use of credit ratings in making investment decisions.

2019

VRM-5

**John Hull,
Options, Futures, and Other Derivatives, 9th Edition
(New York: Pearson, 2014).
Chapter 15. The Black-Scholes-Merton Model**

- Explain the lognormal property of stock prices, the distribution of rates of return, and the calculation of expected return.
- Compute the realized return and historical volatility of a stock.
- Describe the assumptions underlying the Black-Scholes-Merton option pricing model.
- Compute the value of a European option using the Black-Scholes-Merton model on a non-dividend-paying stock.
- Compute the value of a warrant and identify the complications involving the valuation of warrants.
- Define implied volatilities and describe how to compute implied volatilities from market prices of options using the Black-Scholes-Merton model.
- Explain how dividends affect the decision to exercise early for American call and put options.
- Compute the value of a European option using the Black-Scholes-Merton model on a dividend-paying stock.

2020

VRM-5

**Aswath Damodaran,
Country Risk: Determinants, Measures and Implications -
The 2018 Edition**

- Identify sources of country risk.
- Explain how a country's position in the economic growth life cycle, political risk, legal risk, and economic structure affect its risk exposure.
- **!** NEW: Evaluate composite measures of risk that incorporate all major types of country risk.
- Compare instances of sovereign default in both foreign currency debt and local currency debt, and explain common causes of sovereign defaults.
- Describe the consequences of sovereign default.
- Describe factors that influence the level of sovereign default risk; explain and assess how rating agencies measure sovereign default risks.
- **!** NEW: Describe characteristics of sovereign credit spreads and sovereign CDS, and compare the use of sovereign spreads to credit ratings.

2019	2020
VRM-6	**VRM-6**
John Hull, **Options, Futures, and Other Derivatives, 9th Edition** **(New York: Pearson, 2014).** **Chapter 19. Greek Letters**	**Gerhard Schroeck,** **Risk Management and Value Creation in Financial** **Institutions (New York: John Wiley & Sons, 2002).**

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- Describe and assess the risks associated with naked and covered option positions.
- Explain how naked and covered option positions generate a stop loss trading strategy.
- Describe delta hedging for an option, forward, and futures contracts.
- Compute the delta of an option.
- Describe the dynamic aspects of delta hedging and distinguish between dynamic hedging and hedge-and-forget strategy.
- Define the delta of a portfolio.
- Define and describe theta, gamma, vega, and rho for option positions.
- Explain how to implement and maintain a delta neutral and a gamma neutral position.
- Describe the relationship between delta, theta, gamma, and vega.
- Describe how hedging activities take place in practice, and describe how scenario analysis can be used to formulate expected gains and losses with option positions.
- Describe how portfolio insurance can be created through option instruments and stock index futures.

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- Evaluate a bank's economic capital relative to its level of credit risk.
- ⚠ NEW: Explain the distinctions between economic capital and regulatory capital, and describe how economic capital is derived. Identify and describe important factors used to calculate economic capital for credit risk: probability of default, exposure, and loss rate.
- Define and calculate expected loss (EL).
- ⚠ NEW: Define and explain unexpected loss (UL).
- ⚠ NEW: Estimate the mean and standard deviation of credit losses assuming a binomial distribution.
- ⚠ NEW: Describe the Gaussian copula model and its application.
- ⚠ NEW: Describe and apply the Vasicek model to estimate default rate and credit risk capital for a bank.
- ⚠ NEW: Describe the CreditMetrics model and explain how it is applied in estimating economic capital.
- ⚠ NEW: Describe and use the Euler's theorem to determine the contribution of a loan to the overall risk of a portfolio.
- ⚠ NEW: Explain why it is more difficult to calculate credit risk capital for derivatives than for loans.
- Describe challenges to quantifying credit risk.

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Bruce Tuckman, **Fixed Income Securities, 3rd Edition** **(Hoboken, NJ: John Wiley & Sons, 2011).** **Chapter 1. Prices, Discount Factors, and Arbitrage**	**John Hull,** **Risk Management and Financial Institutions, 4th Edition** **(Hoboken, NJ: John Wiley & Sons, 2015).** **Chapter 23. Operational Risk**

2019 VRM-7

- Define discount factor and use a discount function to compute present and future values.
- Define the "law of one price," explain it using an arbitrage argument, and describe how it can be applied to bond pricing.
- Identify the components of a U.S. Treasury coupon bond, and compare and contrast the structure to Treasury STRIPS, including the difference between P-STRIPS and C-STRIPS.
- Construct a replicating portfolio using multiple fixed income securities to match the cash flows of a given fixed income security.
- Identify arbitrage opportunities for fixed income securities with certain cash flows.
- Differentiate between "clean" and "dirty" bond pricing and explain the implications of accrued interest with respect to bond pricing.
- Describe the common day-count conventions used in bond pricing.

2020 VRM-7

- ⚠ NEW: Describe the different categories of operational risk and explain how each type of risk can arise.
- ⚠ NEW: Compare the basic indicator approach, the standardized approach, and the advanced measurement approach for calculating operational risk regulatory capital.
- ⚠ NEW: Describe the standardized measurement approach and explain the reasons for its introduction by the Basel committee.
- ⚠ NEW: Explain how a loss distribution is derived from an appropriate loss frequency distribution and loss severity distribution using Monte Carlo simulations.
- Describe the common data issues that can introduce inaccuracies and biases in the estimation of loss frequency and severity distributions.
- Describe how to use scenario analysis in instances when data is scarce.
- ⚠ NEW: Describe how to identify causal relationships and how to use Risk and Control Self-Assessment (RCSA), Key Risk Indicators (KRIs), and education to measure and manage operational risks.
- Describe the allocation of operational risk capital to business units.
- Explain how to use the power law to measure operational risk.
- Explain the risks of moral hazard and adverse selection when using insurance to mitigate operational risks.

2019

VRM-8

Bruce Tuckman,
Fixed Income Securities, 3rd Edition
(Hoboken, NJ: John Wiley & Sons, 2011).
Chapter 2. Spot, Forward and Par Rates

- Calculate and interpret the impact of different compounding frequencies on a bond's value.

- Calculate discount factors given interest rate swap rates.

- Compute spot rates given discount factors.

- Interpret the forward rate, and compute forward rates given spot rates.

- Define par rate and describe the equation for the par rate of a bond.

- Interpret the relationship between spot, forward and par rates.

- Assess the impact of maturity on the price of a bond and the returns generated by bonds.

- Define the "flattening" and "steepening" of rate curves and describe a trade to reflect expectations that a curve will flatten or steepen.

2020

VRM-8

Stress Testing: Approaches, Methods, and Applications,
Edited by Akhtar Siddique and Iftekhar Hasan
(London: Risk Books, 2013).
Chapter 1. Governance over Stress Testing
Chapter 2. Stress Testing and Other Risk Management Tools

- Describe the rationale for the use of stress testing as a risk management tool.

- ⚠ NEW: Identify key aspects of stress testing governance, including choice of scenarios, regulatory specifications, model building, stress-testing coverage, capital and liquidity stress testing, and reverse stress testing.

- Describe the relationship between stress testing and other risk measures, particularly in enterprise-wide stress testing.

- ⚠ NEW: Explain the importance of stressed inputs and their importance in stressed VaR and stressed ES.

- Identify the advantages and disadvantages of stressed risk metrics.

- Describe the key elements of effective governance over stress testing.

- Describe the responsibilities of the board of directors and senior management in stress testing activities.

- ⚠ NEW: Identify elements of clear and comprehensive policies, procedures, and documentations for stress testing.

- ⚠ NEW: Identify areas of validation and independent review for stress tests that require attention from a governance perspective.

- Describe the important role of the internal audit in stress testing governance and control.

- ⚠ NEW: Describe the Basel stress testing principles for banks regarding the implementation of stress testing.

VRM-9

VRM-9

Bruce Tuckman,
Fixed Income Securities, 3rd Edition
(Hoboken, NJ: John Wiley & Sons, 2011).
Chapter 3. Returns, Spreads and Yields

Bruce Tuckman,
Fixed Income Securities, 3rd Edition
(Hoboken, NJ: John Wiley & Sons, 2011).
Chapter 1. Prices, Discount Factors, and Arbitrage

- Distinguish between gross and net realized returns, and calculate the realized return for a bond over a holding period including reinvestments.

- Define and interpret the spread of a bond, and explain how a spread is derived from a bond price and a term structure of rates.

- Define, interpret, and apply a bond's yield-to-maturity (YTM) to bond pricing.

- Compute a bond's YTM given a bond structure and price.

- Calculate the price of an annuity and a perpetuity.

- Explain the relationship between spot rates and YTM.

- Define the coupon effect and explain the relationship between coupon rate, YTM, and bond prices.

- Explain the decomposition of P&L for a bond into separate factors including carry roll-down, rate change and spread change effects.

- Identify the most common assumptions in carry roll-down scenarios, including realized forwards, unchanged term structure, and unchanged yields.

- Define discount factor and use a discount function to compute present and future values.

- Define the "law of one price," explain it using an arbitrage argument, and describe how it can be applied to bond pricing.

- Identify arbitrage opportunities for fixed income securities with certain cash flows.

- ⚠ NEW: Identify the components of a US Treasury coupon bond, and compare the structure to Treasury STRIPS, including the difference between P-STRIPS and C-STRIPS.

- ⚠ NEW: Construct a replicating portfolio using multiple fixed income securities to match the cash flows of a given fixed- income security.

- ⚠ NEW: Differentiate between "clean" and "dirty" bond pricing and explain the implications of accrued interest with respect to bond pricing.

- ⚠ NEW: Describe the common day-count conventions used in bond pricing.

2019	2020
VRM-10	**VRM-10**
Bruce Tuckman, Fixed Income Securities, 3rd Edition (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 4. One-Factor Risk Metrics and Hedges	**Bruce Tuckman, Fixed Income Securities, 3rd Edition (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 2. Spot, Forward and Par Rates**

2019 — VRM-10

- Describe an interest rate factor and identify common examples of interest rate factors.
- Define and compute the DV01 of a fixed income security given a change in yield and the resulting change in price.
- Calculate the face amount of bonds required to hedge an option position given the DV01 of each.
- Define, compute, and interpret the effective duration of a fixed income security given a change in yield and the resulting change in price.
- Compare and contrast DV01 and effective duration as measures of price sensitivity.
- Define, compute, and interpret the convexity of a fixed income security given a change in yield and the resulting change in price.
- Explain the process of calculating the effective duration and convexity of a portfolio of fixed income securities.
- Explain the impact of negative convexity on the hedging of fixed income securities.
- Construct a barbell portfolio to match the cost and duration of a given bullet investment, and explain the advantages and disadvantages of bullet versus barbell portfolios.

2020 — VRM-10

- Calculate and interpret the impact of different compounding frequencies on a bond's value.
- **!** NEW: Define spot rate and compute spot rates given discount factors.
- Interpret the forward rate, and compute forward rates given spot rates.
- Define par rate and describe the equation for the par rate of a bond.
- **!** NEW: Interpret the relationship between spot, forward, and par rates.
- Assess the impact of maturity on the price of a bond and the returns generated by bonds.
- **!** NEW: Define the "flattening" and "steepening" of rate curves and describe a trade to reflect expectations that a curve will flatten or steepen.
- **!** NEW: Describe a swap transaction and explain how a swap market defines par rates.

2019	2020
VRM-11	**VRM-11**
Bruce Tuckman, Fixed Income Securities, 3rd Edition (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 5. Multi-Factor Risk Metrics and Hedges	Bruce Tuckman, Fixed Income Securities, 3rd Edition (Hoboken, NJ: John Wiley & Sons, 2011). Chapter 3. Returns, Spreads and Yields

2019 — VRM-11

- Describe and assess the major weakness attributable to single-factor approaches when hedging portfolios or implementing asset liability techniques.
- Define key rate exposures and know the characteristics of key rate exposure factors including partial '01s and forward-bucket '01s.
- Describe key-rate shift analysis.
- Define, calculate, and interpret key rate '01 and key rate duration.
- Describe the key rate exposure technique in multi-factor hedging applications; summarize its advantages and disadvantages.
- Calculate the key rate exposures for a given security, and compute the appropriate hedging positions given a specific key rate exposure profile.
- Relate key rates, partial '01s and forward-bucket '01s, and calculate the forward bucket '01 for a shift in rates in one or more buckets.
- Construct an appropriate hedge for a position across its entire range of forward bucket exposures.
- Apply key rate and multi-factor analysis to estimating portfolio volatility.

2020 — VRM-11

- Distinguish between gross and net realized returns, and calculate the realized return for a bond over a holding period including reinvestments.
- Define and interpret the spread of a bond, and explain how a spread is derived from a bond price and a term structure of rates.
- [!] NEW: Define, interpret, and apply a bond's yield-to-maturity (YTM) to bond pricing.
- [!] NEW: Compute a bond's YTM given a bond structure and price.
- Calculate the price of an annuity and a perpetuity.
- [!] NEW: Explain the relationship between spot rates and YTM.
- Define the coupon effect and explain the relationship between coupon rate, YTM, and bond prices.
- [!] NEW: Explain the decomposition of the profit and loss (P&L) for a bond position or portfolio into separate factors including carry roll-down, rate change, and spread change effects.
- [!] NEW: Explain the following four common assumptions in carry roll-down scenarios: realized forwards, unchanged term structure, unchanged yields, and realized expectations of short-term rates; and calculate carry roll down under these assumptions.

VRM-12

VRM-12

**Aswath Damodaran,
Country Risk: Determinants, Measures and Implications -
The 2017 Edition (July 19, 2017).
(Pages 1-47 only).**

**Bruce Tuckman,
Fixed Income Securities, 3rd Edition
(Hoboken, NJ: John Wiley & Sons, 2011).
Chapter 4. One-Factor Risk Metrics and Hedges**

- Identify sources of country risk.

- Explain how a country's position in the economic growth life cycle, political risk, legal risk, and economic structure affect its risk exposure.

- Evaluate composite measures of risk that incorporate all types of country risk and explain limitations of the risk services.

- Compare instances of sovereign default in both foreign currency debt and local currency debt, and explain common causes of sovereign defaults.

- Describe the consequences of sovereign default.

- Describe factors that influence the level of sovereign default risk; explain and assess how rating agencies measure sovereign default risks.

- Describe the advantages and disadvantages of using the sovereign default spread as a predictor of defaults.

- [!] NEW: Describe a one-factor interest rate model and identify common examples of interest rate factors.

- Define and compute the DV01 of a fixed income security given a change in yield and the resulting change in price.

- Calculate the face amount of bonds required to hedge an option position given the DV01 of each.

- Define, compute, and interpret the effective duration of a fixed income security given a change in yield and the resulting change in price.

- Compare and contrast DV01 and effective duration as measures of price sensitivity.

- Define, compute, and interpret the convexity of a fixed income security given a change in yield and the resulting change in price.

- Explain the process of calculating the effective duration and convexity of a portfolio of fixed income securities.

- [!] NEW: Describe an example of hedging based on effective duration and convexity.

- Construct a barbell portfolio to match the cost and duration of a given bullet investment, and explain the advantages and disadvantages of bullet versus barbell portfolios.

VRM-13

VRM-13

**Arnaud de Servigny and Olivier Renault,
Measuring and Managing Credit Risk
(New York: McGraw-Hill, 2004).
Chapter 2. External and Internal Ratings**

**Bruce Tuckman, Fixed Income Securities, 3rd Edition
(Hoboken, NJ: John Wiley & Sons, 2011).
Chapter 5. Multi-Factor Risk Metrics and Hedges**

- Describe external rating scales, the rating process, and the link between ratings and default.

- Describe the impact of time horizon, economic cycle, industry, and geography on external ratings.

- Explain the potential impact of ratings changes on bond and stock prices.

- Compare external and internal ratings approaches.

- Explain and compare the through-the-cycle and at-the-point internal ratings approaches.

- Describe a ratings transition matrix and explain its uses.

- Describe the process for and issues with building, calibrating and backtesting an internal rating system.

- Identify and describe the biases that may affect a rating system.

- ⚠ • NEW: Describe and assess the major weakness attributable to single-factor approaches when hedging portfolios or implementing asset liability techniques.

- ⚠ • NEW: Describe the principal components analysis and explain its use in understanding term structure movements.

- ⚠ • NEW: Define key rate exposures and know the characteristics of key rate exposure factors including partial '01s and forward-bucket '01s.

- ⚠ • NEW: Describe key-rate shift analysis.

- Define, calculate, and interpret key rate '01 and key rate duration.

- ⚠ • NEW: Describe the key rate exposure technique in multi-factor hedging applications; summarize its advantages and disadvantages.

- Calculate the key rate exposures for a given security, and compute the appropriate hedging positions given a specific key rate exposure profile.

- ⚠ • NEW: Relate key rates, partial '01s and forward-bucket '01s, and calculate the forward-bucket '01 for a shift in rates in one or more buckets.

- ⚠ • NEW: Apply key rate and multi-factor analysis to estimating portfolio volatility.

2019

VRM-14

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

- Evaluate a bank's economic capital relative to its level of credit risk

- Identify and describe important factors used to calculate economic capital for credit risk: probability of default, exposure, and loss rate.

- Define and calculate expected loss (EL).

- Define and calculate unexpected loss (UL).

- Estimate the variance of default probability assuming a binomial distribution.

- Calculate UL for a portfolio and the risk contribution of each asset.

- Describe how economic capital is derived.

- Explain how the credit loss distribution is modeled.

- Describe challenges to quantifying credit risk.

2020

VRM-14

New Edition: John C. Hull,
Options, Futures, and Other Derivatives, 10th Edition
(New York: Pearson, 2017).
Chapter 13.

- **!** NEW: Calculate the value of an American and a European call or put option using a one-step and two-step binomial model.

- Describe how volatility is captured in the binomial model.

- Describe how the value calculated using a binomial model converges as time periods are added.

- Define and calculate delta of a stock option.

- **!** NEW: Explain how the binomial model can be altered to price options on stocks with dividends, stock indices, currencies, and futures.

2019

VRM-15

- Compare three approaches for calculating regulatory capital.

- Describe the Basel Committee's seven categories of operational risk.

- Derive a loss distribution from the loss frequency distribution and loss severity distribution using Monte Carlo simulations.

- Describe the common data issues that can introduce inaccuracies and biases in the estimation of loss frequency and severity distributions.

- Describe how to use scenario analysis in instances when data is scarce.

- Describe how to identify causal relationships and how to use risk and control self-assessment (RCSA) and key risk Indicators (KRIs) to measure and manage operational risks.

- Describe the allocation of operational risk capital to business units.

- Explain how to use the power law to measure operational risk.

- Explain the risks of moral hazard and adverse selection when using insurance to mitigate operational risks.

2020

VRM-15

- Explain the lognormal property of stock prices, the distribution of rates of return, and the calculation of expected return.

- Compute the realized return and historical volatility of a stock.

- ⚠ NEW: Describe the assumptions underlying the Black-Scholes-Merton option pricing model.

- ⚠ NEW: Compute the value of a European option using the Black-Scholes-Merton model on a non-dividend-paying stock.

- ⚠ NEW: Define implied volatilities and describe how to compute implied volatilities from market prices of options using the Black-Scholes-Merton model.

- Explain how dividends affect the decision to exercise early for American call and put options.

- ⚠ NEW: Compute the value of a European option using the Black-Scholes-Merton model on a dividend-paying stock, futures, and exchange rates.

- ⚠ NEW: Describe warrants, calculate the value of a warrant, and calculate the dilution cost of the warrant to existing shareholders.

VRM-16

VRM-16

**Stress Testing: Approaches, Methods, and Applications,
Edited by Akhtar Siddique and Iftekhar Hasan
(London: Risk Books, 2013).
Chapter 1. Governance over Stress Testing**

**John Hull,
Options, Futures, and Other Derivatives, 9th Edition
(New York: Pearson, 2014).
Chapter 19. Greek Letters**

- Describe the key elements of effective governance over stress testing.
- Describe the responsibilities of the board of directors and senior management in stress testing activities.
- Identify elements of clear and comprehensive policies, procedures and documentations on stress testing.
- Identify areas of validation and independent review for stress tests that require attention from a governance perspective.
- Describe the important role of the internal audit in stress testing governance and control.
- Identify key aspects of stress testing governance, including stress-testing coverage, stress-testing types and approaches, and, capital and liquidity stress testing

- Describe and assess the risks associated with naked and covered option positions.
- ⚠ NEW: Describe the use of a stop loss hedging strategy, including its advantages and disadvantages, and explain how this strategy can generate naked and covered option positions.
- Describe delta hedging for an option, forward, and futures contracts.
- Compute the delta of an option.
- ⚠ NEW: Describe the dynamic aspects of delta hedging and distinguish between dynamic hedging and hedge-and-forget strategy.
- ⚠ NEW: Define and calculate the delta of a portfolio.
- ⚠ NEW: Define and describe theta, gamma, vega, and rho for option positions, and calculate the gamma and vega for a portfolio.
- ⚠ NEW: Explain how to implement and maintain a delta-neutral and a gamma-neutral position.
- Describe the relationship between delta, theta, gamma, and vega.
- Describe how portfolio insurance can be created through option instruments and stock index futures.