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# READING ASSIGNMENTS AND LEARNING OBJECTIVES

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*The following material is a review of the Financial Markets and Products principles designed to address the learning objectives set forth by the Global Association of Risk Professionals.*

## READING ASSIGNMENTS

John C. Hull, *Risk Management and Financial Institutions*, 4th Edition (Hoboken, New Jersey: John Wiley & Sons, 2015).

31. "Banks," Chapter 2 (page 1)

32. "Insurance Companies and Pension Plans," Chapter 3 (page 10)

33. "Mutual Funds and Hedge Funds," Chapter 4 (page 24)

John C. Hull, *Options, Futures, and Other Derivatives*, 9th Edition (New York: Pearson Prentice Hall, 2014).

34. "Introduction," Chapter 1 (page 40)

35. "Mechanics of Futures Markets," Chapter 2 (page 56)

36. "Hedging Strategies Using Futures," Chapter 3 (page 68)

37. "Interest Rates," Chapter 4 (page 80)

38. "Determination of Forward and Futures Prices," Chapter 5 (page 96)

39. "Interest Rate Futures," Chapter 6 (page 109)

40. "Swaps," Chapter 7 (page 123)

41. "Mechanics of Options Markets," Chapter 10 (page 140)

42. "Properties of Stock Options," Chapter 11 (page 155)

43. "Trading Strategies Involving Options," Chapter 12 (page 167)

44. "Exotic Options," Chapter 26 (page 183)

Robert McDonald, *Derivatives Markets*, 3rd Edition (Boston: Addison-Wesley, 2013).

45. "Commodity Forwards and Futures," Chapter 6 (page 194)

Jon Gregory, *Central Counterparties: Mandatory Clearing and Bilateral Margin Requirements for OTC Derivatives* (New York: John Wiley & Sons, 2014).

**Book 3****Reading Assignments and Learning Objectives**

46. "Exchanges, OTC Derivatives, DPCs and SPVs," Chapter 2 (page 215)

47. "Basic Principles of Central Clearing," Chapter 3 (page 225)

48. "Risks Caused by CCPs," Chapter 14 (section 14.4 only) (page 236)

Anthony Saunders and Marcia Millon Cornett, *Financial Institutions Management: A Risk Management Approach*, 8th Edition (New York: McGraw-Hill, 2014).

49. "Foreign Exchange Risk," Chapter 13 (page 243)

Frank Fabozzi (editor), *The Handbook of Fixed Income Securities*, 8th Edition (New York: McGraw-Hill, 2012).

50. "Corporate Bonds," Chapter 12 (page 257)

Bruce Tuckman and Angel Serrat, *Fixed Income Securities: Tools for Today's Markets*, 3rd Edition (New York: John Wiley & Sons, 2011).

51. "Mortgages and Mortgage-Backed Securities," Chapter 20 (page 270)

## LEARNING OBJECTIVES

### 31. Banks

1. Identify the major risks faced by a bank. (page 1)
2. Distinguish between economic capital and regulatory capital. (page 2)
3. Explain how deposit insurance gives rise to a moral hazard problem. (page 2)
4. Describe investment banking financing arrangements including private placement, public offering, best efforts, firm commitment, and Dutch auction approaches. (page 3)
5. 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 4)
6. Describe the distinctions between the “banking book” and the “trading book” of a bank. (page 4)
7. Explain the originate-to-distribute model of a bank and discuss its benefits and drawbacks. (page 5)

### 32. Insurance Companies and Pension Plans

1. Describe the key features of the various categories of insurance companies and identify the risks facing insurance companies. (page 10)
2. Describe the use of mortality tables and calculate the premium payment for a policy holder. (page 12)
3. Calculate and interpret loss ratio, expense ratio, combined ratio, and operating ratio for a property-casualty insurance company. (page 15)
4. Describe moral hazard and adverse selection risks facing insurance companies, provide examples of each, and describe how to overcome the problems. (page 15)
5. Distinguish between mortality risk and longevity risk and describe how to hedge these risks. (page 16)
6. Evaluate the capital requirements for life insurance and property-casualty insurance companies. (page 16)
7. Compare the guaranty system and the regulatory requirements for insurance companies with those for banks. (page 17)
8. Describe a defined benefit plan and a defined contribution plan for a pension fund and explain the differences between them. (page 18)

### 33. Mutual Funds and Hedge Funds

1. Differentiate among open-end mutual funds, closed-end mutual funds, and exchange-traded funds (ETFs). (page 24)
2. Calculate the net asset value (NAV) of an open-end mutual fund. (page 28)
3. Explain the key differences between hedge funds and mutual funds. (page 28)
4. 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 29)
5. 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 31)
6. Describe hedge fund performance and explain the effect of measurement biases on performance measurement. (page 34)

**Book 3****Reading Assignments and Learning Objectives****34. Introduction (Options, Futures, and Other Derivatives)**

1. Describe the over-the-counter market, distinguish it from trading on an exchange, and evaluate its advantages and disadvantages. (page 40)
2. Differentiate between options, forwards, and futures contracts. (page 41)
3. Identify and calculate option and forward contract payoffs. (page 41)
4. Calculate and compare the payoffs from hedging strategies involving forward contracts and options. (page 45)
5. Calculate and compare the payoffs from speculative strategies involving futures and options. (page 47)
6. Calculate an arbitrage payoff and describe how arbitrage opportunities are temporary. (page 50)
7. Describe some of the risks that can arise from the use of derivatives. (page 50)

**35. Mechanics of Futures Markets**

1. Define and describe the key features of a futures contract, including the asset, the contract price and size, delivery, and limits. (page 56)
2. Explain the convergence of futures and spot prices. (page 58)
3. Describe the rationale for margin requirements and explain how they work. (page 58)
4. Describe the role of a clearinghouse in futures and over-the-counter market transactions. (page 59)
5. Describe the role of collateralization in the over-the-counter market and compare it to the margining system. (page 60)
6. Identify the differences between a normal and inverted futures market. (page 61)
7. Describe the mechanics of the delivery process and contrast it with cash settlement. (page 61)
8. Evaluate the impact of different trading order types. (page 62)
9. Compare and contrast forward and futures contracts. (page 56)

**36. Hedging Strategies Using Futures**

1. Define and differentiate between short and long hedges and identify their appropriate uses. (page 68)
2. Describe the arguments for and against hedging and the potential impact of hedging on firm profitability. (page 68)
3. Define the basis and explain the various sources of basis risk, and explain how basis risks arise when hedging with futures. (page 69)
4. Define cross hedging, and compute and interpret the minimum variance hedge ratio and hedge effectiveness. (page 69)
5. Compute the optimal number of futures contracts needed to hedge an exposure, and explain and calculate the “tailing the hedge” adjustment. (page 72)
6. Explain how to use stock index futures contracts to change a stock portfolio’s beta. (page 73)
7. Explain the term “rolling the hedge forward” and describe some of the risks that arise from this strategy. (page 74)

**37. Interest Rates**

1. Describe Treasury rates, LIBOR, and repo rates, and explain what is meant by the “risk-free” rate. (page 80)
2. Calculate the value of an investment using different compounding frequencies. (page 81)

3. Convert interest rates based on different compounding frequencies. (page 81)
4. Calculate the theoretical price of a bond using spot rates. (page 82)
5. Derive forward interest rates from a set of spot rates. (page 86)
6. Derive the value of the cash flows from a forward rate agreement (FRA). (page 87)
7. Calculate the duration, modified duration and dollar duration of a bond. (page 88)
8. Evaluate the limitations of duration and explain how convexity addresses some of them. (page 89)
9. Calculate the change in a bond's price given its duration, its convexity, and a change in interest rates. (page 90)
10. Compare and contrast the major theories of the term structure of interest rates. (page 91)

### **38. Determination of Forward and Futures Prices**

1. Differentiate between investment and consumption assets. (page 96)
2. Define short-selling and calculate the net profit of a short sale of a dividend-paying stock. (page 96)
3. Describe the differences between forward and futures contracts and explain the relationship between forward and spot prices. (page 97)
4. Calculate the forward price given the underlying asset's spot price, and describe an arbitrage argument between spot and forward prices. (page 97)
5. Explain the relationship between forward and futures prices. (page 101)
6. Calculate a forward foreign exchange rate using the interest rate parity relationship. (page 100)
7. Define income, storage costs, and convenience yield. (page 102)
8. Calculate the futures price on commodities incorporating income/storage costs and/or convenience yields. (page 102)
9. Calculate, using the cost-of-carry model, forward prices where the underlying asset either does or does not have interim cash flows. (page 97)
10. Describe the various delivery options available in the futures markets and how they can influence futures prices. (page 103)
11. Explain the relationship between current futures prices and expected future spot prices, including the impact of systematic and nonsystematic risk. (page 103)
12. Define and interpret contango and backwardation, and explain how they relate to the cost-of-carry model. (page 104)

### **39. Interest Rate Futures**

1. 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 109)
2. Calculate the conversion of a discount rate to a price for a US Treasury bill. (page 111)
3. 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 110)
4. Explain and calculate a US Treasury bond futures contract conversion factor. (page 112)
5. Calculate the cost of delivering a bond into a Treasury bond futures contract. (page 112)
6. Describe the impact of the level and shape of the yield curve on the cheapest-to-deliver Treasury bond decision. (page 112)
7. Calculate the theoretical futures price for a Treasury bond futures contract. (page 113)

**Book 3****Reading Assignments and Learning Objectives**

8. Calculate the final contract price on a Eurodollar futures contract. (page 115)
9. Describe and compute the Eurodollar futures contract convexity adjustment. (page 115)
10. Explain how Eurodollar futures can be used to extend the LIBOR zero curve. (page 116)
11. Calculate the duration-based hedge ratio and create a duration-based hedging strategy using interest rate futures. (page 116)
12. Explain the limitations of using a duration-based hedging strategy. (page 117)

**40. Swaps**

1. Explain the mechanics of a plain vanilla interest rate swap and compute its cash flows. (page 123)
2. 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 124)
3. Explain the role of financial intermediaries in the swaps market. (page 124)
4. Describe the role of the confirmation in a swap transaction. (page 124)
5. Describe the comparative advantage argument for the existence of interest rate swaps and evaluate some of the criticisms of this argument. (page 125)
6. Explain how the discount rates in a plain vanilla interest rate swap are computed. (page 126)
7. Calculate the value of a plain vanilla interest rate swap based on two simultaneous bond positions. (page 126)
8. Calculate the value of a plain vanilla interest rate swap from a sequence of forward rate agreements (FRAs). (page 128)
9. Explain the mechanics of a currency swap and compute its cash flows. (page 130)
10. Explain how a currency swap can be used to transform an asset or liability and calculate the resulting cash flows. (page 132)
11. Calculate the value of a currency swap based on two simultaneous bond positions. (page 130)
12. Calculate the value of a currency swap based on a sequence of FRAs. (page 131)
13. Describe the credit risk exposure in a swap position. (page 133)
14. Identify and describe other types of swaps, including commodity, volatility and exotic swaps. (page 133)

**41. Mechanics of Options Markets**

1. Describe the types, position variations, and typical underlying assets of options. (page 140)
2. Explain the specification of exchange-traded stock option contracts, including that of nonstandard products. (page 146)
3. Describe how trading, commissions, margin requirements, and exercise typically work for exchange-traded options. (page 148)

**42. Properties of Stock Options**

1. Identify the six factors that affect an option's price and describe how these six factors affect the price for both European and American options. (page 155)
2. Identify and compute upper and lower bounds for option prices on non-dividend and dividend paying stocks. (page 157)
3. Explain put-call parity and apply it to the valuation of European and American stock options. (page 158)
4. Explain the early exercise features of American call and put options. (page 160)

**43. Trading Strategies Involving Options**

1. Explain the motivation to initiate a covered call or a protective put strategy. (page 167)
2. Describe the use and calculate the payoffs of various spread strategies. (page 168)
3. Describe the use and explain the payoff functions of combination strategies. (page 173)

**44. Exotic Options**

1. Define and contrast exotic derivatives and plain vanilla derivatives. (page 183)
2. Describe some of the factors that drive the development of exotic products. (page 183)
3. Explain how any derivative can be converted into a zero-cost product. (page 184)
4. Describe how standard American options can be transformed into nonstandard American options. (page 184)
5. Identify and describe the characteristics and pay-off structure of the following exotic options: gap, forward start, compound, chooser, barrier, binary, lookback, shout, Asian, exchange, rainbow, and basket options. (page 185)
6. Describe and contrast volatility and variance swaps. (page 188)
7. Explain the basic premise of static option replication and how it can be applied to hedging exotic options. (page 189)

**45. Commodity Forwards and Futures**

1. Apply commodity concepts such as storage costs, carry markets, lease rate, and convenience yield. (page 194)
2. Explain the basic equilibrium formula for pricing commodity forwards. (page 194)
3. Describe an arbitrage transaction in commodity forwards, and compute the potential arbitrage profit. (page 196)
4. Define the lease rate and explain how it determines the no-arbitrage values for commodity forwards and futures. (page 199)
5. Define carry markets, and illustrate the impact of storage costs and convenience yields on commodity forward prices and no-arbitrage bounds. (page 201)
6. Compute the forward price of a commodity with storage costs. (page 201)
7. Compare the lease rate with the convenience yield. (page 203)
8. Identify factors that impact gold, corn, electricity, natural gas, and oil forward prices. (page 203)
9. Compute a commodity spread. (page 206)
10. Explain how basis risk can occur when hedging commodity price exposure. (page 206)
11. Evaluate the differences between a strip hedge and a stack hedge and explain how these differences impact risk management. (page 207)
12. Provide examples of cross-hedging, specifically the process of hedging jet fuel with crude oil and using weather derivatives. (page 208)
13. 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 194)

**46. Exchanges, OTC Derivatives, DPCs and SPVs**

1. Describe how exchanges can be used to alleviate counterparty risk. (page 215)
2. Explain the developments in clearing that reduce risk. (page 215)
3. Compare exchange-traded and OTC markets and describe their uses. (page 216)

**Book 3****Reading Assignments and Learning Objectives**

4. Identify the classes of derivatives securities and explain the risk associated with them. (page 217)
5. Identify risks associated with OTC markets and explain how these risks can be mitigated. (page 218)

**47. Basic Principles of Central Clearing**

1. Provide examples of the mechanics of a central counterparty (CCP). (page 225)
2. Describe advantages and disadvantages of central clearing of OTC derivatives. (page 228)
3. Compare margin requirements in centrally cleared and bilateral markets, and explain how margin can mitigate risk. (page 229)
4. Compare and contrast bilateral markets to the use of novation and netting. (page 229)
5. Assess the impact of central clearing on the broader financial markets. (page 230)

**48. Risks Caused by CCPs**

1. Identify and explain the types of risks faced by CCPs. (page 236)
2. Identify and distinguish between the risks to clearing members as well as non-members. (page 238)
3. Identify and evaluate lessons learned from prior CCP failures. (page 239)

**49. Foreign Exchange Risk**

1. Calculate a financial institution's overall foreign exchange exposure. (page 243)
2. Explain how a financial institution could alter its net position exposure to reduce foreign exchange risk. (page 243)
3. Calculate a financial institution's potential dollar gain or loss exposure to a particular currency. (page 243)
4. Identify and describe the different types of foreign exchange trading activities. (page 244)
5. Identify the sources of foreign exchange trading gains and losses. (page 245)
6. Calculate the potential gain or loss from a foreign currency denominated investment. (page 245)
7. Explain balance-sheet hedging with forwards. (page 247)
8. 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 250)
9. Explain why diversification in multicurrency asset-liability positions could reduce portfolio risk. (page 251)
10. Describe the relationship between nominal and real interest rates. (page 251)

**50. Corporate Bonds**

1. Describe a bond indenture and explain the role of the corporate trustee in a bond indenture. (page 257)
2. Explain a bond's maturity date and how it impacts bond retirements. (page 257)
3. Describe the main types of interest payment classifications. (page 258)
4. Describe zero-coupon bonds and explain the relationship between original-issue discount and reinvestment risk. (page 258)
5. Distinguish among the following security types relevant for corporate bonds: mortgage bonds, collateral trust bonds, equipment trust certificates, subordinated and convertible debenture bonds, and guaranteed bonds. (page 259)

6. Describe the mechanisms by which corporate bonds can be retired before maturity.  
(page 261)
7. Differentiate between credit default risk and credit spread risk. (page 262)
8. Describe event risk and explain what may cause it in corporate bonds. (page 263)
9. Define high-yield bonds, and describe types of high-yield bond issuers and some of the payment features unique to high yield bonds. (page 263)
10. Define and differentiate between an issuer default rate and a dollar default rate.  
(page 264)
11. Define recovery rates and describe the relationship between recovery rates and seniority. (page 265)

## 51. Mortgages and Mortgage-Backed Securities

1. Describe the various types of residential mortgage products. (page 270)
2. Calculate a fixed rate mortgage payment, and its principal and interest components.  
(page 273)
3. Describe the mortgage prepayment option and the factors that influence prepayments. (page 276)
4. Summarize the securitization process of mortgage backed securities (MBS), particularly formation of mortgage pools including specific pools and TBAs.  
(page 277)
5. Calculate weighted average coupon, weighted average maturity, and conditional prepayment rate (CPR) for a mortgage pool. (page 277)
6. Describe a dollar roll transaction and how to value a dollar roll. (page 282)
7. Explain prepayment modeling and its four components: refinancing, turnover, defaults, and curtailments. (page 285)
8. Describe the steps in valuing an MBS using Monte Carlo Simulation. (page 287)
9. Define Option Adjusted Spread (OAS), and explain its challenges and its uses.  
(page 290)



The following is a review of the Financial Markets and Products principles designed to address the learning objectives set forth by GARP®. This topic is also covered in:

# BANKS

## Topic 31

### EXAM FOCUS

This topic 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.

### TYPES OF 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

#### LO 31.1: Identify the major risks faced by a bank.

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

- **Credit risk** refers to the risk that borrowers may default on loans or that counterparties to contracts such as derivatives may default on their obligations. One measure of credit risk is a bank's loan losses as a percentage of its assets.

**Topic 31****Cross Reference to GARP Assigned Reading – Hull, Chapter 2**

- 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. Later in this topic, we will distinguish between the "trading book" and the "banking book" of a bank.
- Operational risk refers to the possibility of losses arising from external events or failures of a bank's internal controls. We will describe this risk in greater detail in Book 4, Topic 66.

Regulators in most jurisdictions require banks to hold adequate capital against these risks. Typically, they consider credit risk and operational risk with a time horizon of one year and market risk with a shorter time horizon.

## ECONOMIC CAPITAL VS. REGULATORY CAPITAL

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### LO 31.2: 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 as a percentage of assets is a key measure of capital adequacy. Banks may also issue long-term debt to bolster their capital. This debt is subordinated to the claims of depositors if a bank faces financial distress.

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 amount determined by bank regulators. In terms of bank regulation, equity is referred to as "Tier 1 capital" and subordinated long-term debt is referred to as "Tier 2 capital."



*Professor's Note: Regulations concerning bank capital, such as Basel I, Basel II, and Solvency II, are described in the FRM Part II curriculum.*

**Economic capital** refers to the amount of capital that a bank believes is adequate based on its own risk models. Even if economic capital is less than regulatory capital, as is often the case, a bank must maintain its capital at the regulatory minimum or greater.

## DEPOSIT INSURANCE AND MORAL HAZARD

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### LO 31.3: 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 (as we will cover in the next topic on "Insurance Companies and Pension Plans"), 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 31.4: 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. 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). 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. Each bidder 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. The price at which the last of the shares can be sold becomes the price paid by all successful bidders.

**Topic 31****Cross Reference to GARP Assigned Reading – Hull, Chapter 2**

## POTENTIAL CONFLICTS OF INTEREST

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**LO 31.5: 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 31.6: Describe the distinctions between the "banking book" and the "trading book" of a bank.**

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A bank's financial statements reflect accounting rules that apply to different aspects of its business. Revenue and income from its fee-based activities are recorded using the normal rules of accrual accounting, but other rules apply to its lending and trading activities.

The **banking book** refers to loans made, which are the primary assets of a commercial bank. Normally, the balance sheet value of a loan includes the principal amount to be repaid and accrued interest on the loan. However, for a **nonperforming loan** the value does not include accrued interest. A loan is typically classified as nonperforming if payments are more than 90 days overdue.

A bank will recognize a loss on a loan if it becomes likely that the borrower will not fully repay the principal. Bank financial statements reflect a reserve for loan losses that is determined by management, against which actual loan losses are charged. Increases or

decreases in the loan loss reserve are a potential tool for earnings manipulation, such as smoothing across business cycles, by a bank's management.

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. This is straightforward for items that trade in liquid markets and have readily available prices. For items that lack a liquid market, do not trade frequently, or are complex or custom instruments, marking to market involves estimating a price. Such items are sometimes said to be "marked to model."

## THE ORIGINATE-TO-DISTRIBUTE MODEL

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### LO 31.7: 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 2007–2009.

## KEY CONCEPTS

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### LO 31.1

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.
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### LO 31.2

Regulatory capital is the amount of capital that regulators require a bank to hold. This may include equity, or Tier 1 capital, and long-term subordinated debt, or Tier 2 capital.

Economic capital is the amount of capital a bank believes it needs to hold based on its own models. Regulatory capital is typically greater than economic capital.

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### LO 31.3

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.

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### LO 31.4

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.

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### LO 31.5

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.

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**LO 31.6**

The banking book refers to loans made by a bank. The balance sheet value of a loan includes the principal amount to be repaid and accrued interest, unless the loan becomes nonperforming, in which case the value does not include accrued interest.

The trading book refers to assets and liabilities related to a bank's trading activities. Trading book items are marked to market daily based on actual market prices when they exist or on estimated prices when necessary.

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**LO 31.7**

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.

## CONCEPT CHECKERS

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. private placement.
  - C. best efforts offering.
  - D. 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.

## CONCEPT CHECKER ANSWERS

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.
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.
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.
4. B Chinese walls are internal controls to prevent a banking company's commercial banking, securities, and investment banking operations from sharing information.
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.

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The following is a review of the Financial Markets and Products principles designed to address the learning objectives set forth by GARP®. This topic is also covered in:

# INSURANCE COMPANIES AND PENSION PLANS

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Topic 32

## EXAM FOCUS

The focus of this topic 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. Also, 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.

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## CATEGORIES OF INSURANCE COMPANIES

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**LO 32.1: 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 of time. No payments are made to the policyholder's beneficiaries if the policyholder survives the term of the policy; therefore, payment is not certain. **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 32.2), 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.

## 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. Property insurers may be subject to catastrophic risks arising from many large claims due to natural disasters. Such risks could be managed using geographical, seismographical, 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. Liability insurance is subject to long-tail risk, which is the risk of legitimate claims being submitted years after the insurance coverage has ended. An example could include exposure to cancer-causing substances during the period of coverage but with the symptoms not occurring until years later.

Many property and casualty insurance companies insure a wide variety of risks, which in and of itself is a form of risk diversification. In addition, the expected payouts on claims can be estimated with a high degree of confidence if many policies are written on thousands of independent events. However, 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 pre-existing medical conditions. Some companies provide group health insurance plans through employers that cover both the employee and the employee's dependents.

## 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 period of time.
- *Poor return 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.

**Topic 32****Cross Reference to GARP Assigned Reading – Hull, Chapter 3**

- *Liquidity risk of investments.* Purchasing privately placed fixed-income securities, or publicly traded securities with a thinner market, may result in the inability to easily convert them to cash when most needed to satisfy a surge of claims.
- *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, human error).

**MORTALITY TABLES**

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**LO 32.2: 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 1.

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 1: 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	0.99301	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.

**Topic 32****Cross Reference to GARP Assigned Reading – Hull, Chapter 3**

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 32.3: 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, usually between 60–80% and increasing over time.
- The **expense ratio** for a given year is the percentage of expenses versus premiums generated, usually between 25–30% and decreasing over time. 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 (if applicable).
- The **operating ratio** for a given year is the combined ratio (after dividends) less investment income. 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 32.4: 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. As a result of 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. As a result, 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 pay a fixed percentage of losses, less than 100%, over the deductible amount), 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: (1) greater initial due diligence (e.g., mandatory physical examinations for life insurance, researching driving records for

**Topic 32****Cross Reference to GARP Assigned Reading – Hull, Chapter 3**

automobile insurance) and (2) 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 32.5: 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.

### Hedging Mortality and Longevity Risks

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.

To the extent that there is excessive net exposure to mortality risk, longevity risk, or both, an insurance company may consider **reinsurance contracts**. With this type of contract, the insurance company pays a fee to another insurance company to assume some or all of the risks that were originally insured.

Longevity derivatives are used to hedge longevity risk inherent in annuity contracts and defined benefit pensions. A good 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 32.6: Evaluate the capital requirements for life insurance and property-casualty insurance companies.**

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A life insurance company might have the following summarized balance sheet composition:

- *Assets*: investments (80%), other assets (20%)
- *Liabilities and Equity*: policy reserves (85%), subordinated long-term debt (5%), equity capital (10%)

Under an asset-liability management approach, the life insurance company attempts to equate asset duration with liability duration. There is risk associated with both sides of the

balance sheet. On the asset side, corporate bonds comprise the bulk of the investments, so there is credit risk assumed. On the liability side, the policy reserves represent the present value of the future payouts as determined by actuaries. The risk is that the policy reserves are set too low if life insurance policyholders die too soon or annuity holders live too long. Equity capital represents contributed capital plus retained earnings and serves as a protection barrier if payouts are larger than loss reserves.

A P&C insurance company might have the following summarized balance sheet composition:

- *Assets*: investments (80%), other assets (20%)
- *Liabilities and Equity*: policy reserves (50%), unearned premiums (10%), subordinated long-term debt (5%), equity capital (35%)

On the asset side, the investments typically comprise of highly liquid bonds with shorter maturities than those used by life insurance companies. On the liability side, the unearned premiums represent prepaid insurance contracts whereby amounts are received but the coverage applies to future time periods; unearned premiums do not generally exist for life insurance companies. Finally, there is substantially more equity capital for a P&C insurance company than for a life insurance company. This is due to the highly unpredictable nature of claims (both timing and amount) for P&C insurance contracts.

## GUARANTY SYSTEM FOR INSURANCE COMPANIES

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### LO 32.7: 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 small policyholders of the insolvent company. In some cases, an annual limit may apply with regard to the contribution, which may contribute to a delay in accumulating sufficient funds to pay all of the policyholders. Most frequently, the policyholders of insolvent life insurance companies are transferred to other life insurance companies.

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.

**Topic 32****Cross Reference to GARP Assigned Reading – Hull, Chapter 3**

## PENSION FUNDS

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**LO 32.8: 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 for the remainder of her life.

**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 of time. 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). Additionally, some defined benefit plans may include one or more of the following features: (1) indexation of pension amounts to account for inflation, (2) continued pension payments (likely on a reduced basis) to the surviving spouse upon the death of a retired employee, or (3) a lump sum payment to an employee's dependents upon the death of a currently active 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. 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.

## KEY CONCEPTS

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### LO 32.1

Three categories of insurance companies include life insurance, nonlife [property and casualty (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 of time. Whole (permanent) life insurance provides a specified amount of insurance coverage for the life of the policyholder.

Risks facing insurance companies include: (1) insufficient funds to satisfy policyholders' claims, (2) poor return on investments, (3) liquidity risk of investments, (4) credit risk, and (5) operational risk.

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### LO 32.2

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.

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### LO 32.3

P&C insurance companies compute the following ratios:

$$\text{loss ratio} + \text{expense ratio} = \text{combined ratio}$$

$$\text{combined ratio} + \text{dividends} = \text{combined ratio after dividends}$$

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

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### LO 32.4

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.

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### LO 32.5

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

**Topic 32****Cross Reference to GARP Assigned Reading – Hull, Chapter 3**

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. Other forms of hedging include reinsurance contracts with other insurance companies and longevity derivatives.

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**LO 32.6**

Under an asset-liability management approach, the life insurance company attempts to equate asset duration with liability duration. There is risk associated with both sides of the balance sheet. Equity capital represents contributed capital plus retained earnings and serves as a protection barrier if payouts are larger than loss reserves.

For P&C insurance companies, assets typically comprise of highly liquid bonds with shorter maturities than those used by life insurance companies. On the liability side, there are unearned premiums (non-existent with life insurance companies) that represent prepaid insurance contracts whereby amounts are received but the coverage applies to future time periods. Finally, there is substantially more equity capital than for a life insurance company because of the highly unpredictable nature of claims for P&C insurance contracts.

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**LO 32.7**

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 Federal Deposit Insurance Corporation (FDIC). No such permanent fund exists for insurance companies.

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**LO 32.8**

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 of time. 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.

## CONCEPT CHECKERS

1. Which of the following forms of insurance is most likely subject to long-tail risk?
  - A. Health insurance.
  - B. Life insurance.
  - C. Liability insurance.
  - D. Property insurance.
  
2. 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 1 on page 13), 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.
  
3. 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%.
  
4. 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. Catastrophic risk.
  - C. Longevity risk.
  - D. Moral hazard.
  
5. 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. Unearned premiums can be found on the balance sheets of both life insurance and property and casualty insurance companies.
  - D. The amount of equity on the balance sheet of a life insurance company is typically lower than that of a property and casualty insurance company.

## CONCEPT CHECKER ANSWERS

1. C Liability insurance is subject to long-tail risk, which is the risk of legitimate claims being submitted years after the insurance coverage has ended. An example could include exposure to cancer-causing substances during the period of coverage but with the symptoms not occurring until years later.
2. 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  $(1 - 0.002092) \times 0.002224 = 0.0022353$ , 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.

3. B The operating ratio is computed as follows:

$$\begin{aligned} \text{loss ratio (74\%)} &+ \text{expense ratio (23\%)} + \text{dividends (2\%)} - \text{investment income (5\%)} \\ &= 94\% \end{aligned}$$

The combined ratio is computed as follows:

$$\text{loss ratio (74\%)} + \text{expense ratio (23\%)} = 97\%$$

The combined ratio after dividends is computed as follows:

$$\text{loss ratio (74\%)} + \text{expense ratio (23\%)} + \text{dividends (2\%)} = 99\%$$

4. 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 prior to providing coverage.
5. 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 property and casualty insurance company's balance sheet, there are unearned premiums that represent prepaid insurance contracts whereby amounts are received but the coverage applies to future time periods. Unearned premiums do not exist with life insurance companies.