



THE PROFESSIONAL RISK MANAGER (PRM™)
CERTIFICATION PROGRAMME

PRM Self Study Guide – Exam I

(ONE OF FIVE)

FINANCE THEORY, FINANCIAL INSTRUMENTS, FINANCIAL MARKETS





[PREE·mee·ah]

FROM THE CRADLE TO THE PINNACLE OF YOUR CAREER

A Higher Standard for Risk Professionals

As a non-profit, member-led association of professionals, the Professional Risk Managers' International Association (PRMIA) is dedicated to advancing the standards of the profession worldwide through the free exchange of ideas. We are committed to helping our members achieve these standards through the following resources.

- CONNECTION TO A LOCAL CHAPTER NETWORK OF 54,000 MEMBERS IN OVER 180 COUNTRIES – Over 150 meetings each year are offered through more than 65 local PRMIA chapters, giving members access to the best practices of the global risk profession and to a local network of colleagues.
- THE PROFESSIONAL RISK MANAGER (PRM) CERTIFICATION – Endorsed by leading universities and businesses, the PRM certification is the global standard for financial risk managers and is offered in 140 countries.
- ASSOCIATE PRM CERTIFICATE – Covers the core concepts of risk management, allowing non-specialists to interpret risk management information and reports, make critical assessments, and evaluate the implications and the limitations of such results.
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PRM™ SELF-STUDY GUIDE – EXAM I

Finance Theory, Financial Instruments, Financial Markets

OVERVIEW

Exam I of the PRM™ certification tests a candidate's knowledge and understanding of the foundations of finance theory, the financial instruments that provide tools for the mitigation or transfer of risk, and the financial markets in which instruments are traded and capital is raised.

As a whole, the reading material for Exam I gives an overview of the theoretical and practical aspects of finance that are used in the management of financial risks. Many concepts, some quite complex, are explained in a relatively simple language and are demonstrated with numerous examples. Studying these books should refresh your knowledge of financial models, products and markets and provide the background for risk management applications.

You can use this Self-Study Guide to focus your study on the key Learning Outcome Statements from each chapter. These Learning Outcome Statements form the basis for the questions asked during the examination that you will take as Exam I of the PRM™ certification program. We recommend that you first read the chapter, then review the Learning Outcome Statements, then re-read the chapter with particular emphasis on these points.

We recommend strongly that you do not simply read the Learning Outcome Statements and then try to find the information about each in the books as a short-cut way of preparing for the exam. Real-life risk management requires your ability to assemble information from many simultaneous inputs and you can expect that some exam questions will draw from multiple Learning Outcome Statements.

After studying the three books for this section, becoming comfortable with your knowledge and understanding of each Learning Outcome Statement, and working through the Study Questions and the Sample Exam Questions, you will have read the materials necessary for passing Exam I of the PRM™ Certification program. You may then wish to purchase access to online Sample Exams (Diagnostics) via the PRMIA website to assess your readiness.

Taking the PRM™ qualification, as well as working as a risk officer, requires a certain amount of mathematical expertise. This is not excessive. Anyone who was passed mathematics studies at advanced high school level, or who has completed the first year of a university degree in a mathematical-based qualification (physics, economics, engineering, etc) should have no problem with the requirements. For others, we recommend that they take tuition in the mathematics required and that they focus on this as the first part of their studies for the PRM™.

Please note that testing conditions, your state of mind and various factors can make your performance on the actual exams somewhat less strong than on the Sample Exams. If your Sample Exam scores are near to the passing mark, you may wish to study the subject materials even further.

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Please remember that the exams of the PRM™ certification are very challenging. After all it's "a higher standard in risk certification" and you would expect nothing less. There is no guarantee that using the Self-Study Guide, in combination with the reading materials and Sample Exams will give you a passing score. But, they should all provide you with assistance in doing your best. We wish you much success in your effort to become certified as a Professional Risk Manager!

WORD DEFINITIONS

In this guide, we use Command Words. These are similar to those used by the CFA Institute, with a few additional words, and indicate levels of ability expected from successful candidates on each Learning Outcome Statement.

Calculate	To ascertain or determine by mathematical processes.
Characterize	To describe the essential character or quality of.
Compare	To examine the character or qualities of, for the primary purpose of discovering resemblances.
Construct	To create by organizing ideas or concepts logically and coherently.
Contrast	To compare in respect to differences.
Deconstruct	To disassemble the key elements of ideas or concepts.
Define	To set forth the meaning of; specifically, to formulate a definition of.
Demonstrate	To prove or make clear by reasoning or evidence; to illustrate and explain, especially with examples.
Derive	To obtain by reasoning
Describe	To transmit a mental image, an impression, or an understanding of the nature and characteristics of.
Differentiate	To mark or show a difference in; to develop different characteristics in.
Discuss	To discourse about through reasoning or argument; to present in detail.
Draw	To express graphically in words; to delineate.
Explain	To give the meaning or significance of; to provide an understanding of; to give the reason for or cause of.
Identify	To establish the identity of; to show or prove the sameness of.
List	To enumerate.
Show	To set forth in a statement, account, or description; to make evident or clear.
State	To express in words.

STUDY TIME

Preparation time will vary greatly according to your knowledge and understanding of the subject matter prior to your self-study, your ability to commit dedicated and uninterrupted time to your study and other factors. In general, candidates who prepare for the exams of the PRM™ certification program allocate about three months to preparation for each exam.

You may spend three hours each week in study, or as much as ten or more, each week to ready yourself. Follow the suggestions above regarding the use of the Learning Outcome Statements and Sample Exams. Once you are comfortable with your readiness, it's time to register for the exam.

TESTING STRATEGIES

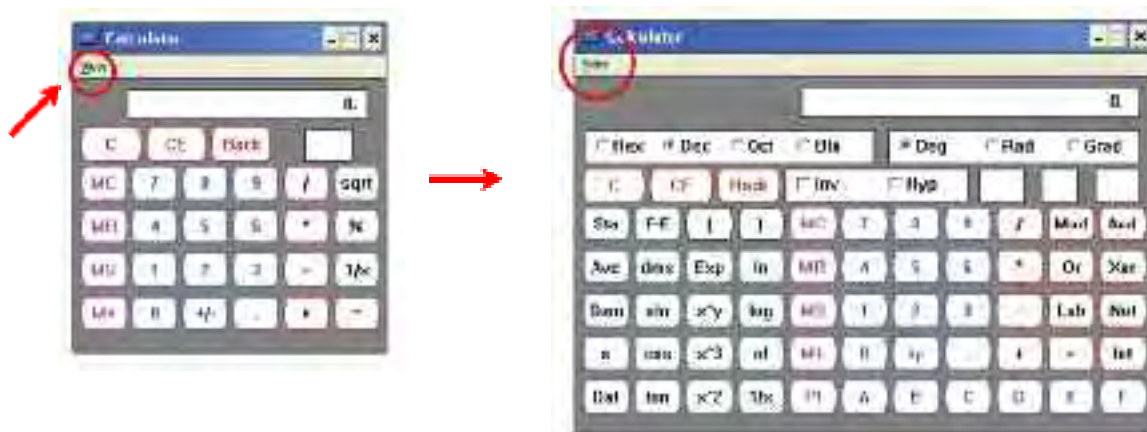
All questions are multiple-choice and there are no penalties for incorrect answers. Bear in mind that it is vitally important to finish the exam in the time allotted. Do not linger over questions longer than is sensible.

For example, if the exam has 30 questions in 90 minutes, do not spend longer than three minutes per question. If at the end of three minutes you have not answered the question, decide on the best answer you can (ignoring the obviously wrong), mark your answer and move on. If you do have any spare time at the end of the exam you can always go back and review the answer. However, make absolutely sure that you have an answer for every question at the end of the exam!

Another strategy would be to go through all the questions answering the ones you find easier ones first. Then after a first pass, divide the remaining questions by the time remaining and proceed as above.

USAGE OF THE CALCULATOR

At the exam centre you will have access to an on-line calculator. This is very similar to the Microsoft Calculator (available as standard with Microsoft Windows) and offers both scientific and standard functionality which is toggled through a “View” menu option.



Candidates may **not** take their own calculators into the exam venue. Candidates must familiarize themselves with the usage of this calculator before the exam including all calculations described in the PRM™ Handbooks. Finding out during the exam that the exam venue calculator is not the same as that with which you are familiar is not a recommended strategy!

STUDY QUESTIONS

A few questions, with answers, have been provided to help the candidate understand some of the concepts of the PRM™ Handbook. These study questions are not comprehensive of all concepts in the exam, nor are they necessarily questions of a similar type to those in the exam. They are provided in good faith as a study aid.

SAMPLE EXAM QUESTIONS

In Volume 5 of this Study Guide there are sample questions from all four exams. These sample questions should give you a flavor for the format and content of the actual exams. They are only part of the length of the actual exams and therefore do not cover all subjects contained in the detailed content description provided in this document. Questions on any of the subjects listed previously may appear on the actual exam.

FINANCE THEORY

The modern theory of finance is the solid basis of risk management and thus it naturally represents the basis of the PRM™ certification program. All major areas of finance are involved in the process of risk management: from the expected utility approach and risk aversion, which were the forerunners of the capital asset pricing model (CAPM), to portfolio theory and the risk-neutral approach to pricing derivatives. All of these great financial theories and their interactions are presented in *The Professional Risk Managers' Guide to Finance Theory and its Applications*. Many examples demonstrate how the concepts are applied in practical situations.

THE INTRODUCTION presents the fundamental concept that money has a time value that results from investment opportunities. It covers basic measures of interest rates, the value of time and compounding methods. These foundational concepts have relevance for the valuation of all financial assets.

Interest Rates and Time Value

Learning Outcome Statement

The candidate should be able to:

- Differentiate between continuous and discrete compounding
- Differentiate between the nominal interest rate and effective yield

CHAPTER 1 provides a general overview of risk and risk aversion, introduces the utility function and mean–variance criteria. Various risk-adjusted performance measures are described. A summary of several widely used utility functions is presented in the appendix.

Risk and Risk Aversion

Learning Outcome Statement

The candidate should be able to:

- Explain the concepts of Utility and Utility Maximization
- Explain the ways of the determination of utility function
- Explain the concept of Risk Aversion
- Discuss the Mean-Variance Criterion
- Define the Sharpe, Treynor and Information Ratios
- Define Jensen's Alpha, RAROC, RoVaR and RAPM
- Define the Sortino, Omega Index and Kappa Ratios

CHAPTER 2 provides an introduction to portfolio mathematics, from means and variances of returns to correlation and portfolio variance. This leads the reader to the efficient frontier, portfolio theory and the concept of portfolio diversification. Eventually this chapter discusses normally distributed returns and basic applications for value-at-risk, as well as the probability of reaching a target or beating a benchmark. This chapter is very useful for anybody with little experience in applying basic mathematical models in finance.

Portfolio Mathematics

Learning Outcome Statement

The candidate should be able to:

- Calculate the return, mean return, variance and standard deviation of a single asset
- Calculate the return, mean return, variance and standard deviation of a portfolio

- Calculate the correlation between two assets
- Identify a dominated portfolio
- Discuss the efficient frontier
- Calculate the minimum variance hedge ratio
- Describe how diversification reduces risk
- Describe the impact of serial correlation on the standard deviation of returns
- Calculate Value at Risk in a portfolio
- Calculate the probability that one portfolio will outperform another portfolio
- Calculate the probability of attaining a return goal

The concept of capital allocation is another fundamental notion for risk managers. [CHAPTER 3](#) describes how capital is allocated between portfolios of risky and riskless assets, depending on risk preference. Then the efficient frontier, the capital market line, the Sharpe ratio and the separation principle are introduced. These concepts lead naturally to a discussion of the CAPM model and the idea that marginal risk (rather than absolute risk) is the key issue when pricing risky assets.

Capital Allocation

Learning Outcome Statement

The candidate should be able to:

- Describe efficient portfolios that satisfy the mean-variance criterion
- Describe tolerances and preferences for Risk vs. Return
- Show the efficient frontier for two assets
- Show the efficient frontier for a multi-asset portfolio
- Define the risk-free asset
- Derive and describe the Capital Allocation Line
- Describe the Capital Markets Line
- Define the market portfolio
- Describe the separation principle
- List the predictions of Mean-Variance Portfolio Theory

[CHAPTER 4](#) provides a rigorous description of the CAPM model, including betas, systematic risk, alphas and performance measures. Arbitrage pricing theory and multifactor models are also introduced in this chapter.

The CAPM and Multifactor Models

Learning Outcome Statement

The candidate should be able to:

- Describe the Capital Asset Pricing Model (CAPM)
- Describe Beta as a Measure of Relative Risk
- List the assumptions of the CAPM
- Define risk premium
- Derive the Security Market Line
- Define and Calculate the Sharpe Ratio and Jensen's Alpha
- Describe the Single Index Model
- Describe systematic and specific risk
- Describe the Arbitrage Pricing Theory (APT)

Capital structure is an important theoretical concept for risk managers since capital is viewed as the last defense against extreme, unexpected outcomes. **CHAPTER 5** introduces capital structure, advantages and costs related to debt financing, various agency costs, various types of debt and equity, return on equity decomposition, examples of attractive and unattractive debt, bankruptcy and financial distress costs.

Basics of Capital Structure

Learning Outcome Statement

The candidate should be able to:

- Explain and Show the formula for the Value of a Firm
- Describe the Agency costs of Equity
- Describe the Agency costs of Debt
- Describe the characteristics of Debt and Equity
- Characterize the impact of leverage on ROE volatility
- Characterize the impact of taxes on the debt/equity decision
- Compare the CFO considerations for issuing debt vs. equity

Interest rates are an integral part of the valuation of financial assets, making an understanding of the term structure of interest rates crucial to risk management professionals. **CHAPTER 6** explains simple methods for constructing the term structure of yields from observed bond prices, and then turns to the models that practitioners use in valuation, portfolio construction and risk management.

The Term Structure of Interest Rates

Learning Outcome Statement

The candidate should be able to:

- Describe yield to maturity as an internal rate of return
- Define spot curve, spot rate and term structure
- Define and describe the yield curve
- Demonstrate the process of bootstrapping
- Define no-arbitrage pricing
- Calculate implied forward rates
- Describe normal, flat and inverted yield curves
- Describe the pure expectations theory
- Describe the liquidity preference theory
- Describe the preferred habitat theory
- Describe the market segmentation theory
- Compare and contrast the Ho-Lee, Hull-White and Black-Derman-Toy models
- Compare and contrast single-factor and multi-factor models
- Describe mean reversion
- Calculate the value of non-callable bonds using term structure models
- Describe the impact of an embedded call on the value of a bond using term structure models
- Calculate effective duration and convexity within a term structure model
- Define Option Adjusted Spread
- Discuss the implications of choosing one term structure model over the others

These days all risk managers must be well versed in the use and valuation of derivatives. The two basic types of derivatives are forwards (having a linear payoff) and options (having a non-linear payoff). All other derivatives can be decomposed to these underlying payoffs or alternatively they are variations on these basic ideas.

CHAPTER 7 describes valuation methods used for forward contracts. Cost-of carry model is used to value forward contracts with and without intermediate cash flow.

Valuing Forward Contracts

Learning Outcome Statement

The candidate should be able to:

- Define spot price and forward price
- Calculate the value of a forward contract at expiration and prior to expiration
- Describe the impact of intermediate cash flows on the value of a forward contract
- Describe the impact of storage costs on the value of a forward contract
- Describe the impact of convenience yield on the value of a forward contract
- Calculate the forward price of a bond, stock, currency and commodity
- Define and Discuss a Forward Rate Agreement (FRA)
- Calculate the value and price of FRA
- Compare and contrast forwards and futures

CHAPTER 8 introduces the principles of option pricing. It starts with definitions of basic put and call options, put–call parity, binomial models, risk-neutral methods and simple delta hedging. Then the Black–Scholes–Merton formula is introduced. Finally, implied volatility and smile effects are briefly described.

Basic Principles of Option Pricing

Learning Outcome Statement

The candidate should be able to:

- Discuss the factor influencing option price
- Describe put-call parity
- Discuss the basic principles of the binomial option model
- Define and discuss delta-hedging
- Explain risk-neutral valuation
- Calculate an option price using a one-step binomial model
- Define the symbols and letters of inputs into the binomial model
- Describe the basic principles of the Black-Scholes-Merton model
- State the Black-Scholes-Merton formula for pricing a call option
- Calculate an option price using Black-Scholes-Merton model
- Identify and discuss the graphic representations of a put and a call
- Define delta, gamma, vega, theta and rho
- Define and discuss implied volatility
- Define a volatility smile
- Define intrinsic value and time value

FINANCIAL INSTRUMENTS

Having firmly established the theoretical basis for valuation in *The Professional Risk Managers' Guide to Finance Theory and its Applications*, *The Professional Risk Managers' Guide to Financial Instruments* applies these theories to the most commonly used financial instruments.

CHAPTER 1 introduces bonds, defines the main types of bonds and describes the market conventions for major types of treasuries, strips, floaters (floating-rate notes) and inflation-protected bonds in different countries. Bloomberg screens are used to show how the market information is presented.

General Characteristics of Bonds Learning Outcome Statement

The candidate should be able to:

- Define and discuss the various characteristics of bond issues
- List and discuss the Moody's and S&P ratings for bonds
- Define clean price, dirty price, accrued interest and bond yield
- Define bond spread (yield spread) and bid/ask spread
- Describe the impact of liquidity on spreads
- Discuss strips, floating rate notes and inflation-indexed bonds

CHAPTER 2 analyses the main types of bonds, describes typical cash flows and other features of bonds and also gives a brief description of non-conventional instruments. Examples of discounting, day conventions and accrued interest are provided, as well as yield calculations. The connection between yield and price is described, thus naturally leading the reader to duration, convexity and hedging interest-rate risk.

The Analysis of Bonds

Learning Outcome Statement

The candidate should be able to:

- Define nominal (notional, face, par, maturity) value, maturity, term to maturity, coupon, coupon-rate, zero-coupon and vanilla bond
- Describe a bond as a series of cash flows
- Define index-linked bonds, securitized bonds, amortizing bonds, callable bonds, puttable bonds and convertible bonds
- Define discount and premium
- Calculate the clean and dirty price of a bond
- Calculate current yield and yield to maturity
- Describe the relationship between yield and price
- Discuss the "pull to par" of bond prices
- Compare and contrast Macauley Duration and Modified Duration
- Define DVBP, dollar duration and key rate duration
- Calculate the modified duration of a bond
- Describe the shortcomings of Macauley and Modified durations
- Calculate the DVBP of a bond
- Discuss Effective Duration
- Discuss the duration of a floating rate note
- Describe the impact of an embedded call or put on duration
- Define basis point value (BPV)
- Calculate the hedge ratio for a bond using BPV

- Define and discuss convexity
- Describe the impact of an embedded call or put on convexity
- Discuss the various risks associated with a bond

CHAPTER 3 examines and compares futures and forward contracts. Usage of these contracts for hedging and speculation is discussed. Examples of currency, commodity, bonds and interest-rate contracts are used to explain the concept and its applications. Mark-to-market, quotation, settlements and other specifications are described here as well. The principles of forward valuation are next applied to swap contracts, which may be considered to be bundles of forward contracts.

Futures and Forwards

Learning Outcome Statement

The candidate should be able to:

- Compare and Contrast forward and futures contracts
- Discuss some uses of stock index futures
- Define index point and value of an index point
- Describe index arbitrage and program trading
- Calculate a minimum variance hedge ratio for a portfolio of stocks, using futures, given beta
- Describe some risks in index hedging
- Discuss “tailing the hedge”
- Compare and contrast currency forwards and futures contracts
- Define covered interest parity
- Calculate a forward exchange rate
- Calculate a hedge ratio using foreign exchange futures
- Discuss the relative basis risks with commodity futures
- Define forward rate agreement (FRA)
- Discuss FRAs, their nomenclature, uses and settlement
- Calculate T-bill and Eurodollar futures prices
- Construct a hedge using Eurodollar or T-bill futures
- Define the tick value of a Eurodollar or T-bill futures contract
- Define cheapest-to-deliver and conversion factor
- Compare and contrast T-Bond and Gilt futures contracts
- Define the tick value of a T-Bond and Gilt futures contract
- Construct a hedge using T-bond futures
- Compare and contrast stack and strip hedges

CHAPTER 4 analyses some of the most popular swap varieties, explaining how they may be priced and used for managing risk.

Swaps

Learning Outcome Statement

The candidate should be able to:

- Define a swap
- List the key components of a swap agreement
- Discuss equity swaps
- Discuss commodity swaps

- Define buyer of interest rate swaps
- Discuss interest rate swaps
- Discuss currency swaps
- Discuss basis swaps
- Discuss volatility swaps
- Decompose a swap into its respective cash flows
- Define par swap, accrual swap, commodity-linked interest rate swap, crack spread swap, overnight index swap, power LIBOR swap and extendible swap
- Define swap spread and swap rate
- Define the payer and receiver in swaps
- Discuss risk of swaps
- Discuss main uses of swaps

The remaining chapters in the book all apply the principles of option valuation as introduced in Chapter 8 of the *Professional Risk Managers' Guide to Finance Theory and its Applications*. The power of the option concept is obvious when we see its applications to so many instruments and risk management problems. [CHAPTER 5](#) begins with an analysis of vanilla options.

Vanilla Options

Learning Outcome Statement

The candidate should be able to:

- Define premium, underlying, strike (exercise) price, expiration date (expiry), in-the-money, at-the-money and out-of-the-money
- Draw the expiration payoff diagram of a put and a call
- Compare and contrast the risk of long and short option positions
- Compare and contrast American, European and Bermudan options
- Draw and discuss the expiration payoff diagrams of a covered call, protective put, call spread, put spread, straddle, strangle, collar, butterfly and condor
- Describe a calendar spread
- Discuss uses of straddles, strangles, risk reversals, collars, butterflies and condors

[CHAPTER 6](#) covers one of the newer applications of options: the use of credit risk derivatives to manage credit risk. Whilst not all credit derivatives are options, they can be ultimately decomposed into options, as for any financial instrument.

Credit Derivatives

Learning Outcome Statement

The candidate should be able to:

- Contrast technical default and actual default
- Discuss the applications of credit derivatives
- Define reference entity, credit event, settlement mechanism and deliverable obligation
- Define and discuss funded and unfunded instruments
- List the types of credit events contained in a standard ISDA credit derivatives document
- Define and discuss credit default swaps (CDS) and their prospective cash flows

- Define reference asset
- Discuss some advantages of physical settlement vs. cash settlement in credit default swaps
- Define and discuss loan-only credit default swaps (LCDS)
- Define structured finance security CDS
- Define and discuss pay-as-you-go CDS
- Define and discuss credit-linked notes (CLN) and their prospective cash flows
- Define and discuss total return swaps (TRS) and their prospective cash flows
- Discuss the risks of total return swaps
- Discuss the potential balance-sheet implications of different total return swap structures
- Discuss the use of total return swaps as a funding vehicle
- Define a credit option call and put
- Define and discuss collateralized debt obligations (CDO), collateralized bond obligation (CBO) and collateralized loan obligation (CLO) and their prospective cash flows
- Define tranche, tranching and credit enhancement
- Define senior note, subordinated note, mezzanine note and equity note and how cash flows to each
- List various credit enhancements
- Discuss synthetic CDOs and their prospective cash flows
- Define reference portfolio
- Define first-loss piece
- Describe unfunded, partially funded, fully funded and fully unfunded synthetic CDOs
- Define super-senior swap
- Discuss some uses, advantages and limitations of synthetic CDOs
- Discuss some general applications of credit derivatives
- Discuss some possible unintended risks with credit derivatives

CHAPTER 7 addresses caps, floors and swaptions, which are the main option strategies used in interest-rate markets.

Caps, Floors and Swaptions

Learning Outcome Statement

- Define cap, floor, collar, caplet, floorlet, reference rate, exercise rate, settlement frequency, starting date and maturity
- Describe a cap or floor as a portfolio of options
- Discuss various uses of caps, floors and collars in hedging
- Define swaption, receiver option and payer option
- Discuss the pricing of swaptions
- Discuss the quotation conventions for caps, floors and swaptions
- Discuss some uses of swaptions in hedging and when they might be preferred to caps and floors

Chapter 8, Convertible Bonds, and Chapter 9, Simple Exotics were removed from the PRM™ syllabus in 2006.

FINANCIAL MARKETS

Financial risk management takes place in the context of markets and varies depending on the nature of the market. In *The Professional Risk Managers' Guide to Financial Markets*, CHAPTER 1 provides a general introduction to world financial markets. They can be variously classified – geographically, by type of exchange, by issuers, liquidity and type of instruments – all are provided here. The importance of liquidity, the distinction between exchange and over-the-counter markets and the role of intermediaries in their various forms are explained in more detail.

The Structure of Financial Markets

Learning Outcome Statement

The candidate should be able to:

- Compare and contrast financial exchanges and OTC markets
- Define inter-dealer market and inter-dealer broker
- Compare and contrast the size of various markets (bonds, foreign exchange, equities, etc)
- Discuss the importance of market liquidity
- Describe a repo and a reverse repo and their roles as sources of liquidity
- Define an ISDA Master Agreement
- Describe how screen-trading systems work
- Describe a market “specialist”
- Describe an “open-outcry” trading system
- Describe an ECN
- Describe the steps in post-trade processing
- Describe straight-through processing
- Compare and contrast retail, wholesale and prime brokers
- Discuss issues with “new market” developments and structured products

Money markets are the subject of CHAPTER 2. These markets are of vital importance to the risk manager as the closest thing to a ‘risk-free’ asset is found here. This chapter covers all short-term debt securities, whether issued by governments or corporations. It also explains the repo markets – markets for borrowing/lending on a secured basis.

The Money Markets

Learning Outcome Statement

The candidate should be able to:

- Describe the characteristics of fixed income instruments
- Define term, principal, interest rate and secured vs. unsecured
- Describe the types of deposits (demand, notice and fixed-term)
- Define a reference rate
- Describe a credit facility
- Discuss syndication
- Calculate the interest payment on a term repo
- Describe the Eurocurrency market, particularly the Eurodollar market
- Define “add-on” interest
- Define LIBOR
- Describe different types of money market securities
- Calculate the bond-equivalent yield of a T-bill
- Define a commercial paper and a promissory note

- Define banker's acceptance and certificate of deposit
- Define basis point
- Define a stamping fee

The market for longer-term debt securities is discussed in [CHAPTER 3](#), which classifies bonds by issuer: government, agencies, corporate and municipal. There is a comparison of bond markets in major countries and a description of the main intermediaries and their roles. International bond markets are introduced as well.

Bond Markets

Learning Outcome Statement

The candidate should be able to:

- Compare and contrast a retail and an investment bank
- Define market-making and origination
- Describe the various market participants by group
- Compare and contrast a proprietary trader and a market-maker (dealer) and an inter-dealer broker
- Define bid-price and offer-price
- Compare and contrast sovereign, agency, corporate and municipal bonds
- Describe on-the-run, off-the-run and benchmark securities
- Compare and contrast general obligation and revenue bonds
- Define a sinking fund
- Define property clauses and call provision
- Define types of foreign bonds (Yankee, Bulldog, Samurai, Alpine and Matador)
- Compare gross and net interest payments
- Compare and contrast the primary and secondary markets
- Compare and contrast a public offer and a private offer
- Describe the process of underwriting a new issue
- Define underwriter, lead manager and book-runner
- Define a fixed-price re-offer mechanism
- Define a bought-deal
- Describe the characteristics of the Eurobond market
- Define the different day-count conventions
- Define default and recovery rates
- Describe how a bond's rating affects the yield spread
- Describe the role of Rating Agencies

[CHAPTER 4](#) turns to the foreign exchange market – the market with the biggest volume of trade. Various aspects of this market are explained, such as quotation conventions, types of brokers, and examples of cross rates. Economic theories of exchange rates are briefly presented here along with central banks' policies. Forward rates are introduced together with currency swaps. Interest-rate parity is explained with several useful examples.

The Foreign Exchange Market

Learning Outcome Statement

The candidate should be able to:

- Define an exchange rate
- Describe the interbank market
- Define decentralized, continuous, open bid and double-auction

- Define direct and indirect-term quotations
- Compare and contrast direct dealing, foreign exchange brokers and electronic systems
- Define the trading terms “mine” and “yours”
- Define the trading term “big figure”
- Define a cross-rate and a cross-trade
- Calculate a cross-rate given two exchange rates
- Describe some economic factors that might affect exchange rates
- Discuss central bank intervention
- Discuss spot and forward markets
- Define currency swap rate, forward premium and forward discount
- Calculate the forward premium or discount
- Define covered-interest arbitrage / interest rate parity
- Describe a typical foreign exchange operation
- Define front, middle and back office

CHAPTER 5 provides a broad introduction to stock markets. This includes the description and characteristics of several types of stocks, stock market indices and priorities in the case of liquidation. Dividends and dividend-based stock valuation methods are described in this chapter. Primary and secondary markets are distinguished. Market mechanics, including types of orders, market participants, margin and short trades, are explained here with various examples clarifying these transactions. Some exchange-traded options on stocks are introduced as well.

The Stock Market

Learning Outcome Statement

The candidate should be able to:

- Describe the common characteristics of a stock
- Define IPO, primary issue, and secondary offering
- Discuss shareholder rights
- Define dividend and ex-dividend trading
- Compare and contrast ordinary and preference shares
- Define market capitalization
- Discuss stock indices
- Define the dividend discount and Gordon growth models of stock valuation
- Discuss the types of stock market participants
- Define listing and float
- Compare and contrast matched market and market maker
- Define T+1 and T+3 settlement
- Define private placement and seasoned new issue
- Describe the process of an IPO
- Describe the process of a private placement
- Describe the role of exchanges
- Describe the role of the OTC market
- Define the bid/offer spread
- Discuss margin trading
- Discuss short-selling and borrowing stocks
- Compare and contrast single-stock and index options

CHAPTER 6 introduces the futures markets; this includes a comparison of the main exchange-traded markets, options on futures, specifications of the most popular contracts, the use of futures for hedging, trade orders for futures contracts, mark-to-market procedures, and various expiration conventions. A very interesting description of the main market participants concludes this chapter.

The Futures Markets

Learning Outcome Statement

The candidate should be able to:

- Define a futures contract
- Discuss some of the reasons that futures markets exist
- Define open-outcry, contract size, tick size, limit up, limit down, expanded limit, initial margin, maintenance margin, mark-to-market, daily settlement, delivery month, offsetting transaction, volume and open interest
- Discuss types of orders in futures markets
- Discuss the importance of standardization in futures contracts
- Discuss the role of the clearing house
- Compare and contrast physical delivery and cash-settlement
- Discuss the process of physical settlement
- Define and discuss the various types of orders
- Define flex option
- Discuss the exercise of an option on a futures contract
- Discuss the various participants in futures markets: hedgers, speculators, managed futures investors
- Calculate initial margin and change in margin due to market movements
- Define calendar spread and basis

CHAPTER 7 introduces the structure of the commodities market. It starts with the spot market and then moves to commodity forwards and futures. Specific features, such as delivery and settlement methods, are described. The spot–forward pricing relationship is used to decompose the forward price into spot and carrying costs. Various types of price term structure (such as backwardation and contango) are described, together with some economic theory. The chapter also describes short squeezes and regulations. Risk management at the commodity trading desk is given at a good intuitive level. The chapter concludes with some interesting facts on distribution of commodity returns.

The Structure of Commodities Markets

Learning Outcome Statement

The candidate should be able to:

- List four general types of commodities
- Contrast base, strategic, minor and precious metals
- Contrast grains, oilseeds and fibers
- Define “on the spot” and “settlement of difference”
- Define in store, ex store, Free on Board (FOB), Free alongside Ship (FOS), Cost Insurance & Freight (CIF) and Exchange for Physicals (EFP)
- Discuss the uniqueness of the gold market
- Define contango, backwardation, carrying cost (cost of carry) and lease rate
- Discuss the impact of shortages on commodity prices and the history of short squeezes
- Define short squeeze and demand for immediacy

- Discuss the convenience yield theory
 - State the arbitrage equation for commodity pricing
 - Discuss the decomposition of risk factors in commodities
 - Discuss the importance of non-normality of commodity price distributions
-

Finally, CHAPTER 8 examines one of the most rapidly developing markets for risk – the energy markets. These markets allow participants to manage the price risks of oil and gas, electricity, coal and so forth. Some other markets closely linked with energy are also briefly discussed here, including markets for greenhouse gas emissions, weather derivatives and freight. Energy markets create enormous challenges and opportunities for risk managers – in part because of the extreme volatility of prices that can occur.

The Energy Markets

Learning Outcome Statement

The candidate should be able to:

- Discuss the size of markets for energy
 - Discuss the various energy futures markets
 - List the major energy futures contracts
 - Describe various options on energy
 - Discuss using futures markets to hedge energy risk
 - Construct an energy hedge using futures contracts
 - Discuss physical delivery in energy markets
 - Define basis contracts in OTC energy markets
 - Discuss the role of the Singapore Market
 - Discuss the role of the European Market
 - Discuss the role of the North American OTC energy market
 - Discuss the role of NordPool
 - Discuss the role that Platts plays in the energy market
 - Discuss the Coal market
 - Discuss the weather derivatives market
 - Discuss the emergence of green trading
 - Define Heating Degree Day (HDD) and Cooling Degree Day (CDD)
 - Discuss the issues of future energy trading
-

STUDY QUESTIONS

FINANCE THEORY

Mean-Variance Analysis

Q: When does diversifying an investment from a single asset into a portfolio show more merit?

Considering two assets, provided they are not perfectly correlated, the loss on the underperforming asset will tend to be compensated for by the gain on the other. This will therefore lower the total risk (i.e. the P&L variance of the basket of assets). In more quantitative terms, the variance of the return of a two-asset portfolio is lower than the sum of the variances provided that they are not perfectly correlated. Hence the total portfolio will be less risky than individual assets. This is more valid when the asset returns are less correlated, and even more when the assets are negatively correlated. This is why investing in gold-related assets, when gold was a hoarding tool, was a good defensive measure: when the political situation went bad, most assets depreciated while scared investors took their savings into gold, waiting for a war.

Capital Asset Pricing Model

Q: What would make a knowledgeable investor choose a CAPM-suboptimal portfolio?

Apart from idiosyncratic preferences (ethical investing or others), a knowledgeable investor will have views on the market that do not necessarily coincide with the views of the market. He will then see different expected returns, assess different variances. Moreover, he will have some practical difficulties to invest into the full market portfolio.

Capital Asset Pricing Model

Q: Assume you live in a CAPM world and the expected return on the market portfolio is 9%, while the risk-free rate is 3%. If the beta of stock A is 1.3, the expected return on A is:

- a) 14.7%
- b) 12.9%
- c) 10.8%
- d) 16.8%

CAPM says that the expected return is the risk-free rate plus beta times the market premium (which is the difference between the market expected return and the risk-free rate, here 6%): $3 + 1.3 * 6 = 10.8$: c).

Efficient Frontiers, Capital Market Line, Beta

Q: What would happen if an investor's preference curve were not tangent to the capital market line?

An investor's preference curve is the (convex) curve representing the points of same degree of satisfaction with the risk and return of a portfolio. If the investor is at a point on his curve which is below the capital market line, he will move his preferences until he touches the line, and will then move along the line to another, more ambitious preference curve. In other words, he would raise his expectations. If no point of his preference curve touches the capital market line, i.e. he has too greedy expectations; he would get into lower preference curves, parallel to the first one, until a point of a preference curve touches the market line. In short, this investor will correct his expectations to fit the market line.

The Black-Scholes-Merton Model

Q: How critical is it to apply the Black-Scholes framework to European-type options only?

In theory, it is not at all, as exercising an American type or Bermudan-type option before maturity is renouncing the volatility value of the option (subject to the presence of dividends). A holder of such option should then only hedge his position, or sell the option if it is a negotiable one. In practice, the difference matters, as a non-European option offers more flexibility to its owner. This flexibility can be very valuable in the presence of difficulties to hedge, uncertain dividends, or frictions in the market. The effects of early exercise can substantially increase the value of derivatives over their European equivalent in certain circumstances (e.g. deep in the money put on a stock paying a large dividend near expiry). The basic approach to valuation however does not change from the Black-Scholes framework, but it is important to solve the partial differential equation (PDE) in a numerical framework which allows the effects of early exercise to be modelled, e.g. in the Binomial model rather than using the regular BS "closed form solution."

The Binomial Option Model

Q: Which of the following is true:

- a) Non-Markovian interest rate processes are usually represented by recombining trees
- b) Markovian interest rate processes are usually represented by recombining trees
- c) Non-Markovian interest rate processes are usually represented by trinomial trees
- d) None of the above

Markovian processes are stochastic processes where successive prices are partially determined by previous prices with the size of price movement also proportional. They can be, and usually are, represented by a recombining tree: b).

Put-Call Parity

Q: What should an investor do to hedge a position including a long call and a short put at the same strike price?

A graphic representation shows that this is equivalent to a long position in the underlying. To hedge this, just short (sell) the underlying and invest the cash at the risk-free rate until the expiry date of the options.

Interest Rate Parity

Q: What should an operator do if $\text{JPY}/\text{USD} = 120$, forward 6M = 114, 6M interest for USD and JPY are 4% and 1% respectively?

The forward price suggested by the market is: $120 * 1.005 / 1.02 = 118$. The interest rate in JPY is undervalued. Hence borrow JPY at 1%, convert these into USD spot (120) and lend at 4%, then hedge your spot position by selling forward USD for JPY at 1USD = 114 JPY. These trades will lock-in a risk-free arbitrage profit of JPY 4 at expiry.

Cash and Carry Pricing

Q: The 1-year forward price of a commodity is 3% above the spot price. What should the cost of storage be to deter arbitrage, knowing that one-year interest is 2%? No margins are to be considered.

To have an arbitrage-free price in the physical commodity in 1 year, we should be economically indifferent to buying it spot and storing it or buying it forward. Hence the cost of financing (interest) plus the cost of storage should equate the forward premium, hence the cost of storage should be of $3 - 2 = 1\%$.

FINANCIAL INSTRUMENTS

Compounding Methods

Q: A bond pays interest of 10% semi-annually on an actual/actual convention, what is the rate of interest on an annual actual/actual basis?

The day count convention is the same so we do not have to worry about converting this, payment of 10% semi-annually means payment of 5% each half year, so this equates to $(1+5\%)*(1+5\%) = (1+10.25\%)$ i.e. 10.25% on an annual compounding basis.

Simple Bonds

Q: A fixed-income instrument will pay 12-month Libor on a 1,000 Swiss Francs (CHF) face value two times: one year from today and two years from today (no principal payment). The rates are set in arrears (payments at the end of a year reflect the Libor rate at the beginning of the year). What is the price of this instrument if the (zero-coupon) two-year CHF swap curve is a 3% for all maturities?

- a) CHF 57.4
- b) CHF 1000
- c) CHF 106
- d) CHF 67.6

Swap rates are quoted against LIBOR (floating rate index) and a flat swap curve implies that forward LIBOR is constant over the curve and equal to the swap rate. The cash flows are, for the first year, 3% on 1000 CHF payable in two installments, and the same for the second year: 60 CHF in total. As there is no principal repaid, b) and c) are out of the question. As these payments are discounted (as coming later than today), 57.4 is the only possible solution: a).

Floating Rate Notes

Q: A company issues an FRN at par, which pays LIBOR plus 125 b.p., quarterly. Overtime the credit rating of the firm declines from AA to BBB, how would this effect the price of this FRN?

The spread to LIBOR represents the extra return for assuming the credit risk of the issuer of the bonds. If the creditworthiness of the issuer declines the market will require a higher return for assuming this risk, i.e. they require a higher spread than 125 b.p., so they will pay less for this FRN and it will trade at a price below par (100).

Futures and Forwards

Q: A gas market maker (MM) has agreed to deliver gas at USD 3/MMBtu 6 months from now. The spot price for gas is USD 2.50/MMBtu, the 6-month forward price is USD 2.75/MMBtu, the interest rate is 6% and storage cost is USD 0.03/month per MMBtu. The MM is confident that the price would be USD 2.70 in six months from now. Given the MM's market view, what is the best strategy for the MM to meet its obligation?

- a) Buy on the spot market
- b) Buy the forward
- c) Do nothing
- d) MM is indifferent between c) and b)

The reaction of many a candidate will be to consider hedging as a given, and to compare the price of buying spot and storing the gas to the forward price to determine if a), b) or d) is the correct answer. However, the Market Maker has a strong bearish view on the market. In such a situation, there is no point in hedging, but he should just wait for the price to come down to purchase the gas. The fact that hedges are available does not mean that operators should surrender their market views. Hence c).


Options


Q: In a long option straddle strategy, where one buys a put and a call simultaneously at the same strike, the following is true:

- a) Delta will be zero, regardless of the level of the spot price
- b) Gamma will be the highest at the money and approaching maturity
- c) Delta will be near to 1 at the money and approaching maturity
- d) Gamma will be zero at the money and approaching maturity

It helps to picture out the payout functions.

call: 

put: 

strategy: 

The long option strategy will result in the dotting curve above, tending towards the V-shape seen above. Delta (the slope) will not be zero, it could tend to -1 or to 1 . Gamma (the curviness) will tend to infinite when approaching maturity and if at-the-money, when the curve gets into the bottom of the V-shape: b).

Term Structure Basics

Q: A customer wants a tailored six-month swap with constant volumes, but requests the fixed price for the last two months to be set at USD 20/bbl. What must be the fixed price for the first four months?

- a) not determinable
- b) 26.0
- c) 23.7
- d) none of the above

The question says we can ignore the time value of money, so we do not have to do any present valuing of the cash flows. In this commodity swap the basic idea is to quote one fixed rate (price) per month to supply the commodity on a month basis over the six-month period, hence what we are looking for is a simple volume weighted average. The price of USD 20 for the last two months is below market; hence the other prices must be above market. This does not eliminate any alternative (although b) can look intuitively too high). The sum of prices must equate, hence $(21+22+23+24+25+26)$, which equals the average times the number of prices, hence 23.5 times 6, equals 141. Choose if doing the sum on a calculator is quicker or not. Then $141-20-20$, divided four months, gives 25.25. None of the above: d).

Hybrid Instruments

Q: Which of the following is/are true concerning preferred stocks?

- a) They are somehow similar to subordinated debt, but, unlike bondholders, preferred shareholders could not force a company into bankruptcy if preferred coupons (dividends) were not paid on time
- b) Many preferred shares provide for cumulative preferred dividend payments having priority over ordinary dividends
- c) From an issuer's tax perspective, preferred stocks are a more expensive source of financing than bonds
- d) All of the above

There are generally two kinds of preference shares, cumulative and non-cumulative. The preference share generally pays a fixed dividend that must be paid if an ordinary share dividend is paid. However if a company is doing badly and no dividend is paid the payment on the preference share may not be paid. If it is a cumulative preference stock, this dividend foregone must be repaid if the company recovers, whereas if the preference stock is non-cumulative the dividends foregone are not repaid one the company starts paying dividends. Preference shares rank above ordinary shares for repayment in the event of a company liquidation. The dividends on prefs, like that on the common stock are generally not tax deductible as they are a distribution of shareholders funds rather than debt financing which is generally regarded as an operating expense and therefore tax deductible. A preferred stock is a hybrid instrument, in which remuneration is variable, but dividends are protected. Generally, if no dividend is paid, the preferred shares become ordinary shares. Assertion c) is relevant for tax purposes only, as preferred shares dividends are not always tax-deductible, contrarily to bond coupons: d).

Convertible Bonds

Q: A convertible bond is issued at 100% with a USD 10,000 notional value. Each bond gives the right of the holder to convert each bond into 200 shares of the issuing company. If the current share price is USD 40, how much conversion premium is the investor paying for the conversion right?

Each bond costs USD 10,000 and converts into 200 shares that give a cost per share of USD 50. The current share price is USD 40, so the investor is paying a conversion premium of $(50 - 40)/40$ equal to 25%.

Swaps

Q: A corporate bond is bought in the market at a par yield of 6.50%, the equivalent maturity Government bond has a par yield of 5.75%. If the swap spread for this maturity is 20 b.p. what is the asset swap price of this corporate bond?

An asset swap is a package of a swap and a bond to create a synthetic floating rate note, in this case the spread between the corporate bond and the swap is 55 b.p. since the par swap rate is 20 b.p. above the (Govt.) risk free rate, hence

if the corporate bond pays 6.50% fixed with a swap rate of 5.95%, the floating rate payment needs to be LIBOR plus 55 b.p. Hence the asset swap “price” is “LIBOR plus 55.”

Caps, Floors and Swaptions

Q: A Cap consists of three caplets that expire in three months, six months and nine months. The holder of the cap is paying 3m LIBOR set in advance and paid in arrears on a floating rate loan that will be repaid in nine months time. The cap rate is 5% and the loan amount is USD 10m. If the LIBOR fixing today is 6% for payment in three months time, what is the approximate value of the first caplet at exercise?

The LIBOR rate on the loan is fixed today and payable in three months time, this rate is 6% for three months on USD 10m. But the caplet has a strike price of 5% on the same notional, so the option payoff will protect the loan holder from the higher interest rate. Without the cap, he would pay $(6\%/4) \times \text{USD } 10\text{m}$ but with the cap he effectively pays $(5\%/4) \times \text{USD } 10\text{m}$ so the caplet must pay out USD 25,000 to compensate for the higher rate. Obviously the overall cost to him also includes the premium paid for the cap and this will effectively give him a marginally higher cost as the price for buying protection.

Simple Exotics

Q: An up-and-out knock out call option has a strike price of 100 and a knock out level of 110. What are the major risk issues in trying to delta hedge this option?

With the spot price below 100 the option behaves much like a normal call option with a low delta rising as the option moves in to the money. However when the option approaches the barrier the option has intrinsic value close to 10 units, but once it crosses the barrier it has zero value. Hence the delta hedge must have the opposite risk profile and increase in value by almost 10 units when the spot price moves through 110. This means that the delta hedge must be many times the underlying value (notional) of the single option and hence suffer from liquidity problems, i.e. the hedging process itself causes the knock out of the option and the market moves wildly against the hedger causing excessive hedging costs.

MARKETS

Money Markets / FX Markets

Q: Two otherwise identical instruments are quoted in different currencies, both freely and widely traded. What would be the main factors to explain price differences?

- a) The countries' credit ratings
- b) The relative interest rates in both currencies
- c) The liquidity of both currencies
- d) The correlation of both currencies to USD

Whereas a) and c) would intervene to a small extent (say, some 10s of basis points), d) would not, b) would be most relevant, as differences in interest rates between currencies are quite significant (commonly some 2-5% within OECD): b).

Capital Markets

Q: Put the following instruments in order of what would capital markets offer in terms of expected returns:

- a) Equity of a well-established chemistry company
- b) Foreign (OECD) government long-term bond
- c) CD issued by a BB bank
- d) Interbank deposit

Backwardation in a commodities market means that the spot price of the commodity is higher than the price for forward delivery, taking into account storage and other costs of carry. It is usually brought about by a short term

Markets for Commodities

Q: What could be an explanation for the market for oil being in backwardation?

Backwardation in a commodities market means that the spot price of the commodity is higher than the price for forward delivery, taking into account storage and other costs of carry. It is usually brought about by a short term increase in spot demand which is expected to subside shortly (for instance a sudden cold snap in winter driving up short term heating oil prices) and can also occur when this increase in short term demand occurs in a market which needs time to respond to increased demand by increased supply, e.g. there is a delay of several weeks / months between crude oil being pumped in the Middle East and gasoline being purchased at a filling station in the Mid-Western United States.

Seasonal factors affecting demand could be a factor. Operators expect the price of oil to drop within a certain time frame. The political situation in a major oil-producing region could be a factor, as well as the expectation that operators release inventories held for precaution. The nature of these anticipations by market operators is the key factor.

Energy Markets

Q: What are the main impediments to successfully predicting power market prices with random walk theory?

These are numerous, the main ones being:

- seasonality of prices, intra-day, within the year, etc., hence prices tend to follow sinusoids (sine waves, or regular up-and-down cycles), rather than straight lines, before the error terms are added
- presence of shocks (power disruptions and others), breaking trend lines error terms, due to numerous market frictions e.g. weather and difficulties of delivery, are larger than in financial markets
- error terms, due to numerous market frictions e.g. weather and difficulties of delivery, are larger than in financial markets.

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