

# Book 3: Financial Markets and Products

SchweserNotes™ 2020

FRM Part I

FRM 2020 PART I BOOK 3: FINANCIAL MARKETS AND PRODUCTS

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# CONTENTS

---

Learning Objectives and Reading Assignments .....	vii
---	-----

## READING 25

Banks .....	1
Exam Focus .....	1
Module 25.1: Banks .....	1
Key Concepts .....	8
Answer Key for Module Quizzes .....	10

## READING 26

Insurance Companies and Pension Plans.....	11
Exam Focus .....	11
Module 26.1: Insurance Companies and Pension Plans.....	11
Key Concepts .....	22
Answer Key for Module Quizzes .....	24

## READING 27

Fund Management .....	27
Exam Focus .....	27
Module 27.1: Mutual Funds and Exchange-Traded Funds.....	27
Module 27.2: Hedge Funds .....	31
Key Concepts .....	38
Answer Key for Module Quizzes .....	40

## READING 28

Introduction to Derivatives.....	41
Exam Focus .....	41
Module 28.1: Derivatives Markets and Securities.....	41
Module 28.2: Derivatives Traders.....	47
Key Concepts .....	53
Answer Key for Module Quizzes .....	55

## READING 29

Exchanges and OTC Markets.....	57
Exam Focus .....	57
Module 29.1: Exchange-Traded Derivatives.....	57
Module 29.2: Over-the-Counter Derivatives .....	60
Key Concepts .....	65
Answer Key for Module Quizzes .....	67

## READING 30

Central Clearing .....	69
Exam Focus .....	69
Module 30.1: Principles of Central Clearing.....	69
Module 30.2: Risks Faced by Central Counterparties.....	75

Key Concepts .....	79
Answer Key for Module Quizzes .....	81

**READING 31**

Futures Markets .....	83
Exam Focus .....	83
Module 31.1: Futures Characteristics .....	83
Module 31.2: Futures Markets .....	87
Key Concepts .....	91
Answer Key for Module Quizzes .....	93

**READING 32**

Using Futures for Hedging .....	95
Exam Focus .....	95
Module 32.1: Principles of Hedging .....	95
Module 32.2: Hedging With Stock Index Futures .....	99
Key Concepts .....	103
Answer Key for Module Quizzes .....	105

**READING 33**

Foreign Exchange Markets .....	107
Exam Focus .....	107
Module 33.1: Foreign Exchange Quotes and Risks .....	107
Module 33.2: Interest Rates, Inflation, and Exchange Rates .....	111
Key Concepts .....	116
Answer Key for Module Quizzes .....	119

**READING 34**

Pricing Financial Forwards and Futures .....	121
Exam Focus .....	121
Module 34.1: Forward and Futures Prices .....	121
Key Concepts .....	129
Answer Key for Module Quizzes .....	131

**READING 35**

Commodity Forwards and Futures .....	133
Exam Focus .....	133
Module 35.1: Fundamentals of Commodities .....	133
Module 35.2: Pricing Commodity Forwards .....	135
Key Concepts .....	144
Answer Key for Module Quizzes .....	147

**READING 36**

Options Markets .....	149
Exam Focus .....	149
Module 36.1: Option Types, Positions, and Underlying Assets .....	149
Module 36.2: Option Specification and Trading .....	155
Key Concepts .....	161
Answer Key for Module Quizzes .....	163

**READING 37**

Properties of Options.....165  
 Exam Focus ..... 165  
 Module 37.1: Option Pricing Factors ..... 165  
 Module 37.2: Upper and Lower Option Pricing Bounds..... 167  
 Key Concepts ..... 176  
 Answer Key for Module Quizzes ..... 177

**READING 38**

Trading Strategies.....179  
 Exam Focus ..... 179  
 Module 38.1: Protective Puts, Covered Calls, and Principal Protected Notes... 179  
 Module 38.2: Option Spread Strategies..... 181  
 Module 38.3: Option Combination Strategies ..... 186  
 Key Concepts ..... 190  
 Answer Key for Module Quizzes ..... 192

**READING 39**

Exotic Options .....193  
 Exam Focus ..... 193  
 Module 39.1: Exotic Option Development ..... 193  
 Module 39.2: Types of Exotic Options ..... 195  
 Key Concepts ..... 203  
 Answer Key for Module Quizzes ..... 205

**READING 40**

Properties of Interest Rates.....207  
 Exam Focus ..... 207  
 Module 40.1: Types of Interest Rates ..... 207  
 Module 40.2: Spot Rates, Forward Rates, and Forward Rate Agreements..... 210  
 Module 40.3: Duration and Convexity ..... 217  
 Key Concepts ..... 221  
 Answer Key for Module Quizzes ..... 223

**READING 41**

Corporate Bonds.....225  
 Exam Focus ..... 225  
 Module 41.1: Corporate Bond Fundamentals and Types..... 225  
 Module 41.2: Credit Risk, Event Risk, and High-Yield Bonds..... 231  
 Key Concepts ..... 234  
 Answer Key for Module Quizzes ..... 236

**READING 42**

Mortgages and Mortgage-Backed Securities.....237  
 Exam Focus ..... 237  
 Module 42.1: Mortgage Loans..... 237  
 Module 42.2: Mortgage-Backed Securities..... 241  
 Module 42.3: Prepayment Modeling..... 248  
 Key Concepts ..... 254  
 Answer Key for Module Quizzes ..... 258

**READING 43**

Interest Rate Futures.....259  
Exam Focus ..... 259  
Module 43.1: Day Count Conventions and Quotations ..... 259  
Module 43.2: Treasury Bond and Eurodollar Futures..... 262  
Module 43.3: Duration-Based Hedging..... 268  
Key Concepts ..... 270  
Answer Key for Module Quizzes ..... 272

**READING 44**

Swaps .....273  
Exam Focus ..... 273  
Module 44.1: Mechanics of Interest Rate Swaps ..... 273  
Module 44.2: Valuation of Interest Rate Swaps ..... 277  
Module 44.3: Other Types of Swaps ..... 281  
Key Concepts ..... 285  
Answer Key for Module Quizzes ..... 287

Formulas ..... 288  
Index ..... 293

# LEARNING OBJECTIVES AND READING ASSIGNMENTS

## 25. Banks

**Global Association of Risk Professionals. *Financial Markets and Products*. New York, NY: Pearson, 2019. Chapter 1.**

After completing this reading, you should be able to:

- a. identify the major risks faced by a bank and explain ways in which these risks can arise. (page 2)
- b. distinguish between economic capital and regulatory capital. (page 2)
- c. summarize Basel Committee regulations for regulatory capital and their motivations. (page 3)
- d. explain how deposit insurance gives rise to a moral hazard problem. (page 3)
- e. describe investment banking financing arrangements including private placement, public offering, best efforts, firm commitment and Dutch auction approaches. (page 4)
- f. 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. (page 5)
- g. describe the distinctions between the “banking book” and the “trading book” of a bank. (page 5)
- h. explain the originate-to-distribute model of a bank and discuss its benefits and drawbacks. (page 6)

## 26. Insurance Companies and Pension Plans

**Global Association of Risk Professionals. *Financial Markets and Products*. New York, NY: Pearson, 2019. Chapter 2.**

After completing this reading, you should be able to:

- a. describe the key features of the various categories of insurance companies and identify the risks facing insurance companies. (page 11)
- b. describe the use of mortality tables and calculate the premium payment for a policy holder. (page 14)
- c. distinguish between mortality risk and longevity risk and describe how to hedge these risks. (page 18)
- d. describe a defined benefit plan and a defined contribution plan for a pension fund and explain the differences between them. (page 20)
- e. calculate and interpret loss ratio, expense ratio, combined ratio and operating ratio for a property-casualty insurance company. (page 17)
- f. describe moral hazard and adverse selection risks facing insurance companies, provide examples of each and describe how to overcome the problems. (page 17)
- g. evaluate the capital requirements for life insurance and property-casualty insurance companies. (page 18)
- h. compare the guaranty system and the regulatory requirements for insurance companies with those for banks. (page 19)

## 27. Fund Management

**Global Association of Risk Professionals. *Financial Markets and Products*. New York, NY: Pearson, 2019. Chapter 3.**

After completing this reading, you should be able to:

- a. differentiate among open-end mutual funds, closed-end mutual funds and exchange-traded funds (ETFs). (page 27)
- b. identify and describe potential undesirable trading behaviors at mutual funds. (page 30)
- c. calculate the net asset value (NAV) of an open-end mutual fund. (page 31)
- d. explain the key differences between hedge funds and mutual funds. (page 31)

- e. 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. (page 32)
- f. 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. (page 34)
- g. describe characteristics of mutual fund and hedge fund performance and explain the effect of measurement biases on performance measurement. (page 36)

## 28. Introduction to Derivatives

**Global Association of Risk Professionals. *Financial Markets and Products*. New York, NY: Pearson, 2019. Chapter 4.**

After completing this reading, you should be able to:

- a. define derivatives, describe features and uses of derivatives and compare linear and non-linear derivatives. (page 41)
- b. describe the over-the-counter market, distinguish it from trading on an exchange and evaluate its advantages and disadvantages. (page 42)
- c. differentiate between options, forwards and futures contracts. (page 42)
- d. identify and calculate option and forward contract payoffs. (page 43)
- e. differentiate among the broad categories of traders: hedgers, speculators and arbitrageurs. (page 47)
- f. calculate and compare the payoffs from hedging strategies involving forward contracts and options. (page 48)
- g. calculate and compare the payoffs from speculative strategies involving futures and options. (page 49)
- h. calculate an arbitrage payoff and describe how arbitrage opportunities are temporary. (page 51)
- i. describe some of the risks that can arise from the use of derivatives. (page 51)

## 29. Exchanges and OTC Markets

**Global Association of Risk Professionals. *Financial Markets and Products*. New York, NY: Pearson, 2019. Chapter 5.**

After completing this reading, you should be able to:

- a. describe how exchanges can be used to alleviate counterparty risk. (page 57)
- b. explain the developments in clearing that reduce risk. (page 57)
- c. describe netting and describe a netting process. (page 58)
- d. describe the implementation of a margining process and explain the determinants of initial and variation margin requirements. (page 59)
- e. compare exchange-traded and OTC markets and describe their uses. (page 60)
- f. identify the classes of derivative securities and explain the risk associated with them. (page 61)
- g. identify risks associated with OTC markets and explain how these risks can be mitigated. (page 62)
- h. describe the role of collateralization in the over-the-counter market and compare it to the margining system. (page 62)
- i. explain the use of special purpose vehicles (SPVs) in the OTC derivatives market. (page 62)

## 30. Central Clearing

**Global Association of Risk Professionals. *Financial Markets and Products*. New York, NY: Pearson, 2019. Chapter 6.**

After completing this reading, you should be able to:

- a. provide examples of the mechanics of a central counterparty (CCP). (page 69)
- b. describe the role of CCPs and distinguish between bilateral and centralized clearing. (page 70)

- c. describe advantages and disadvantages of central clearing of OTC derivatives. (page 71)
- d. explain regulatory initiatives for the OTC derivatives market and their impact on central clearing. (page 72)
- e. compare margin requirements in centrally cleared and bilateral markets and explain how margin can mitigate risk. (page 72)
- f. compare and contrast bilateral markets to the use of novation and netting. (page 73)
- g. assess the impact of central clearing on the broader financial markets. (page 74)
- h. identify and explain the types of risks faced by CCPs. (page 75)
- i. identify and distinguish between the risks to clearing members as well as non-members. (page 77)

### 31. Futures Markets

**Global Association of Risk Professionals. *Financial Markets and Products*. New York, NY: Pearson, 2019. Chapter 7.**

After completing this reading, you should be able to:

- a. 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. (page 83)
- b. explain the convergence of futures and spot prices. (page 84)
- c. describe the rationale for margin requirements and explain how they work. (page 85)
- d. describe the role of an exchange in futures and over-the-counter market transactions. (page 87)
- e. identify the differences between a normal and inverted futures market. (page 87)
- f. explain the different market quotes. (page 87)
- g. describe the mechanics of the delivery process and contrast it with cash settlement. (page 88)
- h. evaluate the impact of different trading order types. (page 88)
- i. describe the application of marking to market and hedge accounting for futures. (page 89)
- j. compare and contrast forward and futures contracts. (page 90)

### 32. Using Futures for Hedging

**Global Association of Risk Professionals. *Financial Markets and Products*. New York, NY: Pearson, 2019. Chapter 8.**

After completing this reading, you should be able to:

- a. define and differentiate between short and long hedges and identify their appropriate uses. (page 95)
- b. describe the arguments for and against hedging and the potential impact of hedging on firm profitability. (page 96)
- c. define the basis and explain the various sources of basis risk and explain how basis risks arise when hedging with futures. (page 97)
- d. define cross hedging and compute and interpret the minimum variance hedge ratio and hedge effectiveness. (page 97)
- e. compute the optimal number of futures contracts needed to hedge an exposure and explain and calculate the “tailing the hedge” adjustment. (page 99)
- f. explain how to use stock index futures contracts to change a stock portfolio’s beta. (page 100)
- g. 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. (page 101)

### 33. Foreign Exchange Markets

**Global Association of Risk Professionals. *Financial Markets and Products*. New York, NY: Pearson, 2019. Chapter 9.**

After completing this reading, you should be able to:

- a. 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. (page 107)
- b. 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. (page 107)
- c. compare outright (forward) and swap transactions. (page 108)
- d. define, compare and contrast transaction risk, translation risk and economic risk. (page 109)
- e. describe examples of transaction, translation and economic risks and explain how to hedge these risks. (page 109)
- f. describe the rationale for multi-currency hedging using options. (page 110)
- g. identify and explain the factors that determine exchange rates. (page 111)
- h. calculate and explain the effect of an appreciation/depreciation of a currency relative to a foreign currency. (page 111)
- i. explain the purchasing power parity theorem and use this theorem to calculate the appreciation or depreciation of a foreign currency. (page 112)
- j. describe the relationship between nominal and real interest rates. (page 113)
- k. 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. (page 113)
- l. distinguish between covered and uncovered interest rate parity conditions. (page 115)

### 34. Pricing Financial Forwards and Futures

**Global Association of Risk Professionals. *Financial Markets and Products*. New York, NY: Pearson, 2019. Chapter 10.**

After completing this reading, you should be able to:

- a. differentiate between investment and consumption assets. (page 121)
- b. define short-selling and calculate the net profit of a short sale of a dividend-paying stock. (page 122)
- c. describe the differences between forward and futures contracts and explain the relationship between forward and spot prices. (page 123)
- d. calculate the forward price given the underlying asset's spot price and describe an arbitrage argument between spot and forward prices. (page 123)
- e. distinguish between the forward price and the value of a forward contract. (page 123)
- f. calculate the value of a forward contract on a financial asset that does or does not provide income or yield. (page 123)
- g. explain the relationship between forward and futures prices. (page 125)
- h. calculate a forward foreign exchange rate using the interest rate parity relationship. (page 126)
- i. calculate the value of a stock index futures contract and explain the concept of index arbitrage. (page 126)

### 35. Commodity Forwards and Futures

**Global Association of Risk Professionals. *Financial Markets and Products*. New York, NY: Pearson, 2019. Chapter 11.**

After completing this reading, you should be able to:

- a. explain the key differences between commodities and financial assets. (page 133)
- b. define and apply commodity concepts such as storage costs, carry markets, lease rate and convenience yield. (page 137)
- c. identify factors that impact prices on agricultural commodities, metals, energy and weather derivatives. (page 134)

- d. explain the basic equilibrium formula for pricing commodity forwards. (page 135)
- e. describe an arbitrage transaction in commodity forwards and compute the potential arbitrage profit. (page 137)
- f. define the lease rate and explain how it determines the no-arbitrage values for commodity forwards and futures. (page 139)
- g. describe the cost of carry model and illustrate the impact of storage costs and convenience yields on commodity forward prices and no-arbitrage bounds. (page 141)
- h. compute the forward price of a commodity with storage costs. (page 141)
- i. compare the lease rate with the convenience yield. (page 141)
- j. 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. (page 135)
- k. explain the relationship between current futures prices and expected future spot prices, including the impact of systematic and nonsystematic risk. (page 142)
- l. define and interpret normal backwardation and contango. (page 142)

### 36. Options Markets

**Global Association of Risk Professionals. *Financial Markets and Products*. New York, NY: Pearson, 2019. Chapter 12.**

After completing this reading, you should be able to:

- a. describe the types, position variations, payoffs and profits and typical underlying assets of options. (page 149)
- b. explain the specification of exchange-traded stock option contracts, including that of nonstandard products. (page 155)
- c. explain how dividends and stock splits can impact the terms of a stock option. (page 156)
- d. describe how trading, commissions, margin requirements and exercise typically work for exchange-traded options. (page 157)
- e. define and describe warrants, convertible bonds and employee stock options. (page 159)

### 37. Properties of Options

**Global Association of Risk Professionals. *Financial Markets and Products*. New York, NY: Pearson, 2019. Chapter 13.**

After completing this reading, you should be able to:

- a. identify the six factors that affect an option's price. (page 165)
- b. identify and compute upper and lower bounds for option prices on non-dividend and dividend paying stocks. (page 167)
- c. 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. (page 169)
- d. explain and assess potential rationales for using the early exercise features of American call and put options. (page 171)

### 38. Trading Strategies

**Global Association of Risk Professionals. *Financial Markets and Products*. New York, NY: Pearson, 2019. Chapter 14.**

After completing this reading, you should be able to:

- a. explain the motivation to initiate a covered call or a protective put strategy. (page 179)
- b. describe principal protected notes (PPNs) and explain necessary conditions to create a PPN. (page 180)
- c. describe the use and calculate the payoffs of various spread strategies. (page 181)
- d. describe the use and explain the payoff functions of combination strategies. (page 186)

### 39. Exotic Options

**Global Association of Risk Professionals. *Financial Markets and Products*. New York, NY: Pearson, 2019. Chapter 15.**

After completing this reading, you should be able to:

- a. define and contrast exotic derivatives and plain vanilla derivatives. (page 193)
- b. describe some of the factors that drive the development of exotic derivative products. (page 193)
- c. explain how any derivative can be converted into a zero-cost product. (page 194)
- d. describe how standard American options can be transformed into nonstandard American options. (page 194)
- e. identify and describe the characteristics and payoff structure of the following exotic options: gap, forward start, compound, chooser, barrier, binary, lookback, Asian, exchange and basket options. (page 195)
- f. describe and contrast volatility and variance swaps. (page 200)
- g. explain the basic premise of static option replication and how it can be applied to hedging exotic options. (page 201)

### 40. Properties of Interest Rates

**Global Association of Risk Professionals. *Financial Markets and Products*. New York, NY: Pearson, 2019. Chapter 16.**

After completing this reading, you should be able to:

- a. describe Treasury rates, LIBOR, Secured Overnight Financing Rate (SOFR) and repo rates and explain what is meant by the “risk-free” rate. (page 207)
- b. calculate the value of an investment using different compounding frequencies. (page 208)
- c. convert interest rates based on different compounding frequencies. (page 208)
- d. calculate the theoretical price of a bond using spot rates. (page 210)
- e. calculate the duration, modified duration and dollar duration of a bond. (page 217)
- f. evaluate the limitations of duration and explain how convexity addresses some of them. (page 218)
- g. calculate the change in a bond’s price given its duration, its convexity and a change in interest rates. (page 219)
- h. derive forward interest rates from a set of spot rates. (page 214)
- i. derive the value of the cash flows from a forward rate agreement (FRA). (page 215)
- j. calculate zero-coupon rates using the bootstrap method. (page 210)
- k. compare and contrast the major theories of the term structure of interest rates. (page 216)

### 41. Corporate Bonds

**Global Association of Risk Professionals. *Financial Markets and Products*. New York, NY: Pearson, 2019. Chapter 17.**

After completing this reading, you should be able to:

- a. describe features of bond trading and explain the behavior of bond yield. (page 225)
- b. describe a bond indenture and explain the role of the corporate trustee in a bond indenture. (page 226)
- c. define high-yield bonds and describe types of high-yield bond issuers and some of the payment features unique to high yield bonds. (page 232)
- d. differentiate between credit default risk and credit spread risk. (page 231)
- e. describe event risk and explain what may cause it in corporate bonds. (page 231)
- f. describe the different classifications of bonds characterized by issuer, maturity, interest rate, and collateral. (page 227)
- g. describe the mechanisms by which corporate bonds can be retired before maturity. (page 229)

- h. define recovery rate and default rate, differentiate between an issuer default rate and a dollar default rate and describe the relationship between recovery rates and seniority. (page 232)
- i. evaluate the expected return from a bond investment and identify the components of the bond's expected return. (page 233)

## 42. Mortgages and Mortgage-Backed Securities

**Global Association of Risk Professionals. *Financial Markets and Products*. New York, NY: Pearson, 2019. Chapter 18.**

After completing this reading, you should be able to:

- a. describe the various types of residential mortgage products. (page 237)
- b. calculate a fixed rate mortgage payment and its principal and interest components. (page 239)
- c. describe the mortgage prepayment option and the factors that influence prepayments. (page 241)
- d. summarize the securitization process of mortgage backed securities (MBS), particularly formation of mortgage pools including specific pools and to-be-announced (TBAs). (page 241)
- e. calculate weighted average coupon, weighted average maturity, single monthly mortality rate (SMM) and conditional prepayment rate (CPR) for a mortgage pool. (page 241)
- f. describe the process of trading of pass-through agency MBS. (page 244)
- g. explain the mechanics of different types of agency MBS products, including collateralized mortgage obligations (CMOs), interest-only securities (IOs) and principal-only securities (POs). (page 245)
- h. describe a dollar roll transaction and how to value a dollar roll. (page 244)
- i. explain prepayment modeling and its four components: refinancing, turnover, defaults and curtailments. (page 248)
- j. describe the steps in valuing an MBS using Monte Carlo simulation. (page 249)
- k. define Option Adjusted Spread (OAS) and explain its challenges and its uses. (page 251)

## 43. Interest Rate Futures

**Global Association of Risk Professionals. *Financial Markets and Products*. New York, NY: Pearson, 2019. Chapter 19.**

After completing this reading, you should be able to:

- a. 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. (page 259)
- b. calculate the conversion of a discount rate to a price for a US Treasury bill. (page 261)
- c. differentiate between the clean and dirty price for a US Treasury bond; calculate the accrued interest and dirty price on a US Treasury bond. (page 260)
- d. explain and calculate a US Treasury bond futures contract conversion factor. (page 262)
- e. calculate the cost of delivering a bond into a Treasury bond futures contract. (page 262)
- f. describe the impact of the level and shape of the yield curve on the cheapest-to-deliver Treasury bond decision. (page 262)
- g. calculate the theoretical futures price for a Treasury bond futures contract. (page 264)
- h. calculate the final contract price on a Eurodollar futures contract and compare Eurodollar futures to FRAs. (page 265)
- i. describe and compute the Eurodollar futures contract convexity adjustment. (page 265)
- j. explain how Eurodollar futures can be used to extend the LIBOR zero curve. (page 267)

- k. calculate the duration-based hedge ratio and create a duration-based hedging strategy using interest rate futures. (page 268)
- l. explain the limitations of using a duration-based hedging strategy. (page 268)

#### 44. Swaps

**Global Association of Risk Professionals. *Financial Markets and Products*. New York, NY: Pearson, 2019. Chapter 20.**

After completing this reading, you should be able to:

- a. explain the mechanics of a plain vanilla interest rate swap and compute its cash flows. (page 273)
- b. explain how a plain vanilla interest rate swap can be used to transform an asset or a liability and calculate the resulting cash flows. (page 274)
- c. explain the role of financial intermediaries in the swaps market. (page 275)
- d. describe the role of the confirmation in a swap transaction. (page 275)
- e. describe the comparative advantage argument for the existence of interest rate swaps and evaluate some of the criticisms of this argument. (page 275)
- f. explain how the discount rates in a plain vanilla interest rate swap are computed. (page 277)
- g. calculate the value of a plain vanilla interest rate swap based on two simultaneous bond positions. (page 277)
- h. calculate the value of a plain vanilla interest rate swap from a sequence of FRAs. (page 279)
- i. explain the mechanics of a currency swap and compute its cash flows. (page 281)
- j. explain how a currency swap can be used to transform an asset or liability and calculate the resulting cash flows. (page 283)
- k. calculate the value of a currency swap based on two simultaneous bond positions. (page 281)
- l. calculate the value of a currency swap based on a sequence of forward exchange rates. (page 282)
- m. identify and describe other types of swaps, including commodity, volatility, credit default and exotic swaps. (page 284)
- n. describe the credit risk exposure in a swap position. (page 283)

# READING 25

## Banks

### EXAM FOCUS

This reading introduces a number of concepts about banks that are developed more fully elsewhere in the FRM curriculum. For the exam, focus on understanding the major types of risk a bank faces and how they are addressed, both by banks themselves and by bank regulators. Be prepared to explain the differences between commercial banking and investment banking as well as the conflicts that exist in an organization that performs both of these services. Also, understand the distinctions between the lending and trading operations of a bank. Finally, be able to describe the implications of banks originating loans and distributing them to other parties.

### MODULE 25.1: BANKS

When we speak of banks, we include financial institutions that provide a variety of services. Banks can be categorized by the functions they perform and the customers they serve.

**Commercial banks** are those that take deposits and make loans. Commercial banks include **retail banks**, which primarily serve individuals and small businesses, and **wholesale banks**, which primarily serve corporate and institutional customers.

**Investment banks** are those that assist in raising capital for their customers (e.g., by managing the issuance of debt and equity securities) and advising them on corporate finance matters such as mergers and restructurings.

Whether a bank or bank holding company engages in both commercial banking and investment banking or must only do one or the other depends on the regulations where it does business.

## Major Risks Faced by Banks

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**LO 25.a: Identify the major risks faced by a bank and explain ways in which these risks can arise.**

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The main risks faced by a bank include credit risk, market risk, and operational risk.

**Credit risk** refers to the risk that borrowers do not repay their loans or that counterparties to contracts such as derivatives may default on their obligations when the contract has negative value to the counterparty (and positive value to the bank). The bank's trading of derivatives also introduces market risk since the derivatives contract is dependent on the price of the underlying asset. Regarding loans, the interest rate charged by banks on loans takes into account the expected losses; for example, assuming a 2% differential in average interest rate charged and cost of funds, expected losses of 0.6% would leave 1.4% remaining for operating costs and profit.

**Market risk** refers to the risk of losses from a bank's trading activities, such as declines in the value of securities the bank owns. Specific examples of market risk factors include changes in interest rates, exchange rates, and stock prices. Banks allow their larger investors to trade in a variety of financial contracts where the bank acts as a market maker. In those instances, the bank has controlled (but not zero) exposures to market risk factors.

**Operational risk** refers to the possibility of losses arising from external events (e.g., cyber attacks or physical asset damage) or failures of a bank's internal controls (e.g., employee defalcation, business interruption, IT failures, and human error). Operationally, banks are most exposed to legal, compliance, and cyber risks.

## Economic Capital vs. Regulatory Capital

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**LO 25.b: Distinguish between economic capital and regulatory capital.**

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To mitigate the risk of bank failures caused by losses on loans or trading assets, banks must be funded by adequate sources of capital. Equity capital is needed to shield against possible losses and to maintain solvency. Banks may also issue long-term debt (debt capital) to bolster their capital. This debt is subordinated to the claims of depositors if a bank faces financial distress.

Equity capital can be thought of as going concern capital since it is meant to cover losses when the bank continues to operate as a business. In contrast, debt capital can be thought of as gone concern capital since it is meant to cover losses only once the bank ceases to operate as a business.

Banks and their regulators may have different views about how much capital is sufficient in light of the risks a bank faces. **Regulatory capital** refers to the minimum amount required and is determined by bank regulators.

**Economic capital** refers to the amount of capital that a bank believes is adequate based on its own risk models. Both regulatory and economic capital refer to funds

that are set aside to be used to cover unexpected losses. The amount of required capital will correspond to the amount of potential losses.

## Basel Committee Regulations

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**LO 25.c: Summarize Basel Committee regulations for regulatory capital and their motivations.**

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The Basel Committee regulations began as capital requirements to account for loan and derivatives contracts defaults (i.e., credit risk only). Over time, the capital requirements evolved and added amounts for market risk and operational risk.

Models are used to compute regulatory capital, specifically standardized models developed by the Basel Committee and internal models developed by the banks. After the credit crisis of 2007 to 2009, the Basel Committee has allowed less use of bank internal models. As of now, all three risks (credit, market, and operational) must be computed using a standardized model. However, if a bank is approved by its national regulator, then it may use an internal model for market and credit risks only. The internal models calculate a required capital amount based on the greater of the capital computed by the internal model, and 72.5% of the capital computed by the standardized model. Note that the 72.5% is a figure that will apply by 2027.

The credit crisis of 2007 to 2009 highlighted that many of the problems arose due to a liquidity shortage as opposed to a capital shortage. As a result, the Basel Committee introduced two liquidity ratio requirements. The **liquidity coverage ratio (LCR)** is meant to ensure that banks have enough funding sources to remain viable for 30 days in the event of minor financial stress periods. The **net stable funding ratio (NSFR)** attempts to control the maturity mismatches between the bank's assets and liabilities.

## Deposit Insurance and Moral Hazard

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**LO 25.d: Explain how deposit insurance gives rise to a moral hazard problem.**

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To increase public confidence in the banking system and prevent runs on banks, most countries have established systems of **deposit insurance**. Typically, a depositor's funds are guaranteed up to some maximum amount if a bank fails. These systems are funded by insurance premiums paid by banks.

Like other forms of insurance, deposit insurance brings an element of **moral hazard**. Moral hazard is the observed phenomenon that insured parties take greater risks than they would normally take if they were not insured. In the banking context, with deposit insurance in place, the moral hazard arises when depositors pay less attention to banks' financial health than they otherwise would. This allows banks to offer higher interest rates on deposits and make higher-risk loans with the funds they attract. Losses on such loans contributed to increased bank failures in the United States in the 1980s and 2000s.

One way of mitigating moral hazard is by making insurance premiums risk-based. For example, in recent years, poorly capitalized banks have been required to pay higher deposit insurance premiums than well-capitalized banks.

## Investment Banking Financing Arrangements

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**LO 25.e: Describe investment banking financing arrangements including private placement, public offering, best efforts, firm commitment and Dutch auction approaches.**

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When an investment bank arranges a securities issuance for a customer, it may try to place the entire issue with a particular buyer or group of buyers or sell the issue in the public market.

In a **private placement**, securities are sold directly to qualified investors with substantial wealth and investment knowledge. The investment bank earns fee income for arranging a private placement.

If the securities are sold to the investing public at large, the issuance is referred to as a **public offering**. Investment banks have two methods of assisting with a public offering. With a **firm commitment**, the investment bank agrees to purchase the entire issue at a price that is negotiated between the issuer and bank. The investment bank earns income by selling the issue to the public at a spread above the price it paid the issuer. An investment bank can also agree to distribute an issue on a **best efforts** basis rather than agreeing to purchase the whole issue, which is less risky for the bank. If only part of the issue can be sold, the bank is not obligated to buy the unsold portion. As with a private placement, the investment bank earns fee income for its services.

First-time issues of stock by firms whose shares are not currently publicly traded are called **initial public offerings** (IPOs). Since the shares are not yet traded, it is challenging to determine a reasonable post-IPO share price. An investment bank can assist in determining an IPO price by analyzing the value of the issuer.

An IPO price may also be discovered through a **Dutch auction** process. A Dutch auction begins with a price greater than what any bidder will pay, and this price is reduced until a bidder agrees to pay it. Bidders may specify how many units they will purchase when accepting a price. The price continues to be reduced until bidders have accepted all the shares that the seller wants to sell. The price at which the last of the shares can be sold becomes the price paid by all successful bidders. Assuming all potential bidders participate, that price is the equilibrium price where demand and supply intersect.

## Potential Conflicts of Interest

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**LO 25.f: 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.**

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If a bank or a bank holding company provides commercial banking, investment banking, and securities services, several conflicts of interest may arise. For example, an investment banking division that is trying to sell newly issued stocks or bonds might want the securities division to sell these to their clients. The investment bankers may press the securities division's financial analysts to maintain buy recommendations, or press its financial advisors to allocate these stocks and bonds to customer accounts. Such pressure may interfere with analysts' independence and objectivity or conflict with advisors' duties to clients.

Another clear conflict of interest among banking departments involves material nonpublic information. A commercial banking or investment banking division may acquire nonpublic information about a company when negotiating a loan or arranging a securities issuance. Other parts of the banking company, such as its trading desk, may benefit unfairly if they gain access to this information.

Because of these inherent conflicts, most bank regulators require some degree of separation among commercial banking, securities services, and investment banking. In some cases, they have prohibited firms from engaging in more than one of these activities, as was true in the United States when the Glass-Steagall Act was in force. Where banking firms are permitted to have commercial banking, securities, and investment banking units, the firms must implement **Chinese walls**, which are internal controls to prevent information from being shared among these units.

## Banking Book vs. Trading Book

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**LO 25.g: Describe the distinctions between the “banking book” and the “trading book” of a bank.**

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Distinctions between banking book and trading book are required when computing regulatory capital.

The **banking book** refers to assets and liabilities that are meant to be held to maturity. For example, it would include loans made, which are the primary assets of a commercial bank. In calculating regulatory capital, credit risk capital calculations apply to the banking book.

The **trading book** refers to assets and liabilities related to a bank's trading activities. Unlike other assets and liabilities, trading book items are marked to market daily. In calculating regulatory capital, market risk capital computations apply to the trading book, which often result in lower capital requirements than the banking book.

In general, the default classification for a given financial instrument is the banking book. However, if a bank dedicates a desk to trade a given instrument, then it would likely be classified in the trading book.

## The Originate-to-Distribute Model

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**LO 25.h: Explain the originate-to-distribute model of a bank and discuss its benefits and drawbacks.**

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In contrast to a bank making loans and keeping them as assets, the **originate-to-distribute model** involves making loans and selling them to other parties. Many mortgage lenders in the United States operate on the originate-to-distribute model. Government agencies such as Ginnie Mae (GNMA), Fannie Mae (FNMA), and Freddie Mac (FHLMC) purchase mortgage loans from banks and issue securities backed by the cash flows from these mortgages.

The benefit of the originate-to-distribute model is that it increases liquidity in the sectors of the lending market where it is used. In addition to the residential mortgage market, this model has been applied in other areas such as student loans, credit card balances, and commercial loans and mortgages. For the banks that originate the loans, selling them to other parties is a way of freeing up capital with which they can meet regulatory requirements or make new loans.

A drawback of this model is that, in some cases, it has led banks to loosen lending standards. This was one of the factors that led to the credit crisis in the United States from 2007 to 2009.



### MODULE QUIZ 25.1

1. The minimum level of capital a bank needs to maintain, according to its own estimates, models, and risk assessments, is best described as its
  - A. equity capital.
  - B. financial capital.
  - C. economic capital.
  - D. regulatory capital.
2. Which of the following actions in the banking system is most likely intended to address the problem of moral hazard?
  - A. Deposit insurers charge risk-based premiums.
  - B. Banks increase loans to higher-risk borrowers.
  - C. Governments implement deposit insurance programs.
  - D. Banks increase the interest rates they offer to depositors.
3. An investment bank is most likely to earn a trading profit from buying and selling securities if it arranges
  - A. a Dutch auction.
  - B. a private placement.
  - C. a best efforts offering.
  - D. a firm commitment offering.
4. The purpose of a Chinese wall in banking is to
  - A. prevent a bank failure from endangering other banks.
  - B. prevent a bank's departments from sharing information.
  - C. restrict companies from offering both banking and securities services.
  - D. restrict companies from engaging in both commercial and investment banking.

5. A drawback of the originate-to-distribute banking model is that it has led to
- A. too little liquidity in certain sectors.
  - B. too much liquidity in certain sectors.
  - C. looser credit standards in certain sectors.
  - D. tighter credit standards in certain sectors.

**KEY CONCEPTS****LO 25.a**

The major risks faced by a bank include the following.

- Credit risk from defaults on loans or by counterparties.
- Market risk from declines in the value of trading book assets.
- Operational risk from external events or failure of internal controls.

**LO 25.b**

To mitigate the risk of bank failures caused by losses on loans or trading assets, banks must be funded by adequate sources of capital. Banks and their regulators may have different views about how much capital is sufficient in light of the risks a bank faces.

**LO 25.c**

Regulatory capital is the amount of capital that regulators require a bank to hold. Economic capital is the amount of capital a bank believes it needs to hold based on its own models.

**LO 25.d**

Deposit insurance exists to increase public trust in the banking system. However, it gives rise to moral hazard by decreasing the attention depositors pay to a bank's financial health and increasing the level of risk a bank is willing to take when its depositors are insured.

**LO 25.e**

In a private placement, securities are sold directly to qualified investors. In a public offering, securities are sold to the investing public.

When assisting a securities issuer on a best-efforts basis, an investment bank sells as much of the issue to the public as it can. In a firm commitment, an investment bank buys an entire issue of securities from the issuer for one price and resells the securities to the public for a higher price. A Dutch auction process may be used to determine a price for an initial public offering.

**LO 25.f**

Within a firm that provides commercial banking, investment banking, and securities services, inherent conflicts of interest exist. Information may be acquired in a commercial banking or investment banking transaction that would give the other units an unfair advantage. An investment bank's task of selling newly issued stocks and bonds may conflict with a securities unit's duties to act in the best interests of its clients and recommend trading actions independently.

Bank regulators generally require commercial banking, investment banking, and securities activities to be kept separate, either by preventing firms from engaging in more than one of these activities or by requiring Chinese walls between these units of a bank.

**LO 25.g**

The banking book refers to a bank's assets and liabilities to be held to maturity (e.g., loans made by a bank for a specific term). The trading book refers to assets and liabilities related to a bank's trading activities. Regulatory capital requirements are generally higher for the banking book than for the trading book.

**LO 25.h**

The originate-to-distribute model involves banks making loans and selling them to other parties, many of which pool the loans and issue securities backed by their cash flows. This model frees up capital for the originating banks and may increase liquidity in sectors of the loan market. However, it has also led to decreased lending standards and lower credit quality of the loans sold.

**ANSWER KEY FOR MODULE QUIZZES****Module Quiz 25.1**

1. **C** Economic capital refers to a bank's own assessment of the minimum level of capital it needs to maintain. Economic capital is often less than regulatory capital, which is the minimum level a bank must maintain to comply with capital adequacy regulations. (LO 25.b)
2. **A** Charging risk-based premiums is a measure intended to address the problem of moral hazard, which exists when insured parties take greater risks than they would take in the absence of insurance. (LO 25.d)
3. **D** With a firm commitment offering, an investment bank buys an entire issue of securities from the issuer and attempts to sell them to the public at a higher price. In a private placement or a best efforts offering, an investment bank earns fee income rather than trading income. A Dutch auction is a method of price discovery for an initial public offering that does not involve buying and reselling shares. (LO 25.e)
4. **B** Chinese walls are internal controls to prevent a banking company's commercial banking, securities, and investment banking operations from sharing information. (LO 25.f)
5. **C** One drawback to the originate-to-distribute model is that it has led to looser credit standards in certain sectors, such as residential mortgages. A benefit of the model is that it has increased liquidity in certain sectors. (LO 25.h)

# READING 26

## Insurance Companies and Pension Plans

### EXAM FOCUS

The focus of this reading is primarily on concepts related to life insurance and nonlife (property and casualty) insurance, such as moral hazard, adverse selection, mortality risk, and longevity risk. For the exam, be able to apply mortality tables to perform life expectancy computations and breakeven premium computations for life insurance companies, and be able to compute ratios relevant to property and casualty insurance companies. In addition, understand the risks facing insurance companies and be able to discuss specific ways to mitigate them.

### MODULE 26.1: INSURANCE COMPANIES AND PENSION PLANS

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**LO 26.a: Describe the key features of the various categories of insurance companies and identify the risks facing insurance companies.**

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Insurance companies protect policyholders from specific loss events in exchange for the payment of periodic premiums. Three categories of insurance companies include life insurance, property and casualty (nonlife) insurance, and health insurance.

#### Life Insurance

Life insurance companies usually provide long-term coverage and make a specified payment to the policyholder's beneficiaries upon the natural death (i.e., certain event) of the policyholder during the policy term. Coverage is also available for accidental death (i.e., uncertain event).

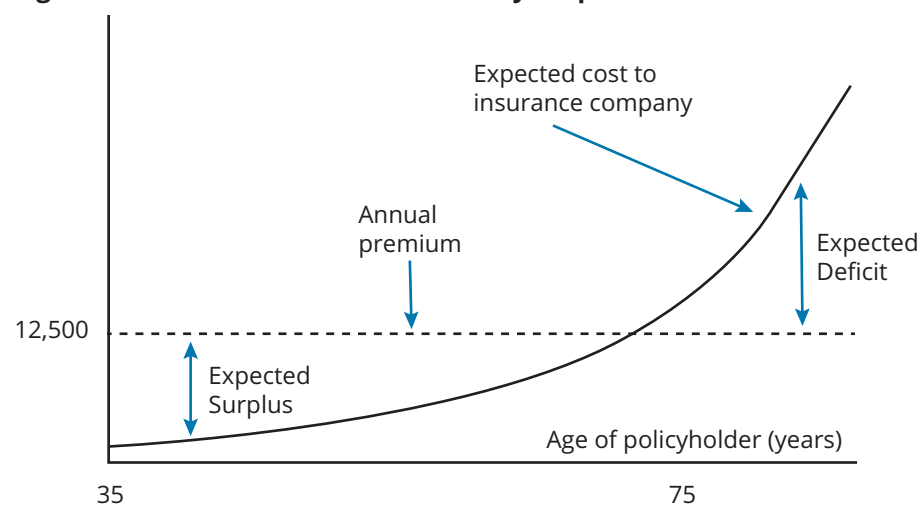
**Term (temporary) life insurance** provides a specified amount of insurance coverage for a fixed period. No payments are made to the policyholder's beneficiaries if the policyholder survives the term of the policy; therefore, payment is not certain. Payment is only made if the policyholder dies during the policy term. The use of mortality tables to calculate breakeven premiums is discussed later. **Endowment life insurance** is a subset of term insurance that has a payout at the stated contract maturity. If the policyholder dies before maturity, then there will be a payout at death. A with-profits endowment policy involves a higher payout assuming the insurance company's underlying investments perform well. A unit-linked endowment policy involves the policyholder choosing an investment and having the payout amount linked to the performance of the investment.

Employers on behalf of their employees usually arrange **group life insurance**. It involves the pooling of risks for a large number of individuals. Because medical examinations are often not required for group insurance, there will be some good risks and some bad risks taken by the insurance company.

**Whole (permanent) life insurance** provides a specified amount of insurance coverage for the life of the policyholder so payment will occur upon death, but there is uncertainty as to the timing. For both term and whole life insurance, it is most common for premiums and the amount of coverage to be fixed for the entire period in question.

In analyzing the relationship between the cost of one year of life insurance and whole life insurance premiums, assume a 30-year-old male purchases a \$2 million whole life policy with an annual premium of \$12,000. Based on mortality tables (as shown in LO 26.b), the probability of death within the year of a 30-year-old male is 0.001467, so the premium for one year of insurance should be \$2,934. The excess of \$9,066 is a surplus premium that is not required to cover the risk of a payout and is therefore invested by the insurance company for the policyholder. The process continues year after year while the cost of a one-year policy increases as the policyholder ages. Later in the policyholder's life, the one-year policy cost will exceed the annual premium (\$12,000). From an overall perspective, the surplus in the earlier years is offset by the deficit in the later years. This concept is illustrated graphically in Figure 26.1.

**Figure 26.1: Whole Life Insurance Policy Surplus and Deficit**



Some variations of whole life insurance include variable life insurance whereby the final payout may be increased if the underlying investments outperform and universal life insurance whereby the premium may be reduced in exchange for a reduced final payout.

**Annuity contracts** are the opposite of life insurance contracts. In general, an initial lump sum payment is made by the annuitant to the insurance company in return for a stream of future payments from the insurance company to the annuitant for the remainder of life. Some annuities begin immediately while others start an agreed-upon number of years later (e.g., deferred annuities). Some deferred annuities have a guaranteed minimum amount of payments. The funds invested in the annuity will earn investment income; the total amount of the principal and income less the total payments made to the annuitant is equal to the accumulation value. Depending on the terms of the contract, the accumulation value may be withdrawn prematurely but likely with penalties.

## Property and Casualty (P&C) Insurance

P&C insurance companies usually provide annual and renewable coverage against loss events. The premiums may increase or decrease based on any changes in estimates of expected payout. **Property insurance** covers property losses such as fire and theft. The risks can be managed in some instances because the expected payouts on claims can be estimated with a high degree of confidence if many policies are written on thousands of independent events (e.g., automobile insurance). However, property insurers may be subject to catastrophe risks arising from many large claims due to natural disasters, or they may benefit if there are no natural disasters, hence, the all-or-nothing nature of catastrophe risks. Such risks could be managed using geographical, seismographic, and meteorological information to determine the probability and severity of catastrophic events. **Casualty (liability) insurance** covers third-party liability for injuries sustained while on a policyholder's premises or caused by the policyholder's use of a vehicle, for example.

In general, for P&C insurance companies, property damage claims from natural disasters, and liability insurance claims are subject to fluctuating payouts and are very challenging to predict.

## Health Insurance

Health insurance companies provide coverage to policyholders for medical services that are not covered under a publicly funded health care system. Policyholders pay ongoing premiums and the insurance company will make payments for events such as necessary hospital treatment or prescription medication. Premiums may increase due to general increases in health care costs (similar to automobile insurance), but they typically will not increase due to the worsening of the policyholder's health (similar to life insurance). In some cases, insurance coverage may not be denied to individuals with preexisting (but unknown) medical conditions.

## Risks Facing Insurance Companies

Major risks facing insurance companies include the following:

- *Insufficient funds to satisfy policyholders' claims.* The liability computations often provide a significant cushion, but it is always possible to have a sudden surge of payouts in a short time (e.g., mortality risk and catastrophe risk) or payouts that continue for longer than expected (e.g., longevity risk).
- *Poor return (market risk) on investments.* Insurance companies often invest in fixed-income securities and if defaults suddenly increase, insurance companies will incur losses. Diversification of investments by industry sector and geography can help mitigate such losses.
- *Credit risk.* By transacting with banks and reinsurance companies, insurance companies face credit risk if the counterparty defaults on its obligations.
- *Operational risk.* Similar to banks, an insurance company faces losses due to failure of its systems and procedures or from external events outside the company's control (e.g., computer failure and human error).

## Mortality Tables

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**LO 26.b: Describe the use of mortality tables and calculate the premium payment for a policy holder.**

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An excerpt from mortality tables estimated by the U.S. Social Security Administration for 2013 is provided in Figure 26.2.

As an example, examine the row for a male aged 40. The second column indicates that the probability of a 40-year-old male dying within the next year is 0.002092 (or 0.2092%). The third column indicates that the probability of a male surviving to age 40 is 0.95908 (or 95.908%). The fourth column indicates that a 40-year-old male has a remaining life expectancy of 38.53 years so that, on average, he will live to age 78.53. The remaining three columns show the same estimates for a female and they appear slightly better than for a male.

Figure 26.2: Partial Mortality Table

Age (Years)	Male			Female		
	Probability of Death Within 1 Year	Survival Probability	Life Expectancy	Probability of Death Within 1 Year	Survival Probability	Life Expectancy
0	0.006519	1	76.28	0.005377	1	81.05
1	0.000462	0.99348	75.78	0.000379	0.99462	80.49
2	0.000291	0.99302	74.82	0.000221	0.99425	79.52
3	0.000209	0.99273	73.84	0.000162	0.99403	78.54
30	0.001467	0.97519	47.82	0.000664	0.98635	52.01
40	0.002092	0.95908	38.53	0.001287	0.97753	42.43
41	0.00224	0.95708	37.61	0.001393	0.97627	41.48
42	0.002418	0.95493	36.7	0.001517	0.97491	40.54
43	0.002629	0.95262	35.78	0.001662	0.97343	39.6
50	0.005038	0.9294	29.58	0.003182	0.95829	33.16
51	0.00552	0.92472	28.73	0.003473	0.95524	32.27
52	0.006036	0.91961	27.89	0.003767	0.95193	31.38
53	0.006587	0.91406	27.05	0.004058	0.94834	30.49
60	0.011197	0.86112	21.48	0.006545	0.91526	24.46
61	0.012009	0.85147	20.72	0.007034	0.90927	23.62
62	0.012867	0.84125	19.97	0.007607	0.90287	22.78
63	0.013772	0.83042	19.22	0.008281	0.896	21.95
70	0.023528	0.73461	14.24	0.015728	0.82864	16.43
71	0.025693	0.71732	13.57	0.017338	0.81561	15.68
72	0.028041	0.69889	12.92	0.019108	0.80147	14.95
73	0.030567	0.6793	12.27	0.021041	0.78616	14.23
80	0.059403	0.50629	8.2	0.043289	0.6388	9.64
90	0.167291	0.17735	4.03	0.132206	0.29104	4.8

Source: Social Security Administration, [www.ssa.gov/OACT/STATS/table4c6.html](http://www.ssa.gov/OACT/STATS/table4c6.html)

When examining the full table, the probability of death during the following year is a decreasing function of age until age 10 and then it increases. For an 80-year-old male, the probability of death within the next year is about 5.9% and increases to about 16.7% at age 90.

Some probabilities can be computed indirectly using other numbers in the table. For example, in the third column, the probability of a male surviving to age 70 is 0.73461 and the probability of the male surviving to age 71 is 0.71732. Therefore, the probability of death of a male between age 70 and 71 is  $0.73461 - 0.71732 = 0.01729$  (or about 1.73%). Given that a male reaches age 70, the probability of death within the following year is  $0.01729 / 0.73461 = 0.023536$  (or about 2.35%), which is consistent with the number in the second column.

Going further, the probability of the death of a 70-year-old male in the second year (between ages 71 and 72) is the probability that he does not die in the first year times the probability that he does die in the second year. Using the numbers in the second column, the probability is  $(1 - 0.023528) \times 0.025693 = 0.025088$  (or about 2.51%).

With the information in the mortality tables, we can calculate the breakeven premium payment by equating the present value of the expected payout to the present value of the expected premium payments.

### **EXAMPLE: Breakeven Premium Payments**

The relevant interest rate for insurance contracts is 3% per annum (semiannual compounding applies), and all premiums are paid annually at the beginning of the year. A \$500,000 term insurance contract is being proposed for a 60-year-old male in average health. Assuming that payouts occur halfway throughout the year, calculate the insurance company's breakeven premium for a one-year term and a two-year term.

#### **Answer:**

*One-year term:*

The expected payout for a one-year term is  $0.011197 \times \$500,000 = \$5,598.50$ . Assuming the payout occurs in six months, the breakeven premium is:  $\$5,598.50 / 1.015 = \$5,515.76$ .

*Two-year term:*

The expected payout for a two-year term is the sum of the expected payouts in both the first year and the second year. The probability of death in the second year is  $(1 - 0.011197) \times 0.012009 = 0.011874$ , so the expected payout in the second year is  $0.011874 \times \$500,000 = \$5,937.27$ . If the payout occurs in 18 months, then the present value is  $\$5,937.27 / (1.015)^3 = \$5,677.91$ . The total present value of the payouts is then  $\$5,515.76 + \$5,677.91 = \$11,193.67$ .

The first premium payment occurs immediately (i.e., beginning of the first year) so it is certain to be received. However, the probability of the second premium payment being made at the beginning of the second year is the probability of not dying in the first year, which is  $1 - 0.011197 = 0.988803$ . The present value of the premium payments (using  $Y$  as the breakeven premium) =  $Y + (0.988803Y / 1.015^2) = 1.959793Y$ .

Computing the breakeven annual premium equates the present value of the payouts and the premium payments as follows:  $11,193.67 = 1.959793Y$ . Solving for  $Y$ , the breakeven annual premium is \$5,711.66.

## P&C Insurance Ratios

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**LO 26.e: Calculate and interpret loss ratio, expense ratio, combined ratio and operating ratio for a property-casualty insurance company.**

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Property and casualty insurance companies compute the following ratios:

- The **loss ratio** for a given year is the percentage of payouts versus premiums generated. Assuming a loss ratio of 65%, then for every \$100 of generated premiums, \$65 will be paid out in claims and \$35 is left to pay expenses and possibly earn profits.
- The **expense ratio** for a given year is the percentage of expenses versus premiums generated. The largest expenses are usually loss adjustments (e.g., claims investigation and assessing payout amounts) and selling (e.g., broker commissions).
- The **combined ratio** for a given year is equal to the sum of the loss ratio and the expense ratio.
- The **combined ratio after dividends** for a given year is equal to the combined ratio plus the payment of dividends to policyholders as a percentage of premiums (if applicable).
- The **operating ratio** for a given year is the combined ratio (after dividends) less investment income as a percentage of premiums. The mismatch of the cash inflows (generally earlier) and outflows (generally later) for many insurance companies allows them to earn interest income. For example, policyholders tend to pay their premiums upfront at the beginning of the year, but insurance companies tend to pay out claims throughout the year or after year-end.

## Moral Hazard and Adverse Selection

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**LO 26.f: Describe moral hazard and adverse selection risks facing insurance companies, provide examples of each and describe how to overcome the problems.**

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**Moral hazard** describes the risk to the insurance company that having insurance will lead the policyholder to act more recklessly than if the policyholder did not have insurance.

An example of moral hazard would be the existence of collision and liability coverage with automobile insurance. By having such coverage, some drivers would be willing to drive over the speed limits knowing that if an accident occurs, they would be covered for damage to the car and any resulting injury to a third party. Another example would be the existence of health insurance. By having such coverage, some policyholders may request more health services than necessary.

Methods to mitigate against moral hazard include deductibles (e.g., policyholder is responsible for a fixed amount of the loss), coinsurance provisions (e.g., insurance company will only pay a fixed percentage of losses), and policy limits (e.g., fixed maximum payout).

**Adverse selection** describes the situation where an insurer is unable to differentiate between a good risk and a bad risk. By charging the same premiums to all policyholders, the insurer may end up insuring more bad risks (e.g., careless drivers, sick individuals).

Methods to mitigate against adverse selection include greater initial due diligence (e.g., mandatory physical examinations for life insurance, researching driving records for automobile insurance) and ongoing due diligence (e.g., updating driving records and adjusting premiums to reflect changing risk).

## Mortality Risk vs. Longevity Risk

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**LO 26.c: Distinguish between mortality risk and longevity risk and describe how to hedge these risks.**

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**Mortality risk** refers to the risk of policyholders dying earlier than expected due to illness or disease, for example. From the perspective of the insurance company, the risk of losses increases due to the earlier-than-expected life insurance payout.

**Longevity risk** refers to the risk of policyholders living longer than expected due to better healthcare and healthier lifestyle choices, for example. From the perspective of the insurance company, the risk of losses increases due to the longer-than-expected annuity payout period.

There is a natural hedge (or offset) for insurance companies that deal with both life insurance products and annuity products. For example, longevity risk is bad for the annuity business but is good for the life insurance business due to the delayed payout (or no payout if the policyholder has term insurance and dies after the policy expires). Mortality risk is bad for the life insurance business but is good for the annuity business because of the earlier-than-expected termination of payouts. The offset is not likely to be even, thereby resulting in some residual exposure that could be controlled with longevity derivatives, for example.

Longevity derivatives are used to hedge longevity risk inherent in annuity contracts and defined benefit pensions. An example of a payoff could be calculated as  $(\text{pre-stated fixed mortality rate} - \text{actual mortality rate}) \times \text{principal amount}$ . Another example would be a longevity bond (or a survivor bond) whereby the bond coupon is set to an amount that is linked to the number of people in a defined population group that are still alive.

## Capital Requirements for Insurance Companies

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**LO 26.g: Evaluate the capital requirements for life insurance and property-casualty insurance companies.**

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No global capital requirements exist for insurance companies; however, Solvency II is a set of regulations that is applicable in the European Union (EU). Under

Solvency II, there is a minimum capital requirement (MCR) and a solvency capital requirement (SCR):

- If capital < SCR, capital must increase above the SCR.
- If capital < MCR, business operations may become significantly restricted.
- MCR is usually 25% to 45% of SCR.

SCR and MCR are calculated based on the sum of charges for

- investment risk (assets), which includes credit and market risk,
- underwriting risk (liabilities),
- and operational risk.

There is substantially more equity capital required for a P&C insurance company than for a life insurance company due to the potentially catastrophic nature and amount of claims for P&C insurance contracts. In contrast, the risks are lesser for life insurance companies that face exposure to more predictable longevity and mortality risks.

## Guaranty System for Insurance Companies

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**LO 26.h: Compare the guaranty system and the regulatory requirements for insurance companies with those for banks.**

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In the United States, a **guaranty system** exists for both insurance companies and banks. Insurance companies are regulated at the state level while banks are regulated at the federal level.

For insurance companies, every insurer must be a member of the guaranty association in the state(s) in which it operates. If an insurance company becomes insolvent in a state, each of the other insurance companies must contribute an amount to the state guaranty fund (based on the amount of premium income it earns in that state). The guaranty fund proceeds are distributed to the policyholders of the insolvent company. In some cases, limits may apply on claims and there may be delays in settlement.

In contrast, the guaranty system for banks is a permanent fund to protect depositors and consists of amounts remitted by banks to the Federal Deposit Insurance Corporation (FDIC). No such permanent fund generally exists for insurance companies; therefore, insurance companies must make contributions whenever a default occurs.

## Pension Plans

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**LO 26.d: Describe a defined benefit plan and a defined contribution plan for a pension fund and explain the differences between them.**

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Many companies establish pension plans on behalf of their employees with contributions being made by both parties. Upon retirement, the employee will receive periodic pension payments until death.

**Defined benefit plans** (i.e., employee benefit known, employer contribution unknown) explicitly state the amount of the pension that the employee will receive upon retirement. It is usually calculated as a fixed percentage times the number of years of employment times the annual salary for a specific period. There is significant risk borne by the employer because it is obligated to fund the benefit to the employee; therefore, when the present value of the pension obligation exceeds the market value of the pension assets, the employer must cover the deficiency. As a result, there is no risk borne by the employee (in theory). The computation of the pension liability is highly sensitive to the discount rate used and generally must be equal to the yield on AA rated bonds. Additionally, some defined benefit plans may include indexation of pension amounts to account for inflation and/or continued pension payments (likely on a reduced basis) to the surviving spouse upon the death of a retired employee.

**Defined contribution plans** (i.e., employer contribution known, employee benefit unknown) involve both employer and employee contributions being invested in one or more investment options selected by the employee. Upon retirement, the employee could opt to receive a lifetime pension (based on the ending value of the contributions) in the form of an annuity or, in some cases, simply to receive a lump sum. In contrast to defined benefit plans, there is virtually no risk borne by the employer because it is obligated simply to make a set contribution and no more. The risk of underperformance of the plan's investments is borne solely by the employee.

A defined contribution plan involves one individual account associated with one employee. The individual pension is computed based only on the funds in that account. In contrast, a defined benefit plan involves one pooled account for all employees; all contributions go into and all payments come out of the one account.



### MODULE QUIZ 26.1

1. The relevant interest rate for insurance contracts is 2% per annum (semiannual compounding applies) and all premiums are paid annually at the beginning of the year. A \$2,000,000 term insurance contract is being proposed for a 40-year-old male in average health. Assume that payouts occur halfway throughout the year. Using the mortality rates estimated by the U.S. Social Security Administration (in Figure 26.2), which of the following amounts is closest to the insurance company's breakeven premium for a two-year term?
  - A. \$4,246
  - B. \$4,287
  - C. \$4,332
  - D. \$8,482

2. The following information pertains to a property and casualty (P&C) insurance company:

Investment income	5%
Dividends	2%
Loss ratio	74%
Expense ratio	23%

Based on the information provided, what is this company's operating ratio?

- A. 90%
  - B. 94%
  - C. 97%
  - D. 99%
3. Which of the following problems would most likely be a concern for life insurance companies that are worried about differentiating between good risks and bad risks?
- A. Adverse selection
  - B. Catastrophe risk
  - C. Longevity risk
  - D. Moral hazard
4. Which of the following statements regarding the capital requirements and regulation of insurance companies is correct?
- A. Insurance companies are regulated at both the state and federal level.
  - B. The guaranty system for insurance companies consists of a permanent fund created from premiums paid by insurers.
  - C. If an insurance company's capital falls below the solvency capital requirement (SCR), then its business operations may become significantly restricted.
  - D. The amount of equity required on the balance sheet of a life insurance company is typically lower than that of a P&C insurance company.
5. A new hire is researching the differences between a defined benefit plan and a defined contribution plan. Which of the following statements within the company's policies would indicate that the pension plan is a defined benefit plan? A defined benefit plan
- A. involves one individual account associated with one employee.
  - B. risks underperformance of the plan's investments, and this risk is borne solely by the employee.
  - C. does not explicitly state the amount of the pension that the employee will receive upon retirement.
  - D. involves one pooled account for all employees as all contributions go into and all payments come out of the one account.

**KEY CONCEPTS****LO 26.a**

Three categories of insurance companies include life insurance, nonlife (P&C) insurance, and health insurance. Life insurance companies usually provide long-term coverage and will make a specified payment to the policyholder's beneficiaries upon the death of the policyholder during the policy term. Term (temporary) life insurance provides a specified amount of insurance coverage for a fixed period. Whole (permanent) life insurance provides a specified amount of insurance coverage for the life of the policyholder.

Risks facing insurance companies include insufficient funds to satisfy policyholders' claims, poor return (market risk) on investments, credit risk, and operational risk.

**LO 26.b**

Mortality tables can be used to compute life insurance premiums. Mortality tables include information related to the probability of an individual dying within the next year, the probability of an individual surviving to a specific age, and the remaining life expectancy of an individual of a specific age.

**LO 26.c**

Mortality risk refers to the risk of policyholders dying earlier than expected. For the insurance company, the risk of losses increases due to the earlier-than-expected life insurance payouts. Longevity risk refers to the risk of policyholders living longer than expected. For the insurance company, the risk of losses increases due to the longer-than-expected annuity payout period. There is a natural hedge (or offset) for insurance companies that deal with both life insurance products and annuity products because longevity risk is bad for the annuity business but good for the life insurance business, and mortality risk is bad for the life insurance business but good for the annuity business.

**LO 26.d**

Defined benefit plans explicitly state the amount of the pension that the employee will receive upon retirement. It is usually calculated as a fixed percentage times the number of years of employment times the annual salary for a specific period. There is significant risk borne by the employer because it is obligated to fund the benefit to the employee.

Defined contribution plans involve both employer and employee contributions being invested in one or more investment options selected by the employee. There is virtually no risk borne by the employer because it is obligated simply to make a set contribution and no more. The risk of underperformance of the plan's investments is borne solely by the employee.

### LO 26.e

P&C insurance companies compute the following ratios:

- $\text{loss ratio} + \text{expense ratio} = \text{combined ratio}$
- $\text{combined ratio} + \text{dividends} = \text{combined ratio after dividends}$
- $\text{combined ratio after dividends} - \text{investment income} = \text{operating ratio}$

### LO 26.f

Moral hazard describes the risk to the insurance company that having insurance will lead the policyholder to act more recklessly than if the policyholder did not have insurance. Methods to mitigate moral hazard include deductibles, coinsurance, and policy limits.

Adverse selection describes the situation where an insurer is unable to differentiate between a good risk and a bad risk. Methods to mitigate adverse selection include greater initial due diligence and ongoing due diligence.

### LO 26.g

Under Solvency II, there is an MCR and a SCR:

- If  $\text{capital} < \text{SCR}$ , capital must increase above the SCR.
- If  $\text{capital} < \text{MCR}$ , business operations may become significantly restricted.
- MCR is usually 25% to 45% of SCR.

For a P&C insurance company, there is substantially more equity capital required than for a life insurance company because of the highly unpredictable nature of claims for P&C insurance contracts.

### LO 26.h

For insurance companies in the United States, every insurer must be a member of the guaranty association in the state(s) in which it operates. If an insurance company becomes insolvent in a state, then each of the other insurance companies must contribute an amount to the state guaranty fund based on the amount of premium income it earns in that state.

The guaranty system for banks in the United States is a permanent fund to protect depositors that consists of amounts remitted by banks to the FDIC. No such permanent fund exists for insurance companies.

## ANSWER KEY FOR MODULE QUIZZES

### Module Quiz 26.1

1. **B** One-year term:

The expected payout for a one-year term is  $0.002092 \times \$2,000,000 = \$4,184$ . Assuming the payout occurs in six months, the breakeven premium is  $\$4,184 / 1.01 = \$4,142.57$ .

Two-year term:

The expected payout for a two-year term is the sum of the expected payouts in both the first year and the second year. The probability of death in the second year is  $(1 - 0.002092) \times 0.00224 = 0.0022353$ , so the expected payout in the second year is  $0.0022353 \times \$2,000,000 = \$4,470.63$ . If the payout occurs in 18 months, then the present value is  $\$4,470.63 / (1.01)^3 = \$4,339.15$ . The total present value of the payouts is then  $\$4,142.57 + \$4,339.15 = \$8,481.72$ .

The first premium payment occurs immediately (i.e., beginning of the first year) so it is certain to be received. However, the probability of the second premium payment being made at the beginning of the second year is the probability of not dying in the first year, which is  $1 - 0.002092 = 0.997908$ . The present value of the premium payments is as follows (using  $Y$  as the breakeven premium):  $Y + (0.997908Y / 1.01^2) = 1.978245Y$ .

Computing the breakeven annual premium equates the present value of the payouts and the premium payments as follows:  $8,481.72 = 1.978245Y$ . Solving for  $Y$ , the breakeven annual premium is  $\$4,287.50$ .

Response A ( $\$4,246$ ) is not correct because it performs the computation on the assumption that all payouts occur at the end of the year instead of halfway throughout the year. Response C ( $\$4,332$ ) is not correct because it did not apply any discounting (at the 1% semiannual rate). Response D ( $\$8,482$ ) is not correct because it is simply the total present value of the payouts. (LO 26.b)

2. **B** The operating ratio is computed as follows:

loss ratio (74%) + expense ratio (23%) + dividends (2%) – investment income (5%) = 94%

The combined ratio is computed as follows:

loss ratio (74%) + expense ratio (23%) = 97%

The combined ratio after dividends is computed as follows:

loss ratio (74%) + expense ratio (23%) + dividends (2%) = 99%

(LO 26.e)

3. **A** Adverse selection describes the situation where an insurer is unable to differentiate between a good risk and a bad risk. In the context of life insurance, by charging the same premiums to all policyholders (healthy and unhealthy individuals), the insurer may end up insuring more bad risks (e.g., unhealthy individuals). To mitigate adverse selection, a life insurance company might require physical examinations before providing coverage. (LO 26.f)

4. **D** Property and casualty insurance companies typically have a greater amount of equity than a life insurance company because of the highly unpredictable nature of P&C claims (both timing and amount).

Insurance companies are regulated at the state level only (and banks are regulated at the federal level only). The guaranty system for insurance companies is not a permanent fund; in contrast, banks have a permanent fund created from premiums paid by banks to the FDIC. On the liability side of a P&C insurance company's balance sheet, there are unearned premiums that represent prepaid insurance contracts whereby amounts are received but the coverage applies to future periods. If an insurance company's capital falls below the MCR, then its business operations may become significantly restricted. If capital falls below the SCR, then plans must be made to increase capital above the SCR. (LO 26.g, LO 26.h)

5. **D** A defined contribution plan involves one individual account associated with one employee. The individual pension is computed based only on the funds in that account. In contrast, a defined benefit plan involves one pooled account for all employees; all contributions go into and all payments come out of the one account. Defined benefit plans explicitly state the amount of the pension that the employee will receive upon retirement. (LO 26.d)



# READING 27

## Fund Management

### EXAM FOCUS

Not every investor has the time or the skill to manage their own financial assets. For this reason, investors will sometimes hire a professional manager in the form of a mutual fund or perhaps a hedge fund. These pooled investment vehicles offer instant diversification and professional management to their investors. Smaller investors often use mutual funds while hedge funds are tools for wealthy individuals. Because hedge funds are limited only to those who can afford to lose their investment, they are subject to much less regulation. For the exam, be able to describe the various types of mutual funds and hedge funds along with their regulatory environments and typical fee structures.

### MODULE 27.1: MUTUAL FUNDS AND EXCHANGE-TRADED FUNDS

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**LO 27.a: Differentiate among open-end mutual funds, closed-end mutual funds and exchange-traded funds (ETFs).**

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**Mutual funds** are pooled investment vehicles that offer instant diversification for their investors. This diversification is very important because it spreads out risk to different sectors and asset classes. Most investors either do not have the time or the skill to properly diversify on their own. For this reason, investment vehicles like open-end mutual funds, closed-end mutual funds, and exchange-traded funds (ETFs) were created. There has been significant growth in mutual fund assets in the United States over the years, from \$0.5 billion in 1940 to about \$19 trillion in 2017.

## Open-End Mutual Funds

**Open-end mutual funds**, which are often simply called mutual funds, are the most common pooled investment vehicle (more than 98% of U.S. mutual fund assets). Essentially, investors are commingling their funds to be better diversified, to save on transaction fees, and to hire a professional management team. The professional management team will conduct research and ultimately invest commingled assets on behalf of their investors. These investors begin their investment by purchasing a set dollar amount of an open-end mutual fund and then they receive a proportional ownership interest (in the form of shares) in the mutual fund. This means that the number of shares goes up as new investors arrive and goes down as investors withdraw assets. When investors decide that they want to exit their investment in an open-end mutual fund, they can redeem their shares directly from the fund company, who will promptly send them either a check or a digital transfer of the value of their investment.

At a high level, open-end mutual funds are broken down into four main categories: money market funds, equity funds, bond funds, and hybrid funds. Money market funds invest in short-term interest-bearing instruments, such as Treasury bills, commercial paper, and banker's acceptances. Money market investors are typically risk averse. This category is an alternative to interest-bearing bank accounts and is often the "cash" portion of an investor's asset allocation mix. Equity funds invest solely in stocks. Within this category, one can find index funds that track a broad market index, such as the S&P 500 Index, funds that follow a certain style, such as medium company value funds, or sector funds, such as a health care sector fund. The amount of tracking error is indicative of the success of a fund in tracking the desired index. Bond funds invest only in fixed-income instruments, such as sovereign debt, corporate bonds, and asset-backed securities. Hybrid funds will blend stock and bond ownership into the same fund.

Open-end funds trade at the fund's **net asset value** (NAV), which is essentially the sum of all assets owned minus any liabilities of the fund then divided by the shares outstanding. When investors decide they want to buy shares of an open-end mutual fund, they will transact at the next available NAV, which is not calculated until after the market closes at 4:00 pm in New York City. An investor who decides at 10:00 am that they want to buy shares will enter a buy order for a set dollar amount, but they will not know the price at which they will transact until after the market closes. For this reason, we say that open-end fund investors have poor price visibility. Since shares are transacted at an unknown price, investors cannot use stop orders or limit orders. They must place a market order to transact in shares of an open-end mutual fund.

Taxes are levied against open-end mutual fund investors as if they owned the diversified fund's holdings outright. If the underlying investment pays a dividend, then the investors must pay taxes on their proportional ownership interest in that dividend. The open-end fund may also buy and sell underlying investments and generate taxable short-term or long-term capital gains. These taxable events are also passed on to investors. Dividends and capital gains are distributed to investors typically toward the end of the calendar year, but they can be automatically reinvested in the fund to purchase more shares. Investors often choose reinvestment if they do not need the cash flow for current consumption.

The cost of investing is also a major consideration for any investment category. Open-end mutual funds have a management fee and potentially a sales charge. The management fee covers the operational costs of the open-end mutual fund company, including the salaries of the management team. The expense ratio is calculated as the annual management fee divided by the assets under management. Management fees vary depending on country but are significantly lower for index funds compared to actively managed funds, due to the increased complexity of the actively managed funds. Sales charges are commonly called loads. A **front-end load** is a set percentage that is charged to the investor upon initial investment in the fund. Alternatively, some funds impose a sales charge when the investor sells an investment in the fund. This is called a **back-end load**.

## Closed-End Mutual Funds

**Closed-end mutual funds** are a similar concept to open-end funds with a few notable differences.

The first difference is that a purchase of shares in an open-end mutual fund will increase the number of shares outstanding because new shares are created, but a closed-end fund's number of shares remains static. Investors who desire to purchase or sell shares of a closed-end fund do not transact directly with the fund company but rather with other investors. Recall that investors who want to close their investment position in an open-end fund can simply redeem their shares from the fund company. This is where the fund gets the name open-end.

The second difference is that closed-end fund shares can be bought or sold at any time and both long and short positions can be taken; open-end fund shares can only be bought or sold at specific times and only long positions can be taken.

The third difference is that, while open-end funds always transact at the next available NAV, a closed-end fund can transact at a price other than NAV. It is very common for a closed-end fund to trade at a discount to its actual NAV. In the case of a discount, an argument can be made that the discount arises because of management fees.



### PROFESSOR'S NOTE

In terms of trading, a closed-end fund behaves much like an individual stock. Investors can trade closed-end funds throughout the trading day, which means they have better price visibility and can utilize stop orders and limit orders if they so choose.

## Exchange-Traded Funds

**Exchange-traded funds (ETFs)** are created by depositing shares with an ETF and then receiving shares of the ETF. They represent an innovative twist on the open-end mutual fund. They enable instant diversification like an open-end fund, but they are exchange-traded, which means they trade throughout the day on the open market just as a closed-end fund does. Because they trade throughout the day, investors can utilize stop orders, limit orders, and even short selling in some cases.

Unlike a closed-end fund, ETFs typically trade at their NAV. Many ETFs are passively managed index funds, although some new actively managed ETFs are beginning to come to market. One of the most widely known ETFs is the SPDR S&P 500 (SPY).

ETFs must disclose their holdings twice each day, which enables investors to have tremendous visibility into their underlying investments. Open-end mutual funds, on the other hand, disclose their holdings very infrequently, perhaps as delayed as once per quarter.

## Undesirable Trading Behaviors

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### LO 27.b: Identify and describe potential undesirable trading behaviors at mutual funds.

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Potential undesirable trading behaviors among mutual funds include late trading, market timing, front running, and directed brokerage.

**Late trading** occurs when orders are accepted after the 4:00 pm cut off trading time (in the United States for open-end mutual funds). It is possible for significant market events to occur shortly after 4:00 pm that would cause previously submitted trades to be reversed. Therefore, the acceptance of orders after 4:00 pm would be considered illegal and subject to prosecution.

**Market timing** occurs because some fund assets are not actively traded, thereby resulting in stale pricing when calculating NAV. If market prices are rising (falling) shortly before the 4:00 pm cut off, it may be profitable to buy (sell) at the NAV at 4:00 pm since the stale pricing means that the value of the shares is likely higher (lower) than the NAV. Market timing trades may result in sudden fluctuations in the fund's size that will require the fund to maintain greater liquidity to satisfy redemptions (holding liquid assets such as cash would lead to reduced fund returns since cash generates little or no investment income). Although of potential concern to regulators if trading exceptions are made for market timing, the act of market timing is not illegal.

**Front running** involves trading ahead of a likely price increase or decrease due to a known upcoming trade to be made by the fund. It may involve the trader's own account or favored clients or employees. Like late trading, front running is illegal, and is subject to prosecution.

**Directed brokerage** involves a quid pro quo whereby a mutual fund will direct trades to a broker in exchange for the broker investing its clients in the mutual fund. Although not illegal, it is a strongly discouraged practice.

## Net Asset Value

### LO 27.c: Calculate the net asset value (NAV) of an open-end mutual fund.

To calculate the **net asset value** (NAV), the fund needs to know the current value of all investment holdings (including cash positions), any liabilities such as management fees payable, and the total number of shares outstanding. Calculation of the NAV is shown as follows:

$$\text{NAV} = \frac{\text{fund assets} - \text{fund liabilities}}{\text{total shares outstanding}}$$

#### EXAMPLE: Computing NAV

Consider an open-end mutual fund that owns \$1.1 billion in equities, \$350 million in bonds, and \$35 million in cash. They owe \$1.85 million in management fees payable at this point in the quarter and they have 39.635 million shares outstanding. Calculate this fund's NAV.

**Answer:**

$$\$37.42 = \frac{(\$1,100 + \$350 + \$35) - 1.85}{39.635}$$

Investors who wish to buy or sell this fund will transact at exactly \$37.42 per share, which is not calculated until after the market closes on the trading day in question. If they wanted to invest \$25,000, then they would buy exactly 668.092 (= \$25,000 / \$37.42) shares after the market closes on the relevant trading day.

Recall that the NAV for an open-end mutual fund is only calculated after the close of trading on any given day, while the NAV for closed-end funds and ETFs is calculated continuously throughout the day.



#### MODULE QUIZ 27.1

- Which of the following statements is not correct regarding investment funds available to all investors?
  - Open-end mutual funds always transact at the next available NAV.
  - Stop orders can be used on closed-end funds.
  - Open-end mutual funds can be purchased with a limit order.
  - Short selling is available for some ETFs.

## MODULE 27.2: HEDGE FUNDS

### LO 27.d: Explain the key differences between hedge funds and mutual funds.

Mutual funds are marketed to all investors, while hedge funds are restricted to only wealthy and sophisticated investors and institutions. As a result, hedge funds escape certain regulations that apply to mutual funds (although hedge funds may face

some restrictions posed by their prime broker, the bank that provides the hedge fund with financing and trade processing). Specifically, they do not need to provide the redemption of shares at any time the investor chooses, a daily calculated NAV, or the full disclosure of their investment policies and strategies. Hedge funds are also permitted to use leverage while mutual funds are not. Because hedge funds can use leverage and are permitted to use both long and short investment strategies, they are considered to be an alternative investment class. Finally, hedge funds charge an additional incentive fee while mutual funds do not.

The term hedge fund implies that the fund is hedging some form of risk. This may be the case if the fund is using both long and short positions (long positions for expected outperformers and short positions for expected underperformers), but not all hedge funds focus on risk reduction. Some involve no hedging and focus on risk enhancement.

Since hedge funds are not required to redeem shares any time an investor requests, they have lockup periods. The **lockup period** is a certain amount of time (often one year) in which the investor is not able to withdraw his funds.



#### PROFESSOR'S NOTE

A lockup period exists for one key reason—many hedge fund investments are not easy to unwind on short notice. Some hedge fund investments are illiquid, which means managers cannot sell them quickly and retain a proper value. In addition, some hedge fund investments are bets on certain asset mispricing, and those trades can take time to unwind.

## Hedge Fund Expected Returns and Fee Structures

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**LO 27.e: 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.**

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While mutual funds charge fees as a set percentage of assets under management (AUM), hedge funds deploy a more complex compensation structure centered around incentive fees. These **incentive fees** are engineered to give hedge fund managers significant payouts based on their performance. The typical hedge fund fee structure is known as **2 plus 20%**, which means that they charge a flat 2% of all assets that they manage plus an additional 20% of all profits above a specified benchmark. An assumption needs to be made as to whether management fees are computed based on beginning or end of year assets and whether incentive fees are computed before or after deducting management fees.

Using the more conservative assumptions of management fees being computed based on beginning of year assets (A) and incentive fees being computed after deducting management fees, the incentive fee is computed as follows:

$$0.2 \times \max(R \times A - 0.02 \times A, 0)$$

where:

R = return on assets for the year

The incentive fee structure can be thought of as a call option on the dollar asset return with a strike price of 2% of AUM. For the managers, there is significant upside potential with no corresponding downside risk.

Hedge funds do soften the incentive fee structure with a few safeguards for investors. The first safeguard is the **hurdle rate**, which is the benchmark that must be beaten before incentive fees can be charged.

The second safeguard is a **high-water mark clause**, which essentially states that previous losses must first be recouped and hurdle rates surpassed before incentive fees once again apply. Consider a hedge fund that just began with \$100 million in assets from investors. Their hurdle rate is the 10-year Treasury, which is currently yielding 1.5%. In the first year of operation, this hedge fund made some bad decisions and ended up losing \$10 million (ending balance of \$90 million). This means that the managers get to charge the 2% flat fee, but no incentive fees apply. Incentive fees would only have applied to any profits earned above a 1.5% return, meaning that only an ending balance higher than \$101.5 million would have triggered the 20% incentive fee. In year two, this hedge fund would need to get its fund up above \$103 million (two years of beating Treasuries) in order for incentive fees to apply. In this case, the high-water mark for year one is \$101.5 million, and for year two it is \$103 million.

The third safeguard for investors is a **clawback clause**, which enables investors to retain a portion of previously paid incentive fees in an escrow account that is used to offset subsequent investment losses should they occur.

The incentive fee structure of a hedge fund certainly encourages hedge fund managers to reach for profits, but this comes at the expense of also encouraging them to take risks. A hedge fund manager essentially owns a call option against the assets of the hedge fund and payoff for options are higher if volatility is higher. Consider an example where a hedge fund manager is presented with an opportunity that offers a 40% probability of returning 50% and a 60% probability of losing 50%. The expected return of the fund can be calculated as follows:

$$(0.4 \times 50\%) + (0.6 \times -50\%) = -10\%$$

In this example, the hedge fund manager might be willing to take a big risk (60% probability) of losing money, which would end in him only collecting his 2% flat fee. The alternative is that if he were to end up making a huge return with the lower probability event, then he would potentially earn a substantial incentive fee. If this hedge fund generates a 50% profit, then he could potentially earn fees of 11.6% [= 2% (flat fee) + 0.20 × 48% (incentive fee on return above the 2% flat fee)]. The expected payoff for fees then becomes 5.84%:

$$(0.4 \times 11.6\%) + (0.6 \times 2\%) = 5.84\%$$

From the investor's perspective, the expected payoff is -15.84%:

$$[0.4 \times (50\% - 11.6\%)] + [0.6 \times (-50\% - 2\%)] = 0.1536 - 0.312 = -15.84\%$$

The expected return for the hedge fund is 5.84% and the expected return for the hedge fund investor is -15.84%. When these two numbers are added together, we arrive back at the original return of -10%. This shows the disproportionate

payoff for the hedge fund manager. Why would investors be willing to make this investment? Clearly they are hoping that the incentive fees will motivate the hedge fund manager to do everything within their power to produce significant returns for both the investor and the hedge fund manager.

## Hedge Fund Strategies

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**LO 27.f: 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.**

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Hedge funds deploy numerous different strategies in their attempt to capture incentive fees. Not all hedge funds fall easily into a specific category, but the discussion in this section follows the classification system used by the Dow Jones, which provides indices to track various hedge fund strategies. Throughout this section, you will see the term **arbitrage**, which (in the hedge fund context) involves short selling an asset that is believed to be overvalued and buying an asset that is believed to be undervalued in an attempt to exploit a pricing differential.

### ***Long/Short Equity***

**Long/short equity hedge funds** endeavor to find mispriced securities. Managers of a long/short equity fund spend a great deal of time conducting fundamental analysis on stocks that are largely ignored by most analysts, in an attempt to find mispricings. They will buy (go long) a stock that they believe to be undervalued and short sell (go short) a stock that they believe to be overvalued. Sometimes funds can have a net long bias or a net short bias depending on what opportunities they see in the markets. Funds can also be sector neutral, where they net long and short positions that cancel out sector exposure (e.g., automobile stocks General Motors and Ford).

### ***Dedicated Short***

**Dedicated short hedge funds** are focused exclusively on finding a company that they think is overvalued and then short selling the stock. Traditionally, short sellers are looking for companies with weak financial performance that has not been captured by the market. Due to the lack of hedging of overall markets, dedicated short funds do not perform well when markets are performing well.

### ***Distressed Debt***

Bonds with a CCC rating are considered distressed. Distressed bonds usually trade at deep discounts to par value. **Distressed debt hedge funds** are searching for distressed bonds with the potential to turn things around. Many of these distressed companies are in or close to being in bankruptcy proceedings. Some distressed bond investors take an active approach to influencing the target company's reorganization

to their advantage. For example, if they have a large enough position of any class of a bond, then they can block any reorganization plan that is not in their best interest.

## **Merger Arbitrage**

**Merger arbitrage hedge funds** try to find arbitrage opportunities after mergers are announced, but before the deal is closed (i.e., the period where it is not completely certain that the merger will occur).

Consider an all-cash deal where company A announces that it will buy company B at \$50 per share. Preannouncement, company B was trading at \$37.50 and postannouncement company B will typically be trading somewhere near \$48. A merger arbitrage fund would buy the shares of company B and wait for the full \$50 (or better) price to be achieved.

Now consider an all-stock deal where company A offers one share of its stock for every four shares of company B's stock. This could be a realistic ratio if company B had a considerably lower market capitalization than company A. In this case, a merger arbitrage fund would buy a certain amount of company B's shares and, at the same time, they would short sell one-quarter of this number of shares in company A's stock. This is because the acquirer usually pays too much and their stock usually goes down after a merger.

The underlying assumption here is that any assessment of a merger arbitrage strategy takes into account public (and not insider) information.

## **Convertible Arbitrage**

Some hedge funds invest using convertible bonds, which are fixed-income instruments that can be converted into shares of stock if the stock price rises above a prespecified value. **Convertible arbitrage hedge funds** develop a sophisticated model to value convertible bonds. The idea is that if the market price is not the same as the model price, then profits can be made if the two prices converge.

## **Fixed-Income Arbitrage**

**Fixed-income arbitrage hedge funds** attempt to exploit perceived mispricing—long positions in underpriced bonds and short positions in overpriced bonds. The positions are usually highly leveraged to be profitable.

## **Emerging Market**

**Emerging market hedge funds** focus on investments in developing countries; the managers often expend great effort to research their investments in less-known securities. Some hedge funds invest using American depository receipts (ADRs), which are certificates issued in the United States that provide ownership in foreign countries coupled with currency exposure. There are occasionally pricing discrepancies between the ADR and the underlying asset that an adept hedge fund manager can exploit as well. If managers decide to invest using emerging market

debt, then they need to consider default risk because some countries have defaulted numerous times (e.g., Russia, Argentina, Brazil, and Venezuela).

### ***Global Macro***

**Global macro hedge funds** attempt to profit from a macroeconomic trend that they feel is in disequilibrium (i.e., not currently priced correctly and rationally). They will place very large dollar bets on the equilibrium being reestablished. For example, the investment focus may be on foreign exchange rates, interest rates, or inflation. A deviation from equilibrium could take a long time to correct itself and some hedge funds will not be able to wait out the trend.

### ***Managed Futures***

**Managed futures hedge funds** involve strategies that try to predict future movements in commodity prices and invest according to those predictions. Fund managers will often backtest their trading rules using historical data. A key drawback of backtesting is that there is no distinction made between strategies that truly worked based on proper fundamental analysis or strategies that were successful strictly because of luck and subsequently may not have repeated success.

## **Hedge Fund Performance and Measurement Bias**

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**LO 27.g: Describe characteristics of mutual fund and hedge fund performance and explain the effect of measurement biases on performance measurement.**

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Empirical research has suggested that on average, actively managed mutual funds underperform the market once expenses are accounted for. That has led many investors to invest in index funds, which are passively managed and have lower fees. In addition, the few actively managed funds that do beat the market in a given year do not have an increased probability of doing so in subsequent years (i.e., low persistence).

Hedge fund performance is not as easy to assess as mutual fund performance, which is readily available and accurately reported by numerous independent parties. Participation in hedge fund indices is voluntary. If the fund had good performance, then they will report their results to the index vendor. If they did not have good results, then they simply do not report their results to the index. In the Barclay's Hedge Fund Index, the data for August 2016 had 2,914 funds reporting information, while September 2016 only had 617. Based on that example, it is clear that there is **measurement bias** in hedge fund index reporting. When returns are reported by a hedge fund, the database is then backfilled with the fund's previous returns. This is known as **backfill bias** and it creates an issue with reliability for hedge fund benchmarks. It is common for a hedge fund to have a string of several good years and then have a meltdown.



## MODULE QUIZ 27.2

1. Which of the following characteristics is a key differentiator between mutual funds and hedge funds?
  - A. Professional asset management.
  - B. Immediate access to withdrawals from the fund.
  - C. Charging a fee for providing investment services.
  - D. Easy diversification for an investor.
2. What is the expected return to a hedge fund if the fund uses a standard 2 plus 20% incentive fee structure with an investment that has a 35% probability of making 55% and a 65% probability of losing 45%?
  - A. 3.78%
  - B. 5.28%
  - C. 5.71%
  - D. 6.12%
3. Which type of hedge fund focuses on isolating mispricings in foreign exchange markets?
  - A. Fixed-income arbitrage hedge funds
  - B. Global macro hedge funds
  - C. Managed futures hedge funds
  - D. Convertible arbitrage hedge funds
4. Which of the following statements is/are most accurate regarding hedge fund performance reporting?
  - I. When a hedge fund's performance is recorded in an index, all of its prior results are also included.
  - II. Hedge funds are permitted to self-select if their performance is reported in index averages.
  - A. I only
  - B. II only
  - C. Both I and II
  - D. Neither I nor II

**KEY CONCEPTS****LO 27.a**

There are three primary types of commingled pools of investments that are available to investors. They are open-end mutual funds, closed-end mutual funds, and ETFs. Open-end funds transact at the next available NAV, which occurs after the market has closed for the day. Shares may be redeemed directly from the fund company with an open-end fund. Closed-end funds transact throughout the trading day, but shares cannot be redeemed at the fund company and their price may differ substantially from their NAV—the shares must be bought or sold by other investors. ETFs also trade throughout the day, but their shares do trade at the NAV. ETFs usually have the lowest internal fees, which is a big component of investment returns.

**LO 27.b**

Undesirable trading behaviors may occur despite rules designed to prevent fraud and conflicts of interest. These trading behaviors include late trading, market timing, front running, and directed brokerage.

**LO 27.c**

The NAV is easily calculated as the total invested assets of the fund minus any liabilities (typically management fees payable) all divided by the total shares outstanding. The NAV for an open-end fund is set after the trading day is over, while the NAV for a closed-end fund and an exchange-traded fund is calculated continuously throughout the trading day. The NAV is used to determine the number of shares purchased or sold in a fund.

**LO 27.d**

Both mutual funds and hedge funds offer professional management, instant diversification, and the ability to commingle funds with other investors. However, there are some notable differences between mutual funds and hedge funds. Hedge funds are only marketed to wealthy and sophisticated investors. Because of this, hedge funds escape certain regulatory oversight, which enables them to avoid allowing investors to redeem shares at any time they want, calculating the NAV daily, and disclosing investment policies and strategies. They are also permitted to use leverage and short selling, which are commonly not permitted for mutual funds. In addition, hedge funds use lock-up periods to prevent investor withdrawals at the wrong time for the fund.

**LO 27.e**

Hedge funds commonly deploy a 2% and 20% incentive fee structure, where they earn management fees for investment results relative to a given hurdle rate. Investors are partially protected with the use of high-water marks and clawback clauses.

**LO 27.f**

There are many different types of hedge fund strategies. They all search for perceived mispricings in different corners of the markets and then try to exploit them for profit.

Long/short equity funds take both long and short positions in the equity markets, diversifying, or hedging across sectors, regions, or market capitalizations, and have directional exposure to the overall market.

Dedicated short funds tend to take net short positions in equities, and their returns are negatively correlated with equities.

Distressed hedge funds invest across the capital structure of firms that are under financial or operational distress or are in the middle of bankruptcy. These hedge fund managers try to profit from an issuer's ability to improve its operation or come out of a bankruptcy successfully.

Merger arbitrage funds bet on spreads related to proposed merger and acquisition transactions.

Convertible arbitrage funds attempt to profit from the purchase of convertible securities and the shorting of corresponding stock.

Fixed-income arbitrage funds try to obtain profits by exploiting inefficiencies and price anomalies between related fixed-income securities.

Emerging market funds invest in currencies, debt, equities, and other instruments in countries with emerging or developing markets.

Global macro managers make large bets on directional movements in interest rates, exchange rates, commodities, and stock indices, and do better during extreme moves in the currency markets.

Managed futures funds attempt to predict future movements in commodity prices based on either technical analysis or fundamental analysis.

### **LO 27.g**

Mutual fund performance is generally easy and objective to measure. Actively managed funds have generally underperformed the market and led to the increased popularity of passive mutual funds (e.g., index funds) with lower fees. Hedge fund benchmarks are problematic due to measurement bias and backfill bias.

**ANSWER KEY FOR MODULE QUIZZES****Module Quiz 27.1**

1. **C** Open-end mutual funds have very low price transparency because they trade at the next available NAV, which is not calculated until after the market closes. As such, they can only be bought or sold using a market order. Closed-end funds can be bought or sold using stop orders and limit orders. In some cases, ETFs can be sold short. (LO 27.a)

**Module Quiz 27.2**

1. **B** Mutual funds must offer immediate access to withdrawals from their fund. This is an SEC requirement. Hedge funds have advance notification and lock-up periods, which prevent immediate access to withdrawals from the fund. (LO 27.d)
2. **C** The hedge fund could potentially earn fees of 12.6% [2% (flat fee) +  $0.20 \times 53\%$  (incentive fee on return above the 2% flat fee)]. The expected payoff for fees then becomes 5.71% computed as follows:  
$$(0.35 \times 12.6\%) + (0.65 \times 2\%) = 5.71\%$$
(LO 27.e)
3. **B** Global macro funds focus on finding mispricings at the level of the global macro economy. They materialize in foreign exchange pricing and interest rates. Fixed-income arbitrage funds focus on various mispricings with fixed-income securities. Managed futures funds focus on forecasting commodity prices. Convertible arbitrage funds focus on valuing convertible bonds. (LO 27.f)
4. **C** Statement I describes backfill bias and Statement II describes measurement bias. Backfill bias arises when the database is backfilled with the fund's previous returns. Measurement bias indicates that not all hedge funds report their performance to index providers. (LO 27.g)

# READING 28

## Introduction to Derivatives

### EXAM FOCUS

In this reading, we present the basic concepts of derivatives securities and derivatives markets. For the exam, know the basic derivatives terms as well as the terms related to derivatives markets. Also, be able to compute payoffs for the different derivatives securities. Finally, be able to create a hedge and know how to take advantage of an arbitrage situation.

### MODULE 28.1: DERIVATIVES MARKETS AND SECURITIES

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**LO 28.a: Define derivatives, describe features and uses of derivatives and compare linear and non-linear derivatives.**

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A **derivative** security is a financial security whose value is derived in part from another security's characteristics or value. This other security is referred to as the **underlying asset**. A derivative effectively derives its price from some other variable.

Derivatives can be used for financial risk management (i.e., hedging), for speculation, for diversification of exposures, as added features to a bond (e.g., convertible, callable), as employee compensation in the case of stock options, within a capital project as an embedded option (e.g., real or abandonment options).

**Linear derivatives**, such as forward and futures contracts, have a linear payoff that is directly related to the value of the underlying. The contracts specify the buying or selling of an underlying asset for a stated price at a stated time in the future. They are essentially zero-sum games where one party wins the same amount that the other party loses. In contrast, **nonlinear derivatives**, such as options, involve the option purchaser (holder) having the right but not being obligated to buy or sell an

underlying asset at a stated time in the future. Therefore, the payoff is nonlinear in relation to the value of the underlying.

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**LO 28.b: Describe the over-the-counter market, distinguish it from trading on an exchange and evaluate its advantages and disadvantages.**

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Traditional derivatives exchanges use both an open outcry system and an electronic trading system to match buyers with sellers. The open outcry system [e.g., the Chicago Board of Trade (CBOT)] is the more traditional system, which involves traders indicating their trades through hand signals and shouting. Electronic trading does not involve a physical exchange location, but rather involves matching buyers and sellers electronically via computers (e.g., NASDAQ).

An **over-the-counter (OTC) market** differs from a traditional exchange in that the end users and dealers would contact each other either directly or through a broker; dealers frequently use interdealer brokers to transact with other dealers. A dealer maintains bid and offer prices in a security and stands ready to buy or sell lots of the given security. The OTC market typically involves much larger trades than traditional exchanges.

The OTC market is several times the size of the traditional exchange market. For example, in 2017, the OTC market was over \$530 trillion, while the exchange-traded market was over \$80 trillion.

Advantages of OTC trading:

- Terms are not set by any exchange (i.e., not standardized so customization is possible).
- Some new regulations since the credit crisis (e.g., standardized OTC derivatives now traded on swap execution facilities, a central counterparty is now required for standardized trades, and trades are now required to be reported to a central registry)
- Greater anonymity (e.g., an interdealer broker only identifies the client at the conclusion of the trade).

Disadvantages of OTC trading:

- OTC trading has more credit risk than exchange trading when it comes to nonstandardized transactions. Exchanges are organized in such a way that credit risk is eliminated.

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**LO 28.c: Differentiate between options, forwards and futures contracts.**

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An **option contract** is a contract that, in exchange for paying an option premium, gives the option buyer the right, but not the obligation, to buy (sell) an asset at the prespecified exercise (strike) price from (to) the option seller within a specified time period, or depending on the type of option, a precise date (i.e., expiration date). A call option gives the option holder the right to purchase the underlying asset by a certain specified date at the exercise price. A put option gives the option holder the right to sell the underlying asset by a selected date at the exercise price. An **American-style option** contract can be exercised any time between issue date and

expiration date. In contrast, a **European-style option** contract may be exercised only on the actual expiration date. American options will be worth more than European options when the right to early exercise is valuable, and they will have equal value when it is not.

A **forward contract** is a contract that specifies the price and quantity of an asset to be delivered sometime in the future. There is no standardization for forward contracts, and these contracts are traded in the OTC market. One party takes the long position, agreeing to purchase the underlying asset at a future date for a specified price, while the other party is the short, agreeing to sell the asset on that same date for that same price. Forward contracts are often used in foreign exchange situations as these contracts can be used to hedge foreign currency risk.

A **futures contract** is a more formalized, legally binding agreement to buy or sell a commodity or financial instrument in a predesignated month in the future, at a price agreed upon today by the buyer/seller. Futures contracts are highly standardized regarding quality, quantity, delivery time, and location for each specific commodity. These contracts are typically traded on an exchange.

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**LO 28.d: Identify and calculate option and forward contract payoffs.**

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## Call Option Payoff

The payoff on a **call option** to the option buyer is calculated as follows:

$$C_T = \max(0, S_T - X)$$

where:

$C_T$  = payoff on call option

$S_T$  = stock price at maturity

$X$  = strike price of option

The payoff to the option seller is  $-C_T$  [i.e.,  $-\max(0, S_T - X)$ ]. We should note that  $\max(0, S_t - X)$ , where time,  $t$ , is between 0 and  $T$ , is the payoff if the owner decides to exercise the call option early (in the case of an American option as we will discuss later).

The price paid for the call option,  $C_0$ , is referred to as the **call premium**. Thus, the profit to the option buyer is calculated as follows:

$$\text{profit} = C_T - C_0$$

where:

$C_T$  = payoff on call option

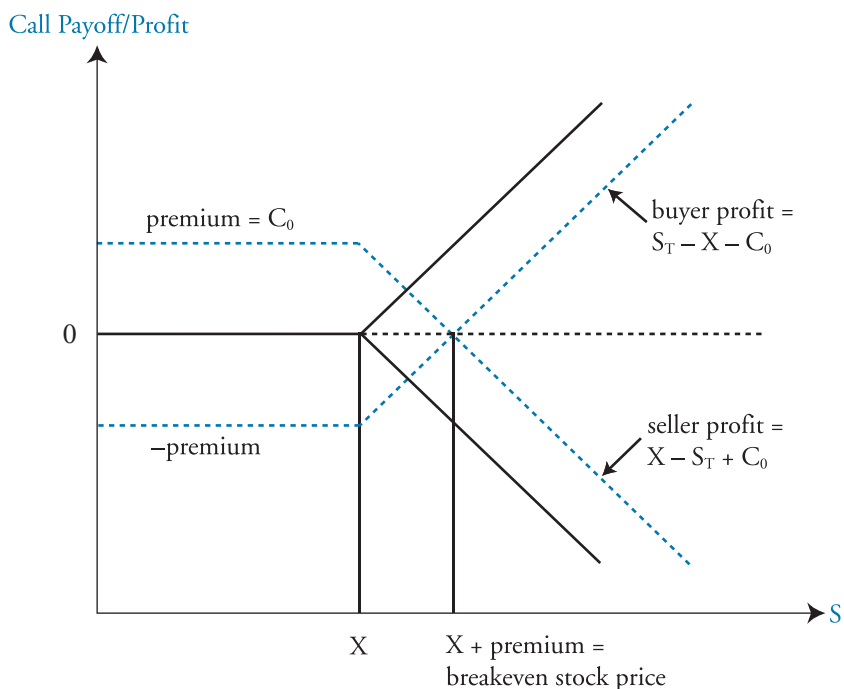
$C_0$  = call premium

Conversely, the profit to the option seller is:

$$\text{profit} = C_0 - C_T$$

Figure 28.1 depicts the payoff and profit for the buyer and seller of a call option.

Figure 28.1: Profit Diagram for a Call at Expiration



### Put Option Payoff

The payoff on a **put option** is calculated as follows:

$$P_T = \max(0, X - S_T)$$

where:

- $P_T$  = payoff on put option
- $S_T$  = stock price at maturity
- $X$  = strike price of option

The payoff to the option seller is  $-P_T$  [i.e.,  $-\max(0, X - S_T)$ ]. We should note that  $\max(0, X - S_t)$ , where  $0 < t < T$ , is also the payoff if the owner decides to exercise the put option early.

The price paid for the put option,  $P_0$ , is referred to as the **put premium**. Thus, the profit to the option buyer is calculated as follows:

$$\text{profit} = P_T - P_0$$

where:

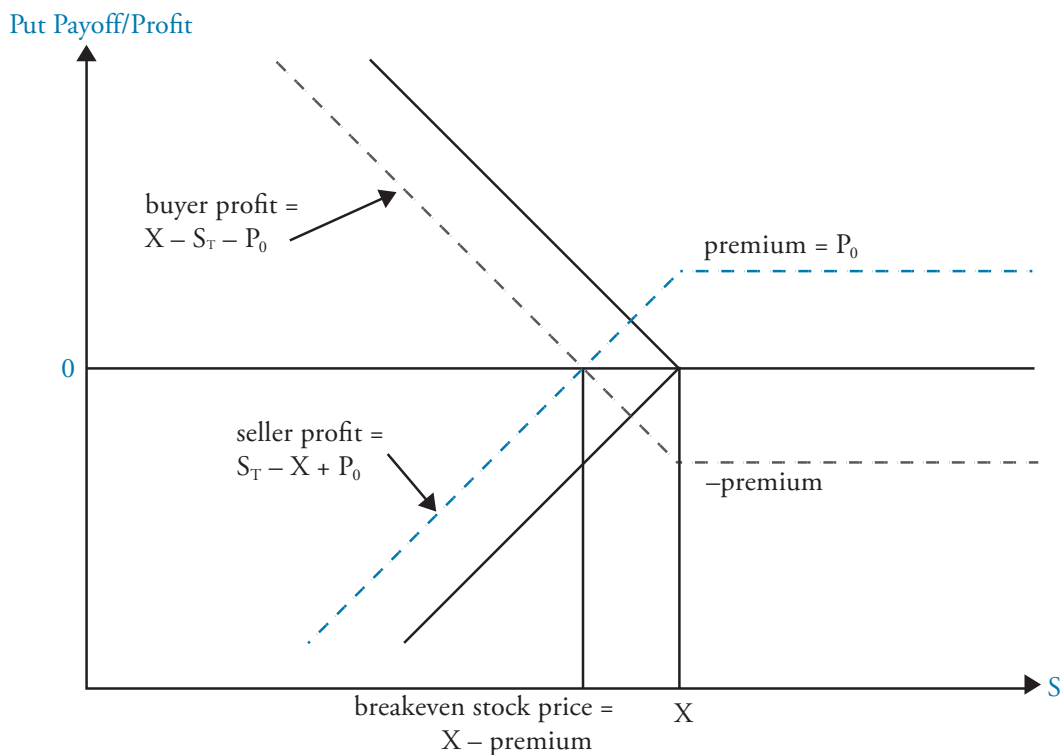
- $P_T$  = payoff on put option
- $P_0$  = put premium

The profit to the option seller is:

$$\text{profit} = P_0 - P_T$$

Figure 28.2 depicts the payoff and profit for the buyer and writer of a put option.

Figure 28.2: Profit Diagram for a Put at Expiration

**EXAMPLE: Calculating Payoffs and Profits From Options**

Compute the payoff and profit to a call buyer, a call writer, put buyer, and put writer if the strike price for both the put and the call is \$45, the stock price is \$50, the call premium is \$3.50, and the put premium is \$2.50.

**Answer:**

Call buyer:

$$\text{payoff} = C_T = \max(0, S_T - X) = \max(0, \$50 - \$45) = \$5$$

$$\text{profit} = C_T - C_0 = \$5 - \$3.50 = \$1.50$$

Call writer:

$$\text{payoff} = -C_T = -\max(0, S_T - X) = -\max(0, \$50 - \$45) = -\$5$$

$$\text{profit} = C_0 - C_T = \$3.50 - \$5 = -\$1.50$$

Put buyer:

$$\text{payoff} = P_T = \max(0, X - S_T) = \max(0, \$45 - \$50) = \$0$$

$$\text{profit} = P_T - P_0 = \$0 - \$2.50 = -\$2.50$$

Put writer:

$$\text{payoff} = -P_T = -\max(0, X - S_T) = -\max(0, \$45 - \$50) = \$0$$

$$\text{profit} = P_0 - P_T = \$2.50 - \$0 = \$2.50$$

## Forward Contract Payoff

The payoff to a long position in a forward contract is calculated as follows:

$$\text{payoff} = S_T - K$$

where:

$S_T$  = spot price at maturity

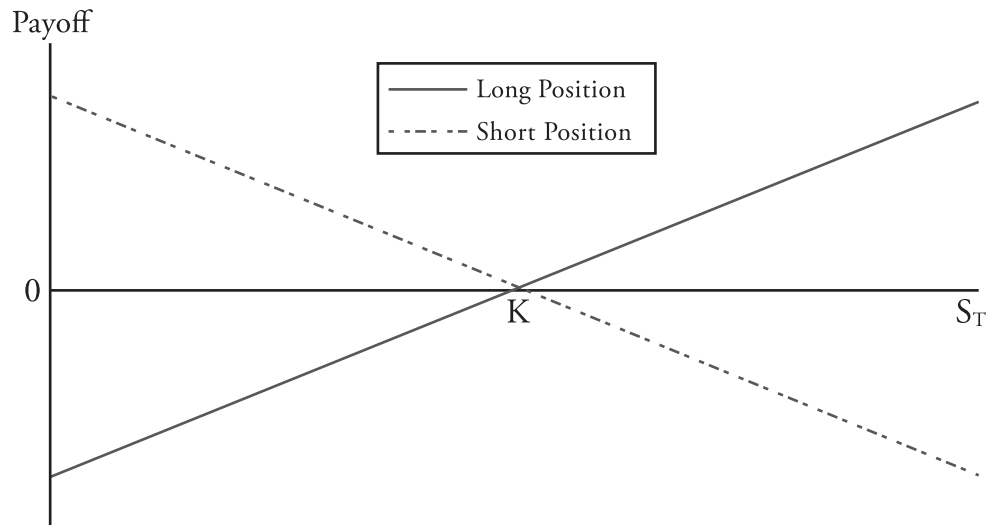
$K$  = delivery price

Conversely, the payoff to a short position in a forward contract is calculated as follows:

$$\text{payoff} = K - S_T$$

Figure 28.3 depicts the payoff for the long and short positions in a forward contract.

**Figure 28.3: Forward Contract Payoff**



### EXAMPLE: Calculating Forward Contract Payoffs

Compute the payoff to the long and short positions in a forward contract given that the forward price is \$25 and the spot price at maturity is \$30.

**Answer:**

Payoff to long position:

$$\text{payoff} = S_T - K = \$30 - \$25 = \$5$$

Payoff to short position:

$$\text{payoff} = K - S_T = \$25 - \$30 = -\$5$$



### MODULE QUIZ 28.1

- Which of the following statements is an advantage that is specific only to exchange trading compared to over-the-counter (OTC) trading? On an exchange system
  - terms are not specified.
  - trades are made in such a way as to reduce credit risk.
  - participants have flexibility to negotiate.
  - there is greater anonymity.
- Which of the following statements regarding futures contracts is most likely correct? A business with a long exposure to an asset would hedge this exposure by either entering into a
  - long futures contract or by buying a call option.
  - long futures contract or by buying a put option.
  - short futures contract or by buying a call option.
  - short futures contract or by buying a put option.
- An agreement sold over an exchange to buy/sell a commodity or financial instrument at a designated future date is known as
  - a spot contract.
  - an option contract.
  - a futures contract.
  - a forward contract.

## MODULE 28.2: DERIVATIVES TRADERS

**LO 28.e: Differentiate among the broad categories of traders: hedgers, speculators and arbitrageurs.**

**Hedgers** typically reduce their risks with forward contracts or options. By using forward contracts (at no cost), the trader is attempting to neutralize risk by fixing the price the hedger will pay or receive for the underlying asset. Option contracts, in contrast, are more of an insurance policy that require the payment of a premium, but will protect against downside risk while keeping some of the upside.

**Speculators** are effectively betting on future price movement. When a speculator uses the underlying asset, any potential gain or loss arises only on the differential between the share purchase price and the future share price. When a speculator uses options, the potential gain is magnified (assuming the same initial dollar investment in shares as options) and the maximum loss is the dollar investment in options.

**Arbitrageurs** take offsetting positions in financial instruments to lock in a riskless profit on the assumption that there are mispricings in the same asset in different markets.

## Hedging Strategies

### LO 28.f: Calculate and compare the payoffs from hedging strategies involving forward contracts and options.

Hedgers use forward contracts and options to reduce or eliminate financial exposure. An investor or business with a long exposure to an asset can hedge exposure by either entering into a short futures contract or by buying a put option. An investor or business with a short exposure to an asset can hedge exposure by either entering into a long futures contract or by buying a call option.

Hedgers use forward contracts to lock in the price of the underlying security. Forward contracts do not require an initial investment, but hedgers give up any price movement that may have had positive results in the event that the position was left unhedged. Option contracts on the other hand function as insurance for the underlying by providing the downside protection that the hedger seeks and allowing for price movement in the direction that could yield positive results. This insurance does not come without a cost, as we described earlier, since hedgers are required to pay a premium to purchase options.

#### **EXAMPLE: Hedging With a Forward Contract**

Suppose that a company based in the United States will receive a payment of €10M in three months. The company is worried that the euro will depreciate and is contemplating using a forward contract to hedge this risk. Compute the following:

1. The value of the €10M in U.S. dollars at maturity given that the company hedges the exchange rate risk with a forward contract at 1.25 \$/€.
2. The value of the €10M in U.S. dollars at maturity given that the company did not hedge the exchange rate risk and the spot rate at maturity is 1.2 \$/€.

#### **Answer:**

1. The value at maturity for the hedged position is:  
$$€10,000,000 \times 1.25 \text{ \$/€} = \$12,500,000$$
2. The value at maturity for the unhedged position is:  
$$€10,000,000 \times 1.2 \text{ \$/€} = \$12,000,000$$

#### **EXAMPLE: Hedging With a Put Option**

Suppose that an investor owns one share of ABC stock currently priced at \$30. The investor is worried about the possibility of a drop in share price over the next three months and is contemplating purchasing put options to hedge this risk. Compute the following:

1. The profit on the unhedged position if the stock price in three months is \$25.
2. The profit on the unhedged position if the stock price in three months is \$35.

3. The profit for a hedged stock position if the stock price in three months is \$25, the strike price on the put is \$30, and the put premium is \$1.50.
4. The profit for a hedged stock position if the stock price in three months is \$35, the strike price on the put is \$30, and the put premium is \$1.50.

**Answer:**

1. Profit =  $S_T - S_0 = \$25 - \$30 = -\$5$
2. Profit =  $S_T - S_0 = \$35 - \$30 = \$5$
3. Profit =  $S_T - S_0 + \max(0, X - S_T) - P_0$   
 $= \$25 - \$30 + \max(0, \$30 - \$25) - \$1.50 = -\$1.50$
4. Profit =  $S_T - S_0 + \max(0, X - S_T) - P_0$   
 $= \$35 - \$30 + \max(0, \$30 - \$35) - \$1.50 = \$3.50$

**PROFESSOR'S NOTE**

Notice that the max term is \$5 in Case #3 and \$0 in Case #4.

## Speculative Strategies

**LO 28.g: Calculate and compare the payoffs from speculative strategies involving futures and options.**

Speculators have a different motivation for using derivatives than hedgers. They use derivatives to make bets on the market, while hedgers try to eliminate exposures.

The motivation for using futures in speculation is that the limited amount of initial investment creates significant leverage. The amount of investment required for futures is the amount of the initial margin required by the exchange. This is generally a small percentage of the notional value of the underlying, and Treasury securities can typically be posted as margin. Futures contracts can result in large gains or large losses, and contract payoffs are symmetrical.

Options also create significant leverage, as investors only need to pay the option premium to purchase an option instead of the face value of the underlying. Options differ from futures in that options have asymmetrical payoffs. Gains can be quite large from going long options, but losses from long option positions are limited to the option premium.

**EXAMPLE: Speculating With Futures**

An investor believes that the euro will strengthen against the dollar over the next three months and would like to take a position with a value of €250,000. He could purchase euros in the spot market at 0.80 \$/€ or purchase two futures contracts at 0.83 \$/€ with an initial margin of \$10,000. Compute the profit from the following:

1. Purchasing euros in the spot market if the spot rate in three months is 0.85 \$/€.

2. Purchasing euros in the spot market if the spot rate in three months is 0.75 \$/€.
3. Purchasing the futures contract if the spot rate in three months is 0.85 \$/€.
4. Purchasing the futures contract if the spot rate in three months is 0.75 \$/€.

**Answer:**

1. Profit = €250,000 × (0.85 \$/€ – 0.80 \$/€) = \$12,500
2. Profit = €250,000 × (0.75 \$/€ – 0.80 \$/€) = –\$12,500
3. Profit = €250,000 × (0.85 \$/€ – 0.83 \$/€) = \$5,000
4. Profit = €250,000 × (0.75 \$/€ – 0.83 \$/€) = –\$20,000

A summary of these four transactions is as follows:

	Purchase Euros in Spot Market	Purchase Long Forward Position
Investment	\$200,000	\$10,000
Profit if spot at maturity = 0.85 \$/€	\$12,500	\$5,000
Profit if spot at maturity = 0.75 \$/€	–\$12,500	–\$20,000

**EXAMPLE: Speculating With Options**

An investor who has \$30,000 to invest believes that the price of stock XYZ will increase over the next three months. The current price of the stock is \$30. The investor could directly invest in the stock, or she could purchase 3-month call options with a strike price of \$35 for \$3. Compute the profit from the following:

1. Investing directly in the stock if the price of the stock is \$45 in three months.
2. Investing directly in the stock if the price of the stock is \$25 in three months.
3. Purchasing call options if the price of the stock is \$45 in three months.
4. Purchasing call options if the price of the stock is \$25 in three months.

**Answer:**

1. Number of stocks to purchase = \$30,000 / \$30 = 1,000  
Profit = 1,000 × (\$45 – \$30) = \$15,000
2. Profit = 1,000 × (\$25 – \$30) = –\$5,000
3. Number of call options to purchase = \$30,000 / \$3 = 10,000  
Profit = 10,000 × [max(0, \$45 – \$35) – \$3] = \$70,000
4. Profit = 10,000 × [max(0, \$25 – \$35) – \$3] = –\$30,000

**PROFESSOR'S NOTE**

Since option contracts are traded in amounts of 100 options, the transactions in #3 and #4 here would entail the purchase of 100 call option contracts (i.e.,  $10,000 / 100 = 100$ ).

A summary of these four transactions is as follows:

	Purchase Stock	Purchase Call Option
# Shares/call option	1,000	10,000
Profit if stock at maturity = \$45	\$15,000	\$70,000
Profit if spot at maturity = \$25	-\$5,000	-\$30,000

## Arbitrage Opportunities

**LO 28.h: Calculate an arbitrage payoff and describe how arbitrage opportunities are temporary.**

Arbitrageurs are also frequent users of derivatives. Arbitrageurs seek to earn a risk-free profit in excess of the risk-free rate through the discovery and manipulation of mispriced securities. They earn a riskless profit by entering into equivalent offsetting positions in one or more markets. Arbitrage opportunities typically do not last long as supply and demand forces will adjust prices to quickly eliminate the arbitrage situation.

### EXAMPLE: Arbitrage of Stock Trading on Two Exchanges

Assume stock DEF trades on the New York Stock Exchange (NYSE) and the Tokyo Stock Exchange (TSE). The stock currently trades on the NYSE for \$32 and on the TSE for ¥2,880. Given the current exchange rate is 0.0105 \$/¥, determine if an arbitrage profit is possible.

**Answer:**

Value in dollars of DEF on TSE =  $¥2,880 \times 0.0105 \text{ \$/¥} = \$30.24$

Arbitrageur could purchase DEF on TSE for \$30.24 and sell on NYSE for \$32.

Profit per share =  $\$32 - \$30.24 = \$1.76$

## Risks From Using Derivatives

**LO 28.i: Describe some of the risks that can arise from the use of derivatives.**

Derivatives are versatile and can be used for hedging, arbitrage, and pure speculation. If, however, the bet one makes starts going in the wrong direction,

the results can be catastrophic (e.g., Barings Bank). Additionally, the risk exists that a trader with instructions to hedge a position may use derivatives to speculate due to the massive potential payoffs if speculation succeeds. This risk is known as an operational risk when it is done in an unauthorized manner. Controls need to be carefully established and monitored within both financial and nonfinancial corporations to prevent misuse of derivatives. Risk limits should be set, and adherence to risk limits should be monitored.



### MODULE QUIZ 28.2

1. Which of the following statements is most likely correct regarding the use of derivatives?
  - A. Although a legitimate risk for all financial institutions, the misuse of derivatives is a relatively small risk overall.
  - B. Speculating using derivatives should be banned to prevent catastrophic losses.
  - C. Due to leverage inherent in derivatives, profits can be magnified while losses can be minimized.
  - D. It can be difficult to differentiate between arbitrage activities and speculative activities.
2. An individual that maintains bid and offer prices in a given security and stands ready to buy or sell lots of said security is
  - A. a hedger.
  - B. an arbitrageur.
  - C. a speculator.
  - D. a dealer.

## KEY CONCEPTS

### LO 28.a

A derivative security is a financial security whose value is derived in part from another security's characteristics or value (i.e., an underlying asset).

Linear derivatives, such as forward and futures contracts, have a linear payoff that is directly related to the value of the underlying. In contrast, nonlinear derivatives, such as options, have a payoff that is nonlinear in relation to the value of the underlying.

### LO 28.b

The over-the-counter (OTC) market is often used for large trades where terms are not set by an exchange, giving traders more flexibility to negotiate mutually agreeable terms. The OTC market has more credit risk for nonstandard transactions, but some regulations have been introduced for more standardized transactions. In contrast, exchanges are organized to eliminate credit risk.

### LO 28.c

A call option gives its holder the right to buy a specified number of shares of the underlying security at the given strike price, on or before the option contract's expiration date, while a put option is the right to sell a fixed number of shares at a fixed price within a given prespecified time period.

A forward contract is an agreement to buy or sell an asset at a preselected future time for a certain price.

A futures contract is a more formalized, legally binding agreement to buy or sell a commodity or financial asset in a predesignated month in the future, at a price agreed upon today by the buyer/seller.

### LO 28.d

The payoff on a call option to the option buyer is calculated as follows:

$$\text{Call}_T = \max(0, S_T - X)$$

where:

$S_T$  = stock price at maturity

$X$  = strike price of option

The payoff on a put option is calculated as follows:

$$\text{Put}_T = \max(0, X - S_T)$$

where:

$S_T$  = stock price at maturity

$X$  = strike price of option

The payoff to a long position in a forward contract is calculated as follows:

$$\text{payoff} = S_T - K$$

where:

$S_T$  = spot price at maturity

$K$  = delivery price

### **LO 28.e**

There are three broad types of traders: hedgers, speculators, and arbitrageurs.

Hedging is used for risk management. The hedger has a risk associated with the underlying commodity or financial instrument. The use of futures helps mitigate those risks.

Speculating does not mitigate risk but is risk-taking. Profit is the motive of the speculator since he has no risk before entering into the futures transactions.

Arbitrage ensures that futures and cash markets stay in balance. Buying in the cheaper market and selling in the overpriced market will bring markets back into alignment and provide a riskless profit for an arbitrageur.

### **LO 28.f**

Hedgers use derivatives to control or eliminate a financial exposure. Futures lock in the price of the underlying security and do not allow for any upside potential. Options hedge negative price movements and allow for upside potential since they have asymmetric payouts.

### **LO 28.g**

Speculators use derivatives to make bets on the market. Futures require a small initial investment, which is the initial margin requirement. Futures contracts can result in large gains or large losses as futures have a symmetrical payout function.

### **LO 28.h**

Arbitrageurs seek to earn a riskless profit through the discovery and manipulation of mispriced securities. Riskless profit is earned by entering into equivalent offsetting positions in one or more markets. Arbitrage opportunities do not last long as the act of arbitrage brings prices back into equilibrium quickly.

### **LO 28.i**

Derivatives are versatile instruments and can be used for hedging, arbitrage, and pure speculation. Controls need to be carefully established to prevent misuse of derivatives. Risk limits must be carefully established and scrupulously enforced.

**ANSWER KEY FOR MODULE QUIZZES****Module Quiz 28.1**

1. **B** Exchanges are organized to reduce credit risk. The other answer choices are advantages of over-the-counter trading. (LO 28.b)
2. **D** A business with a long exposure to an asset would hedge the exposure by either entering into a short futures contract or by buying a put option. (LO 28.d)
3. **C** A futures contract is an agreement sold on an exchange to buy/sell a commodity or financial instrument in a designated future month. (LO 28.c)

**Module Quiz 28.2**

1. **D** A misuse of derivatives could occur when a trader makes speculative activities look like arbitrage activities (i.e., operational risk). This misuse is a significant risk for financial institutions. Speculating is important for a financial institution to maximize profits; therefore, it should be controlled but not banned. Leverage magnifies both losses and gains; purchasing an option allows for huge potential upside and minimal downside in the form of the loss of the option premium paid. (LO 28.i)
2. **D** A dealer maintains bid and offer prices in a security and stands ready to buy or sell lots of the given security. (LO 28.e)



# READING 29

## Exchanges and OTC Markets

### EXAM FOCUS

In this reading, we look at the role of exchanges and the differences between exchange-traded derivatives and over-the-counter (OTC) derivatives trading. We then examine the role of the central counterparty (CCP) in clearing and mitigating counterparty risk. For the exam, be able to compare and contrast exchange-traded and OTC derivatives. Also, be familiar with the development of central clearing, including the various mechanisms that exist to manage risks, including special purpose vehicles (SPVs).

### MODULE 29.1: EXCHANGE-TRADED DERIVATIVES

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**LO 29.a: Describe how exchanges can be used to alleviate counterparty risk.**

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An **exchange** is a central market where standardized futures, options, and other derivatives contracts can be traded. They have a long history and have evolved from simple trading forums (e.g., contract definition, dispute resolution) to sophisticated financial centers with settlement and counterparty risk management functions.

### Clearing

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**LO 29.b: Explain the developments in clearing that reduce risk.**

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**Clearing** is the process of reconciling and matching contracts between counterparties from the time the commitments are made until settlement. Clearing, along with the developments of margining and netting, are important counterparty risk mitigants. *Margining* involves posting both initial and variation margins from one counterparty to another. **Initial margin** represents upfront funds posted to

mitigate against counterparty default, while **variation margin** represents the daily transfer of funds (cash or other assets) to cover position gains and losses (mark-to-market process). **Netting** refers to consolidating multiple offsetting positions (e.g., long and short) between counterparties into a single payment.

Exchanges use **central counterparties** (CCPs) to clear trades between two members. For example, entity X and entity Y agree to a specific trade and then the CCP acts as the counterparty to both X and Y. As a result, neither entity will have concerns about the creditworthiness of the other and may not even know the identity of the other. The CCP will subsequently clear the transaction. In addition, the existence of the CCP allows for a simpler process in closing out positions. Without the CCP, if entity X wants to close out the position, it would need to do so with entity Y or another member and that might not be possible.

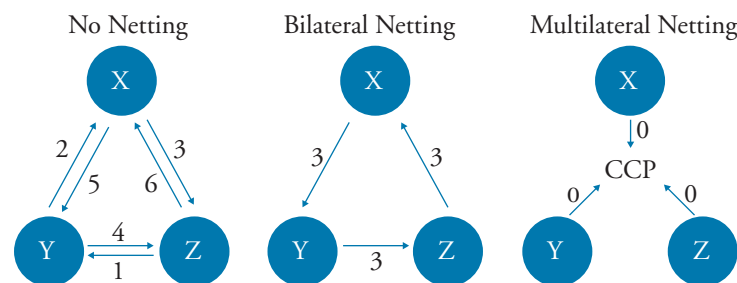
## Netting

### LO 29.c: Describe netting and describe a netting process.

A simple example of **netting** is as follows: Entity X enters into a buy transaction of gold with entity Y for \$500,000 settling in December. Entity Y enters into a separate buy transaction of gold with entity X for \$475,000 settling in December. The two contracts could be netted with entity Y paying entity X \$25,000 in December.

Figure 29.1 illustrates how counterparty risk exposures are reduced through netting and the use of a CCP. Suppose X, Y, and Z represent three different counterparties. The arrows in the figure represent the amount of money owed (i.e., counterparty risk exposure) between the entities. For example, under a no netting framework, entity X has an exposure of two to entity Y, and entity Y has an exposure of five to entity X.

**Figure 29.1: Reduction of Risk Exposure Through Multilateral Netting**



Suppose entity X defaults under the *no netting* framework. This will result in a loss of five for entity Y and a loss of three to entity Z. Under the no netting framework, entity X still claims a total of eight from both entities Y and Z (i.e., 2 + 6). With *bilateral netting*, trades between two entities are cleared, reducing the total exposure in the market. If entity X defaults under the bilateral framework, then entity Y will have a reduced loss of three and entity Z will have no loss because there is no risk exposure remaining from entity X for entity Z.

If entity X defaults under the **multilateral netting** framework, entities Y and Z do not have losses because there is no outstanding counterparty risk exposure from other CCP members. All trades are cleared through the CCP in the multilateral netting framework. Without the CCP, there could be problems if the entities have different credit qualities and it may involve margin arrangements and margin transfers, which could add tremendous complexity. Hence, the market development to have CCPs clear transactions between members has avoided any concerns about creditworthiness.

## Margining

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**LO 29.d: Describe the implementation of a margining process and explain the determinants of initial and variation margin requirements.**

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**Variation margin** and **daily settlement** are interrelated. Futures contracts are settled each day during the life of the contract rather than at the very end. Assume entity X contracts to buy (long position) 100 units of gold for \$1,450 per unit from entity Y. The price of gold falls at the close of trading the next day to \$1,440. Entity X has lost \$1,000 (100 units × \$10/unit) and must pay \$1,000 to the CCP. The CCP will then pay \$1,000 to entity Y. Alternatively, if the price of gold rose from \$1,450 to \$1,470 the next day, then entity X has gained \$2,000 and the CCP will pay \$2,000 to entity X (that was paid to the CCP by entity Y). Such payments are called variation margin.

From the CCP's perspective, there are an equal number of long and short positions so that the CCP experiences net cash flows of zero. Daily settlement facilitates the closing out of futures contracts because everything has been accounted for up to the close of trading on the previous day so only the incremental gain/loss for the current day needs to be considered in closing out the position.

CCPs also have **initial margin** requirements. Initial margin is intended to cover any potential losses from a member who fails to make a variation margin payment and for any further losses that may occur from unfavorable price changes arising from any delays involved with the CCP closing out the member's position. For example, a member with a net short position may fail to make a variation margin payment. The CCP would then need to close out that position by taking a long position in the underlying. If there is a subsequent price increase in the underlying prior to closing out the long position, there would be a further loss to the CCP. The CCP's losses are meant to be recovered from the initial margin previously paid by the defaulting member. However, if the amount of initial margin is insufficient, the **default fund contributions** (a separate requirement of members) of that particular member are applied to cover the difference. If there is still a shortage, then the default fund contributions of other members are applied.

Initial margins are determined by the exchange and are a function of futures price volatility; initial margins may vary depending on market conditions. CCPs will pay interest on initial margin (but not variation margin). As an alternative to cash margin, a member could provide securities (e.g., T-bills). The equivalent cash margin would be a discounted amount of the securities' value, with the discount

known as a haircut. Haircuts increase and decrease accordingly with the price volatility of the underlying asset.

The initial and variation margins may be impacted when there is more than one derivatives contract on the same asset. Assume a short August contract and a long November contract held by one member. A variation margin receipt on the August contract may be offset by a variation margin payment on the November contract, which is a built-in netting mechanism. In addition, there are likely to be provisions to allow for the total initial margin of the short August and long November contracts to be less than the sum of the initial margins for the contracts if they were determined independently.



### MODULE QUIZ 29.1

1. Which of the following methods of managing credit risk is not utilized by an exchange?
  - A. Daily settlement
  - B. Default fund contributions
  - C. Netting
  - D. Physical collateral
2. Which of the following statements regarding the margining process on an exchange is correct?
  - A. The initial margin is calculated as a function of the futures price.
  - B. CCPs pay interest on both the initial margin and the variation margin.
  - C. The initial margin on a futures contract is negotiated between the two parties directly.
  - D. When providing noncash margin, the haircut is positively correlated with the price volatility of the underlying asset.

## MODULE 29.2: OVER-THE-COUNTER DERIVATIVES

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**LO 29.e: Compare exchange-traded and OTC markets and describe their uses.**

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**Exchange-traded derivatives** are standardized contracts with a liquid, active, and regulated market, with the exchange or CCP acting as the central counterparty to trades. In contrast, **OTC derivatives** are privately negotiated bilateral contracts transacted in a market with little or no regulation. OTC derivatives have historically been traded between an end user and a dealer. The terms, settlement, and documentation are bilaterally negotiated. This allows for contracts to be tailored to the specific needs of counterparties and includes a high level of customization.

Clearing and settlement on exchanges are functions carried out centrally by CCPs to mitigate risk. For OTC derivatives, clearing and settlement have traditionally been done bilaterally (e.g., determination of future cash flows), which did not generally mitigate risk. However, there has been more use of CCPs for OTC derivatives (multilateral) over the past 10 years.

The following table provides a comparison of the general differences between exchange-traded and OTC derivatives.

**Figure 29.2: Comparing Exchange-Traded and OTC Markets**

	<b>Exchange-Traded Derivatives</b>	<b>OTC Derivatives</b>
Terms	Standardized	Custom, negotiable
Maturity	Standardized	Negotiable, nonstandard
Liquidity	Strong	Weak
Credit risk	Little (CCP guarantee)	High (bilateral)

## Classes of OTC Derivatives

**LO 29.f: Identify the classes of derivative securities and explain the risk associated with them.**

OTC derivatives comprise of five broad classes: interest rate, foreign exchange, equity, commodity, and credit default swaps. Interest rate derivatives dominate the five classes. As of December 2017, interest rate derivatives had a notional principal (underlying assets) outstanding of \$426.6 trillion, which represented 80% of the total notional principal of OTC derivatives of \$531.9 trillion. The second and third largest categories were foreign exchange derivatives and credit default swaps, respectively, followed by equity and commodity derivatives.

As mentioned, interest rate derivatives dominate the market by notional principal outstanding of contracts. However, measuring OTC derivatives exposure through notional principal can be misleading. A basic fixed-for-floating coupon interest rate swap, for example, does not have principal risk because only the coupon cash flows are exchanged at each settlement. Furthermore, even coupon risk is lower, because only the net cash flows are exchanged. When considering cash flows, the swap may have a negative value to a party when its counterparty defaults. As a result, transaction value is often seen as a more useful measure for OTC derivatives, including the ratio of transaction value to notional principal value. The ratio is typically relatively small, and was close to 2% (at December 2017) for interest rate and foreign exchange derivatives.

## Mitigating Risks of OTC Derivatives

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**LO 29.g: Identify risks associated with OTC markets and explain how these risks can be mitigated.**

**LO 29.h: Describe the role of collateralization in the over-the-counter market and compare it to the margining system.**

**LO 29.i: Explain the use of special purpose vehicles (SPVs) in the OTC derivatives market.**

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Credit risk is the key risk with OTC markets. Various mitigants exist to contain or reduce the risk of the default, including netting, margining, and default fund contributions as discussed previously.

We will now consider three specific examples of risks in the OTC markets that are mitigated with margin accounts: (1) options on stocks, (2) short sales, and (3) buying on margin.

### ***Options on Stocks***

Unlike long positions in option contracts, short positions expose the trader to the risk of having to buy or sell the underlying asset at a price that is relatively too high or low, respectively, upon exercise of the options. To mitigate the risk arising from short positions, the CCP requires traders to post margin equal to 100% of the option value plus some spread that is a function of the underlying stock price or the option exercise price.

For example, assume 200 put options on a stock are sold for \$3 per option when the stock price is \$40. The margin requirement is the greater of: (1) 100% of the option value + 20% of the underlying stock price – the amount that the option is out-of-the-money (OTM), or (2) 100% of the option value + 10% of the exercise price. If the exercise price is \$35, then the option is \$5 OTM and the required margin is the greater of

- $[3 + (0.20 \times 40) - 5] \times 200 = \$1,200$
- $[3 + (0.10 \times 35)] \times 200 = \$1,300$

Therefore, the required margin is \$1,300. With changes to the underlying stock price and option price, the margin requirements could change and the trader could be asked for additional margin. In contrast to futures, options are often settled at maturity. Interest on cash margin balances is paid by the CCP to the trader.

### ***Short Sales***

Short sales require the borrowing of shares that the short seller will repurchase later and return. Often a margin of 150% of the stock price applies, which means that the trader must post additional margin equal to 50% of the stock price. A decrease (increase) in the stock price increases (decreases) the margin balance. In addition, a **maintenance margin** is often set at 125% of the stock price so if the margin balance

becomes less than the maintenance margin, then a margin call will be made to replenish the balance to the maintenance margin.



### PROFESSOR'S NOTE

The maintenance margin is the minimum margin account balance required to retain the position. When the margin account balance falls below the maintenance margin, the investor gets a margin call, and he must bring the margin account back to the initial margin amount. The amount necessary to do this is called the variation margin.

For example, assume a short sale of 100 shares of a stock trading at \$25 that generates \$2,500. Based on a 150% margin requirement, the additional margin to be posted is \$1,250 ( $= 50\% \times \$2,500$ ) for a total of \$3,750. If the stock price rises to \$28, then the shorted shares are worth \$2,800 and the maintenance margin becomes \$3,500 ( $= 1.25 \times \$2,800$ ). The initial margin of \$3,750 is sufficient to cover the maintenance margin. However, a subsequent stock price increase to \$32 results in a maintenance margin of \$4,000 ( $= 1.25 \times \$3,200$ ), which means there is a \$250 margin call ( $= \$4,000 - \$3,750$ ). Interest on margin balances is paid to the short seller.

### Buying on Margin

To take advantage of leverage, an investor may borrow funds from a broker to invest. Assume the purchase of 500 shares for \$40 per share (total cost \$20,000) with a 50% initial margin and 25% maintenance margin requirement. Therefore, the initial margin to be deposited with the broker is \$10,000 and the remaining \$10,000 is borrowed from the broker. The broker holds the shares as collateral.

The margin account balance begins as \$10,000 (share value less amount borrowed from broker) and is increased by gains on the shares and decreased by losses on the shares and interest charged by the broker. Assuming a \$3 fall in the stock price, the value of the shares declines by \$1,500 to \$18,500 and the margin account balance declines to \$8,500. Ignoring interest, the margin to share value ratio is just under 46%. That exceeds the 25% maintenance margin, which avoids a margin call. However, if there is a further \$12 fall in the stock price, the value of the shares declines to \$12,500 and the margin account balance declines to \$2,500. Unfortunately, the margin to share value ratio is now 20% and because it is less than 25%, then a margin call will be required. The additional margin required will be \$625 [ $= 25\% \times \$25 \times 500 - \$2,500$ ]. Upon receipt of the additional margin, the margin account balance becomes \$3,125 ( $= \$2,500 + \$625$ ) and the amount borrowed from the broker becomes \$9,375 ( $= \$10,000 - \$625$ ).

### Collateralization

Bilateral clearing usually includes a master agreement with a credit support annex, which outlines the use of collateral between parties. Providing collateral is a means of reducing credit risk in OTC markets. This collateralization is basically a marked-to-market feature for the OTC market where any loss is settled in cash at the end of the trading day. A cash payment is made to the counterparty with a positive account balance. This is a similar system to trading on margin, where the

futures trader needs to restore funds if the value of the contract drops below the maintenance margin.

### ***Special Purpose Vehicles (SPVs)***

SPVs are also known as special purpose entities (SPEs). They are bankruptcy remote legal entities set up by a parent firm to shield the SPV from any financial distress of the firm. The firm transfers assets to the SPV, which in turn issues structured products to investors to finance a particular project. The primary benefit of using an SPV is to obtain a strong credit rating, typically AAA. The SPV's rating is therefore stronger than the firm's credit rating. As a result, issuing securities through the SPV is more beneficial (i.e., lower cost of funding) than if the firm issued securities directly in the market.

In context of the structured products, SPVs and SPEs pool mortgages or other loans into derivatives securities. Investors of the derivatives will receive cash flows based on the performance of the underlying mortgages and loans. For example, any defaults on the underlying may reduce cash flows.



#### **MODULE QUIZ 29.2**

1. A trader sells short 1,000 shares of Stock A, which is currently trading at \$40 per share. A margin requirement of 140% applies as well as a maintenance margin of 125%. If the share price rises to \$55, the amount of the margin call is closest to
  - A. \$0.
  - B. \$1,000.
  - C. \$14,000.
  - D. \$15,000.
2. Which of the following classes of OTC derivatives accounts for the smallest portion of the OTC market based on underlying asset value?
  - A. Commodity derivatives
  - B. Credit default swaps
  - C. Foreign exchange derivatives
  - D. Interest rate derivatives

## KEY CONCEPTS

### LO 29.a

An exchange is a central market where standardized contracts can be traded.

### LO 29.b

Clearing, margining, and netting are important counterparty risk mitigants. Clearing is the process of reconciling and matching contracts between counterparties.

Margining represents both upfront funds posted to mitigate against counterparty default (initial margin), and daily transfer of funds to cover position gains and losses (variation margin). Netting refers to consolidating multiple offsetting positions between counterparties into a single payment.

### LO 29.c

Netting refers to consolidating multiple offsetting positions (e.g., long and short) between counterparties into a single payment.

With bilateral netting, trades between two entities are cleared, reducing the total exposure in the market.

Multilateral netting refers to creating a single net obligation between each participant and the CCP from the various bilateral OTC trades (which typically include redundant trades). Netting reduces total risk and minimizes contagion from a member default.

### LO 29.d

Variation margin and daily settlement are interrelated. Futures contracts are settled each day during the life of the contract rather than at the very end. Assume entity X contracts to buy (long position) units of gold for a fixed amount per unit from entity Y. If the price of gold falls at the close of trading the next day, entity X has a loss and must pay an amount to the CCP. The CCP will then pay that amount to entity Y. Alternatively, if the price of gold rose the next day, then entity X has a gain and the CCP will pay an amount to entity X (that was paid to the CCP by entity Y). Such payments are called variation margin.

CCPs also have initial margin requirements. Initial margin is intended to cover any potential losses from a member who fails to make a variation margin payment and for any further losses that may occur from unfavorable price changes arising from any delays involved with the CCP closing out the member's position.

### LO 29.e

The following table provides a comparison of the general differences between exchange-traded and OTC derivatives.

	Exchange-Traded Derivatives	OTC Derivatives
Terms	Standardized	Custom, negotiable
Maturity	Standardized	Negotiable, nonstandard
Liquidity	Strong	Weak
Credit risk	Little (CCP guarantee)	High (bilateral)

**LO 29.f**

OTC derivatives comprise of five broad classes of derivatives: interest rate, foreign exchange, equity, commodity, and credit derivatives. Interest rate derivatives comprise the largest class, followed by foreign exchange derivatives and credit derivatives.

Measuring OTC derivatives exposure through notional principal can be misleading. Because only net cash flows are exchanged for most bonds and swaps, the notional principal overstates the amount at risk. As a result, transaction value is often seen as a more useful measure for OTC derivatives, including the ratio of transaction value to notional principal value.

**LO 29.g**

Three specific examples of risks in the OTC markets that are mitigated with margin accounts are: (1) options on stocks, (2) short sales, and (3) buying on margin.

To mitigate the risk arising from short positions, the CCP requires traders to post margin equal to 100% of the option value plus some spread that is a function of the underlying stock price or the option exercise price.

Short sales require the borrowing of shares that the short seller will repurchase later and return. A decrease (increase) in the stock price increases (decreases) the margin balance. In addition, a maintenance margin is often set so if the margin balance becomes less than the maintenance margin, then a margin call will be made to replenish the balance to the maintenance margin.

To take advantage of leverage, an investor may borrow funds from a broker to invest. An initial margin is to be deposited with the broker and the remaining amount is borrowed from the broker. The shares are held by the broker as collateral. The margin account balance begins as the share value less the amount borrowed from broker and is increased by gains on the shares and decreased by losses on the shares and interest charged by the broker.

**LO 29.h**

With the daily mark-to-market of derivatives, any change in the net value generally requires the losing party to post additional collateral equal to the amount of the change.

**LO 29.i**

SPVs are bankruptcy remote legal entities set up by a parent firm to shield the SPV from any financial distress of the firm. The firm transfers assets to the SPV, which in turn issues structured products to investors to finance projects.

## ANSWER KEY FOR MODULE QUIZZES

### Module Quiz 29.1

1. **D** Daily settlement, default fund contributions, and netting are explicitly used by exchanges. However, physical collateral is not, although initial margin and variation margin are a form collateral but they are not physical collateral per se. (LO 29.b)
2. **D** Haircuts increase and decrease accordingly with the price volatility of the underlying asset.

The initial margin is calculated as a function of futures price *volatility* and is determined by the exchange (not by the two parties). CCPs pay interest on *initial margin only*. (LO 29.d)

### Module Quiz 29.2

1. **C** The short sale of 1,000 shares of Stock A trading at \$40 generates \$40,000. Based on a 140% margin requirement, the additional margin to be posted is \$16,000 ( $= 40\% \times \$40,000$ ) for a total of \$56,000. If the stock price rises to \$55, then the shorted shares are worth \$55,000 and the maintenance margin becomes \$68,750 ( $= 1.25 \times \$55,000$ ). The initial margin of \$56,000 is insufficient to cover the maintenance margin, which means there is a \$13,750 margin call ( $= \$68,750 - \$55,000$ ). (LO 29.g)
2. **A** As at December 2017, commodity derivatives had underlying assets with a value of about \$1.9 billion, which represented about 0.35% of the OTC market.  
As a percentage of the OTC market, credit default swaps accounted for about 1.8%, followed by foreign exchange derivatives at 16.4%, and finally interest rate derivatives at 80.2%. (LO 29.f)



# READING 30

## Central Clearing

### EXAM FOCUS

This reading covers the principles of central clearing, including the functions and mechanics of a central counterparty (CCP). For the exam, be able to describe these functions and understand the related terminology, including the three key regulatory initiatives. Clearing, novation, and netting are also important concepts for the exam. In addition, understand the advantages and disadvantages of CCPs, and be able to discuss common terms, including loss mutualization, moral hazard, adverse selection, and procyclicality.

### MODULE 30.1: PRINCIPLES OF CENTRAL CLEARING

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**LO 30.a: Provide examples of the mechanics of a central counterparty (CCP).**

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#### Clearing and Settlement

**Clearing** refers to the processes (including margining and netting) between the period from trade execution until settlement. This period is typically short (a few days or months) for classically cleared non-over-the-counter (OTC) derivatives. In contrast, for OTC derivatives, this time period could extend to years or even decades. **Settlement** of a trade occurs when the trade is completed and all payments have been made and legal obligations satisfied.

Key functions of a central counterparty (CCP) related to the clearing process include margining, novation, netting, managing the auction process, and loss mutualization. We will discuss these functions throughout this reading.

CCPs clear trades very similarly in OTC markets versus exchanges in terms of requirements from members for initial margin, variation margin, and default fund contributions. Initial margin is based on the risk of the transaction and not the credit risk of the member. CCPs will usually set the initial margin so that there is only about a 1% chance that the initial margin will be insufficient to cover losses. From there, default fund contributions are utilized. Clearing members typically include large players only, including large banks and global financial institutions.

## Auctions and Defaults

When a member defaults, rather than closing out the trades at market value, the CCP typically auctions off the trades to the surviving members through an auctioning process. Participating in the auctioning process is in the best interest of the members in order to minimize their losses that would otherwise occur with lower market prices or with the use of default fund contributions.

Failed auctions may allow the CCP to assign losses to those who have had recent gains. Alternatively, the CCP could tear up transactions by closing out the defaulting member's trades that will result in the nondefaulting members incurring some losses. **Loss mutualization** is a form of insurance and refers to members' contributions to a default fund to cover future losses from member defaults. Since all members must contribute to the fund, the potential losses from the default of any given member are contained. When a member does default, any amounts that cannot be covered from the member's own resources are covered from the fund. Given that losses are spread among surviving members, it is possible that a member will suffer losses even if it never traded with the defaulting counterparty or had no positions with the CCP.

## Central Counterparties in Over-the-Counter Transactions

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**LO 30.b: Describe the role of CCPs and distinguish between bilateral and centralized clearing.**

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A CCP plays an important role in the clearing and settlement of transactions following the initial trade execution. Its primary function is to simplify the operational processes and reduce counterparty risk that exists in the bilateral market (e.g., without the CCP, the trades would need to be cleared between the counterparties, which may involve significant credit risk). When a CCP interjects itself as the central counterparty for standard OTC trades and acts as the seller to each buyer and the buyer to each seller, it reduces the interconnectedness of trades and of participants, and reduces the risk of default or nonpayment by a counterparty. At the same time, the process of centralized clearing improves trade liquidity and transparency.

CCPs operate in a similar fashion to clearinghouses on futures exchanges. After two parties (X and Y) negotiate an OTC agreement, it is submitted to the CCP for acceptance. Assuming the transaction is accepted, the CCP will become the counterparty to both parties X and Y. Thus, it assumes the credit risk of both parties

in an OTC transaction. This risk is managed by requiring the parties to post initial margin and any variation margin on a daily basis.

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**LO 30.c: Describe advantages and disadvantages of central clearing of OTC derivatives.**

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## Advantages of Central Clearing

Central clearing through CCPs has the following advantages:

- *Default management (counterparty risk):* CCPs act as the counterparty to each trade, which reduces counterparty risk. Unlike bilateral clearing, there is no need to negotiate a closeout with the counterparty; the possibility of an unfavorable closeout increases counterparty risk.
- *Loss mutualization:* A member's losses are distributed among all surviving members, which spread the impact of losses, reduce costs, and minimize market impact and systemic risk.
- *Legal and operational efficiency:* The centralized role of CCPs in the clearing (margining, netting) and settlement process improves operational efficiency while reducing costs.
- *Liquidity:* CCPs may greatly facilitate the netting of and closing of trades, which increases liquidity.
- *Standardized documentation:* CCPs promote the use of standardized documentation with OTC derivatives.
- *Increased transparency:* In OTC markets, parties typically do not see all outstanding trades between the various counterparties. CCPs have a consolidated view of trading positions and can therefore better react to extreme events.

## Disadvantages of Central Clearing

While we noted loss mutualization as an advantage of the central clearing process, it can lead to potential problems, including moral hazard and adverse selection:

- *Moral hazard:* Moral hazard is the risk that one party will take on higher risk knowing that another party bears the costs of this risk. In central clearing, the risk is that members will have less incentive to monitor risk knowing that the CCP takes on most of the risks.
- *Adverse selection:* Adverse selection is the risk that participants with a better understanding of product risks and pricing will trade more products whose risks the CCP underprices, and will trade fewer products whose risks the CCP overprices.
- *Procyclicality:* Procyclicality essentially reflects the downside of margining. It reflects a scenario where a CCP increases margin requirements (initial margin) in volatile markets or during a crisis, which may aggravate systemic risk.
- *Credit risk:* CCP members' (not the CCP itself) ability to determine credit risk is challenging because of the lack of transparency regarding other members'

trades, which puts members' default fund contributions and variation margin gains at risk should another member default. That is unlike bilateral clearing, where the risks are more transparent but more concentrated.

## Regulatory Initiatives for OTC Markets

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### LO 30.d: Explain regulatory initiatives for the OTC derivatives market and their impact on central clearing.

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Regulators have pushed for the use of CCPs in OTC markets to try to reduce systemic risk, which is the risk that a failure by a significant financial institution will impact other institutions (due to the extensive interconnections of derivatives dealers) and potentially lead to a collapse of the overall financial system. Prior to the 2007–2009 credit crisis, the OTC derivatives market was essentially unregulated and it is thought that OTC derivatives in subprime mortgages contributed to the crisis.

Three key regulations emerged from the G-20 leaders meeting in September 2009: (1) standardized OTC derivatives must be cleared through CCPs, (2) standardized OTC derivatives must be traded on electronic platforms, and (3) all OTC trades must be reported to a central trade repository.

Standardized derivatives would primarily consist of plain vanilla interest rate swaps and credit default swaps on indices. By clearing all transactions through CCPs, there are much fewer interconnections between dealers, thereby reducing systemic risk. By transacting on electronic platforms, there is much greater knowledge of trading prices by all members, thereby increasing price transparency. By reporting all transactions centrally, regulators are given key inputs in determining the risks involved with OTC derivatives.

The first two regulations only apply to trades between two financial institutions, which exempts dealers when transacting with their nonfinancial entities. However, CCPs must be used for interdealer transactions for standardized products, which has greatly increased the amount of central clearing of OTC derivatives.

## Margining

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### LO 30.e: Compare margin requirements in centrally cleared and bilateral markets and explain how margin can mitigate risk.

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Central clearing applies to standard transactions only (e.g., interest rate swaps or credit default swaps on indices). Standard transactions involving a given security have four key attributes:

- Standard legal and economic terms
- Widespread models to easily value the security

- Active trading of the security to ensure ease of unwinding positions and obtaining valuations
- Long price history of the security to determine initial margin

In contrast, nonstandard transactions are cleared bilaterally and are deemed uncleared. Just like centrally cleared transactions, uncleared transactions between two financial institutions are also required to post initial and variation margin, which is a notable departure from the past regarding initial margins.

To mitigate risk, initial margin is made up of cash or liquid assets transferred by a member at trade inception to cover a worst-case loss in the event of a member default. CCPs set margin requirements based only on the risks of the members' transactions, and the credit quality of the member is typically not a consideration for initial margin. Variation margin is typically cash posted by a member to cover the daily net change of the member's position. Initial margin on uncleared trades is forwarded to a third party in trust while variation margin can be forwarded between counterparties.

## Novation and Netting

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### LO 30.f: Compare and contrast bilateral markets to the use of novation and netting.

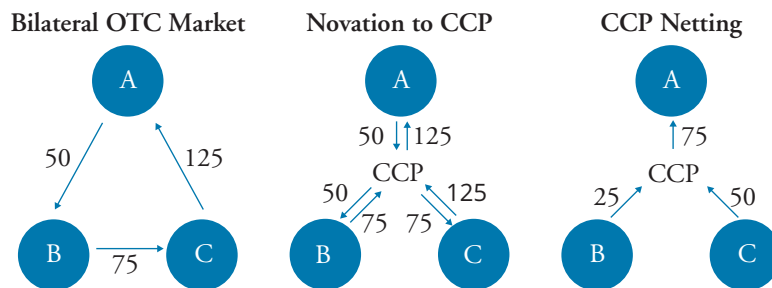
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The legal process of interposing the CCP between the seller and the buyer is called **novation**. Through novation, one contract (the bilateral contract between OTC participants) is replaced with another contract (or contracts) with the CCP. This is important because novation transforms the process from bilateral trading to trading with a CCP, where the CCP is the insurer of counterparty risk. Assuming the legal enforceability of novation, the old contracts cease to exist and the original bilateral parties have no further obligations to each other. At the same time, because all trades are centralized, the CCP maintains a matched book of trades with no net market risk. The CCP does have conditional credit risk from a member's potential default.

Market participants often prefer to offset rather than to terminate trades, which creates redundant trades. When trades are novated to a CCP, these redundant trades become a single net obligation between each participant and the CCP. This process is called **netting**. Netting reduces total risk and minimizes the potential of a domino effect stemming from the default of a participant.

The process of moving from bilateral to novation to netted positions is illustrated in Figure 30.1.

**Figure 30.1: Multilateral Offsetting**



## Impact of Central Clearing

**LO 30.g: Assess the impact of central clearing on the broader financial markets.**

By now it should be evident that central clearing through a CCP has significant advantages, but it is not without its challenges. When a CCP is included in the clearing process, systemic risk in the financial markets is reduced, but can be increased at the same time. Systemic risk is reduced because CCPs reduce counterparty risk by offsetting positions (novation and netting), provide transparency for the market, and improve liquidity. However, the potential requirement that members post higher initial margin during times of increased market volatility could increase systemic risk. In addition, concentrating all trades in a single place exposes the market to the risk of CCP failure and heightened systemic risk.

The long-term maturity of OTC derivatives contracts, often years or decades, also poses challenges for CCPs. It is not yet evident that they are effective in clearing these long-dated, more complex, and illiquid trades.



### MODULE QUIZ 30.1

1. Which of the following statements on central clearing is accurate?
  - I. The composition of clearing members typically includes a combination of large global banks and smaller banks and nonfinancial institutions.
  - II. In the auction process, a CCP normally does not closeout trades at their market value.
  - A. I only
  - B. II only
  - C. Both I and II
  - D. Neither I nor II

2. Alex Dell, a derivatives trader, has some reservations about the central clearing of OTC derivatives with a central counterparty (CCP). Specifically, he is worried that clearing members' willingness to monitor credit risk may decline since the CCP assumes most of the risks, and that CCPs may increase margin requirements during a period of market stress. Which of the following concepts best describe Dell's reservations?
- | <u>Decline in Willingness</u> | <u>Higher Margin Requirements</u> |
|-------------------------------|-----------------------------------|
| A. Moral Hazard               | Procyclicality                    |
| B. Adverse selection          | Netting                           |
| C. Moral hazard               | Netting                           |
| D. Adverse selections         | Procyclicality                    |
3. In a recently released report to management, a credit analyst indicates that the level of initial margin set by a central counterparty (CCP) is dependent on the risk of the member that is required to post it, and on the risk of the specific derivatives transactions. The analyst is correct with respect to these
- | <u>Dependent on Risk of Member</u> | <u>Dependent on Risk of Transactions</u> |
|------------------------------------|--|
| A. Yes                             | Yes                                      |
| B. Yes                             | No                                       |
| C. No                              | Yes                                      |
| D. No                              | No                                       |
4. Alpha Bank recently noted that its bilateral OTC trade obligations with Beta Bank ceased to exist and the bank now directly faces a central counterparty (CCP) for its trade obligations. Which of the following concepts best identify this scenario?
- Netting
  - Novation
  - Margining
  - Multilateral netting

## MODULE 30.2: RISKS FACED BY CENTRAL COUNTERPARTIES

**LO 30.h: Identify and explain the types of risks faced by CCPs.**

### Default Risk

The default of a clearing member and its flow through effects is the most significant risk for a CCP. Because of a default, there may be the default or distress of other clearing members given that default correlation is likely to be high among OTC derivatives market participants.

With CCPs, all members are considered equal credit risks when computing initial margin and default fund contributions. That is in direct contrast with bilateral clearing where credit quality is explicitly considered.

In the event of a failed auction or an insufficient number of bids, the CCP will be required to pass on the defaulting member's losses through rights of assessment,

loss allocation methods, or both. Passing on losses to other clearing members may result in defaults by those members. The loss allocation methods may be considered unfair because some of them, such as variation margin gains haircutting (VMGH) and tear-ups, impose losses on winning positions. With VMGH, members whose positions increased in value (i.e., they are owed variation margin) will likely not receive the full amount for their gains (i.e., haircutting). Members who instead owe money to the CCP will still be required to pay the full margin amount to the CCP. In a tear-up, the CCP terminates the unmatched position, and may balance resources by drawing from both the defaulter's initial margin and the default fund.

Some clearing members may resign from the CCP after the default of another clearing member. The initial resignation may result in a negative reputational impact to the CCP as witnessed by further resignations of clearing members.

## **Model Risk**

OTC derivatives are not priced by the market but are instead priced using valuation models that perform the mark-to-market function, which subjects CCPs to model risk. Especially sensitive to model risk would be a CCP's determination of initial margins. In that context, model risk could arise due to errors pertaining to volatility and in that regard, initial margins should be amended frequently to correspond with changes in volatility.

## **Liquidity Risk**

There are large amounts of cash inflows and outflows flowing through the CCP due to initial margins and margin calls. As a result, CCPs are exposed to liquidity risk. The CCP attempts to earn the greatest return possible on the funds it holds without incurring too much credit or liquidity risk, thereby resulting in a trade-off between more liquid securities (e.g., treasuries) and less liquid securities (e.g., corporate bonds).

Should there be a default by one or more members, the CCP is still required to meet the obligations of the other members. In such a case, the CCP's investments must be quickly and easily convertible to cash. In that regard, investments must be analyzed under stressed market conditions since it is most likely that defaults will occur in such conditions that are contemporaneous with lower liquidity levels.

## **Operational Risk**

Due to the centralization of some functions within a CCP to increase efficiency, additional risks arise that affect counterparties due to concentration at the CCP. CCPs face operational risks that are common to all entities such as business interruption due to information systems failures and internal or external fraud. However, a systems failure within a CCP could have a disastrous impact on many counterparties, especially if they hold large positions.

## Legal Risk

Legal risks in the form of litigation or claims may arise due to differing laws in different jurisdictions or laws that are inconsistent with the CCP's regulations. A good example would involve the segregation and movement of margin and positions (i.e., netting) through a CCP.

## Investment Risk

**Investment risk** occurs in the form of losses of margin funds resulting from investment actions performed within or outside of the stated investment policy.

Overall, it is probable that the various loss events will be correlated and will affect the CCP at the same time. In the case of a default, there will probably be a major market impact that increases the probability of operational and investment issues. Additionally, in a default scenario, there is usually a wide spread between gain and loss positions that increase legal and fraud risks.

## Risks to Clearing Members and Non-Members

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**LO 30.i: Identify and distinguish between the risks to clearing members as well as non-members.**

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Non-members face exposure from CCPs, clearing members, and other non-members. If a CCP fails, a non-member may be able to avoid losses so long as its counterparty (a clearing member) is solvent. Unlike clearing members, non-members are not required to contribute to default funds so, therefore, non-members are not exposed to losses that result from CCP failures.

Furthermore, the extent of non-members' losses due to defaults of CCPs and clearing members lies with the initial margins and whether they are segregated, guaranteed, or both. In addition, non-members face the risk of not being able to port their trades should the counterparty member default. As a result, such trades may have to be closed out at a loss.

Finally, one has to consider non-members' liability with respect to CCP loss allocation rules. It is possible that clearing members are able to pass on losses to non-members through VMGH or tear-up, which would reduce the gains of non-members. Clearing members are unable to pass on losses resulting from default fund utilization, rights of assessment, and forced allocation.



### MODULE QUIZ 30.2

1. Which of the following statements regarding risks facing a CCP is correct?
  - A. OTC derivatives are priced by the market.
  - B. A good example of legal risk would involve netting arrangements.
  - C. Default correlations tend to be low among OTC derivatives market participants.
  - D. Investment risk refers to the risk of losses of margin funds resulting from investment actions performed outside of the stated investment policy.
  
2. Erin Parker and Nate James are analysts at a large financial institution. During one of their recent discussions on OTC derivatives and central clearing with a central counterparty (CCP), Parker states, "CCPs are beneficial because they convert operational and legal risk into counterparty risk." James adds to that statement by suggesting, "When requiring higher margin in turbulent times, CCPs reduce systemic risk." With respect to the statements made,
  - A. only Parker is correct.
  - B. only James is correct.
  - C. both Parker and James are correct.
  - D. neither Parker nor James is correct.

## KEY CONCEPTS

### LO 30.a

CCPs are involved in the clearing and settlement of transactions. Clearing refers to the processes between the period from trade execution until settlement. Settlement refers to the satisfaction of legal obligations and trade completion.

Functions of a CCP include novation, netting, margining, managing the auction process, and loss mutualization. Auctioning refers to selling off the defaulted member's trades to the surviving members through an auctioning process. Loss mutualization refers to members' contributions to a default fund to cover future losses from member defaults.

### LO 30.b

A central counterparty CCP's primary function is to simplify the operational processes and reduce counterparty risk that exists in the bilateral market (e.g. without the CCP, the trades would need to be cleared between the counterparties, which may involve significant credit risk).

CCPs operate in a similar fashion to clearinghouses on futures exchanges. After two parties (X and Y) negotiate an OTC agreement, it is submitted to the CCP for acceptance. Assuming the transaction is accepted, the CCP will become the counterparty to both parties X and Y. Thus, it assumes the credit risk of both parties in an OTC transaction.

### LO 30.c

Advantages of CCPs include: default management, loss mutualization, legal and operational efficiency, liquidity, standardized documentation, and increased transparency.

Disadvantages of CCPs include: moral hazard, adverse selection, procyclicality of margin requirements, and credit risk (from the perspective of members, not the CCP itself).

### LO 30.d

Three key regulations emerged from the G-20 leaders meeting in September 2009: (1) standardized OTC derivatives must be cleared through CCPs, (2) standardized OTC derivatives must be traded on electronic platforms, and (3) all OTC trades must be reported to a central trade repository.

### LO 30.e

Central clearing applies to standard transactions only. In contrast, nonstandard transactions are cleared bilaterally and are deemed uncleared. Just like centrally cleared transactions, uncleared transactions between two financial institutions are also required to post initial and variation margins, which is a notable departure from the past regarding initial margins.

CCPs set margin requirements based only on the risks of the members' transactions, and the credit quality of the member is typically not a consideration for initial margin.

**LO 30.f**

Novation refers to replacing a bilateral OTC contract with another contract (or contracts) with the CCP, where the CCP is the insurer of counterparty risk. The CCP maintains a matched book of trades with no net market risk.

Netting refers to creating a single net obligation between each participant and the CCP from the various bilateral OTC trades (which typically include redundant trades). Netting reduces total risk and minimizes contagion from a member default.

**LO 30.g**

By including a CCP in the clearing process, systemic risk can be both reduced and increased. Systemic risk is reduced because counterparty risk is reduced, and transparency and liquidity improve. Systemic risk is increased because higher initial margin during times of stress would heighten market risk, and the failure of a CCP may lead to a catastrophic event.

**LO 30.h**

CCPs face five major risks: default risk, model risk, liquidity risk, operational risk, legal risk, and investment risk. The default of a clearing member and its flow through effects is the most significant risk for a CCP. Because of a default, there may be the default or distress of other clearing members given that default correlation is likely to be high among OTC derivatives market participants.

**LO 30.i**

Non-members face exposure from CCPs, clearing members, and other non-members. If a CCP fails, a non-member may be able to avoid losses so long as its counterparty is solvent. Non-members are not required to contribute to default funds so they are not exposed to losses that result from CCP failures. The extent of non-members' losses lies with the initial margins and whether they are segregated, guaranteed, or both. Non-members face the risk of not being able to port their trades should the counterparty member default.

## ANSWER KEY FOR MODULE QUIZZES

### Module Quiz 30.1

- B** Clearing members typically include large players only, including large banks and global financial institutions. In the auction process, a CCP normally does not closeout trades at their market value. Instead, trades are auctioned to existing members. (LO 30.a)
- A** Dell's reservations describe moral hazard and procyclicality, respectively. In central clearing, moral hazard is the risk that members have less incentive to monitor risk knowing that the CCP assumes most of the risks of the transactions. Procyclicality describes a scenario where a CCP increases margin requirements (initial margin) in volatile markets or during a crisis, which may aggravate systemic risk.

Netting describes the elimination of duplicate bilateral contracts by transacting through a CCP, which improves flexibility and reduces costs. Adverse selection is the risk that participants with a better understanding of product risks and pricing will trade more products whose risks the CCP underprices, and fewer products whose risks the CCP overprices. (LO 30.f)
- C** CCPs set initial margin requirements based on the risk of the transactions, but not on the risk of the members. (LO 30.a)
- B** Novation describes the process where one contract (the bilateral contract between OTC participants) is replaced with another contract (or contracts) with the CCP. As a result, counterparties' bilateral obligations with each other cease to exist.

Netting refers to creating, from the various bilateral OTC trades, a single net obligation between each participant and the CCP.

Margining is the process of posting some form of collateral, typically cash or marketable securities, to cover member defaults (initial margin) or security mark-to-market movements (variation margin). (LO 30.f)

### Module Quiz 30.2

- B** Legal risks in the form of litigation or claims may arise due to differing laws in different jurisdictions or laws that are inconsistent with the CCP's regulations. A good example would involve the segregation and movement of margin and positions (i.e., netting) through a CCP.

Response B is not correct, because default correlation is likely to be *high* among OTC derivatives market participants. Response C is not correct, because OTC derivatives are not priced by the market but are instead priced using valuation models. Response D is not correct, because investment risk refers to the risk of losses of margin funds resulting from investment actions performed *within or outside* of the stated investment policy. (LO 30.h)

## Reading 30

### Cross-Reference to GARP FRM Part I, Chapter 6

2. **D** Neither Parker nor James is correct. CCPs convert counterparty risk into operational and legal risk. When CCPs require higher margin in turbulent times, CCPs can increase systemic risk. This risk is known as procyclicality. (LO 30.h)

# READING 31

## Futures Markets

### EXAM FOCUS

In this reading, candidates should focus on the terminology of futures markets, how futures differ from forwards, the mechanics of margin deposits, and the process of marking to market. Limit price moves, delivery options, and convergence of spot prices to futures prices are also likely exam concepts. It is also important to understand the ways a futures position can be terminated before contract expiration and how cash settlement is accomplished by the final mark-to-market at contract expiration.

### MODULE 31.1: FUTURES CHARACTERISTICS

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**LO 31.a: 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.**

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Futures contracts are exchange-traded obligations to buy or sell a certain amount of an underlying good at a specified price and date. The underlying asset varies from agricultural products to stock indices. Most futures positions are not held to take delivery of the underlying good. Instead, they are closed out or reversed before the settlement date.

The purchaser of a futures contract is said to have gone long or taken a **long position**, while the seller of a futures contract is said to have gone short or taken a **short position**. For each contract traded, there is a buyer and a seller. The long has contracted to buy the asset at the contract price at contract expiration, and the short has an obligation to sell at that price.

**Open interest** is the total number of long positions in a given futures contract. It also equals the total number of short positions in a futures contract. An open

interest of 200 would imply that there are 200 short positions in existence and 200 long positions in existence. It is possible, on any given day, for the trading volume on a contract to be higher than its open interest. **Trading volume** is the number of contracts traded daily and may exceed open interest when there are many positions being closed out or if there is excessive **day trading** occurring (i.e., trades entered and closed out in one day).

## Key Features of a Futures Contract

When a new futures contract is introduced to the marketplace, the futures exchange must specify the exact features of the contract, which include the following:

- *Underlying asset.* When the underlying asset for the contract is a financial asset, such as Japanese yen, the definition of the asset is straightforward. However, when the underlying asset is a commodity, there may be different levels of quality for that good available in the marketplace (e.g., different qualities of wheat). The futures exchange stipulates the quality of a good that will be acceptable for settling the contract.
- *Contract size.* The contract size specifies the quantity of the asset that must be delivered to settle a futures contract (e.g., one grain contract = 5,000 bushels).
- *Delivery location.* The exchange specifies the place where delivery will take place.
- *Delivery time.* Futures contracts are referred to by the month in which delivery is to take place (e.g., a December corn contract). Some contracts are not settled by delivery but by payment in cash, based on the difference between the futures price and the market price at settlement.
- *Price quotes.* The exchange determines how the price of a contract will be quoted as well as the minimum price fluctuation for the contract, which is referred to as the tick size. For example, grain is quoted in dollars per bushel, and the minimum tick size is  $\frac{1}{4}$  cent per bushel. Since a grain contract consists of 5,000 bushels, the minimum tick size is \$12.50 ( $= 5,000 \times \$0.0025$ ) per contract.
- *Price limits.* The exchange sets the maximum price movement for a contract during a day. For example, wheat cannot move more than \$0.20 from its close the preceding day, for a daily price limit of \$1,000. When a contract moves down by its daily price limit, it is said to be **limit down**. When the contract moves up by its price limit, it is said to be **limit up**.
- *Position limits.* The exchange sets a maximum number of contracts that a speculator may hold to prevent speculators from having an undue influence on the market.

## Futures/Spot Convergence

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### LO 31.b: Explain the convergence of futures and spot prices.

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The spot (cash) price of a commodity or financial asset is the price for immediate delivery. The futures price is the price today for delivery at some future point in time

(i.e., the maturity date). The **basis** is the difference between the spot price and the futures price.

$$\text{basis} = \text{spot price} - \text{futures price}$$

As the maturity date nears, the basis converges toward zero. Before maturity, the futures price may be above or below the spot price. At expiration, the spot price must equal the futures price because the futures price has become the price today for delivery today, which is the same as the spot. Arbitrage will force the prices to be the same at contract expiration.

#### **EXAMPLE: Why the Futures Price Must Equal the Spot Price at Expiration**

Suppose the current spot price of silver is \$4.65. Demonstrate by arbitrage that the futures price of a futures silver contract that expires in one minute must equal the spot price.

#### **Answer:**

Suppose the futures price was \$4.70. We could buy the silver at the spot price of \$4.65, sell the futures contract, and deliver the silver under the contract at \$4.70. Our profit would be  $\$4.70 - \$4.65 = \$0.05$ . Because the contract matures in one minute, there is virtually no risk to this arbitrage trade.

Suppose instead the futures price was \$4.61. Now we would buy the silver contract, take delivery of the silver by paying \$4.61, and then sell the silver at the spot price of \$4.65. Our profit is  $\$4.65 - \$4.61 = \$0.04$ . Once again, this is a riskless arbitrage trade.

Therefore, to prevent arbitrage, the futures price at the maturity of the contract must be equal to the spot price of \$4.65.

## **Margin Requirements**

**LO 31.c: Describe the rationale for margin requirements and explain how they work.**

As discussed in previous readings, margin is cash or highly liquid collateral placed in an account to ensure that any trading losses will be met. Marking to market is the daily procedure of adjusting the margin account balance for daily movements in the futures price. The amount required to open a futures position is called the initial margin. Recall that the maintenance margin is the minimum margin account balance required. An investor will receive a margin call if the margin account balance falls below the maintenance margin. In this case, the investor must bring the margin account back to the initial margin amount (with variation margin).

#### **EXAMPLE: Margin Trading**

Let's return to our investor with the long gold contract. The investor entered the position at \$993.60. Each contract controls 100 troy ounces for a current market value of \$99,360. Assume that the initial margin is \$2,500,

the maintenance margin is \$2,000, and the futures price drops to \$991.00 at the end of the first day and \$985.00 on the end of the second day. Compute the amount in the margin account at the end of each day for the long position and any variation margin needed.

**Answer:**

At the end of the first day, the loss is computed as  $(\$991 - \$993.6)100 = -\$260$ , so when the account is marked to market, \$260 is withdrawn from the buyer's margin account and \$260 deposited in the seller's margin account. The buyer's (long) margin account balance is now \$2,240 ( $= \$2,500 - \$260$ ). The margin account balance for the short position is now \$2,760 ( $= \$2,500 + \$260$ ).

At the end of the second day, the daily loss is  $(\$985 - \$991)100 = -\$600$ , and the buyer's margin account balance is reduced to \$1,640 ( $= \$2,240 - \$600$ ). At \$1,640, the investor will get a margin call since the margin account balance is less than the maintenance margin. The variation margin is the amount necessary to bring the margin account back up to the initial margin. In this case, it is \$860 ( $= \$2,500 - \$1,640$ ).



### MODULE QUIZ 31.1

- When an investor is obligated to buy the underlying asset in a futures position, it is
  - a basis trade.
  - a long-futures position.
  - a short-futures position.
  - a hedged-futures position.
- Which of the following are characteristics specified by a futures contract?
  - Asset quality and asset quantity
  - Delivery arrangements and delivery time
  - I only
  - II only
  - Both I and II
  - Neither I nor II
- An investor enters into a short position in a gold futures contract with the following characteristics:
  - The initial margin is \$3,000.
  - The maintenance margin is \$2,250.
  - The contract price is \$1,300.
  - Each contract controls 100 troy ounces.

If the price drops to \$1,295 at the end of the first day and \$1,290 at the end of the second day, which of the following is closest to the variation margin required at the end of the second day?

  - \$0
  - \$250
  - \$500
  - \$1,000

## MODULE 31.2: FUTURES MARKETS

### Exchanges in Futures Transactions

**LO 31.d: Describe the role of an exchange in futures and over-the-counter market transactions.**

As discussed in previous readings, the exchange guarantees that traders in the futures and over-the-counter (OTC) markets will honor their obligations. The exchange does this by splitting each trade once it is made and acting as the opposite side of each position. The exchange acts as the buyer to every seller and the seller to every buyer. By doing this, the exchange allows either side of the trade to reverse positions at a future date without having to contact the other side of the initial trade. This allows traders to enter the market knowing that they will be able to reverse their position. Traders are also freed from having to worry about the counterparty defaulting since the counterparty is now the exchange.

### Futures Market Quotes

**LO 31.e: Identify the differences between a normal and inverted futures market.**

**LO 31.f: Explain the different market quotes.**

**Futures quotes** can be found from exchanges as well as various online websites. Figure 31.1 contains a subset of gold futures quotes posted on the CME Group website ([www.cmegroup.com](http://www.cmegroup.com)). The first column indicates the maturity month for a given futures contract. Recall that each gold futures contract represents 100 ounces and is priced in U.S. dollars per ounce.

**Figure 31.1: Gold Futures Quotes**

Month	Last Trade	Change	Prior Settlement	Open	High	Low	Volume
Dec-17	1,280.6	+2.9	1,277.7	1,278.0	1,281.8	1,274.9	245,277
Feb-18	1,285.1	+3.0	1,282.1	1,282.8	1,286.1	1,279.4	13,715
Apr-18	1,289.1	+2.8	1,286.3	1,287.4	1,289.7	1,284.0	1,983
Jun-18	1,292.4	+1.8	1,290.6	1,290.4	1,294.1	1,288.2	2,075
Dec-18	1,306.5	+3.1	1,303.4	1,304.1	1,306.5	1,304.1	526

The current trading price of a given futures contract is shown in the second column. The change between the previous day's settlement price and the last trade is reflected in the third column. The settlement price is typically computed as the price right before the end of the previous trading day. This price is used for computing daily gains and losses as well as determining margin requirements.

Figure 31.1 also indicates the opening prices for a given day and the highest and lowest prices during the trading day. As you can see, the December 2017 gold futures contract for this particular day opened at \$1,278/oz., increased to a high of \$1,281.8/oz. and decreased to a low of \$1,274.9/oz. This contract last traded at \$1,280.6/oz., which indicates a change of \$2.9/oz. over the previous day's settlement price.

The last column in Figure 31.1 reflects the trading volume in each futures contract, which is the number of contracts that have been traded on a given day. This amount differs from open interest, discussed earlier, which is the total number of long (or short) positions in a given futures contract. Trading volume could potentially be higher than open interest on any particular day if a large amount of day trading took place, where traders open and close a futures position on the same day.

Figure 31.1 also shows the pattern of futures prices as a function of contract maturity. Depending on the direction of futures settlement prices, the market may be normal or inverted. In this case, gold futures contract prices are moving higher with increasing time horizons. Increasing settlement prices over time would indicate a **normal futures market**. Conversely, decreasing settlement prices over time would indicate an **inverted futures market**.

## The Delivery Process

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**LO 31.g: Describe the mechanics of the delivery process and contrast it with cash settlement.**

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Delivery of the underlying asset occurs very infrequently with futures contracts. The most common way to terminate futures contracts before delivery is to make a reverse or offsetting trade in the futures market.

Now let's assume the short will deliver the goods. When the long [e.g., central counterparty (CCP)] accepts this delivery, the long pays the contract price to the short. This is called **delivery**. The location for delivery (for physical assets), terms of delivery, and details of exactly what is to be delivered are all specified in the **notice of intention to deliver** document. Each exchange has specific rules as to the conditions for making an intent to deliver. However, the price paid or received will be the most recent settlement price. The **first notice day** is the first day when a notice to deliver can be made and the **last notice day** is the last day when it can be made. The **last trading day** is often several days before the last notice day.

In a **cash-settlement contract**, delivery is not an option. The futures account is marked to market based on the settlement price on the last day of trading.

## Types of Trading Orders

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**LO 31.h: Evaluate the impact of different trading order types.**

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There are several different types of orders in the marketplace.

**Market orders** are orders to buy or sell at the best price available. The key problem is that the transaction price may be significantly higher or lower than planned. A **discretionary order** is a market order where the broker has the option to delay transaction in search of a better price.

**Limit orders** are orders to buy or sell away from the current market price. A limit buy order is placed below the current price. A limit sell order is placed above the current price. Limit orders have a time limit, such as instantaneous, one day, one week, one month, or good until canceled. Limit orders are turned over to the specialist by the commission broker.

**Stop-loss orders** are used to prevent losses or to protect profits. Suppose you own a stock currently selling for \$40. You are afraid that it may drop in price, and if it does, you want your broker to sell it, thereby limiting your losses. You would place a stop-loss-sell order at a specific price (e.g., \$35); if the stock price drops to this level, your broker will place a sell market order. A stop-loss-buy order is usually combined with a short sale to limit losses. If the stock price rises to the stop price, the broker enters a market order to buy the stock.

Variations on these order types also exist. **Stop-limit orders** are a combination of a stop and limit order. The stop price and limit price must be specified, so that once the stop level is reached, or bettered, the order would turn into a limit order and hopefully transact at the limit price. **Market-if-touched orders**, or MIT orders, are orders that would become market orders once a specified price is reached in the marketplace.

For those orders that remain outstanding until the designated price range is reached, the trader making the order needs to indicate the time for the order (time-of-day order). **Good-til-canceled (GTC) orders** (a.k.a. **open orders**) are orders that remain open until they either transact or are canceled. A popular method of submitting a limit order is to have it automatically canceled at the end of the trading day in which it was submitted. **Fill-or-kill orders** must be executed immediately or the trade will not take place.

## Marking to Market and Hedge Accounting

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**LO 31.i: Describe the application of marking to market and hedge accounting for futures.**

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Futures contracts are settled daily, therefore, all gains/losses for a given year would be considered realized and, therefore, must be recorded each year (i.e., marked to market). The **mark-to-market process** will most likely increase a firm's earnings volatility.

However, if futures are used to hedge a transaction that will not occur for several years into the future then hedge accounting may apply. In general, **hedge accounting** requires the hedge to be fully documented and for the hedge to be effective (i.e., reasonable economic relationship between hedging instrument and hedged item). Assuming a transaction qualifies for hedge accounting, the accounting rules permit gains and losses from the futures (that would otherwise be reported annually)

to be deferred and reported simultaneously with the gains/losses on the hedged items.

There are corresponding rules for hedges for tax purposes and because the rules may differ significantly between jurisdictions, a given transaction might qualify as a hedge for accounting purposes but not for tax purposes and vice versa.

## Forwards and Futures Contracts

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### LO 31.j: Compare and contrast forward and futures contracts.

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Forward and futures contracts are agreements to purchase or sell an underlying asset at a stated time in the future.

However, forward and futures contracts differ in the following ways:

- Forwards are private (OTC) transactions between two parties; futures are traded on organized exchanges.
- Forwards are customizable to satisfy both parties; futures are standardized for underlying asset, size, and maturity.
- Forwards are bilateral agreements with counterparty risk; futures trade with exchanges and have no counterparty risk.
- It is difficult to offset or cancel a forward contract because trading and liquidity are low; it is easy to offset or cancel futures because the market is active and provides good liquidity.
- Forwards settle at expiration; futures are marked to market and settle daily.



### MODULE QUIZ 31.2

1. Which of the following items are functions of the exchange?
  - I. Determine which contracts trade
  - II. Receive margin deposits from brokers
  - A. I only
  - B. II only
  - C. Both I and II
  - D. Neither I nor II
2. Which of the following types of orders must always be executed?
  - A. Limit orders
  - B. Market-if-touched (MIT) orders
  - C. Stop-limit orders
  - D. Market orders