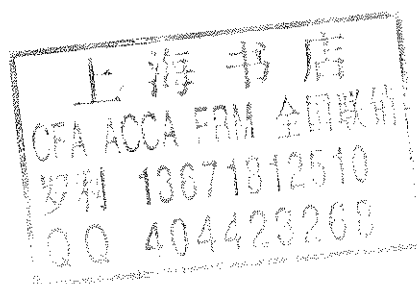


BOOK 5 – FIXED INCOME, DERIVATIVE, AND ALTERNATIVE INVESTMENTS

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READINGS AND LEARNING OUTCOME STATEMENTS

READINGS

The following material is a review of the Fixed Income, Derivative, and Alternative Investments principles designed to address the learning outcome statements set forth by CFA Institute.

STUDY SESSION 15

Reading Assignments

Fixed Income Analysis for the Chartered Financial Analyst® Program, 2nd edition, Frank J. Fabozzi (Frank J. Fabozzi Associates, 2004)

- | | |
|---|---------|
| 65. "Features of Debt Securities," Ch. 1 | page 11 |
| 66. "Risks Associated with Investing in Bonds," Ch. 2 | page 22 |
| 67. "Overview of Bond Sectors and Instruments," Ch. 3 | page 38 |
| 68. "Understanding Yield Spreads," Ch. 4 | page 54 |

Launching Workshop of the ECB-CFS Research Network on "Capital Markets and Financial Integration in Europe," Otmar Issing, Frankfurt am Main (29 April 2002)

- | | |
|---|---------|
| 69. "Monetary Policy in an Environment of Global Financial Markets" | page 68 |
|---|---------|

STUDY SESSION 16

Reading Assignments

Fixed Income Analysis for the Chartered Financial Analyst® Program, 2nd edition, Frank J. Fabozzi (Frank J. Fabozzi Associates, 2004)

- | | |
|--|----------|
| 70. "Introduction to the Valuation of Debt Securities," Ch. 5 | page 73 |
| 71. "Yield Measures, Spot Rates, and Forward Rates," Ch. 6 | page 84 |
| 72. "Introduction to the Measurement of Interest Rate Risk," Ch. 7 | page 111 |

STUDY SESSION 17

Reading Assignments

Analysis of Derivatives for the CFA® Program, Don Chance (AIMR, 2003)

- | | |
|---|----------|
| 73. "Derivative Markets and Instruments," Ch. 1 | page 130 |
| 74. "Forward Markets and Contracts," Ch. 2, pp. 25–37 | page 135 |
| 75. "Futures Markets and Contracts," Ch. 3, pp. 81–103 | page 146 |
| 76. "Option Markets and Contracts," Ch. 4, pp. 159–194 | page 156 |
| 77. "Swap Markets and Contracts," Ch. 5, pp. 269–285 | page 178 |
| 78. "Risk Management Applications of Option Strategies," Ch. 7, pp. 411–429 | page 190 |

STUDY SESSION 18

Reading Assignments

International Investments, 5th edition, Bruno Solnik and Dennis McLeavey (AIMR, 2004)

- | | |
|--------------------------------------|----------|
| 79. "Alternative Investments," Ch. 8 | page 200 |
|--------------------------------------|----------|

LEARNING OUTCOME STATEMENTS (LOS)

The CFA Institute Learning Outcome Statements are listed below. These are repeated in each topic review; however, the order may have been changed in order to get a better fit with the flow of the review.

STUDY SESSION 15

The topical coverage corresponds with the following CFA Institute assigned reading:

65. "Features of Debt Securities"

The candidate should be able to:

- a. explain the purposes of a bond's indenture, and describe affirmative and negative covenants. (page 11)
- b. describe the basic features of a bond (e.g., maturity, par value, coupon rate), the various coupon rate structures (e.g., zero-coupon bonds, step-up notes, deferred coupon bonds, floating-rate securities), the structure of floating-rate securities (i.e., the coupon formula, caps and floors), and interest payment and price definitions (e.g., accrued interest, full price, and clean price). (page 11)
- c. describe the provisions for redeeming bonds, including the distinction between a nonamortizing bond and an amortizing bond. (page 13)
- d. explain the provisions for early retirement of debt (e.g., call and refunding provisions, prepayment options, and sinking fund provisions) and differentiate between a regular redemption price and a special redemption price. (page 13)
- e. identify the various options embedded in a bond issue (call option, prepayment option, accelerated sinking fund option, put option and conversion option), the importance of understanding embedded options, and whether such options benefit the issuer or the bondholder. (page 14)
- f. describe methods used by institutional investors in the bond market to finance the purchase of a security (i.e., margin buying and repurchase agreements). (page 15)

The topical coverage corresponds with the following CFA Institute assigned reading:

66. "Risks Associated with Investing in Bonds"

The candidate should be able to:

- a. explain the risks associated with investing in bonds (e.g., interest rate risk, yield curve risk, call and prepayment risk, reinvestment risk, credit risk, liquidity risk, exchange-rate risk, inflation risk, volatility risk, event risk, and sovereign risk). (page 22)
- b. identify the relationships among a bond's coupon rate, the yield required by the market, and the bond's price relative to par value (i.e., discount, premium, or equal to par). (page 23)
- c. explain how features of a bond (e.g., maturity, coupon, and embedded options) and the level of a bond's yield affect the bond's interest rate risk. (page 24)
- d. identify the relationship among the price of a callable bond, the price of an option-free bond, and the price of the embedded call option. (page 25)
- e. explain the interest rate risk of a floating-rate security and why such a security's price may differ from par value. (page 26)
- f. compute and interpret the duration of a bond, given the bond's change in price when interest rates change, and compute the approximate percentage price change of a bond and new price of a bond, given the duration and change in yield. (page 26)
- g. describe yield curve risk and explain why duration does not account for yield curve risk for a portfolio of bonds. (page 28)
- h. explain the disadvantages of a callable or prepayable security to an investor. (page 29)

- i. identify the factors that affect the reinvestment risk of a security and explain why prepayable amortizing securities expose investors to greater reinvestment risk than nonamortizing securities. (page 29)
- j. describe the various forms of credit risk (i.e., default risk, credit spread risk, downgrade risk) and describe the meaning and role of credit ratings. (page 29)
- k. explain why liquidity risk might be important to investors even if they expect to hold a security to the maturity date. (page 30)
- l. describe the exchange rate risk an investor faces when a bond makes payments in a foreign currency. (page 31)
- m. explain inflation risk. (page 31)
- n. explain how yield volatility affects the price of a bond with an embedded option and how changes in volatility affect the value of a callable bond and a puttable bond. (page 31)
- o. describe the various forms of event risk (e.g., natural catastrophe, corporate takeover/restructuring and regulatory risk). (page 32)

The topical coverage corresponds with the following CFA Institute assigned reading:

67. "Overview of Bond Sectors and Instruments"

The candidate should be able to:

- a. explain how a country's bond market sectors are classified, including the distinguishing characteristics of internal and external bonds. (page 38)
- b. describe the features, credit risk characteristics and distribution methods for government securities. (page 38)
- c. describe the types of securities issued by the U.S. Department of the Treasury (e.g., bills, notes, bonds, and inflation protection securities), and distinguish between on-the-run and off-the-run Treasury securities. (page 39)
- d. describe how stripped Treasury securities are created and distinguish between coupon strips and principal strips. (page 40)
- e. describe the types and characteristics of securities issued by U.S. federal agencies. (page 41)
- f. describe mortgage-backed securities (including mortgage passthrough securities, collateralized mortgage obligations, and stripped MBS), and explain the cash flows, prepayments and prepayment risk for each. (page 41)
- g. state the motivation for creating a collateralized mortgage obligation. (page 43)
- h. describe the types of securities issued by municipalities in the United States, and distinguish between tax-backed debt and revenue bonds. (page 43)
- i. describe the characteristics and motivation for the various types of debt used by corporations (including corporate bonds, medium-term notes, structured notes, commercial paper, negotiable CDs and bankers acceptances). (page 44)
- j. define an asset-backed security, describe the role of a special purpose vehicle in an asset-backed securities transaction, state the motivation for a corporation to issue an asset-backed security, and describe the types of external credit enhancements for asset-backed securities. (page 48)
- k. describe collateralized debt obligations. (page 48)
- l. describe the structures of the primary and secondary markets in bonds. (page 49)

The topical coverage corresponds with the following CFA Institute assigned reading:

68. "Understanding Yield Spreads"

The candidate should be able to:

- a. identify the interest rate policy tools available to the U.S. Federal Reserve Board. (page 54)
- b. describe the Treasury yield curve and the various shapes of the yield curve. (page 54)

- c. explain the basic theories of the term structure of interest rates (i.e., pure expectations theory, liquidity preference theory, and market segmentation theory) and describe the implications of each theory for the shape of the yield curve. (page 55)
- d. define a Treasury spot rate. (page 58)
- e. explain the different types of yield spread measures (e.g., absolute yield spread, relative yield spread, yield ratio), compute yield spread measures given the yields for two securities, and explain why investors may find a relative yield spread to be a better measure of yield spread than the absolute yield spread. (page 59)
- f. describe a credit spread and discuss the suggested relationship between credit spreads and the economic well being of the economy. (page 60)
- g. identify how embedded options affect yield spreads. (page 60)
- h. explain how the liquidity or issue-size of a bond affects its yield spread relative to risk-free securities and relative to other issues that are comparable in all other ways except for liquidity. (page 60)
- i. compute the after-tax yield of a taxable security and the tax-equivalent yield of a tax-exempt security. (page 60)
- j. define LIBOR and explain why it is an important measure to funded investors who borrow short-term. (page 61)

The topical coverage corresponds with the following CFA Institute assigned reading:

69. **"Monetary Policy in an Environment of Global Financial Markets"**

The candidate should be able to:

- a. identify how central bank behavior affects financial markets, including the role of short-term interest rates, systemic liquidity and market expectations. (page 68)
- b. describe the importance of communication between a central bank and the financial markets. (page 68)
- c. discuss the importance of predictability, credibility, and transparency of monetary policy, measures of predictability, and the problem of information asymmetry. (page 69)

STUDY SESSION 16

The topical coverage corresponds with the following CFA Institute assigned reading:

70. **"Introduction to the Valuation of Debt Securities"**

The candidate should be able to:

- a. explain the steps in the bond valuation process (i.e., estimate expected cash flows, determine an appropriate discount rate or rates, and compute the present value of the cash flows). (page 73)
- b. identify the types of bonds for which estimating the expected cash flows is difficult, and explain the problems encountered when estimating the cash flows for these bonds. (page 73)
- c. compute the value of a bond, given the expected annual or semiannual cash flows and the appropriate single (constant) discount rate, explain how the value of a bond changes if the discount rate increases or decreases, and compute the change in value that is attributable to the rate change. (page 74)
- d. explain how the price of a bond changes as the bond approaches its maturity date, and compute the change in value that is attributable to the passage of time. (page 76)
- e. compute the value of a zero-coupon bond. (page 77)
- f. explain the arbitrage-free valuation approach and the market process that forces the price of a bond toward its arbitrage-free value, and explain how a dealer could generate an arbitrage profit if a bond is mispriced. (page 78)

71. *The topical coverage corresponds with the following CFA Institute assigned reading:*
“Yield Measures, Spot Rates, and Forward Rates”

The candidate should be able to:

- a. explain the sources of return from investing in a bond (i.e., coupon interest payments, capital gain/loss, reinvestment income). (page 84)
- b. compute and interpret the traditional yield measures for fixed-rate bonds (e.g., current yield, yield to maturity, yield to first call, yield to first par call date, yield to refunding, yield to put, yield to worst, cash flow yield) and explain the assumptions underlying traditional yield measures and the limitations of the traditional yield measures. (page 84)
- c. explain the importance of reinvestment income in generating the yield computed at the time of purchase, calculate the amount of income required to generate that yield, and discuss the factors that affect reinvestment risk. (page 90)
- d. compute and interpret the bond equivalent yield of an annual-pay bond, and the annual-pay yield of a semiannual-pay bond. (page 91)
- e. describe the methodology for computing the theoretical Treasury spot rate curve and compute the value of a bond using spot rates. (page 91)
- f. distinguish between the nominal spread and the zero-volatility spread and explain the limitations of the nominal spread. (page 95)
- g. explain an option-adjusted spread for a bond with an embedded option and explain the option cost. (page 96)
- h. define a forward rate, and compute spot rates from forward rates and forward rates from spot rates. (page 97)
- i. compute the value of a bond using forward rates. (page 100)

72. *The topical coverage corresponds with the following CFA Institute assigned reading:*
“Introduction to the Measurement of Interest Rate Risk”

The candidate should be able to:

- a. distinguish between the full valuation approach (the scenario analysis approach) and the duration/convexity approach for measuring interest rate risk, and explain the advantage of using the full valuation approach. (page 111)
- b. describe the price volatility characteristics for option-free, callable, prepayable, and putable bonds when interest rates change (including the concepts of “positive convexity” and “negative convexity”). (page 113)
- c. compute and interpret the effective duration of a bond, given information about how the bond's price will increase and decrease for given changes in interest rates, and compute the approximate percentage price change for a bond, given the bond's effective duration and a specified change in yield. (page 115)
- d. distinguish among the alternative definitions of duration (modified, effective or option-adjusted, and Macaulay), and explain why effective duration is the most appropriate measure of interest rate risk for bonds with embedded options. (page 117)
- e. compute the duration of a portfolio, given the duration of the bonds comprising the portfolio, and identify the limitations of portfolio duration. (page 119)
- f. describe the convexity measure of a bond and estimate a bond's percentage price change, given the bond's duration and convexity and a specified change in interest rates. (page 119)
- g. distinguish between modified convexity and effective convexity. (page 121)
- h. compute the price value of a basis point (PVBP), and explain its relationship to duration. (page 121)

STUDY SESSION 17

The topical coverage corresponds with the following CFA Institute assigned reading:

73. "Derivative Markets and Instruments"

The candidate should be able to:

- define a derivative and differentiate between exchange-traded and over-the-counter derivatives. (page 130)
- define a forward commitment, identify the types of forward commitments, and describe the basic characteristics of forward contracts, futures contracts, options (calls and puts), and swaps. (page 130)
- discuss the purposes and criticisms of derivative markets. (page 131)
- explain the concept of arbitrage and the role it plays in determining prices and in promoting market efficiency. (page 131)

The topical coverage corresponds with the following CFA Institute assigned reading:

74. "Forward Markets and Contracts"

The candidate should be able to:

- discuss the differences between the positions held by the long and short parties to a forward contract in terms of delivery/settlement and default risk. (page 135)
- describe the procedures for settling a forward contract at expiration, and discuss how a party to a forward contract can terminate a position prior to expiration as well as how credit risk is affected by the way in which a position is terminated. (page 136)
- differentiate between a dealer and an end user of a forward contract. (page 137)
- describe the characteristics of equity forward contracts and forward contracts on zero-coupon and coupon bonds. (page 137)
- explain the characteristics of the Eurodollar time deposit market, define LIBOR and Euribor, and describe the characteristics of forward rate agreements (FRAs). (page 139)
- calculate and interpret the payment at expiration of an FRA and explain each of the component terms, when provided with the formula. (page 139)
- describe the characteristics of currency forward contracts. (page 141)

The topical coverage corresponds with the following CFA Institute assigned reading:

75. "Futures Markets and Contracts"

The candidate should be able to:

- identify the institutional features that distinguish futures contracts from forward contracts and describe the characteristics of futures contracts. (page 146)
- differentiate between margin in the securities markets and margin in the futures markets; and define initial margin, maintenance margin, variation margin, and settlement price. (page 147)
- describe how a futures trade takes place. (page 148)
- describe price limits and the process of marking to market and compute and interpret the margin balance, given the previous day's balance and the new futures price. (page 148)
- describe how a futures contract can be terminated by a close-out (i.e., offset) at expiration (or prior to expiration), delivery, an equivalent cash settlement, or an exchange-for-physicals. (page 149)
- describe the characteristics of the following types of futures contracts: Eurodollar, Treasury bond, stock index, and currency. (page 150)

The topical coverage corresponds with the following CFA Institute assigned reading:

76. "Option Markets and Contracts"

The candidate should be able to:

- a. define European option, American option, moneyness, payoff, intrinsic value, and time value and differentiate between exchange-traded options and over-the-counter options. (page 157)
- b. identify the different types of options in terms of the underlying instruments. (page 161)
- c. compare and contrast interest rate options to forward rate agreements (FRAs). (page 161)
- d. explain how option payoffs are determined, and show how interest rate option payoffs differ from the payoffs of other types of options. (page 162)
- e. define interest rate caps and floors. (page 163)
- f. identify the minimum and maximum values of European options and American options; calculate and interpret the lowest prices of European and American calls and puts based on the rules for minimum values and lower bounds. (page 164)
- g. describe the relationship between options that differ only by exercise price. (page 168)
- h. explain how option prices are affected by the time to expiration of the option. (page 169)
- i. explain put-call parity for European options, given the payoffs on a fiduciary call and a protective put. (page 169)
- j. explain the relationship between American options and European options in terms of the lower bounds on option prices and the possibility of early exercise. (page 171)
- k. explain how cash flows on the underlying asset affect put-call parity and the lower bounds of option prices. (page 171)
- l. identify the directional effect of an interest rate change or volatility change on an option's price. (page 171)

The topical coverage corresponds with the following CFA Institute assigned reading:

77. "Swap Markets and Contracts"

The candidate should be able to:

- a. describe the characteristics of swap contracts and explain how swaps are terminated. (page 179)
- b. define and give examples of currency swaps, plain vanilla interest rate swaps, and equity swaps, and calculate and interpret the payments on each, when provided with the formulas. (page 180)

The topical coverage corresponds with the following CFA Institute assigned reading:

78. "Risk Management Applications of Option Strategies"

The candidate should be able to:

- a. determine the value at expiration, profit, maximum profit, maximum loss, breakeven underlying price at expiration, and general shape of the graph of the strategies of buying and selling calls and buying and selling puts, and explain each strategy's characteristics. (page 190)
- b. determine the value at expiration, profit, maximum profit, maximum loss, breakeven underlying price at expiration, and general shape of the graph of the covered call strategy and the protective put strategy, and explain each strategy's characteristics. (page 193)

STUDY SESSION 18

The topical coverage corresponds with the following CFA Institute assigned reading:

79. "Alternative Investments"

The candidate should be able to:

- a. distinguish between an open end and a closed end fund. (page 200)
- b. explain how the net asset value of a fund is calculated. (page 200)
- c. explain the nature of various fees charged by investment companies. (page 201)
- d. distinguish among style, sector, index, global, and stable value strategies in equity investment. (page 202)
- e. distinguish among exchange traded funds (ETFs), traditional mutual funds, and closed end funds. (page 202)

- f. explain the advantages and risks of ETFs. (page 203)
- g. describe the forms of real estate investment and explain their characteristics as an investable asset class. (page 204)
- h. describe the various approaches to the valuation of real estate. (page 205)
- i. calculate the net operating income (NOI) from a real estate investment. (page 205)
- j. calculate the value of a property using the sales comparison and income approaches. (page 206)
- k. calculate the after-tax cash flows, net present value, and yield of a real estate investment. (page 207)
- l. explain the various stages in venture capital investing. (page 207)
- m. discuss venture capital investment characteristics and the challenges to venture capital valuation and performance measurement. (page 208)
- n. calculate the net present value (NPV) of a venture capital project, given the project's possible payoff and conditional failure probabilities. (page 209)
- o. discuss the descriptive accuracy of the term "hedge fund," define hedge fund in terms of objectives, legal structure, and fee structure, and describe the various classifications of hedge funds. (page 209)
- p. discuss the benefits and drawbacks to fund of funds investing. (page 210)
- q. discuss the leverage and unique risks of hedge funds. (page 210)
- r. discuss the performance of hedge funds, the biases present in hedge fund performance measurement, and explain the effect of survivorship bias on the reported return and risk measures for a hedge fund data base. (page 211)
- s. explain how the legal environment affects the valuation of closely held companies. (page 212)
- t. describe alternative valuation methods for closely held companies and distinguish among the bases for the discounts and premiums for these companies. (page 212)
- u. discuss distressed securities investing and the similarities between venture capital investing and distressed securities investing. (page 213)
- v. discuss the role of commodities as a vehicle for investing in production and consumption. (page 213)
- w. discuss the motivation for investing in commodities, commodities derivatives, and commodity-linked securities. (page 213)
- x. discuss the sources of return on a collateralized commodity futures position. (page 214)

FEATURES OF DEBT SECURITIES

Study Session 15

EXAM FOCUS

Fixed income securities, historically, were promises to pay a stream of semiannual payments for a given number of years and then repay the loan amount at the maturity date. The contract between the borrower and the lender (the indenture) can really be designed to have any payment stream or pattern that the parties agree to. Types of contracts that are used frequently have specific names, and there is no shortage of those (for you to learn) here.

You should pay special attention to how the periodic payments are determined (fixed, floating, and variants of these) and to how/when the principal is repaid (calls, puts, sinking funds, amortization, and prepayments). These features all affect the value of the securities and will come up again when you learn how to value these securities and compare their risks, both at Level 1 and Level 2.

LOS 65.a: Explain the purposes of a bond's indenture, and describe affirmative and negative covenants.

The contract that specifies all the rights and obligations of the issuer and the owners of a fixed income security is called the **bond indenture**. The indenture defines the obligations of and restrictions on the borrower and forms the basis for all future transactions between the bondholder and the issuer. These contract provisions are known as *covenants* and include both *negative covenants* (prohibitions on the borrower) and *affirmative covenants* (actions that the borrower promises to perform) sections.

Negative covenants include restrictions on asset sales (the company can't sell assets that have been pledged as collateral), negative pledge of collateral (the company can't claim that the same assets back several debt issues simultaneously), and restrictions on additional borrowings (the company can't borrow additional money unless certain financial conditions are met).

Affirmative covenants include the maintenance of certain financial ratios and the timely payment of principal and interest. For example, the borrower might promise to maintain the company's current ratio at a value of two or higher. If this value of the current ratio is not maintained, then the bonds could be considered to be in (technical) default.

LOS 65.b: Describe the basic features of a bond (e.g., maturity, par value, coupon rate), the various coupon rate structures (e.g., zero-coupon bonds, step-up notes, deferred coupon bonds, floating-rate securities), the structure of floating-rate securities (i.e., the coupon formula, caps and floors), and interest payment and price definitions (e.g., accrued interest, full price, and clean price).

A "straight" (option-free) bond is the simplest case. Consider a Treasury bond that has a 6% coupon and matures five years from today in the amount of \$1,000. This bond is a promise by the issuer (the U.S. Treasury) to pay 6% of the \$1,000 par value (i.e., \$60) each year for five years and to repay the \$1,000 five years from today.

With Treasury bonds and almost all U.S. corporate bonds, the annual interest is paid in two semiannual installments. Therefore, this bond will make nine coupon payments (one every six months) of \$30 and a final payment of \$1,030 (the par value plus the final coupon payment) at the end of five years. This stream of payments is fixed when the bonds are issued and does not change over the life of the bond.

Note that each semiannual coupon is one-half the coupon rate (which is always expressed as an annual rate) times the par value, which is sometimes called the *face value* or *maturity value*. An 8% Treasury note with a face value of \$100,000 will make a coupon payment of \$4,000 every six months and a final payment of \$104,000 at maturity.

A U.S. Treasury bond is denominated (of course) in U.S. dollars. Bonds can be issued in other currencies as well. The currency denomination of a bond issued by the Mexican government will likely be Mexican pesos. Bonds can be issued that promise to make payments in any currency.

Coupon Rate Structures: Zero-Coupon Bonds, Step-Up Notes, Deferred Coupon Bonds

Zero-coupon bonds are bonds that do not pay periodic interest. They pay the par value at maturity and the interest results from the fact that zero-coupon bonds are initially sold at a price below par value (i.e., they are sold at a significant *discount to par value*). Sometimes we will call debt securities with no explicit interest payments *pure discount securities*.

Accrual bonds are similar to zero-coupon bonds in that they make no periodic interest payments prior to maturity, but different in that they are sold originally at (or close to) par value. There is a stated coupon rate, but the coupon interest accrues (builds up) at a compound rate until maturity. At maturity, the par value, plus all of the interest that has accrued over the life of the bond, is paid.

Step-up notes have coupon rates that increase over time at a specified rate. The increase may take place once or more during the life of the issue.

Deferred-coupon bonds carry coupons, but the initial coupon payments are deferred for some period. The coupon payments accrue, at a compound rate, over the deferral period and are paid as a lump sum at the end of that period. After the initial deferment period has passed, these bonds pay regular coupon interest for the rest of the life of the issue (to maturity).

Floating-Rate Securities

Floating-rate securities are bonds for which the coupon interest payments over the life of the security vary based on a specified interest rate or index. For example, if market interest rates are moving up, the coupons on straight floaters will rise as well. In essence, these bonds have coupons that are reset periodically (normally every 3, 6, or 12 months) based on prevailing market interest rates.

The most common procedure for setting the coupon rates on floating-rate securities is one which starts with a *reference rate* (such as the rate on certain U.S. Treasury securities or the London Interbank Offered Rate [LIBOR]) and then adds or subtracts a stated *margin* to or from that reference rate. The quoted margin may also vary over time according to a schedule that is stated in the indenture. The schedule is often referred to as the *coupon formula*. Thus, to find the new coupon rate, you would use the following coupon formula:

$$\text{new coupon rate} = \text{reference rate} \pm \text{quoted margin}$$

Just as with a fixed-coupon bond, a semiannual coupon payment will be one-half the (annual) coupon rate.

Caps and floors. The parties to the bond contract can limit their exposure to extreme fluctuations in the reference rate by placing upper and lower limits on the coupon rate. The upper limit, which is called a *cap*, puts a *maximum* on the interest rate paid by the borrower/issuer. The lower limit, called a *floor*, puts a minimum on the periodic coupon interest payments received by the lender/security owner. When both limits are present simultaneously, the combination is called a *collar*.

Consider a floating-rate security (floater) with a coupon rate at issuance of 5%, a 7% cap, and a 3% floor. If the coupon rate (reference rate plus the margin) rises above 7%, the borrower will pay (lender will receive) only 7%

for as long as the coupon rate, according to the formula, remains at or above 7%. If the coupon rate falls below 3%, the borrower will pay 3% for as long as the coupon rate, according to the formula, remains at or below 3%.

Accrued Interest, Full Price, and Clean Price

When a bond trades between coupon dates, the seller is entitled to receive any interest earned from the previous coupon date through the date of the sale. This is known as *accrued interest* and is an amount that is payable by the buyer (new owner) of the bond. The new owner of the bond will receive *all of the next coupon payment* and will then recover any accrued interest paid on the date of purchase. The accrued interest is calculated as the fraction of the coupon period that has passed times the coupon.

In the U.S., the convention is for the bond buyer to pay any accrued interest to the bond seller. The amount that the buyer pays to the seller is the agreed-upon price of the bond (the *clean price*) *plus any accrued interest*. In the U.S., bonds trade with the next coupon attached, which is termed *cum coupon*. A bond traded without the right to the next coupon is said to be trading *ex-coupon*. The total amount paid, including accrued interest, is known as the *full (or dirty) price* of the bond. The full price = clean price + accrued interest.

If the issuer of the bond is in default (i.e., has not made periodic obligatory coupon payments), the bond will trade without accrued interest, and it is said to be trading *flat*.

LOS 65.c: Describe the provisions for redeeming bonds, including the distinction between a nonamortizing bond and an amortizing bond.

The redemption provisions for a bond refer to how, when, and under what circumstances the principal will be repaid.

Coupon Treasury bonds and most corporate bonds are **nonamortizing**; that is, they pay only interest until maturity, at which time the entire par or face value is repaid. This repayment structure is referred to as a “bullet bond” or “bullet maturity.” Alternatively, the bond terms may specify that the principal be repaid through a series of payments over time or all at once prior to maturity, at the option of either the bondholder or the issuer (putable and callable bonds).

Amortizing securities make periodic *interest and principal* payments over the life of the bond. A conventional mortgage is an example of an amortizing loan; the payments are all equal, and each payment consists of the periodic interest payment and the repayment of a portion of the original principal. For a fully amortizing loan, the final (level) payment at maturity retires the last remaining principal on the loan (e.g., a typical automobile loan).

LOS 65.d: Explain the provisions for early retirement of debt (e.g., call and refunding provisions, prepayment options, and sinking fund provisions) and differentiate between a regular redemption price and a special redemption price.

Prepayment options give the issuer/borrower the right to accelerate the principal repayment on a loan. These options are present in mortgages and other *amortizing loans*, such as automobile loans. Amortizing loans require a series of equal payments that cover the periodic interest and reduce the outstanding principal each time a payment is made. When a person gets a home mortgage or an automobile loan, she often has the right to prepay it at any time, in whole or in part. If the borrower sells the home or auto, she is required to pay the loan off in full. The significance of a prepayment option to an investor in a mortgage or mortgage-backed security is that there is additional uncertainty about the cash flows to be received compared to a security that does not permit prepayment.

Call provisions give the issuer the right (but not the obligation) to retire all or a part of an issue prior to maturity. If the bonds are “called,” the bondholders have no choice but to surrender their bonds for the call price because

the bonds quit paying interest when they are called. Call features give the issuer the opportunity to replace higher-than-market coupon bonds with lower-coupon issues.

Typically, there is a period of years after issuance during which the bonds cannot be called. This is termed the period of *call protection* because the bondholder is protected from a call over this period. After the period (if any) of call protection has passed, the bonds are referred to as *currently callable*.

There may be several call dates specified in the indenture, each with a lower call price. Customarily, when a bond is called on the first permissible call date, the call price is above the par value. If the bonds are not called entirely or not called at all, the call price declines over time according to a schedule. For example, a call schedule may specify that a 20-year bond can be called after five years at a price of 110 (110% of par), with the call price declining to 105 after ten years and 100 in the 15th year.

Nonrefundable bonds prohibit the call of an issue using the proceeds from a lower coupon bond issue. Thus, a bond may be callable but not refundable. A bond that is *noncallable* has absolute protection against a call prior to maturity. In contrast, a callable but *nonrefundable* bond can be called for any reason other than refunding.

When bonds are called through a call option or through the provisions of a sinking fund, the bonds are said to be **redeemed**. If a lower coupon issue is sold to provide the funds to call the bonds, the bonds are said to be **refunded**.

Sinking fund provisions provide for the repayment of principal through a series of payments over the life of the issue. For example, a 20-year issue with a face amount of \$300 million may require that the issuer retire \$20 million of the principal every year beginning in the sixth year. This can be accomplished in one of two ways—*cash or delivery*:

- **Cash payment.** The issuer may deposit the required cash amount annually with the issue's trustee who will then retire the applicable proportion of bonds (1/15 in this example) by using a selection method such as a lottery. The bonds selected by the trustee are typically retired at par.
- **Delivery of securities.** The issuer may purchase bonds with a total par value equal to the amount that is to be retired in that year in the market and deliver them to the trustee who will retire them.

If the bonds are trading below par value, delivery of bonds purchased in the open market is the less expensive alternative. If the bonds are trading above the par value, delivering cash to the trustee to retire the bonds at par is the less expensive way to satisfy the sinking fund requirement.

Regular and Special Redemption Prices

When bonds are redeemed under the call provisions specified in the bond indenture, these are known as **regular redemptions**, and the call prices are referred to as **regular redemption prices**. However, when bonds are redeemed to comply with a sinking fund provision or because of a property sale mandated by government authority, the redemption prices (typically par value) are referred to as **special redemption prices**. Asset sales may be forced by a regulatory authority (e.g., the forced divestiture of an operating division by antitrust authorities or through a governmental unit's right of eminent domain). Examples of sales forced through the government's right of eminent domain would be a forced sale of privately held land for erection of electric utility lines or for construction of a freeway.

LOS 65.e: Identify the various options embedded in a bond issue (call option, prepayment option, accelerated sinking fund option, put option and conversion option), the importance of understanding embedded options, and whether such options benefit the issuer or the bondholder.

The following are examples of *embedded options*, embedded in the sense that they are an integral part of the bond contract and are not a separate security. Some embedded options are exercisable at the option of the issuer of the bond, and some are exercisable at the option of the purchaser of the bond.

Security owner options. In the following cases, the option embedded in the fixed-income security is an option granted to the security holder (lender) and gives additional value to the security, compared to an otherwise-identical straight (option-free) security.

1. A *conversion option* grants the holder of a bond the right to convert the bond into a fixed number of common shares of the issuer. This choice/option has value for the bondholder. An exchange option is similar but allows conversion of the bond into a security other than the common stock of the issuer.
2. *Put provisions* give bondholders the right to sell (put) the bond to the issuer at a specified price prior to maturity. The put price is generally par if the bonds were originally issued at or close to par. If interest rates have risen and/or the creditworthiness of the issuer has deteriorated so that the market price of such bonds has fallen below par, the bondholder may choose to exercise the put option and require the issuer to redeem the bonds at the put price.
3. *Floors* set a minimum on the coupon rate for a floating-rate bond, a bond with a coupon rate that changes each period based on a reference rate, usually a short-term rate such as LIBOR or the T-bill rate.

Security issuer options. In these cases, the embedded option is exercisable at the option of the issuer of the fixed income security. Securities where the issuer chooses whether to exercise the embedded option will be priced less (or with a higher coupon) than otherwise identical securities that do not contain such an option.

1. *Call provisions* give the bond issuer the right to redeem (pay off) the issue prior to maturity. The details of a call feature are covered later in this topic review.
2. *Prepayment options* are included in many amortizing securities, such as those backed by mortgages or car loans. A prepayment option gives the borrower/issuer the right to prepay the loan balance prior to maturity, in whole or in part, without penalty. Loans may be prepaid for a variety of reasons, such as the refinancing of a mortgage due to a drop in interest rates or the sale of a home prior to its loan maturity date.
3. *Accelerated sinking fund provisions* are embedded options held by the issuer that allow the issuer to (annually) retire a larger proportion of the issue than is required by the sinking fund provision, up to a specified limit.
4. *Caps* set a maximum on the coupon rate for a floating-rate bond, a bond with a coupon rate that changes each period based on a reference rate, usually a short-term rate such as LIBOR or the T-bill rate.

To summarize, the following embedded options favor the *issuer/borrower*: (1) the right to call the issue, (2) an accelerated sinking fund provision, (3) a prepayment option, and (4) a cap on the floating coupon rate that limits the amount of interest payable by the borrower/issuer. Bonds with these options will tend to have higher market yields since bondholders will require a premium relative to otherwise identical option-free bonds.

The following embedded options favor the *bondholders*: (1) conversion provisions, (2) a floor that guarantees a minimum interest payment to the bondholder, and (3) a put option. The market yields on bonds with these options will tend to be lower than otherwise identical option-free bonds since bondholders will find these options attractive.

LOS 65.f: Describe methods used by institutional investors in the bond market to finance the purchase of a security (i.e., margin buying and repurchase agreements).

Margin buying involves borrowing funds from a broker or a bank to purchase securities where the securities themselves are the collateral for the margin loan. The margin amount (percentage of the bonds' value) is regulated by the Federal Reserve in the U.S., under the Securities and Exchange Act of 1934.

A **repurchase (repo) agreement** is an arrangement by which an institution sells a security with a commitment to buy it back at a later date at a specified (higher) price. The *repurchase price* is greater than the selling price and

accounts for the interest charged by the buyer, who is, in effect, lending funds to the seller. The interest rate implied by the two prices is called the *repo rate*, which is the annualized percentage difference between the two prices. A repurchase agreement for one day is called an *overnight repo*, and an agreement covering a longer period is called a *term repo*. The interest cost of a *repo* is customarily less than the rate a bank or brokerage would charge on a margin loan.

Most bond-dealer financing is achieved through repurchase agreements rather than through margin loans. Repurchase agreements are not regulated by the Federal Reserve, and the collateral position of the lender/buyer in a repo is better in the event of bankruptcy of the dealer, since the security is owned by the 'lender.' The lender has only the obligation to sell it back at the price specified in the repurchase agreement, rather than simply having a claim against the assets of the dealer for the margin loan amount.

KEY CONCEPTS

1. The obligations, rights, and any options the issuer or owner of a bond may have are contained in the bond indenture. The specific conditions of the obligation are *covenants*. Affirmative covenants specify acts that the borrower must perform, and negative covenants prohibit the borrower from performing certain acts.
2. Bonds have the following features:
 - Maturity—the term of the loan agreement.
 - Par value—the principal amount of the fixed income security that the borrower promises to pay the lender on or before the bond expires at maturity.
 - Coupon—the rate that determines the periodic interest to be paid on the principal amount. Interest can be paid annually or semiannually, depending on the terms. Coupons may be fixed or variable.
3. Types of fixed-income securities:
 - Zero-coupon bonds pay no periodic interest and are sold at a discount to par value.
 - Accrual bonds pay compounded interest, but the cash payment is deferred until maturity.
 - Step-up notes have a coupon rate that increases over time according to a specified schedule.
 - Deferred coupon bonds initially make no coupon payments (they are deferred for a period of time). At the end of the deferral period, the accrued (compound) interest is paid, and the bonds then make regular coupon payments.
4. A floating (variable) rate bond has a coupon formula that is based on a reference rate (usually LIBOR) and a quoted margin. Caps are a maximum on the coupon rate that the issuer must pay, and a floor is a minimum on the coupon rate that the bondholder will receive.
5. Accrued interest is the interest earned since the last coupon payment date and is paid by a bond buyer to a bond seller. Clean price is the quoted price of the bond without accrued interest, and full price refers to the quoted price plus any accrued interest.
6. Bond payoff provisions:
 - Amortizing securities make periodic payments that include both interest and principal payments so that the entire principal is paid off with the last payment unless prepayment occurs.
 - A prepayment provision is present in some amortizing loans and allows the borrower to pay off principal at any time prior to maturity, in whole or in part.
 - Sinking fund provisions require that a part of a bond issue be retired at specified dates, usually annually.
 - Call provisions enable the borrower to buy back the bonds from the investors (redeem them) at a price(s) specified in the bond indenture.
 - Callable but nonrefundable bonds can be called, but their redemption cannot be funded by the simultaneous issuance of lower coupon bonds.
7. Regular redemption prices refer to prices specified for calls; special redemption prices (usually par value) are prices for bonds that are redeemed to satisfy sinking fund provisions or other provisions for early retirement, such as the forced sale of firm assets.
8. Embedded options that benefit the issuer reduce the bond's value to a bond purchaser; examples are call provisions and accelerated sinking fund provisions.

9. Embedded options that benefit bondholders increase the bond's value to a bond purchaser; examples are conversion options (the option of bondholders to convert their bonds into a certain number of shares of the bond issuer's common stock) and put options (the option of bondholders to return their bonds to the issuer at a preset price).
10. Institutions can finance secondary market bond purchases by margin buying (borrowing some of the purchase price, using the securities as collateral) or, most commonly, by repurchase (repo) agreements (an arrangement in which an institution sells a security with a promise to buy it back at an agreed-upon higher price at a specified later date).

CONCEPT CHECKERS: FEATURES OF DEBT SECURITIES

1. A bond's indenture:
 - A. pledges it as collateral.
 - B. contains its covenants.
 - C. is the same as a debenture.
 - D. relates only to its interest and principal payments.
2. A bond has a par value of \$5,000 and a coupon rate of 8.5% payable semiannually. What is the dollar amount of the semiannual coupon payment?
 - A. \$212.50.
 - B. \$238.33.
 - C. \$425.00.
 - D. \$476.66.
3. From the perspective of the bondholder, which of the following pairs of options would *add value* to a straight (option-free) bond?
 - A. Call option, conversion option.
 - B. Accelerated sinking fund provision, put option.
 - C. Put option, conversion option.
 - D. Prepayment option, exchange option.
4. A 10-year bond pays no interest for three years, then pays \$229.25, followed by payments of \$35 semiannually for seven years and an additional \$1,000 at maturity. This bond is a(n):
 - A. accrual bond.
 - B. zero-coupon bond.
 - C. deferred coupon bond.
 - D. step-up bond.
5. Consider a \$1 million semiannual-pay floating-rate issue where the rate is reset on January 1 and July 1 each year. The reference rate is 6-month LIBOR, and the stated margin is +1.25%. If 6-month LIBOR is 6.5% on July 1, what will the next semiannual coupon be on this issue?
 - A. \$32,500.
 - B. \$38,750.
 - C. \$65,000.
 - D. \$77,500.
6. Which of the following statements is TRUE with regard to *floating-rate issues* that have *caps* and *floors*?
 - A. A cap is an advantage to the bondholder, while a floor is an advantage to the issuer.
 - B. A floor is an advantage to the bondholder, while a cap is an advantage to the issuer.
 - C. A floor is a disadvantage to both the issuer and the bondholder, while a cap is an advantage to both the issuer and the bondholder.
 - D. A floor is an advantage to both the issuer and the bondholder, while a cap is a disadvantage to both the issuer and the bondholder.
7. An investor paid a full price of \$1,059.04 each for 100 bonds. The purchase was between coupon dates, and accrued interest was \$23.54 per bond. What is each bond's *clean price*?
 - A. \$1,000.00.
 - B. \$1,059.04.
 - C. \$1,035.50.
 - D. \$1,082.58.

8. Which of the following statements is TRUE with regard to a *call provision*?
- A. A call provision is an advantage to the bondholder.
 - B. A call provision will benefit the issuer in times of declining interest rates.
 - C. A callable bond will trade at a higher price than an identical noncallable bond.
 - D. A nonrefundable bond provides more protection to the bondholder than a noncallable bond.
9. Which of the following best describes the *maximum* price for a currently callable bond?
- A. Its par value.
 - B. The call price.
 - C. The present value of its par value.
 - D. Its par value plus accrued interest.

Use the following information to answer Questions 10 and 11.

Consider an issue of \$1,000,000 par value, 10-year, 6.5% coupon bonds issued on January 1, 2002. The bonds are callable and there is a sinking fund provision. The market rate for similar bonds is currently 5.70%. The main points of the prospectus are summarized as follows:

Call dates and prices:

- 2002 through 2006: 103.
- After January 1, 2007: 102.

Additional information:

- The bonds are non-refundable.
 - The sinking fund provision requires that the company redeem \$100,000 of the principal amount each year. Bonds called under the terms of the sinking fund provision will be redeemed at par.
 - The credit rating of the bonds is currently the same as at issuance.
10. Using only the above information, Gould should conclude that:
- A. investors will pay a premium for the call option.
 - B. the bonds do not have call protection.
 - C. the bonds were issued at and currently trade at a premium.
 - D. given current rates, the bonds will likely be called and new bonds issued.
11. Which of the following statements is *most likely*?
- A. An investor would benefit from having his or her bonds called under the provision of the sinking fund.
 - B. An investor will receive a premium if the bond is redeemed prior to maturity.
 - C. The bonds do not have an accelerated sinking fund provision.
 - D. The issuer would likely deliver bonds to satisfy the sinking fund provision.
12. An investor buying bonds on margin:
- A. can achieve lower funding costs than one using repurchase agreements.
 - B. must pay interest on a loan.
 - C. is not restricted by government regulation of margin lending.
 - D. actually "loans" the bonds to a bank or brokerage house.

13. Which of the following is NOT a provision for the early retirement of debt by the issuer?
- A. A conversion option.
 - B. A call option.
 - C. A prepayment option.
 - D. A sinking fund.
14. A mortgage is typically NOT:
- A. a collateralized loan.
 - B. subject to early retirement.
 - C. an amortizing security.
 - D. characterized by highly predictable cash flows.

ANSWERS – CONCEPT CHECKERS: FEATURES OF DEBT SECURITIES

1. B An indenture is the contract between the company and its bondholders and contains the bond's covenants.
2. A The annual interest is 8.5% of the \$5,000 par value, or \$425. Each semiannual payment is one-half of that, or \$212.50.
3. C A put option, conversion option, and exchange option all have positive value to the bondholder. The other options favor the issuer and have a lower value than a straight bond.
4. C This pattern describes a deferred coupon bond. The first payment of \$229.25 is the value of the accrued coupon payments for the first three years.
5. B The coupon rate is $6.5 + 1.25 = 7.75$. The (semiannual) coupon payment equals $(0.5)(0.0775)(\$1,000,000) = \$38,750$.
6. B A cap is a maximum on the coupon rate and is advantageous to the issuer. A floor is a minimum on the coupon rate and is therefore advantageous to the bondholder.
7. C The full price includes accrued interest, while the clean price does not. Therefore, the clean price is $1,059.04 - 23.54 = \$1,035.50$.
8. B A call provision gives the bond issuer the right to call the bond at a price specified in the bond indenture. A bond issuer may want to call a bond if interest rates have decreased so that borrowing costs can be decreased by replacing the bond with a lower coupon issue.
9. B Whenever the price of the bond increases above the strike price stipulated on the call option, it will be optimal for the issuer to call the bond. So theoretically, the price of a currently callable bond should never rise above its call price.
10. B The bonds are callable in 2002, indicating that there is no period of call protection. We have no information about the pricing of the bonds at issuance. The company may not *refund* the bonds (i.e., they cannot call the bonds with the proceeds of a new debt offering at the currently lower market yield). The call option benefits the issuer, not the investor.
11. C The sinking fund provision does not provide for an acceleration of the sinking fund redemptions. With rates currently below the coupon rate, the bonds will be trading at a premium to par value. Thus, a sinking fund call at par would not benefit a bondholder, and the issuer would likely deliver cash to the trustee to satisfy the sinking fund provision, rather than buying bonds to deliver to the trustee. A redemption under a sinking fund provision is typically at par.
12. B Margin loans require the payment of interest, and the rate is typically higher than funding costs when repurchase agreements are used.
13. A A conversion option allows bondholders to exchange their bonds for common stock.
14. D A mortgage can typically be retired early in whole or in part (a prepayment option), and this makes the cash flows difficult to predict with any accuracy.

RISKS ASSOCIATED WITH INVESTING IN BONDS

Study Session 15

EXAM FOCUS

This topic review introduces various sources of risk that investors are exposed to when investing in fixed income securities. The key word here is "introduces." The most important source of risk, interest rate risk, has its own full topic review in Study Session 15 and is more fully developed after the material on the valuation of fixed income securities. Prepayment risk has its own topic review at Level 2, and credit risk and reinvestment risk are revisited to a significant extent

in other parts of the Level 1 curriculum. In this review we present some working definitions of the eleven risk measures enumerated in the LOS and identify the factors that will affect these risks. To avoid unnecessary repetition, some of the material is abbreviated here, but be assured that your understanding of this material will be complete by the time you work through this study session and the one that follows.

LOS 66.a: Explain the risks associated with investing in bonds (e.g., interest rate risk, yield curve risk, call and prepayment risk, reinvestment risk, credit risk, liquidity risk, exchange-rate risk, inflation risk, volatility risk, event risk, and sovereign risk).

Interest rate risk refers to the effect of changes in the prevailing market rate of interest on bond values. When interest rates rise, bond values fall. This is the source of interest rate risk which is approximated by a measure called *duration*.

Yield curve risk arises from the possibility of changes in the shape of the yield curve (which shows the relation between bond yields and maturity). While duration is a useful measure of interest rate risk for equal changes in yield at every maturity (parallel changes in the yield curve), changes in the shape of the yield curve mean that yields change by different amounts for bonds with different maturities.

Call risk arises from the fact that when interest rates fall, a callable bond investor's principal may be returned and must be reinvested at the new lower rates. Certainly bonds that are not callable have no call risk, and call protection reduces call risk. When interest rates are more volatile, callable bonds have relatively more call risk because of an increased probability of yields falling to a level where the bonds will be called.

Prepayment risk is similar to call risk. Prepayments are principal repayments in excess of those required on amortizing loans, such as residential mortgages. If rates fall, causing prepayments to increase, an investor must reinvest these prepayments at the new lower rate. Just as with call risk, an increase in interest rate volatility increases prepayment risk.

Reinvestment risk refers to the fact that when market rates fall, the cash flows (both interest and principal) from fixed-income securities must be reinvested at lower rates, reducing the returns an investor will earn. Note that reinvestment risk is related to call risk and prepayment risk. In both of these cases, it is the reinvestment of principal cash flows at lower rates than were expected that negatively impacts the investor. Coupon bonds that contain neither call nor prepayment provisions will also be subject to reinvestment risk, since the coupon interest payments must be reinvested as they are received.

Note that investors can be faced with a choice between reinvestment risk and price risk. A non-callable zero-coupon bond has no reinvestment risk over its life since there are no cash flows to reinvest, but a zero coupon

bond (as we will cover shortly) has more interest rate risk than a coupon bond of the same maturity. Therefore, the coupon bond will have more reinvestment risk and less price risk.

Credit risk is the risk that the creditworthiness of a fixed-income security's issuer will deteriorate, increasing the required return and decreasing the security's value.

Liquidity risk has to do with the risk that the sale of a fixed-income security must be made at a price less than fair market value because of a lack of liquidity for a particular issue. Treasury bonds have excellent liquidity, so selling a few million dollars worth at the prevailing market price can be easily and quickly accomplished. At the other end of the liquidity spectrum, a valuable painting, collectible antique automobile, or unique and expensive home may be quite difficult to sell quickly at fair-market value. Since investors prefer more liquidity to less, a decrease in a security's liquidity will decrease its price, as the required yield will be higher.

Exchange-rate risk arises from the uncertainty about the value of foreign currency cash flows to an investor in terms of his home-country currency. While a U.S. Treasury bill (T-bill) may be considered quite low risk or even risk-free to a U.S.-based investor, the value of the T-bill to a European investor will be reduced by a depreciation of the U.S. dollar's value relative to the euro.

Inflation risk might be better described as *unexpected* inflation risk and even more descriptively as purchasing-power risk. While a \$10,000 zero-coupon Treasury bond can provide a payment of \$10,000 in the future with (almost) certainty, there is uncertainty about the amount of goods and services that \$10,000 will buy at the future date. This uncertainty about the amount of goods and services that a security's cash flows will purchase is referred to here as inflation risk.

Volatility risk is present for fixed-income securities that have embedded options, such as call options, prepayment options, or put options. Changes in interest rate volatility affect the value of these options and thus affect the values of securities with embedded options.

Event risk encompasses the risks outside the risks of financial markets, such as the risks posed by natural disasters and corporate takeovers.

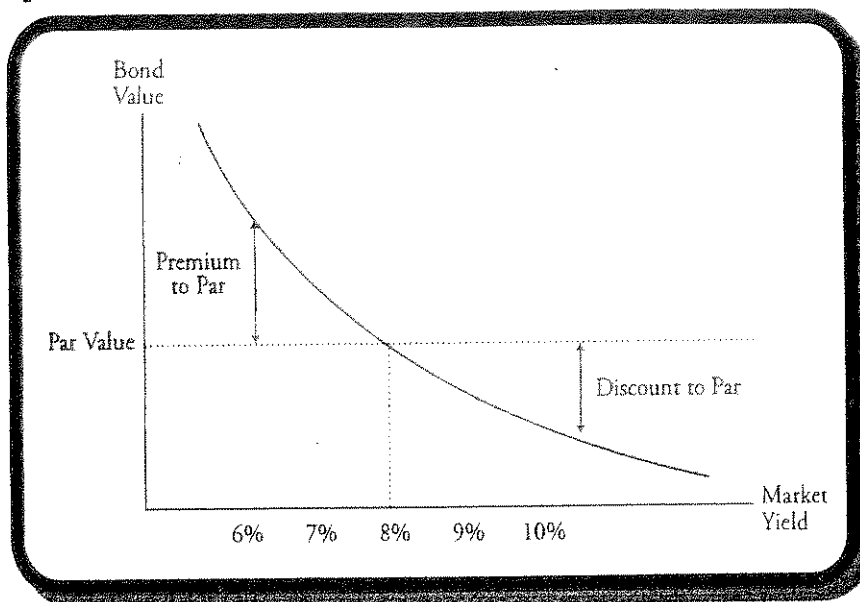
Sovereign risk refers to changes in governmental attitudes and policies toward the repayment and servicing of debt. Governments may impose restrictions on the outflows of foreign exchange to service debt even by private borrowers. Foreign municipalities may adopt different payment policies due to varying political priorities. A change in government may lead to a refusal to repay debt incurred by a prior regime. Remember, the quality of a debt obligation depends not only on the borrower's ability to repay but also on the borrower's desire or willingness to repay. This is true of sovereign debt as well, and we can think of sovereign risk as having *two components*: a change in a government's willingness to repay and a change in a country's ability to repay. The second component has been the important one in most defaults and downgrades of sovereign debt.

LOS 66.b: Identify the relationships among a bond's coupon rate, the yield required by the market, and the bond's price relative to par value (i.e., discount, premium, or equal to par).

When the coupon rate on a bond is equal to its market yield, the bond will trade at its **par value**. When issued, the coupon rate on bonds is typically set at or near the prevailing market yield on similar bonds so that the bonds trade initially at or near their par value. If the yield required in the market for the bond subsequently rises, the price of the bond will fall and it will trade at a **discount** to (below) its par value. Conversely, if the required yield falls, the bond price will increase and the bond will trade at a **premium** to (above) its par value.

The relation is illustrated in Figure 1.

Figure 1: Market Yield vs. Bond Value for an 8% Coupon Bond



Professor's Note: This is a crucial concept and the reasons underlying this relation will be clear after you cover the material on bond valuation methods in the next study session.

LOS 66.c: Explain how features of a bond (e.g., maturity, coupon, and embedded options) and the level of a bond's yield affect the bond's interest rate risk.

Interest rate risk, as we are using it here, refers to the sensitivity of a bond's value to changes in market interest rates/yields. Remember that there is an inverse relationship between yield and bond prices—when yields increase, bond prices decrease. The term we use for the measure of interest rate risk is duration, which gives us a good approximation of a bond's change in price for a given change in yield.

Professor's Note: This is a very important concept. Notice that the terms bond price risk, interest rate risk, interest rate sensitivity, and duration are used interchangeably.

We introduce this concept by simply looking at how a bond's maturity and coupon affect its price sensitivity to interest rate changes. With respect to maturity, if two bonds are identical except for maturity, the one with the longer maturity has the greater duration since it will have a greater percentage change in value for a given change in yield. For two otherwise identical bonds, the one with the higher coupon rate has the lower duration. The price of the bond with the higher coupon rate will change less for a given change in yield than the price of the lower coupon bond will.

The presence of embedded options also affects the sensitivity of a bond's value to interest rate changes (its duration). Prices of putable and callable bonds will react differently to changes in yield than the prices of straight (option-free) bonds will.

A call feature limits the upside price movement of a bond when interest rates decline; loosely speaking, the bond price will not rise above the call price. This leads to the conclusion that the value of a callable bond will be less sensitive to interest rate changes than an otherwise identical option-free bond.

A put feature limits the downside price movement of a bond when interest rates rise; loosely speaking, the bond price will not fall below the put price. This leads to the conclusion that the value of a puttable bond will be less sensitive to interest rate changes than an otherwise identical option-free bond.

The relations we have developed so far are summarized in Figure 2.

Figure 2: Bond Characteristics and Interest Rate Risk

Characteristic	Interest Rate Risk	Duration
Maturity up	Interest rate risk up	Duration up
Coupon up	Interest rate risk down	Duration down
Add a call	Interest rate risk down	Duration down
Add a put	Interest rate risk down	Duration down

Professor's Note: We have examined several factors that affect interest rate risk, but only maturity is positively related to interest rate risk (longer maturity, higher duration). To remember this, note that the words maturity and duration both have to do with time. The other factors, coupon rate, yield, and the presence of puts and calls, are all negatively related to interest rate risk (duration). Increasing coupons, higher yields, and "adding" options all decrease interest rate sensitivity (duration).

LOS 66.d: Identify the relationship among the price of a callable bond, the price of an option-free bond, and the price of the embedded call option.

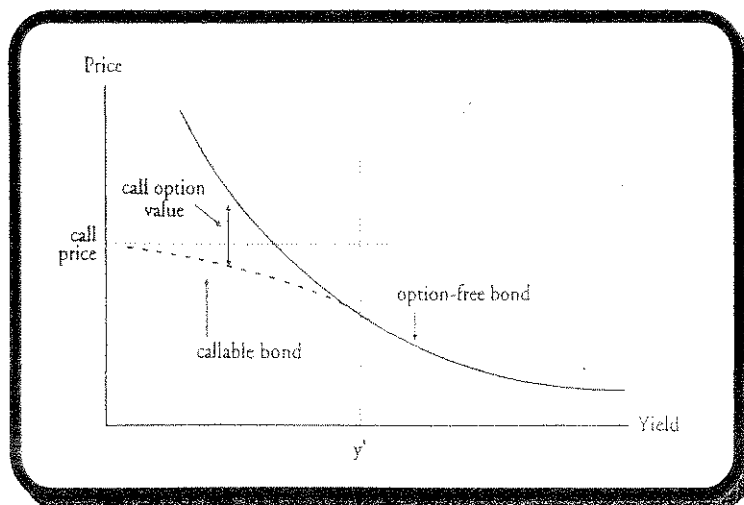
As we noted earlier, a call option favors the issuer and decreases the value of a callable bond relative to an otherwise identical option-free bond. The issuer owns the call. Essentially, when you purchase a callable bond, you have purchased an option-free bond but have "given" a call option to the issuer. The value of the callable bond is less than the value of an option-free bond by an amount equal to the value of the call option.

This relation can be shown as:

$$\text{callable bond value} = \text{value of an option-free bond} - \text{value of the embedded call option}$$

Figure 3 shows this relationship. The value of the call option is greater at lower yields so that as the yield falls, the difference in price between a straight bond and a callable bond increases.

Figure 3: Price-Yield Curves for Callable and Noncallable Bonds



LOS 66.e: Explain the interest rate risk of a floating-rate security and why such a security's price may differ from par value.

Recall that floating-rate securities have a coupon rate that "floats," in that it is periodically reset based on a market-determined reference rate. The objective of the resetting mechanism is to bring the coupon rate in line with the current market yield so the bond sells at or near its par value. This will make the price of a floating-rate security much less sensitive to changes in market yields than a fixed-coupon bond of equal maturity. That's the point of a floating-rate security: less interest rate risk.

Between coupon dates, there is a time lag between any change in market yield and a change in the coupon rate (which happens on the *reset* date). The longer the time period between the two dates, the greater the amount of potential bond price fluctuation. In general, we can say that the longer (shorter) the reset period, the greater (less) the interest rate risk of a floating-rate security at any reset date.

The presence of a cap (maximum coupon rate) can increase the interest rate risk of a floating-rate security. If the reference rate increases enough that the cap rate is reached, further increases in market yields will decrease the floater's price. When the market yield is above its capped coupon rate, a floating-rate security will trade at a discount. To the extent that the cap fixes the coupon rate on the floater, its price sensitivity to changes in market yield will be increased. This is sometimes referred to as *cap risk*.

A floater's price can also differ from par due to the fact that the margin is fixed at issuance. Consider a firm that has issued floating-rate debt with a coupon formula of LIBOR + 2%. This 2% margin should reflect the credit risk and liquidity risk of the security. If the firm's creditworthiness improves, the floater is less risky and will trade at a premium to par. Even if the firm's creditworthiness remains constant, a change in the market's required yield premium for the firm's risk level will cause the value of the floater to differ from par.

LOS 66.f: Compute and interpret the duration of a bond, given the bond's change in price when interest rates change, and compute the approximate percentage price change of a bond and new price of a bond, given the duration and change in yield.

By now you know that duration is a measure of the price sensitivity of a security to changes in yield. Specifically, it can be interpreted as an approximation of the *percentage* change in the security price for a 1% change in yield. We can also interpret duration as the *ratio* of the percentage change in price to the change in yield in percent. This relation is:

$$\text{duration} = - \frac{\text{percentage change in bond price}}{\text{yield change in percent}}$$

When calculating the direction of the price change, remember that yields and prices are inversely related. If you are given a rate decrease, your result should indicate a price increase. Also note that the duration of a zero-coupon bond is approximately equal to its maturity, and the duration of a floater is equal to the time to the next reset date.

Let's consider some numerical examples.

Example 1: Approximate price change when yields increase

If a bond has a duration of 5 and the yield increases from 7% to 8%, calculate the approximate percentage change in the bond price.

Answer:

$-5 \times 1\% = -5\%$, or a 5% decrease in price. Since the yield increased, the price decreased.

Example 2: Approximate price change when yields decrease

A bond has a duration of 7.2. If the yield decreases from 8.3% to 7.9%, calculate the approximate percentage change in the bond price.

Answer:

$-7.2 \times (-0.4\%) = 2.88\%$. Here the yield decreased and the price increased.

The “official” formula for what we just did (because duration is always expressed as a positive number and because of the negative relation between yield and price) is:

$$\text{percentage price change} = - \text{duration} \times (\text{yield change in } \%)$$

Now let's do it in reverse and calculate the duration from the change in yield and the *percentage* change in the bond's price.

Example 3: Calculating duration given a yield increase

If a bond's yield rises from 7% to 8% and its price falls 5%, calculate the duration.

Answer:

$$\text{duration} = - \frac{\text{percentage change in price}}{\text{change in yield}} = - \frac{-5.0\%}{+1.0\%} = 5$$

Example 4: Calculating duration given a yield decrease

If a bond's yield decreases by 0.1% and its price increases by 1.5%, calculate its duration.

Answer:

$$\text{duration} = - \frac{\text{percentage change in price}}{\text{change in yield}} = - \frac{1.5\%}{-0.1\%} = 15$$

Example 5: Calculating the new price of a bond

A bond is currently trading at \$1,034.50, has a yield of 7.38%, and has a duration of 8.5. If the yield rises to 7.77%, calculate the new price of the bond.

Answer:

The change in yield is $7.77\% - 7.38\% = 0.39\%$.

The approximate price change is $-8.5 \times 0.39\% = -3.315\%$.

Since the yield *increased*, the price will decrease by this *percentage*.

The new price is $(1 - 0.03315) \times \$1,034.50 = \$1,000.21$.

LOS 66.g: Describe yield curve risk and explain why duration does not account for yield curve risk for a portfolio of bonds.

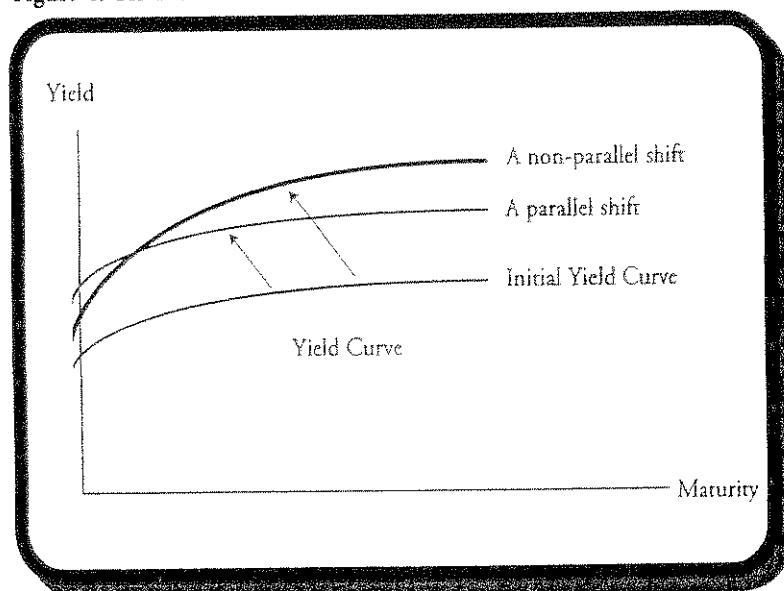
Duration and Yield Curve Risk for a Portfolio of Bonds

The duration for a portfolio of bonds has the same interpretation as for a single bond; it is the approximate percentage change in *portfolio* value for a 1% change in yields. Duration for a portfolio measures the sensitivity of a portfolio's value to an equal change in yield for all the bonds in the portfolio.

A graph of the relationship between maturity and yield is known as a yield curve. The yield curve can have any shape: upward sloping, downward sloping, flat, or some combination of these slopes. Changing yield curve shapes lead to yield curve risk, the interest rate risk of a portfolio of bonds that is not captured by the duration measure.

In Figure 4 we illustrate two possible ways that the yield curve might change when market interest rates rise, a parallel change and a non-parallel change.

Figure 4: Yield Curve Shifts



The duration of a bond portfolio can be calculated from the individual bond durations and the proportions of the total portfolio value invested in each of the bonds. That is, the portfolio duration is a market-weighted average of the individual bond's durations. If the yields on all the bonds in the portfolio change by the same absolute percent amount, we term that a parallel shift. Portfolio duration is an approximation of the price sensitivity of a portfolio to parallel shifts of the yield curve.

For a non-parallel shift in the yield curve, the yields on different bonds in a portfolio can change by different amounts, and duration alone cannot capture the effect of a "yield change" on the value of the portfolio. This risk of decreases in portfolio value from changes in the shape of the yield curve (i.e., from non-parallel shifts in the yield curve) is termed yield curve risk.

Considering the non-parallel yield curve shift in Figure 4, the yield on short maturity bonds has increased by a small amount, and they will have experienced only a small decrease in value as a consequence. Long maturity bonds have experienced a significant increase in yield and significant decreases in value as a result. Duration can be a poor approximation of the sensitivity of the value of a bond portfolio to non-parallel shifts in the yield curve.

LOS 66.h: Explain the disadvantages of a callable or prepayable security to an investor.

Compared to an option-free bond, bonds with call provisions and securities with prepayment options offer a much less certain cash flow stream. This uncertainty about the timing of cash flows is one disadvantage of callable and prepayable securities.

A second disadvantage stems from the fact that the call of a bond and increased prepayments of amortizing securities are both more probable when interest rates have decreased. The disadvantage here is that more principal (all of the principal, in the case of a call) is returned when the opportunities for reinvestment of these principal repayments are less attractive. When rates are low, you get more principal back that must be reinvested at the new lower rates. When rates rise and opportunities for reinvestment are better, less principal is likely to be returned early.

A third disadvantage is that the potential price appreciation of callable and prepayable securities from decreases in market yields is less than that of option-free securities of like maturity. For a currently-callable bond, the call price puts an upper limit on the bond's price appreciation. While there is no equivalent price limit on a prepayable security, the effect of the prepayment option operates similarly to a call feature and reduces the appreciation potential of the securities in response to falling market yields.

Overall, the risks of early return of principal and the related problem of reinvesting the principal at lower rates are termed call risk and prepayment risk, respectively.

LOS 66.i: Identify the factors that affect the reinvestment risk of a security and explain why prepayable amortizing securities expose investors to greater reinvestment risk than nonamortizing securities.

As noted in our earlier discussion of reinvestment risk, cash flows prior to stated maturity from coupon interest payments, bond calls, principal payments on amortizing securities, and prepayments all subject security holders to reinvestment risk. Remember a lower coupon increases duration (interest rate risk) but decreases reinvestment risk compared to an otherwise identical higher coupon issue.

A security has *more* reinvestment risk when:

- The coupon is higher so that interest cash flows are higher.
- It has a call feature.
- It is an amortizing security.
- It contains a prepayment option.

Prepayable Amortizing Securities and Reinvestment Risk

As noted earlier, when interest rates decline there is an increased probability of the early return of principal for prepayable securities. The early return of principal increases the need to reinvest at lower prevailing rates. With prepayable securities, the uncertainty about the bondholder's return due to early return of principal and the prevailing reinvestment rates when it is returned (i.e., reinvestment risk) is greater.

LOS 66.j: Describe the various forms of credit risk (i.e., default risk, credit spread risk, downgrade risk) and describe the meaning and role of credit ratings.

A bond's *rating* is used to indicate its relative probability of default, which is the probability of its issuer not making timely interest and principal payments as promised in the bond indenture. A bond rating of AA is an indication that the expected probability of default over the life of the bond is less than that of an A-rated bond, which has a lower expected probability of default than a BBB ("triple B") rated bond, etc. We can say that lower-rated bonds have more **default risk**, the risk that a bond will fail to make promised/scheduled payments (either

interest payments or principal payments). Since investors prefer less risk of default, a lower-rated issue must promise a higher yield to compensate investors for taking on a greater probability of default.

The difference between the yield on a Treasury security, which is assumed to be default risk free, and the yield on a similar maturity bond with a lower rating is termed the **credit spread**.

$$\text{yield on a risky bond} = \text{yield on a default-free bond} + \text{default risk premium (credit spread)}$$

Credit spread risk refers to the fact that the default risk premium required in the market for a given rating can increase, even while the yield on Treasury securities of similar maturity remains unchanged. An increase in this *credit spread* increases the required yield and decreases the price of a bond.

Downgrade risk is the risk that a credit rating agency will lower a bond's rating. The resulting increase in the yield required by investors will lead to a decrease in the price of the bond. A rating increase is termed an **upgrade** and will have the opposite effect, decreasing the required yield and increasing the price.

Rating agencies give bonds ratings which are meant to give bond purchasers an indication of the risk of default. While the ratings are primarily based on the financial strength of the company, different bonds of the same company can have slightly different ratings depending on differences in collateral or differences in the priority of the bondholders' claim (junior or subordinated bonds may get lower ratings than senior bonds). Bond ratings are not absolute measures of default risk, but rather give an indication of the relative probability of default across the range of companies and bonds.

For ratings given by Standard and Poor's Corporation, a bond rated AAA ("triple-A") has been judged to have the least risk of failing to make its promised interest and principal payments (defaulting) over its life. Bonds with greater risk of defaulting on promised payments have lower ratings such as AA (double-A), A (single-A), BBB, BB, etc. U.S. Treasury securities and a small number of corporate bonds receive an AAA rating.

Pluses and minuses are used to indicate differences in default risk within categories, with AA+ a better rating than AA, which is better than AA-. Bonds rated AAA through BBB are considered 'investment grade' and bonds rated BB and below are considered speculative and sometimes termed 'junk bonds' or, more positively, 'high-yield bonds'. Bonds rated CCC, CC, and C are highly speculative and bonds rated D are currently in default. Moody's (Investor Services, Inc.), another prominent issuer of bond ratings, classifies bonds similarly but uses Aa1 as S&P uses AA+, Aa2 as AA, Aa3 as AA-, and so on. Bonds with lower ratings carry higher promised yields in the market because investors exposed to more default risk require a higher promised return to compensate them for bearing greater default risk.

LOS 66.k: Explain why liquidity risk might be important to investors even if they expect to hold a security to the maturity date.

We described liquidity earlier and noted that investors prefer more liquidity to less. This means that investors will require a higher yield for less liquid securities, other things equal. The difference between the price that dealers are willing to pay for a security (the bid) and the price at which dealers are willing to sell a security (the ask) is called the **bid-ask spread**. The bid-ask spread is an indication of the liquidity of the market for a security. If trading activity in a particular security declines, the bid-ask spread will widen (increase), and the issue is considered to be less liquid.

If investors are planning to sell a security prior to maturity, a decrease in liquidity will increase the bid-ask spread, lead to a lower sale price, and can decrease the returns on the position. Even if an investor plans to hold the security until maturity rather than trade it, poor liquidity can have adverse consequences stemming from the need to periodically assign current values to portfolio securities. This periodic valuation is referred to as **marking to market**. When a security has little liquidity, the variation in dealers' bid prices or the absence of dealer bids

altogether makes valuation difficult and may require that a valuation model or pricing service be used to establish current value. If this value is low, institutional investors may be hurt in two situations.

1. Institutional investors may need to mark their holdings to market to determine their portfolio's value for periodic reporting and performance measurement purposes. If the market is illiquid, the prevailing market price may misstate the true value of the security and can reduce returns/performance.
2. Marking to market is also necessary with repurchase agreements to ensure that the collateral value is adequate to support the funds being borrowed. A lower valuation can lead to a higher cost of funds and decreasing portfolio returns.

Professor's Note: CFA Institute seems to use "low liquidity" and "high liquidity risk" interchangeably. I believe you can treat these (liquidity and liquidity risk) as the same concept on the exam, although you should remember that low liquidity means high liquidity risk.

LOS 66.l: Describe the exchange rate risk an investor faces when a bond makes payments in a foreign currency.

If a U.S. investor purchases a bond that makes payments in a foreign currency, dollar returns on the investment will depend on the exchange rate between the dollar and the foreign currency. A depreciation (decrease in value) of the foreign currency will reduce the returns to a dollar-based investor. Exchange rate risk is the risk that the actual cash flows from the investment may be worth less than was expected when the bond was purchased.

LOS 66.m: Explain inflation risk.

Inflation risk refers to the possibility that prices of goods and services in general will increase more than expected. Since fixed-coupon bonds pay a constant periodic stream of interest income, an increasing price level decreases the amount of real goods and services that bond payments will purchase. For this reason, inflation risk is sometimes referred to as purchasing power risk. When expected inflation increases, the resulting increase in nominal rates and required yields will decrease the values of previously issued fixed-income securities.

LOS 66.n: Explain how yield volatility affects the price of a bond with an embedded option and how changes in volatility affect the value of a callable bond and a puttable bond.

Without any volatility in interest rates, a call provision and a put provision have little if any value, assuming no changes in credit quality that affect market values. In general, an increase in the yield/price volatility of a bond increases the values of both put options and call options.

We already saw that the value of a callable bond is less than the value of an otherwise-identical option-free (straight) bond by the value of the call option because the call option is retained by the issuer, not owned by the bondholder. The relation is:

$$\text{value of a callable bond} = \text{value of an option-free bond} - \text{value of the call}$$

An increase in yield volatility increases the value of the call option and decreases the market value of a callable bond.

A put option is owned by the bondholder, and the price relation can be described as:

$$\text{value of a puttable bond} = \text{value of an option-free bond} + \text{value of the put}$$

An increase in yield volatility increases the value of the put option and increases the value of a puttable bond.

Therefore, we conclude that increases in interest rate volatility affect the prices of callable bonds and puttable bonds in opposite ways. **Volatility risk** for callable bonds is the risk that volatility will increase, and volatility risk for puttable bonds is the risk that volatility will decrease.

LOS 66.o: Describe the various forms of event risk (e.g., natural catastrophe, corporate takeover/restructuring and regulatory risk).

Event risk occurs when something significant happens to a company (or segment of the market) that has a sudden and substantial impact on its financial condition and on the underlying value of an investment. Event risk, with respect to bonds, can take many forms:

- *Disasters* (e.g., hurricanes, earthquakes, or industrial accidents) impair the ability of a corporation to meet its debt obligations if the disaster reduces cash flow. For example, an insurance company's ability to make debt payments may be affected by property/casualty insurance payments in the event of a disaster.
- *Corporate restructurings* (e.g., spin-offs, leveraged buyouts (LBOs), and mergers) may have an impact on the value of a company's debt obligations by affecting the firm's cash flows and/or the underlying assets that serve as collateral. This may result in bond-rating downgrades and may also affect similar companies in the same industry.
- *Regulatory issues*, such as changes in clean air requirements, may cause companies to incur large cash expenditures to meet new regulations. This may reduce the cash available to bondholders and result in a ratings downgrade. A change in the regulations for some financial institutions prohibiting them from holding certain types of security, such as junk bonds, can lead to a volume of sales that decreases prices for the whole sector of the market.

KEY CONCEPTS

1. There are many types of risk associated with fixed income securities:
 - Interest rate risk is defined as the sensitivity of bond prices to changes in interest rates.
 - Call risk is the risk that a bond will be called (redeemed) prior to maturity under the terms of the call provision and that the funds must then be reinvested at the current (lower) yield.
 - Prepayment risk is the risk that the principal on amortizing securities will be repaid early and then must be reinvested at a lower (current) market yield.
 - Yield curve risk is the risk that changes in the shape of the yield curve will negatively impact bond values.
 - Credit risk includes both the risk of default and the risk of decreases in bond value due to a downgrade (reduction in the bond's credit rating).
 - Liquidity risk is the risk that an immediate sale will result in a price below fair value (the prevailing market price).
 - Exchange rate risk is the risk that the foreign exchange value of the currency that a foreign bond is denominated in will fall relative to the home currency of the investor.
 - Volatility risk is the risk that changes in interest rate volatility will affect the value of bonds with embedded options. More volatility decreases callable bond values and increases puttable bond values.
 - Inflation risk is the risk that inflation will be higher than expected, eroding the purchasing power of the cash flows from a fixed income security.
 - Event risk is the risk of decreases in a security's value from disasters, corporate restructurings, or regulatory changes that negatively impact the firm.
 - Sovereign risk is the risk that governments may repudiate debt, prohibit debt repayment by private borrowers, or impose general restrictions on currency flows.
2. When a bond's yield is above (below) its coupon rate, it will trade at a discount (premium) to its par value.
3. The interest rate risk of a bond is positively related to its maturity, negatively related to the coupon rate, and is less for bonds with an embedded option (either puts or calls).
4. The price of a callable bond equals the price of an identical option-free bond minus the value of embedded call.

5. The higher the market yield, the lower the interest rate risk.
6. Floating-rate bonds have interest rate risk between reset dates and may also differ from par value due to changes in liquidity or in credit risk after they have been issued.
7. The duration of a bond is the approximate percentage price change for a 1% change in yield.
8. The percentage price change in a bond = $- \text{duration} \times \text{yield change in percent}$.
9. When yield curve shifts are not parallel, the duration of a bond portfolio does not capture the true price effects because yields on the various bonds in the portfolio may change by different amounts.
10. A security has more reinvestment risk when it has a higher coupon, is callable, is an amortizing security, or has a prepayment option.
11. A prepayable amortizing security has greater reinvestment risk because of the probability of accelerated principal payments when interest rates (including reinvestment rates) fall.
12. Credit risk includes default risk (the probability of default), downgrade risk (the probability of a reduction in the bond rating), and credit spread risk (uncertainty about the bond's yield spread to Treasuries based on its bond rating).
13. Lack of liquidity can negatively impact periodic portfolio valuation and performance measures for a portfolio and thus can affect a manager even though sale of the bonds is not anticipated.
14. An investor who buys a bond with cash flows denominated in a foreign currency will see the value of the bond decrease if the exchange value of the foreign currency declines (the currency depreciates).
15. If inflation increases unexpectedly, the purchasing power of the cash flows is decreased and bond values fall.
16. Increases in yield volatility increase the value of put and call options embedded in bonds, decreasing the value of a callable bond (because the bondholder is short the call) and increasing the value of puttable bonds.
17. Event risk encompasses events that can negatively affect the value of a security, including disasters that negatively impact earnings or diminish asset values, takeovers or restructurings that can negatively impact bondholder claims, and changes in regulation that can negatively affect earnings.

CONCEPT CHECKERS: RISKS ASSOCIATED WITH INVESTING IN BONDS

1. A bond with a 7.3% yield has a duration of 5.4 and is trading at \$985.00. If the yield decreases to 7.1%, the new bond price is *closest to*:
 A. \$974.40.
 B. \$1,038.30.
 C. \$995.60.
 D. \$1091.40.

2. If interest rate volatility *increases*, which of the following bonds will experience a price *decrease*?
 A. A callable bond.
 B. A putable bond.
 C. A zero-coupon, option-free bond.
 D. An option-free, 4% coupon bond.

3. A noncallable, AA-rated, 5-year zero-coupon bond with a yield of 6% has all of the following EXCEPT:
 A. interest rate risk.
 B. inflation risk.
 C. reinvestment risk.
 D. default risk.

4. The current price of a bond is 102.50. If interest rates change by 0.5%, the value of the bond price changes by 2.50. What is the duration of the bond?
 A. 5.00.
 B. 2.44.
 C. 4.88.
 D. 2.50.

5. Which of the following bonds has the greatest interest rate risk?
 A. A 5% 10-year callable bond yielding 4%.
 B. A 5% 10-year putable bond yielding 6%.
 C. A 5% 10-year option-free bond yielding 4%.
 D. A 5% 10-year option-free bond yielding 6%.

6. A floating-rate security will have the greatest duration:
 A. the day before the reset date.
 B. the day after the reset date.
 C. just prior to maturity because that is the largest cash flow.
 D. never—floating-rate securities have a duration of zero.

7. The duration of a bond is 5.47, and its current price is \$986.30. Which of the following is the best estimate of the bond price change if interest rates *increase* by 2%?
 A. -\$109.40.
 B. -\$107.90.
 C. \$107.90.
 D. \$109.40.

8. A straight 5% bond has two years remaining to maturity and is priced at \$981.67. A callable bond that is the same in every respect as the straight bond, except for the call feature, is priced at \$917.60. With the yield curve flat at 6%, what is the value of the embedded call option?
- A. -\$82.40.
 - B. \$45.80.
 - C. \$64.07.
 - D. \$101.00.
9. A straight 5% coupon bond has two years remaining to maturity and is priced at \$981.67 (\$1,000 par value). A puttable bond that is the same in every respect as the straight bond except that the put provision is priced at 101.76 (percent of par value). With the yield curve flat at 6%, what is the value of the embedded put option?
- A. -\$35.93.
 - B. -\$17.60.
 - C. \$17.60.
 - D. \$35.93.
10. All of the following are possible examples of event risk with respect to fixed-income securities, EXCEPT:
- A. an earthquake.
 - B. a change in rate regulation.
 - C. a Federal Reserve decrease in money supply.
 - D. one firm's acquisition by another.
11. Which of the following 5-year bonds has the *highest* interest rate risk?
- A. A floating-rate bond.
 - B. A zero-coupon bond.
 - C. A callable 5% fixed-coupon bond.
 - D. An option-free 5% fixed-coupon bond.
12. An investor is concerned about interest rate risk. Which of the following four bonds (similar except for yield and maturity) has the *least* interest rate risk? The bond with:
- A. 5% yield and 10-year maturity.
 - B. 5% yield and 20-year maturity.
 - C. 6% yield and 10-year maturity.
 - D. 6% yield and 20-year maturity.
13. Which of the following statements about the risks of bond investing is TRUE?
- A. A bond rated AAA has no credit risk.
 - B. A bond with call protection has volatility risk.
 - C. A U.S. Treasury bond has no exchange rate risk.
 - D. A U.S. Treasury bond has no reinvestment risk.
14. Which of the following securities will have the *least* reinvestment risk for a long-term investor?
- A. A 10-year, zero-coupon bond.
 - B. A 6-month T-bill.
 - C. A 30-year, prepayable amortizing bond.
 - D. A 10-year, 4% debenture.
15. Which of the following does a 2-year, zero-coupon U.S. Treasury note NOT have?
- A. Inflation risk.
 - B. Interest rate risk.
 - C. Currency risk.
 - D. Volatility risk.

ANSWERS – CONCEPT CHECKERS: RISKS ASSOCIATED WITH INVESTING IN BONDS

1. C The percentage price change, based on duration is equal to $-5.4 \times (-0.2\%) = 1.08\%$. The new price is $1.0108 \times 985 = \$995.64$.
2. A An increase in volatility will increase the value of the call option and decrease the value of a callable bond. A puttable bond will increase in value. The value of option-free bonds will be unaffected.
3. C A zero-coupon bond, as a security, has no reinvestment risk because there are no cash flows prior to maturity that must be reinvested. A double-A bond has some (small) default risk. Zero-coupon bonds have the most interest rate risk for a given maturity. All bonds that are not indexed to inflation rates have inflation risk, or purchasing power risk.
4. C The duration is computed as follows:

$$\text{duration} = \frac{\text{percentage change in price}}{\text{change in yield as a decimal}} = \frac{\frac{2.50/102.5}{0.005}}{0.5\%} = \frac{2.44\%}{0.5\%} = 4.88$$

5. C Embedded options reduce duration/interest rate risk. The straight bond with the lower coupon will have greater duration than the straight bond with the higher coupon.
6. B The duration of a floating-rate bond is higher the greater the time lag until the next coupon payment/reset date. The greatest duration/interest rate risk is, therefore, immediately after the coupon has been reset.
7. B The approximate dollar change in price is computed as follows:

$$\text{dollar price change} = -5.47 \times 0.02 \times 986.30 = -\$107.90$$
8. C The option value is the difference between the value of an option-free bond and the corresponding price of the callable bond. Its value is computed as:

$$\text{call option value} = \$981.67 - \$917.60 = \$64.07$$
9. D The value of the embedded put option is the difference between the price of the puttable bond and the price of the straight bond. So it is computed as:

$$\text{option value} = \$1,017.60 - \$981.67 = \$35.93$$
10. C Event risk refers to events that can impact a firm's ability to pay its debt obligations that are separate from market risks. The Fed's actions can impact interest rates, but this is a market risk factor, not event risk.
11. B The zero-coupon bond will have the greatest duration of any of the four bonds and, as such, will be subject to the greatest interest rate risk.
12. C Interest rate risk is *inversely* related to the yield and directly related to maturity. All else equal, the lower the yield, the greater the interest rate risk. All else equal, the longer the maturity, the greater the interest rate risk. This bond has the higher yield and the shorter maturity, and thus has the lowest interest rate risk.
13. B A Treasury bond pays semiannual coupon interest and, therefore, has reinvestment risk. A triple-A rated bond can lose its AAA rating, so it has downgrade risk, a component of credit risk. Any bond can have exchange rate risk if the security holder's returns are measured in a different currency. A bond with a call feature has volatility risk even when the call cannot be exercised immediately. The call feature still has value (to the issuer), and its value will be affected by volatility changes.

14. A A 10-year, zero-coupon bond has no cash flows prior to maturity to reinvest while the entire amount invested in 6-month bills must be reinvested twice each year.
15. D It will have both inflation (purchasing power) risk and interest rate risk. It will have currency risk to non-U.S. dollar investors. Volatility risk only applies to bonds with embedded options.

The following is a review of the Analysis of Fixed Income Investments principles designed to address the learning outcome statements set forth by CFA Institute. This topic is also covered in:

OVERVIEW OF BOND SECTORS AND INSTRUMENTS

Study Session 15

EXAM FOCUS

This review introduces the various types of fixed income securities and a fair amount of terminology relating to fixed income securities. Pay special attention to the mechanics of these securities; that is, how they pay, when they pay, and what they pay. The additional information is nice, but likely not crucial. Try to gain enough understanding of the terms listed in the learning outcome statements so that you will understand them when they are used in a question.

Much of this material is unlikely to be tested by itself; however, knowing the basics about Treasury securities, mortgage-backed securities, and municipal securities is important as a foundation for much of the material on debt securities that follows, as well as for the more detailed material on fixed income valuation and risk that is contained in the Level 2 and Level 3 curriculum.

LOS 67.a: Explain how a country's bond market sectors are classified, including the distinguishing characteristics of internal and external bonds.

A country's **internal bond market** is comprised of both a **domestic bond market** and a **foreign bond market**. The *domestic bond market* refers to the market for bonds issued by entities domiciled within the country and subsequently traded in that country's bond markets. The *foreign bond market* refers to bonds issued in a country by entities not domiciled in the country and subsequently traded in that country's bond markets. Foreign bonds include bonds issued by foreign corporations as well as by foreign governments and other foreign entities. These bonds can be denominated in any currency, including the currency of the country in which they are issued.

Some foreign bonds have nicknames. U.S. dollar-denominated foreign bonds issued and traded in the U.S. are called **Yankee bonds**, sterling-denominated foreign bonds traded in the U.K. are called **Bulldog bonds**, and yen-denominated foreign bonds traded in Japan are called **Samurai bonds**.

A country's **external bond market** refers to bonds that are issued by international syndicates simultaneously in several countries. These are typically unregistered bonds and their issuance takes place outside the jurisdiction of any one country. The external bond market is often called the **Eurobond market**. Eurobonds are also referred to by the currency in which they are denominated: Eurodollar bonds (U.S. dollar), Euroyen bonds, or Eurosterling bonds (U.K. pounds). The term **global bond** is often used to refer to a bond that trades in the foreign bond market of at least one country and is also traded in the Eurobond market.

LOS 67.b: Describe the features, credit risk characteristics and distribution methods for government securities.

Bonds issued by a country's central government are referred to as **sovereign bonds** or **sovereign debt**. The sovereign debt of the U.S. government consists of U.S. Treasury securities, which are considered to be essentially free of default risk. The sovereign debt of other countries is considered to have varying degrees of credit risk. Sovereign debt can be issued in a country's own domestic market, another country's foreign bond market, or in the Eurobond market.

Sovereign debt is typically issued in the currency of the issuing country, but can be issued in other currencies as well. Bond rating agencies, such as Standard and Poor's, rate sovereign debt based on its perceived credit risk.

often giving different ratings to sovereign debt denominated in the home currency (local currency) and to the sovereign debt of the same country denominated in foreign currency.

Professor's Note: Remember that it is often easier for a country to print currency (expand the money supply) in order to meet obligations denominated in the home currency than it is to exchange the local currency for a fixed amount of foreign currency. Thus, local currency sovereign debt often receives a higher rating than the foreign currency denominated debt of the same country.

There are four primary methods used by central governments to issue sovereign debt.

1. **Regular cycle auction—single price.** Under this method the debt is auctioned periodically according to a cycle and the highest price (lowest yield) at which the entire issue to be auctioned can be sold is awarded to all bidders. This is the system used by the U.S. Treasury.
2. **Regular cycle auction—multiple price.** Under this method, winning bidders receive the bonds at the price(s) that they bid.
3. **An ad hoc auction system** refers to a method where the central government auctions new securities when it determines market conditions are advantageous.
4. **A tap system** refers to the issuance and auction of bonds identical to previously issued bonds. Under this system, bonds are sold periodically, not according to a regular cycle.

LOS 67.c: Describe the types of securities issued by the U.S. Department of the Treasury (e.g., bills, notes, bonds, and inflation protection securities), and distinguish between on-the-run and off-the-run Treasury securities.

Treasury securities (Treasuries) are issued by the U.S. Treasury. Because they are backed by the full faith and credit of the U.S. government, they are considered to be free from credit risk (though they're still subject to interest rate/price risk). The Treasury issues three distinct types of securities: bills, notes and bonds, and inflation-protected securities.

Treasury bills (T-bills) have maturities of less than one year and do not make explicit interest payments, paying only the face (par) value at the maturity date. T-bills are sold at a discount to par value and interest is received when the par value is paid at maturity (like zero-coupon bonds). The interest on T-bills is sometimes called *implicit interest* since the interest (difference between the purchase price and the par value) is not made in a separate "explicit" payment, as it is on bonds and notes. Securities of this type are known as *pure discount* securities.

- There are *three maturity cycles*: 28, 91, and 182 days, adjustable by one day (up or down) due to holidays. They are also known as 4-week, 3-month, and 6-month T-bills, respectively.
- Periodically, the Treasury also issues *cash management* bills with maturities ranging from a few days to six months to help overcome temporary cash shortages prior to the quarterly receipt of tax payments.

Treasury notes and Treasury bonds pay semiannual coupon interest at a rate that is fixed at issuance. Notes have original maturities of 2, 3, 5, and 10 years. Bonds have original maturities of 20 or 30 years. Although many bonds are still outstanding and still traded, the Treasury is not currently issuing new bonds.

Prior to 1984, some Treasury bonds were issued that are callable at par five years prior to maturity. The Treasury has not issued callable bonds since 1984.

Treasury bond and note prices in the secondary market are quoted in percent and 32nds of 1% of face value. A quote of 102-5 (sometimes 102:5) is 102% plus $\frac{5}{32}$ % of par, which for a \$100,000 face value T-bond, translates to a price of:

$$\left[102 + \frac{5}{32}\right]\% \times \$100,000 = 1.0215625 \times \$100,000 = \$102,156.25$$

Since 1997, the Treasury has issued **Treasury Inflation-Protected Securities (TIPS)**. Currently, only notes are offered but some inflation-protected 20- and 30-year bonds were previously issued and trade in the secondary market. The details of how TIPS work are:

- TIPS make semiannual coupon interest payments at a rate fixed at issuance, just like notes and bonds.
- The par value of TIPS begins at \$1,000 and is adjusted semiannually for changes in the Consumer Price Index (CPI). Even if there is deflation (falling price levels), the par value can never be adjusted to below \$1,000. The fixed coupon rate is paid semiannually as a percentage of the *inflation adjusted par value*.
- Any increase in the par value from the inflation adjustment is taxed as income in the year of the adjustment.

$$\text{TIPS coupon payment} = \text{inflation-adjusted par value} \times \frac{\text{stated coupon rate}}{2}$$

For example, consider a \$100,000 par value TIPS with a 3% coupon rate, set at issuance. Six months later the *annual* rate of inflation (CPI) is 4%. The par value will be increased by one-half of the 4% (i.e., 2%) and will be $1.02 \times 100,000 = \$102,000$.

The first *semiannual* coupon will be one-half of the 3% coupon rate times the inflation adjusted par value: $1.5\% \times 102,000 = \$1,530$. Any percentage change in the CPI over the next 6-month period will be used to adjust the par value from \$102,000 to a new inflation-adjusted value, which will be multiplied by 1.5% to compute the next coupon payment.

On-the-Run and Off-the-Run Treasury Securities

Treasury issues are divided into two categories based on their vintage:

- **On-the-run** issues are the most recently auctioned Treasury issues.
- **Off-the-run** issues are older issues that have been replaced (as the most traded issue) by a more recently auctioned issue. Issues replaced by several more recent issues are known as *well off-the-run* issues.

The distinction is that the on-the-run issues are more actively traded and therefore more liquid than off-the-run issues. Market prices of on-the-run issues provide better information about current market yields.

LOS 67.d: Describe how stripped Treasury securities are created and distinguish between coupon strips and principal strips.

Since the U.S. Treasury does not issue zero-coupon notes and bonds, investment bankers began stripping the coupons from Treasuries to create zero-coupon securities of various maturities to meet investor demand. These securities are termed **stripped Treasuries** or **Treasury strips**. In 1985, the Treasury introduced the Separate Trading of Registered Interest and Principal Securities (STRIPS) program. Under this program, the Treasury issues coupon-bearing notes and bonds as it normally does, but then it allows certain government securities dealers to buy large amounts of these issues, strip the coupons from the principal, repackage the cash flows, and sell them separately as zero-coupon bonds, at discounts to par value.

For example, a 10-year T-note has 20 coupons and one principal payment; these 21 cash flows can be repackaged and sold as 21 different zero-coupon securities. The stripped securities (*Treasury strips*) are divided into two groups:

- **Coupon strips** (denoted as *ci*) refers to strips created from coupon payments stripped from the original security.
- **Principal strips** refers to bond and note principal payments with the coupons stripped off. Those derived from stripped bonds are denoted *bp* and those from stripped notes *np*.

Professor's Note: While the payments on coupon strips and principal strips with the same maturity date are identical, certain countries treat them differently for tax purposes, and they often trade at slightly different prices.

STRIPS are taxed by the IRS on their implicit interest (movement toward par value), which, for fully taxable investors, results in negative cash flows in years prior to maturity. The Treasury STRIPS program also created a procedure for *reconstituting* Treasury notes and bonds from the individual pieces.

LOS 67.e: Describe the types and characteristics of securities issued by U.S. federal agencies.

Agency bonds are debt securities issued by various agencies and organizations of the U.S. Government, such as the Federal Home Loan Bank (FHLB). Most agency issues are *not* obligations of the U.S. Treasury and technically should not be considered the same as Treasury securities. Even so, they are very high quality securities that have almost no risk of default. There are two types of federal agencies:

- **Federally related institutions**, such as the Government National Mortgage Association (Ginnie Mae) and the Tennessee Valley Authority (TVA), which are owned by the U.S. Government and are exempt from Securities Exchange Commission (SEC) registration. In general, these securities are backed by the full faith and credit of the U.S. Government, except in the case of the TVA and Private Export Funding Corporation. Essentially, these securities are free from credit risk.
- **Government sponsored enterprises (GSEs)** include the Federal Farm Credit System, the Federal Home Loan Bank System, the Federal National Mortgage Association (Fannie Mae), the Federal Home Loan Bank Corporation (Freddie Mac), and the Student Loan Marketing Association (Sallie Mae). These are privately owned, but publicly chartered organizations, and were created by the U.S. Congress. They issue their securities directly in the marketplace and expose investors to some (albeit very little) credit risk.

Debentures are securities that are not backed by collateral (i.e., they are unsecured). GSEs commonly issue debentures. These are of many maturity structures and can be coupon interest paying securities or discount securities (referred to as bills).

LOS 67.f: Describe mortgage-backed securities (including mortgage passthrough securities, collateralized mortgage obligations, and stripped MBS), and explain the cash flows, prepayments and prepayment risk for each.

Mortgage-backed securities (MBSs) are backed (secured) by pools of mortgage loans, which not only provide *collateral* but also the *cash flows* to service the debt. A mortgage-backed security is any security where the collateral for the issued security is a pool of mortgages.

The cash flows from a mortgage or from a pool of mortgages are different from the cash flows of a coupon bond. Mortgage loans are amortizing loans in that they make a series of equal payments consisting of the periodic interest on the outstanding principal at the beginning of the period and a partial repayment of the principal amount. Residential real estate mortgages are typically for 30 years and consist of 360 equal monthly payments. In the early years, interest is the largest portion of the payment and the final payment after 30 years is almost all principal.

Professor's Note: Amortizing loans and amortization schedules are covered in Study Session 2.

Prepayments and Prepayment Risk

The cash flows of a mortgage passthrough security mirror those of a mortgage loan, with some interest and some principal. Any payment of principal in excess of the scheduled principal repayment (the principal component of the regular level mortgage payment) is called a **prepayment**. A prepayment on a mortgage loan that is less than the entire remaining principal amount is called a **curtailment**.

Most mortgage loans allow the borrower to prepay principal at any time and in any amount without a penalty. Therefore, mortgage passthrough securities are subject to the **prepayment risk** described in the previous topic review. Since homeowners are more likely to prepay principal when interest rates fall (are low), the prepayment option is similar to a call feature. A prepayment option subjects the security holder to more reinvestment risk than would be the case with a mortgage that could not be prepaid (or only prepaid with a significant penalty).

In summary, the monthly cash flows into a mortgage pool underlying a passthrough security consist of three components:

- Monthly interest.
- Scheduled monthly principal payments.
- Prepayments, or principal repayments in excess of scheduled principal payments.

A **mortgage passthrough security** is created by pooling a number of mortgages together, usually several thousand mortgages.

- Shares of such mortgage pools are sold in the form of *participation certificates* representing ownership of a fractional share of the pool of underlying mortgages. A \$100,000 (par value) participation certificate would represent a 1% interest in the cash flows from a \$10 million (face value) pool of mortgages.
- The interest and principal payments made by the homeowners whose mortgages are in the pool are collected and *passed through* to investors after deducting a small amount for administrative and servicing fees.

Ginnie Mae, Freddie Mac, and Fannie Mae all issue passthrough securities and guarantee timely payment of interest and principal.

Collateralized mortgage obligations (CMOs) are created from mortgage passthrough certificates and referred to as derivative mortgage-backed securities, since they are derived from a simpler MBS structure. CMOs have a more complex structure than mortgage passthroughs. A CMO issue has different "tranches," each of which has a different type of claim on the cash flows from the pool of mortgages (i.e., their claims are not just a fractional claim on the total cash flows from the pool).

Professor's Note: Tranche is from the French word for "slice." In finance, when a security issue consists of different classes of securities with differing claims and especially with differing risks, the different classes of securities are called tranches. You will likely run into this term only in reference to the different classes of securities that make up a CMO.

An example of a simple *sequential* CMO structure with three tranches will help to illustrate a CMO structure. Assume that three tranches are created out of a passthrough security. Let's call them Tranches I, II, and III. They receive interest on the basis of their outstanding par values. The following are the details of the payments to each of the three tranches.

- Tranche I (the *short-term* segment of the issue) receives net interest on outstanding principal and all of the principal payments from the mortgage pool until it is completely paid off.
- Tranche II (the *intermediate-term*) receives its share of net interest and starts receiving all of the principal payments after Tranche I has been completely paid off. Prior to that, it only receives interest payments.

- Tranche III (the *long-term*) receives monthly net interest and starts receiving all principal repayments after Tranches I and II have been completely paid off. Prior to that it only receives interest payments.

Tranche I has the shortest expected maturity and may appeal to an investor with a preference for securities with a shorter time horizon, who previously could not participate in the mortgage-backed securities market. Other structures, with prepayments primarily affecting only some of the tranches, are used to redistribute prepayment risk. The tranches with less prepayment risk will become more attractive to some investors. Investors better able to bear prepayment risk will find the tranches with higher prepayment risk attractive.

LOS 67.g: State the motivation for creating a collateralized mortgage obligation.

The motivation for creating collateralized mortgage obligations (CMOs) is to *redistribute the prepayment risk* inherent in mortgage passthrough securities and/or *create securities with various maturity ranges*. The CMO structure takes the cash flows from the mortgage pool and, in a simple structure, allocates any principal payments (both scheduled payments and prepayments) sequentially over time to holders of different CMO tranches, rather than equally to all security holders. Creating a CMO does not alter the *overall* risk of prepayment, it redistributes prepayment risk.

As a general rule, CMOs are created to satisfy a broader range of investor risk/return preferences—making investing in mortgage-backed securities more appealing to a wider audience and decreasing overall borrowing costs.

LOS 67.h: Describe the types of securities issued by municipalities in the United States, and distinguish between tax-backed debt and revenue bonds.

Debt securities issued by state and local governments in the U.S. are known as *municipal bonds* (or “munis” for short). *Municipal bonds* are issued by states, counties, cities, and other political subdivisions (such as school, water, or sewer districts). These bonds are often issued as *serial bonds*, that is, a larger issue is divided into a series of smaller issues, each with its own maturity date and coupon rate.

Municipal bonds are often referred to as *tax-exempt* or *tax-free* bonds, since the coupon interest is exempt from federal income taxes. Note that, while interest income may be tax free, realized capital gains are not. They are subject to normal capital gains taxes at the federal level. However, not all municipal bonds are tax exempt; some are taxable:

- *Tax exempt*. Different states tax municipal securities differently; the vast majority of states treat *their own bonds* (i.e., those issued within the state) as tax exempt, but consider the interest income earned on out-of-state bonds as fully taxable. Thus, the interest income earned on most in-state bonds held by a resident of that state is free from *both* state and federal income tax. Such bonds are referred to as *double tax free*.
- *Taxable*. A municipal bond must meet certain federal standards in order to qualify for the tax-exempt status. If they don't, the bonds are considered “taxable” and the *interest income on these bonds is subject to federal income tax* (they could still be exempt from state taxes). *Taxable municipal bonds are the exception* rather than the rule, as most municipal issues are exempt from federal taxes.

An opinion as to the tax-exempt status of the bonds, typically by a well-respected law firm specializing in municipal bond issues, is provided to purchasers when the bonds are issued.

Tax-Backed Debt and Revenue Bonds

Tax-backed bonds, also called general obligation (GO) bonds, are backed by the full faith, credit, and *taxing power* of the issuer. Tax-backed debt is issued by school districts, towns, cities, counties, states, and special districts, and include the following types:

- *Limited tax GO debt* is subject to a statutory limit on taxes that may be raised to pay off the obligation.

- *Unlimited tax GO debt*, the most common type of GO bond, is secured by the full faith and credit of the borrower and backed by its unlimited taxing authority, which includes the ability to impose individual income tax, sales tax, property tax, and corporate tax. This is the more secure form of GO.
- *Double-barreled bonds*, a special class of GOs, are backed not only by the issuing authority's taxing power, but also by additional resources that could include fees, grants, and special charges that fall outside the general fund.
- *Appropriation-backed obligations* are also known as *moral obligation bonds*. States sometimes act as a back up source of funds for issuers during times of shortfall. However, the state's obligation is not legally binding, but is a "moral obligation." The state may appropriate funds from its general fund. This *moral pledge* enhances the security of such bonds.
- Debt supported by *public credit enhancement* programs possess a guarantee by the state or federal government, which is a legally enforceable contract and is used normally to assist the state's school system.

Revenue bonds are supported only through revenues generated by projects that are funded with the help of the original bond issue. For example, revenue bonds can be issued to fund transportation systems, housing projects, higher education, health care, sports arenas, harbors, and ports. These bonds fall outside GO debt limits and do not require voter approval.

The distinction between a general obligation and a revenue bond is important for a bondholder, because the issuer of a revenue bond is obligated to pay principal and interest *only if a sufficient level of revenue is generated* by the project. If the funds aren't there, the issuer does not make payments on the bond. In contrast, general obligation bonds are required to be serviced in a timely fashion irrespective of the level of tax income generated by the municipality. At issuance, revenue bonds typically involve more risk than general obligation bonds and, therefore, provide higher yields.

Insured Bonds and Prerefunded Bonds

Insured bonds carry the guarantee of a third party that all principal and interest payments will be made in a timely manner. The third-party guarantee (insurance) typically cannot be canceled; it is good for the life of the bond. There are several firms that specialize in providing insurance for municipal bond issues. Municipal bond insurance results in higher ratings, usually AAA, which reduces the required yield and improves the liquidity of the bonds. Insured bonds are especially common in the revenue bond market but the general obligation bonds of smaller municipal issuers are often insured to broaden their appeal to investors.

Prerefunded bonds are bonds for which Treasury securities have been purchased and placed in a special escrow account in an amount sufficient to make all the remaining required bond payments. The Treasury securities' income and principal payments must be sufficient to fund the municipal bond's required payments until maturity or through the first call date. Bonds that are prerefunded have little or no credit risk and are likely to receive a rating of AAA.

LOS 67.i: Describe the characteristics and motivation for the various types of debt used by corporations (including corporate bonds, medium-term notes, structured notes, commercial paper, negotiable CDs and bankers acceptances).

Rating Agencies and Credit Ratings

Rating agencies, such as Moody's and S&P, rate specific debt issues of corporations. Some of the factors they consider are quantitative, but many are qualitative. Even quantitative factors can be somewhat subjective. The ratings are issued to indicate the relative probability that all promised payments on the debt will be made over the life of the security and, therefore, must be forward looking. Ratings on long-term bonds will consider factors that may come into play over at least one full economic cycle.

Some of the *firm-specific* factors considered are:

- Past repayment history.
- Quality of management, ability to adapt to changing conditions.
- The industry outlook and firm strategy.
- Overall debt level of the firm.
- Operating cash flow, ability to service debt.
- Other sources of liquidity (cash, salable assets).
- Competitive position, regulatory environment, union contracts/history.
- Financial management and controls.
- Susceptibility to event risk and political risk.

Some factors *specific to a particular debt issue* are:

- Priority of the claim being rated.
- Value/quality of any collateral pledged to secure the debt.
- The covenants of the debt issue.
- Any guarantees or obligations for parent company support.

Professor's Note: It may help to remember the primary factors as all Cs: Character of the issuer, Capacity to repay, the Collateral provided, and the Covenants of the debt issue.

Secured Debt, Unsecured Debt, and Credit Enhancements for Corporate Bonds

Secured debt is backed by the pledge of assets/collateral, which can take the following forms:

- *Personal property* (e.g., machinery, vehicles, patents).
- *Financial assets* (e.g., stocks, bonds, notes).
- These assets are marked to market from time to time to monitor their liquidation values. Covenants may require a pledge of more assets if values are insufficient.
- *Real property* (e.g., land and buildings).
- In all of these cases, the bondholder holds a lien on the pledged property. In the case of default, the lien holder can sell the property and use the proceeds to satisfy the obligations of the borrower. In most cases of default, some mutual agreement will be reached for a new structure, but the bondholders' claim on the pledged assets significantly strengthens their position in renegotiation.

Unsecured debt is not backed by any pledge of specific collateral. Unsecured bonds are referred to as *debentures*. They represent a general claim on any assets of the issuer that have not been pledged to secure other debt. If pledged assets generate funds upon liquidation in excess of the obligation, then these excess funds are available for satisfying the claims of unsecured debt holders. *Subordinated debentures* have claims that are satisfied after (subordinate to) the claims of *senior debt*.

Credit enhancements are the guarantees of others that the corporate debt obligation will be paid in a timely manner. Typically, they take one of the following forms:

- *Third-party* guarantees that the debt obligations will be met. Often, parent companies guarantee the loans of their affiliates and subsidiaries.
- *Letters of credit* are issued by banks and guarantee that the bank will advance the funds to service the corporation's debt.
- *Bond insurance* can be obtained from firms that specialize in providing it.

When analyzing credit-enhanced debt, analysts should focus on the financial strength of both the corporation issuing the debt and the financial strength of the party providing credit enhancement. The protection to the

bond holder is no better than the promise of the entity offering the credit enhancement. A decrease in the creditworthiness of the guarantor (enhancer) can lead to a rating downgrade of the debt issue.

Medium-Term Notes

Professor's Note: Be careful here, medium-term notes are not necessarily medium-term or notes!

Corporate bond issues typically (1) are sold all at once, (2) are sold on a firm-commitment basis whereby an underwriting syndicate guarantees the sale of the whole issue, and (3) consist of bonds with a single coupon rate and maturity.

Medium-term notes (MTNs) differ from a regular corporate bond offering in all of these characteristics.

MTNs are registered under SEC Rule 415 (*shelf registration*) which means that they need not be sold all at once. Once registered, such securities can be "placed on the shelf" and sold in the market over time at the discretion of the issuer. MTNs are sold over time, with each sale satisfying some minimum dollar amount set by the issuer, typically one million dollars and up.

MTNs are issued in various maturities, ranging from 9 months to periods as long as 100 years. Issuers provide *maturity ranges* (e.g., 18 months to 2 years) for MTNs that they wish to sell and provide yield quotes for those ranges, typically as a spread to comparable maturity Treasury issues. Investors interested in purchasing the notes make an offer to the issuer's agent, specifying the face value and an exact maturity within one of the ranges offered. The agent then confirms the issuer's willingness to sell those MTNs and effects the transaction.

The offering is done by the issuer's agent on a *best-efforts* basis. There is no firm commitment on the agent's part to sell a specific amount of bonds.

MTNs can have fixed or floating-rate coupons, can be denominated in any currency, and can have special features, such as calls, caps, floors, and non-interest rate indexed coupons. The notes issued can be combined with derivative instruments to create the special features that an investor requires. The combination of the derivative and notes is called a *structured security*.

Structured Notes

A **structured note** is a debt security created when the issuer combines a typical bond or note with a derivative. This is done to create a security that has special appeal to some institutional investors. As with any innovative debt security, the motivation to issue them is to lower overall borrowing costs. The fact that the targeted institutional investors face restrictions on the types of securities they can purchase leads to the reduction in borrowing costs and structured securities allow them to avoid these restrictions and essentially "break the rules."

As an example, consider an institutional investor that is prohibited from owning equity or derivative securities. An issuer could create a structured note where the periodic coupon payments were based on the performance of an equity security or an equity index. This structured note would still be a debt security, but would produce returns closer to holding the equity index itself. The mechanics of creating this security would be to issue a debt security and combine it with an *equity swap*. An equity swap is a derivative that requires the payment of a fixed rate of interest (the coupon rate on the bond here), and pays its owner the rate of return on the equity or equity index each period. By combining the bond with the equity swap, a structured note is created that pays the percentage rate of return on the equity semiannually instead of paying a fixed coupon payment.

We will cover equity swaps, interest rate swaps, and other derivatives commonly used to create structured notes in a subsequent study session. For our purposes here, it is sufficient that you understand that structured notes are created by combining regular debt with derivative securities to make a "debt security" that allows certain institutional investors to get around restrictions they face and thereby reduce the borrowing costs of the company creating the structured note.

Commercial Paper: Directly-Placed and Dealer-Placed Paper

Commercial paper is a short-term, unsecured debt instrument used by corporations to borrow money at rates lower than bank rates. Commercial paper is issued with maturities of 270 days or less, since debt securities with maturities of 270 days or less are exempt from SEC registration. It is issued with maturities as short as two days, with most issues being in the 2-day to 90-day range.

Like T-bills, commercial paper is typically issued as a pure discount security and makes a single payment equal to the face value at maturity. There is no active secondary market in commercial paper and most buyers hold commercial paper until maturity.

Commercial paper is generally issued by corporations with relatively strong credit and the proceeds are often used to finance credit given to the firm's customers or to finance inventories. Finance subsidiaries of manufacturing firms issue commercial paper to fund customers' purchases of the parent company's products. Issuers often keep unused bank lines of credit in place to use in case new paper cannot be issued to generate the funds needed to pay off maturing paper.

Directly-placed paper is commercial paper that is sold to large investors without going through an agent or broker-dealer. Large issuers will deal with a select group of regular commercial paper buyers who customarily buy very large amounts.

Dealer-placed paper is sold to purchasers through a commercial-paper dealer. Most large investment firms have commercial paper desks to serve their customers' needs for short-term cash-management products.

Negotiable CDs and Bankers Acceptances

Certificates of deposit (CDs) are issued by banks and sold to their customers. They represent a promise by the bank to repay a certain amount plus interest and, in that way, are similar to other bank deposits. In contrast to regular bank deposits, CDs are issued in specific denominations and for specified periods of time that can be of any length. In the U.S., CDs are insured by the Federal Deposit Insurance Corporation (FDIC) for up to \$100,000 in the event the issuing bank becomes insolvent. Amounts above \$100,000 are not insured and are, therefore, only as secure as the bank that issues the CD.

Typical bank CDs in the U.S. carry a penalty to the CD owner if the funds are withdrawn earlier than the maturity date of the CD. **Negotiable CDs**, however, permit the owner to sell the CD in the secondary market at any time. Negotiable CDs issued in the U.S. by U.S. banks are termed domestic CDs, whereas U.S. dollar denominated CDs issued by foreign banks and branches of U.S. banks outside the U.S. are termed Eurodollar CDs. Negotiable CDs have maturities ranging from days up to 5 years. The interest rate paid on them is called the London Interbank Offering Rate because they are primarily issued by banks' London branches.

Bankers acceptances are essentially guarantees by a bank that a loan will be repaid. They are created as part of commercial transactions, especially international trade. As an example, consider an importer who agrees to pay for goods shipped to him by an exporter, 45 days after the goods are shipped. The importer goes to his bank and gets a letter of credit stating that the bank will guarantee the payment, say \$1 million. This letter must be sent to the bank of the exporter before the exporter will actually ship the goods. When the exporter delivers the shipping documents to her bank, she will receive the present value of the \$1 million, discounted because the payment will not be made for 45 days.

The final step in the creation of a bankers acceptance is that the exporter's bank presents the evidence of shipment to the issuing bank (the importer's bank) which then "accepts" the evidence of shipment. It is this accepted promise to pay \$1 million in 45 days that is the bankers acceptance. The importer will sign documents evidencing his obligation to his bank and becomes the borrower of the funds. When this final step is completed, the importer receives the documents necessary to receive the shipment of goods.

The exporter's bank can either continue to hold the acceptance or sell it to an investor, often a money market fund interested in short-term paper. The acceptance is a discount instrument and sells for the present value of the single \$1 million payment to be made 45 days from the shipping date. The secondary market for bankers acceptances is limited so their liquidity is limited and most purchasers intend to hold them until their maturity dates.

The credit risk of a bankers acceptance is the risk that the importer (the initial borrower of the funds) and the accepting bank will both fail to make the promised payment.

LOS 67.j: Define an asset-backed security, describe the role of a special purpose vehicle in an asset-backed securities transaction, state the motivation for a corporation to issue an asset-backed security, and describe the types of external credit enhancements for asset-backed securities.

Credit card debt, auto loans, bank loans, and corporate receivables are often securitized in the same way as mortgages are in the MBS structure. These financial assets are the underlying collateral for bonds which are also asset-backed securities (ABSs). While the above types of underlying assets are the most common, innovative ABSs have also been created. In one case, singer David Bowie sold a \$55 million dollar ABS issue where the underlying assets were the royalties from 25 of his albums released prior to 1990.

Role of a Special Purpose Vehicle

A *special purpose vehicle* or *special purpose corporation* is a separate legal entity to which a corporation transfers the financial assets for an ABS issue. The importance of this is that a legal transfer of the assets is made to the special purpose vehicle. This shields the assets from the claims of the corporation's general creditors, making it possible for the ABS issue to receive a higher credit rating than the corporation as a whole. Because the assets are sold to the special purpose vehicle, they are highly unlikely to be subject to any claims arising from the bankruptcy of the corporation, and the special purpose vehicle is termed a *bankruptcy remote* entity.

The **motivation for a corporation to issue asset-backed securities** is to reduce borrowing costs. By transferring the assets into a separate entity, the entity can issue the bonds and receive a higher rating than the unsecured debt of the corporation. The higher rating reduces the required yield on the (ABS) debt.

External Credit Enhancements

Since asset-backed securities, on their own, may not receive the highest possible credit rating, the issuer may choose to enhance the credit rating by providing additional guarantees or security. Credit quality can be enhanced either externally or internally. **External credit enhancement** commonly takes the following forms:

- *Corporate guarantees*, which may be provided by the corporation creating the ABS or its parent.
- *Letters of credit*, which may be obtained from a bank for a fee.
- *Bond insurance*, which may be obtained from an insurance company or a provider specializing in underwriting such structures. This is also referred to as an *insurance wrap*.

None of these enhancements come without cost. The decision of how much enhancement to provide involves a tradeoff between the cost of enhancement and the resulting decrease in the market yield required on the bonds.

Note that the quality of a credit-enhanced security is only as good as the quality of the guarantor, and the credit rating of the security can reflect any deterioration in the guarantor's rating.

LOS 67.k: Describe collateralized debt obligations.

A **collateralized debt obligation (CDO)** is a debt instrument where the collateral for the promise to pay is an underlying pool of other debt obligations and even other CDOs. These underlying debt obligations can be business loans, mortgages, debt of developing countries, corporate bonds of various ratings, asset-backed

securities, or even problem/non-performing loans. Tranches of the CDO are created based on the seniority of the claims to the cash flows of the underlying assets, and these are given separate credit ratings depending on the seniority of the claim, as well as the creditworthiness of the underlying pool of debt securities.

CDOs may be created by a sponsor that seeks to profit on the spread between the rate to be earned on the underlying assets and the rate promised to the CDO holder (an arbitrage CDO), or created by a bank or insurance company seeking to reduce its loan exposure on its balance sheet (a balance sheet CDO).

LOS 67.l: Describe the structures of the primary and secondary markets in bonds.

The primary market for debt (newly created debt securities) functions in a manner similar to the primary market for equities. Typically, an investment banker is involved in advising the debt issuer and in distributing (selling) the debt securities to investors. When the investment banker actually purchases the entire issue and resells it, they are said to have "underwritten" the issue. This arrangement is termed a *firm commitment* while the deal is termed a *bought deal*. In an underwritten offering of debt securities, the underwriter will typically put together a syndicate of other investment bankers to aid in distributing the securities. The underwriters can reduce their risk by preselling as much of the offering as possible to their institutional clients and hedging the interest rate risk exposure of the issue for the period they anticipate owning the securities. An alternative is for the investment banker to agree to sell all of the issue that they can and this is termed doing the offering on a *best efforts* basis.

In the above described process, since the price paid for the issue and the anticipated sale price is determined between the (lead) investment bank and the issuing company, the offering is termed a *negotiated offering*. Another approach is an *auction process* where an issuer of debt securities determines the size and terms of the issue and several investment banks, or underwriting syndicates of multiple investment banks, bid on what interest rate they require to sell it. The syndicate with the lowest interest rate bid will be awarded the deal.

In the U.S., securities to be offered to public investors must be registered with the SEC. When a new issue of debt securities is not registered for sale to the public, it still may be sold to a small number of investors. This is called a *private placement* or Rule 144A offering (after the rule that allows such transactions). Avoidance of the registration process is valuable to the issuer and, since a private placement involves a sale to a small number of investors/institutions, the issue can be tailored to the needs and preferences of the buyers. Since the issue cannot be sold to the public unless it is subsequently registered, the buyers will require a slightly higher interest rate to compensate them for the lack of liquidity of securities that are sold through a private placement.

The secondary market for debt securities includes exchanges, an over-the-counter dealer market, and electronic trading networks. Traditionally, most secondary trading in debt securities was transacted in a dealer market, with broker/dealers buying and selling bonds for and from their inventories (i.e., acting as market makers). More recently, the costs and risks of supplying the capital necessary to adequately fund bond trading operations have increased and spreads have decreased. Because of this, electronic trading has become a more important part of the secondary market for debt securities. These electronic networks can be bids and offers by a single dealer, bids and offers by multiple dealers, or simply anonymous customer bids and offers posted on an electronic trading system with a trade clearing system.

KEY CONCEPTS

1. A country's internal bond market refers to bonds traded within that country and under its jurisdiction and includes bonds issued by firms domiciled in that country (domestic bonds) and bonds issued by firms domiciled outside that country (foreign bonds).
2. A country's external bond market refers to bonds issued by international syndicates outside the jurisdiction of any single country and offered to investors in several countries simultaneously (also called Eurobonds).
3. Sovereign debt refers to the debt obligations of governments. U.S. Treasury securities are sovereign debt.

4. The primary securities issued by the U.S. Treasury are bills (pure-discount securities maturing in four weeks, three months, or six months), notes (maturing in two to ten years), and bonds (maturing in more than ten years).
5. Treasury Inflation Protected Securities (TIPS) are U.S. Treasury issues in which the coupon rate is fixed but the par value is adjusted periodically to account for inflation.
6. Treasury strips are traded in two forms—coupon strips and principal strips—and are taxed by the IRS on the basis of accrued interest, like other zero-coupon securities.
7. U.S. Treasuries trade in the secondary market and are termed on-the-run (i.e., the most recent issue) or off-the-run (i.e., older issues).
8. Prices for U.S. Treasuries are quoted in whole percent and 32nds of a percent of par value; a price of 92-11 is a price of 92 and $\frac{11}{32}$ % of 1,000 or \$923.44.
9. A mortgage-backed security (MBS) is backed by a pool of amortizing mortgage loans (the collateral) and has monthly cash flows that include both interest and principal payments.
10. Prepayment risk is significant for investors of MBSs, since most mortgage loans contain a prepayment option, which allows the issuer (borrower) to make additional principal payments at any time.
11. Collateralized mortgage obligations (CMOs) are customized claims to the principal and/or interest payments or mortgage-backed securities created to decrease borrowing costs by redistributing prepayment risk or altering the maturity structure to better suit specific investor preferences.
12. State and local government securities (municipal securities or munis) are usually exempt from U.S. federal taxes, and state-tax exempt in the state of issuance.
13. Municipal bonds include tax-backed debt, backed by the taxing authority of the governmental unit issuing the securities, and revenue bonds, backed only by the revenues from the project financed by the bond issue.
14. Insured bonds are guaranteed by a firm specializing in bond insurance and prerefunded bonds are back by U.S. Treasury securities.
15. Corporate securities include bonds, medium-term notes, and commercial paper.
16. Bond rating agencies rate corporate bonds on capacity to repay (liquid assets and cash flow), management quality, industry prospects, corporate strategy, financial policies, credit history, overall debt levels, the collateral for the issue, and the nature of the covenants.
17. Corporate bonds may be secured or unsecured (called debentures). Security can be in the form of real property, financial assets, or personal property/equipment.
18. Medium-term notes (MTN) are issued periodically by corporations under a shelf registration, sold by agents on a best-efforts basis, and have maturities ranging from 9 months to over 30 years.
19. Commercial paper is a short-term corporate financing vehicle and does not require registration with the SEC if its maturity is less than 270 days. CP comes in two forms: (1) directly-placed paper—sold directly by the issuer; and (2) dealer-placed paper—sold to investors through agents/brokers.
20. Negotiable CDs are issued in a wide range of maturities by banks, trade in a secondary market, are backed by bank assets, and are termed Eurodollar CDs when denominated in \$U.S. and issued outside the U.S.
21. Bankers acceptances are issued by banks to guarantee a future payment for goods shipped, sold at a discount to the future payment they promise, short-term, and have limited liquidity.
22. Asset-backed securities are debt that is supported by an underlying pool of mortgages, auto loans, credit card receivables, commercial loans, or other financial assets.
23. Collateralized debt obligations (CDOs) are backed by an underlying pool of debt securities which may be any one of a number of types: corporate bonds, loans, emerging markets debt, mortgage-backed securities, or other CDOs.
24. The primary market in bonds includes underwritten and best-efforts public offerings, as well as private placements.
25. The secondary market in bonds includes some trading on exchanges and a much larger volume of trading in a dealer (OTC) market, but electronic trading networks continue to be an increasingly important part of the secondary market for bonds.

CONCEPT CHECKERS: OVERVIEW OF BOND SECTORS AND INSTRUMENTS

1. A Treasury security is quoted at 97-17 and has a par value of \$100,000. Which of the following is its quoted dollar price?
 - A. \$97,170.00.
 - B. \$97,531.25.
 - C. \$100,000.00.
 - D. \$975,312.50.
2. An investor holds \$100,000 (par value) worth of Treasury Inflation Protected Securities (TIPS) that carry a 2.5% semiannual pay coupon. If the annual inflation rate is 3%, what is the inflation-adjusted principal value of the bond after six months?
 - A. \$100,000.
 - B. \$101,500.
 - C. \$102,500.
 - D. \$103,000.
3. An investor holds \$100,000 (par value) worth of TIPS currently trading at par. The coupon rate of 4% is paid semiannually, and the annual inflation rate is 2.5%. What coupon payment will the investor receive at the end of the first six months?
 - A. \$2,000.
 - B. \$2,025.
 - C. \$2,050.
 - D. \$4,000.
4. A Treasury note (T-note) principal strip has six months remaining to maturity. How is its price likely to compare to a 6-month Treasury bill (T-bill) that has just been issued? The T-note price should be:
 - A. lower.
 - B. higher.
 - C. the same.
 - D. set at the coupon rate.
5. Which of the following statements is *most correct*?
 - A. Treasury principal strips are usually created from Treasury bills.
 - B. Treasury bonds may be used to create Treasury coupon STRIPS.
 - C. Treasury coupon strips can be created from Treasury bonds, notes, or bills.
 - D. Treasury coupon strips make lower coupon payments than Treasury principal strips.
6. Which of the following municipal bonds typically has the *greater* risk and is issued with *higher* yields?
 - A. Revenue bonds.
 - B. Appropriation backed obligations.
 - C. Limited tax general obligation bonds.
 - D. Unlimited tax general obligation bonds.
7. A bond issue that is serviced with the earnings from a pool of Treasury securities that have been placed in escrow is called a(n):
 - A. insured bond.
 - B. prerefunded bond.
 - C. absolute priority bond.
 - D. credit-enhanced obligation.

8. Of the following, the debt securities that are most often registered according to the requirements of SEC Rule 415 (shelf registration) are:
 - A. corporate bonds.
 - B. medium-term notes.
 - C. double-barreled bonds.
 - D. mortgage-backed securities.
9. A Yankee bond and a Samurai bond are bonds that are issued and traded in the United States and Japan by issuers that are domiciled in a country other than the U.S. or Japan, respectively. These bonds are referred to as:
 - A. eurobonds.
 - B. foreign bonds.
 - C. sovereign debt.
 - D. special purpose vehicles.
10. A corporation issuing asset-backed securities can often improve the credit rating of the securities to above that of the issuing company by transferring the assets to a(n):
 - A. asset trust.
 - B. special purpose vehicle.
 - C. bond insurer.
 - D. fiduciary account.
11. Which of the following is a *difference* between an on-the-run and an off-the-run issue? An on-the-run issue:
 - A. will always carry a higher coupon.
 - B. is the most recently issued security of that type.
 - C. has a shorter maturity than an off-the-run issue.
 - D. is publicly traded whereas an off-the-run issue is not.
12. Compared to a public offering, a private placement of debt securities *likely* has:
 - A. more liquidity and a lower yield.
 - B. more liquidity and a higher yield.
 - C. less liquidity and a lower yield.
 - D. less liquidity and a higher yield.
13. Compared to negotiable CDs, bankers acceptances:
 - A. are more liquid.
 - B. are less likely to default.
 - C. have shorter maturities on average.
 - D. are more likely to pay periodic interest.
14. A debt security that is collateralized by a pool of the sovereign debt of several developing countries is *likely* a(n):
 - A. CMO.
 - B. CDO.
 - C. EMD.
 - D. ABS.
15. Activities in the primary market for debt securities would NOT include:
 - A. market making.
 - B. an auction process.
 - C. a best-efforts offering.
 - D. a firm commitment.

ANSWERS – CONCEPT CHECKERS: OVERVIEW OF BOND SECTORS AND INSTRUMENTS

1. B This value is computed as follows: dollar price = $97\frac{17}{32}\% \times \$100,000 = 0.9753125 \times \$100,000 = \$97,531.25$.
2. B The annual inflation rate is 3%, which corresponds to 1.5% semiannually. Therefore, the principal value has increased by 1.5%. So we have: new principal = $\$100,000 \times 1.015 = \$101,500$.
3. B This coupon payment is computed as follows:

$$\text{Coupon payment} = (\$100,000 \times 1.0125) \left(\frac{0.04}{2} \right) = \$2,025$$
4. C The T-note principal strip has exactly the same cash flows (the principal) as the T-bill. Therefore, the prices of the two securities should be (about) equal. However, market imperfections, such as illiquidity, may lead to differences.
5. B Treasury coupon and principal strips are created by separating (stripping) the principal and coupons from Treasury notes and bonds and selling packages of these single-maturity cash flows as individual zero-coupon securities. Treasury bills cannot be used because they are already zero-coupon securities.
6. A Revenue bond issues are only obligated to pay principal and interest if revenue from the project that they helped fund is sufficient to service the issue. When issued, revenue bonds typically are riskier than general obligation bonds and, consequently, have higher yields.
7. B The cash flows generated by an escrow pool of Treasury securities are used to service prerefunded bonds. Insured bonds carry third-party guarantees. There are no securities formally known as absolute priority bonds or credit enhanced obligations (yet).
8. B Shelf registration is used with medium-term notes. This permits the issue to be held in inventory (on the "shelf") and sold in parcels at the discretion of the issuer. Corporate, MBS, and double-barreled municipal bond issues are usually sold all at once.
9. B Foreign bonds are traded and issued in a country other than the country of the issuer. For example, the bonds of Toyota Motor Company, a Japanese firm, issued and traded in Great Britain are foreign bonds (called bulldog bonds).
10. B The assets are sold to a special purpose vehicle to protect them from general claims against the issuing corporation.
11. B On-the-run issues are the most recently issued securities.
12. D Investors require a higher yield to compensate for the fact that privately placed debt is not registered for public sale and is therefore less liquid than debt registered for public sale.
13. C Bankers acceptances are short-term and pay no periodic interest. Like negotiable CDs, they are as good as the credit of the issuing bank but have a very limited secondary market.
14. B A CDO or collateralized debt obligation is backed by an underlying pool of debt securities which may be emerging markets debt. A CMO is backed by a pool of mortgages, an ABS is backed by financial assets, and EMD is made up.
15. A Market making refers to a dealer that trades in the secondary market for its own account from inventory.

UNDERSTANDING YIELD SPREADS

Study Session 15

EXAM FOCUS

Yield spreads are simply differences between the yields of any two debt securities or types of debt securities. Try to get a good grip on the spread terminology in this review and the characteristics that drive yield spreads. You should know all three theories of the term structure, not only their implications for the

shape of the yield curve but also what the yield curve shape can tell us under each of the three theories. Learn the relationships between taxable and after-tax yields and between tax-free and taxable equivalent yields well. Calculations of these relations are almost sure to be worth some points come exam day.

LOS 68.a: Identify the interest rate policy tools available to the U.S. Federal Reserve Board.

While interest rates are determined by a variety of economic conditions, in the U.S. the Federal Reserve (Fed) attempts to manage short-term rates through its *monetary policy tools*. The four interest rate tools of the Fed are as follows:

1. **The discount rate** is the rate at which banks can borrow reserves from the Fed. A lower rate tends to increase bank reserves, encourage lending, and decrease interest rates. A higher discount rate has the opposite effect, raising rates.
2. **Open market operations** refers to the buying or selling of Treasury securities by the Fed in the open market. When the Fed buys securities, cash replaces securities in investor accounts, more funds are available for lending, and interest rates decrease. Sales of securities by the Fed have the opposite effect, reducing cash balances and funds available for lending as well as increasing rates.
3. **Bank reserve requirements** are the percentage of deposits that banks must retain (not loan out). By increasing the percentage of deposits banks are required to retain as *reserves*, the Fed effectively decreases the funds that are available for lending. This decrease in amounts available for lending will tend to increase interest rates. A decrease in the percentage reserve requirement will increase the funds available for loans and tends to decrease interest rates.
4. **Persuading banks to tighten or loosen their credit policies.** By asking banks to alter their lending policies, the Fed attempts to affect their willingness to lend. Encouraging lending will tend to decrease rates and vice versa.

The most commonly used policy tool is *open market operations*.

LOS 68.b: Describe the Treasury yield curve and the various shapes of the yield curve.

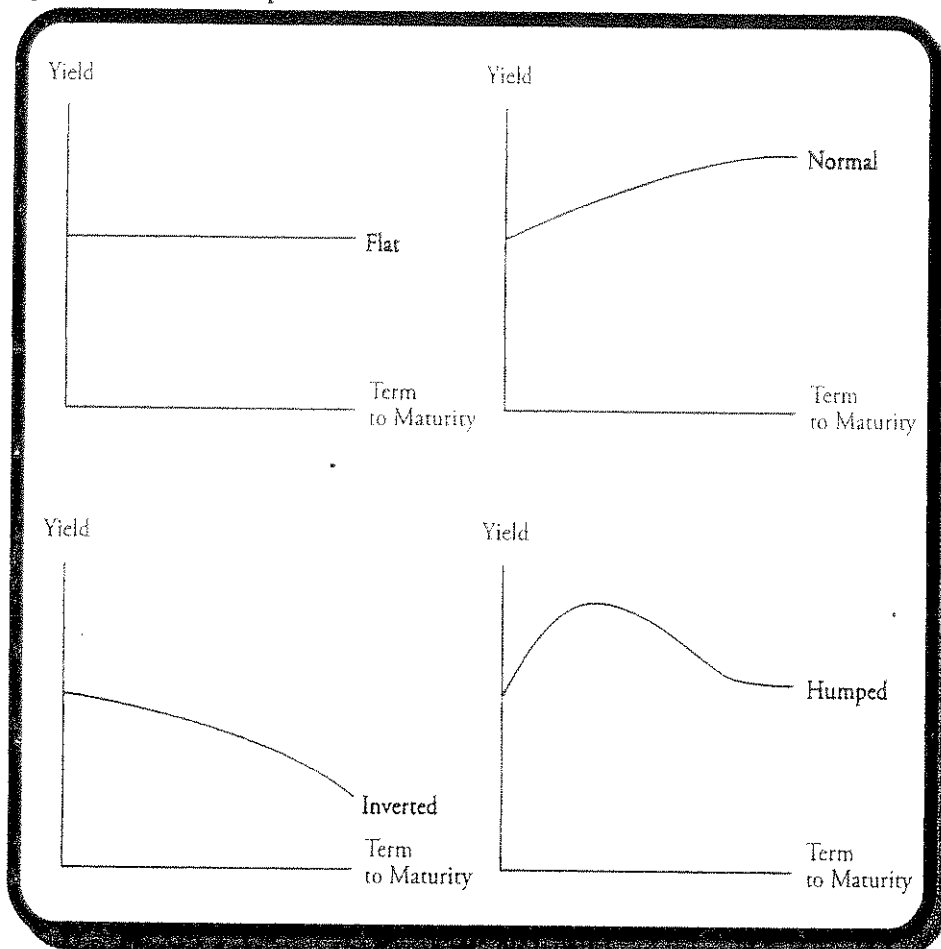
We have mentioned yield curves previously as just a plot of yields by years to maturity. For a view of a current Treasury yield curve and related information, you can look at www.bloomberg.com/markets/rates/index.html. The Treasury yield curve shows the yields for U.S. Treasury securities (bills, notes, and bonds) with maturities from three months to 30 years.

There are four general shapes that we use to describe yield curves:

- Normal or upward sloping.
- Inverted or downward sloping.
- Flat.
- Humped.

These four shapes are illustrated in Figure 1.

Figure 1: Yield Curve Shapes



Yield curves can take on just about any shape, so don't think these examples are the only ones observed. These four are representative of general types, and you need to be familiar with what is meant by an "upward sloping" or "normal" yield curve and by an "inverted" or "downward sloping" yield curve. Humped and flat yield curves usually go by just those descriptive names and shouldn't present any problem. Just remember that a flat yield curve means that yields are all equal at every maturity.

LOS 68.c: Explain the basic theories of the term structure of interest rates (i.e., pure expectations theory, liquidity preference theory, and market segmentation theory) and describe the implications of each theory for the shape of the yield curve.

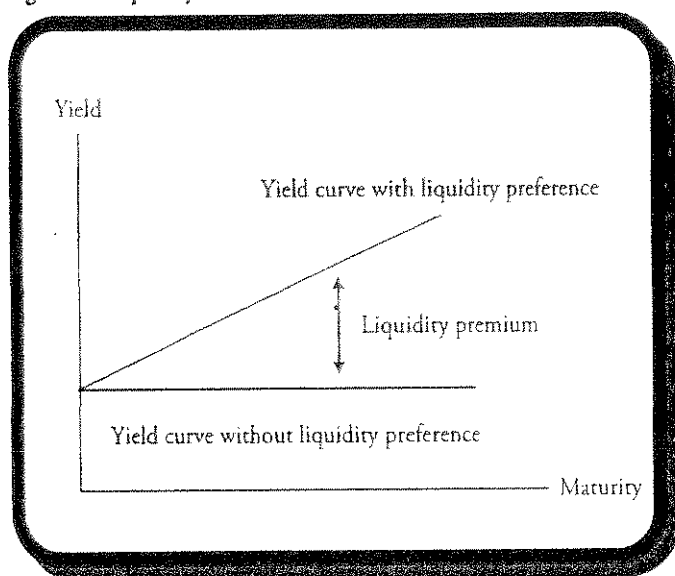
The pure expectations theory states that the yield for a particular maturity is an average (not a simple average) of the short term rates that are expected in the future. If short term rates are expected to rise in the future, interest rate yields on longer maturities will be higher than those on shorter maturities, and the yield curve will be

upward sloping. If short term rates are expected to fall over time, longer maturity bonds will be offered at lower yields.

Proponents of the liquidity preference theory believe that, in addition to expectations about future short term rates, investors require a risk premium for holding longer term bonds. This is consistent with the fact that interest rate risk is greater for longer maturity bonds.

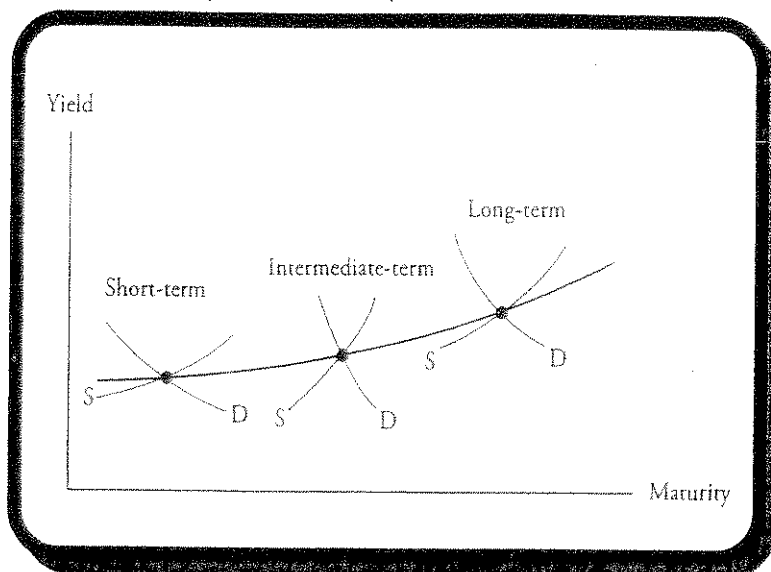
Under this theory, the size of the liquidity premium will depend on how much additional compensation investors require to induce them to take on the greater risk of longer maturity bonds or, alternatively, how strong their preference for the greater liquidity of shorter term debt is. An illustration of the effect of a liquidity premium on a yield curve, where expected future short-term rates are constant, is presented in Figure 2.

Figure 2: Liquidity Premium



The market segmentation theory is based on the idea that investors and borrowers have preferences for different maturity ranges. Under this theory, the supply of bonds (desire to borrow) and the demand for bonds (desire to lend) determine equilibrium yields for the various maturity ranges. Institutional investors may have strong preferences for maturity ranges that closely match their liabilities. Life insurers and pension funds may prefer long maturities due to the long-term nature of the liabilities they must fund. A commercial bank that has liabilities of a relatively short maturity may prefer to invest in shorter-term debt securities. Another argument for the market segmentation theory is that there are legal or institutional policy restrictions that prevent investors from purchasing securities with maturities outside a particular maturity range. The determination of yields for various maturity ranges of the yield curve is illustrated in Figure 3.

Figure 3: Market Segmentation Theory and the Yield Curve



A somewhat weaker version of the market segmentation theory is the *preferred habitat theory*. Under this theory, yields also depend on supply and demand for various maturity ranges, but investors can be induced to move from their preferred maturity ranges when yields are sufficiently higher in other (non-preferred) maturity ranges.

Term Structure Theories and the Shape of the Yield Curve

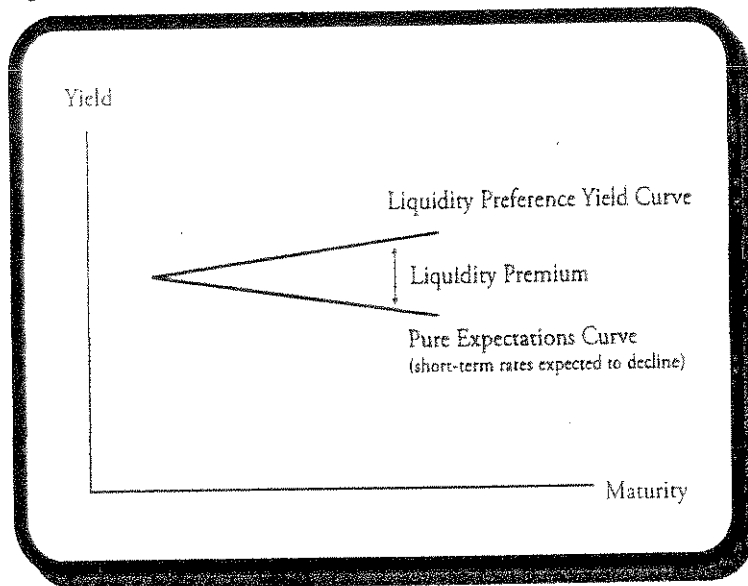
The pure expectations theory by itself has no implications for the shape of the yield curve. The various expectations and the shapes that are consistent with them are:

- Short-term rates expected to rise in the future → upward sloping yield curve
- Short-term rates are expected fall in the future → downward sloping yield curve
- Short-term rates expected to rise then fall → humped yield curve
- Short-term rates expected to remain constant → flat yield curve

The shape of the yield curve, under the pure expectations theory, provides us with information about investor expectations about future short-term rates.

Under the **liquidity preference theory**, the yield curve may take on any of the shapes we have identified. If rates are expected to fall a great deal in the future, even adding a liquidity premium to the resulting negatively sloped yield curve can result in a downward sloping yield curve. A humped yield curve could still be humped even with a liquidity premium added to all the yields. Also note that, under the liquidity preference theory, an upward sloping yield curve can be consistent with expectations of declining short term rates in the future. This case is illustrated in Figure 4.

Figure 4: Liquidity Premium Added to Decreasing Expected Rates



The **market segmentation theory** of the term structure is consistent with any yield curve shape. Under this theory, it is supply and demand for debt securities at each maturity range that determines the yield for that maturity range. There is no specific linkage among the yields at different maturities, although, under the *preferred habitat theory*, higher rates at an adjacent maturity range can induce investors to purchase bonds with maturities outside their preferred range of maturities.

LOS 68.d: Define a Treasury spot rate.

Yield to maturity is the single discount rate that makes the present value of a bond's promised cash flows equal to its market price. Actually, the appropriate discount rates for cash flows that come at different points in time are typically not all the same. The discount rate for a payment that comes one year from now is not necessarily the same discount rate that should be applied to a payment that comes five or ten years from now. That is, the yield curve is not *flat* (horizontal).

The appropriate discount rates for the promised payments from a Treasury bond at different times in the future are called **Treasury spot rates**. The spot rates for different time periods that correctly value (produce a value equal to market price) a Treasury bond are called **arbitrage-free Treasury spot rates**, or the *theoretical Treasury spot rate curve*. We will examine the methodology for estimating these rates and why they are called "arbitrage-free" spot rates a bit later. Here we just introduce the idea of spot rates to differentiate them from coupon bond yields (YTM's). Conceptually, spot rates are the discount rates for (yields on) zero-coupon bonds, securities that have only a single cash flow at a future date. A simple example (with annual rather than semiannual payments) will illustrate this concept as applied to coupon bonds.

Consider an annual-pay bond with a 10% coupon rate and three years to maturity. This bond will make three payments. For a \$1,000 bond these payments will be \$100 in one year, \$100 at the end of two years, and \$1,100 three years from now. Suppose we are given the following spot rates:

1 year = 8%

2 year = 9%

3 year = 10%

Discounting each promised payment by its corresponding spot rate, we can value the bond as:

$$\frac{100}{1.08} + \frac{100}{1.09^2} + \frac{1,100}{1.10^3} = 1,003.21$$

LOS 68.e: Explain the different types of yield spread measures (e.g., absolute yield spread, relative yield spread, yield ratio), compute yield spread measures given the yields for two securities, and explain why investors may find a relative yield spread to be a better measure of yield spread than the absolute yield spread.

A yield spread is simply the difference between the yields on two bonds or two types of bonds. Three different yield spread measures are as follows:

The **absolute yield spread** is simply the difference between yields on two bonds. This simple measure is sometimes called the *nominal spread*. Absolute yield spreads are usually expressed in basis points (100ths of 1%).

$$\text{absolute yield spread} = \text{yield on the higher-yield bond} - \text{yield on the lower-yield bond}$$

The **relative yield spread** is the absolute yield spread expressed as a percentage of the yield on the lower-yield bond.

$$\text{relative yield spread} = \frac{\text{absolute yield spread}}{\text{yield on the lower-yield bond}} = \frac{\text{higher yield}}{\text{lower yield}} - 1$$

The **yield ratio** is the ratio of the yields on the two bonds.

$$\text{yield ratio} = \frac{\text{higher yield}}{\text{lower yield}}$$

Note that the yield ratio is simply one plus the relative yield spread. The calculation of these yield spread measures is illustrated in the following example.

Example: Computing yield spreads

Consider two bonds, X and Y. Their respective yields are 6.50% and 6.75%. Using bond X as the reference bond, compute the absolute yield spread, the relative yield spread, and the yield ratio for these bonds.

Answer:

$$\text{absolute yield spread} = 6.75\% - 6.50\% = 0.25\% \text{ or } 25 \text{ basis points}$$

$$\text{relative yield spread} = 0.25\% / 6.50\% = 0.038 = 3.8\%$$

$$\text{yield ratio} = 6.75\% / 6.50\% = 1.038$$

The most commonly used yield spread is the *absolute* yield spread, even though it is the most simplistic. A shortcoming of the absolute yield spread is that it may remain constant, even though overall rates rise or fall. In this case, the effect of rising or falling rates on spreads is captured by the relative yield spread or the yield ratio.

For example, consider two yields that rise from 6.5% and 7.0% to 7.0% and 7.5%, respectively. The absolute yield spread remains constant at 50 basis points, while the relative spread falls from 7.69% to 7.14% and the yield ratio decreases from 1.077 to 1.071.

LOS 68.f: Describe a credit spread and discuss the suggested relationship between credit spreads and the economic well being of the economy.

A credit (or quality) spread is the difference in yields between two issues that are similar in all respects except for credit rating. An example of a credit spread is the difference in yields between long AA-rated general obligation (GO) municipal bonds and long A-rated GO munis (an intramarket spread as well). Obviously, these spreads show the effect of credit quality on yields and reveal the risk-return tradeoff the investor can expect (i.e., how much added return an investor can earn by investing in issues with higher perceived credit risk).

Credit spreads are related to the state of the economy. During an expanding economy, credit spreads decline as corporations are expected to have stronger cash flows. On the other hand, during economic contractions, cash flows are pressured, leading to a greater probability of default and higher yields on lower-quality issues. When investors anticipate an economic downturn, they often sell low-quality issues and buy high-quality issues, including Treasuries. This “flight to quality” puts downward pressure on the prices of low-quality issues, raising their yields.

LOS 68.g: Identify how embedded options affect yield spreads.

A call option on a bond is an option the bond issuer holds and will only be exercised if it is advantageous to the issuer to do so. From the bondholder's perspective, a non-callable bond is preferred to a bond that is otherwise identical but callable. Investors will require a higher yield on a callable bond, compared to the same bond without the call feature. Therefore, yield spreads to a benchmark bond, such as a similar maturity Treasury issue, are higher for the callable bond. By the same reasoning, yield spreads must be greater to compensate bondholders for the prepayment option embedded in mortgage passthrough securities.

The inclusion of a put provision or a conversion option with a bond will have the opposite effect; the choice of whether to exercise either of these options is the bondholder's. Compared to an identical option-free bond, a puttable bond will have a lower yield spread to Treasuries due to the value of the put feature “included” with the bond.

The fact that option provisions affect yield spreads is important because this tells us that spreads for bonds with embedded options are not purely premiums for credit risk, liquidity differences, and maturity (duration) risk.

LOS 68.h: Explain how the liquidity or issue-size of a bond affects its yield spread relative to risk-free securities and relative to other issues that are comparable in all other ways except for liquidity.

Bonds that have *less liquidity have higher spreads* to Treasuries. Investors prefer more liquidity to less and will pay a premium for greater liquidity. A higher price for a bond that is identical to another in all aspects except that it is more actively traded—and therefore more liquid—translates into a lower yield compared to the less liquid bond.

Liquidity is affected by the size of an issue. *Larger issues normally have greater liquidity* because they are more actively traded in the secondary market. Empirical evidence suggests that issues with *greater size have lower yield spreads*. When compared with identical but smaller issues, larger-size issues have lower yields due to their greater liquidity.

LOS 68.i: Compute the after-tax yield of a taxable security and the tax-equivalent yield of a tax-exempt security.

The after-tax yield on a taxable security can be calculated as:

$$\text{after-tax yield} = \text{taxable yield} \times (1 - \text{marginal tax rate})$$

Example: Computing after-tax yield

What is the after-tax yield on a corporate bond with a yield of 10% for an investor with a 40% marginal tax rate?

Answer:

Investors are concerned with after-tax returns. The marginal tax rate is the percentage that must be paid in taxes on one additional dollar of income, in this case interest income.

For an investor with a marginal tax rate of 40%, 40 cents of every additional dollar of taxable interest income must be paid in taxes. For a taxable bond that yields 10%, the after-tax yield to an investor with a 40% marginal tax rate will be:

$$10\%(1 - 0.4) = 6.0\% \text{ after tax}$$

Tax-exempt securities can offer lower yields compared to taxable securities because the yields they offer are after-tax yields. The higher an investor's marginal tax rate, the greater the attractiveness of a tax exempt issue compared to a taxable issue. The **taxable-equivalent yield** is the yield a particular investor must earn on a taxable bond to have the same after-tax return they would receive from a particular tax-exempt issue. The calculation is just a rearrangement of the after-tax yield formula above.

$$\text{taxable-equivalent yield} = \frac{\text{tax-free yield}}{(1 - \text{marginal tax rate})}$$

Example: Taxable-equivalent yield

Consider a municipal bond that offers a yield of 4.5%. If an investor is considering buying a fully taxable Treasury security offering a 6.75% yield, should she buy the Treasury security or the municipal bond, given that her marginal tax rate is 35%?

Answer:

We can approach this problem from two perspectives. First, the taxable equivalent yield on the municipal bond is $\frac{4.5\%}{(1 - 0.35)} = 6.92\%$, which is higher than the taxable yield, so the municipal bond is preferred.

Alternatively, the after-tax return on the taxable bond is $0.0675 \times (1 - 0.35) = 4.39\%$.

Thus, the after-tax return on the municipal bond (4.5%) is greater than the after-tax yield on the taxable bond (4.39%), and the municipal bond is preferred.

Either approach gives the same answer; she should buy the municipal bond.

LOS 68.j: Define LIBOR and explain why it is an important measure to funded investors who borrow short-term.

We previously mentioned LIBOR (London Interbank Offered Rate) in reference to the rates paid on negotiable CDs by banks and bank branches located in London. LIBOR has become the most important benchmark or reference rate for floating-rate debt securities and short-term lending. LIBOR is determined each day and published by the British Bankers' Association for several currencies, including the U.S., Canadian, and Australian dollars, the Euro, Japanese yen, British pounds, and Swiss francs, among others. While the maturity of the CDs

that banks invest in can range from overnight to five years, LIBOR is most important for short-term rates of one year or less.

A **funded investor** is one who borrows to finance an investment position. The importance of LIBOR in this context is as a measure of the funding costs because the loans to finance the investment are most often floating-rate loans or short-term loans where the reference rate is published LIBOR. Recall that floating-rate loans are based on a reference rate plus a margin. A funded investor with a borrowing rate of 2-month (60-day) LIBOR + 40 basis points would have a borrowing cost (annualized) of 2.6% when 2-month LIBOR is quoted at 2.2%. The profits of such a funded investor would depend on his or her ability to earn greater than a 2.6% annual rate on the investments funded in such a manner.

KEY CONCEPTS

1. The Federal Reserve Board's tools for affecting short-term interest rates are the discount rate, open-market operations, the reserve requirement, and persuasion to influence banks lending policies.
2. "Yield curves" represent the plot of yield against maturity for a particular type of bond. The general shapes are upward or downward sloping, flat, or humped.
3. Theories of the yield curve and their implications for the shape of the yield curve are:
 - The pure expectations theory argues that rates at longer maturities depend only on expectations of future short-term rates and is consistent with any yield curve shape.
 - The liquidity preference theory of the term structure states that longer term rates reflect investors' expectations about future short-term rates as well as a liquidity premium to compensate them for exposure to interest rate risk. The liquidity preference theory adds an increasing term premium to all yield curve points but can be consistent with a downward sloping curve if an expected decrease in short-term rates outweighs the term premium.
 - The market segmentation theory argues that lenders and borrowers have preferred maturity ranges and that the shape of the yield curve is determined by the supply and demand for securities within each maturity range, independent of the yield in other maturity ranges. It is consistent with any yield curve shape and in a somewhat weaker form is known as the preferred habitat theory.
4. Treasury spot rates are the appropriate discount rates for single cash flows (coupon or principal payments) from a U.S. Treasury security, given the time until a payment is to be received.
5. Types of yield spreads:
 - The absolute yield spread is the difference between the yield on a particular security or sector and the yield of a reference (benchmark) security or sector, which is often on-the-run Treasury securities of like maturity.
 - The relative yield spread is the absolute yield spread expressed as a percentage of the benchmark yield. This is arguably a superior measure to the absolute spread, since it will reflect changes in the level of interest rates even when the absolute spread remains constant.
 - The yield ratio is the ratio of the yield on a security or sector to the yield on a benchmark security or sector; it is simply one plus the relative yield spread.
6. A credit spread is the yield difference between two bond issues due to differences in credit (default) risk, as reflected in their credit ratings. These spreads narrow when the economy is healthy and expanding, while they increase during contractions/recessions reflecting a "flight to (higher) quality" by investors.
7. Call options and prepayment options increase yields and yield spreads compared to option-free bonds. Put options and conversion options decrease yields and yield spreads compared to comparable option-free bonds.
8. Empirical evidence suggests that larger debt issues by the same borrower are more liquid when other bond characteristics are alike. Greater liquidity implies a lower-liquidity risk premium, and more liquid bonds tend to have lower yields and lower yield spreads relative to a benchmark issue.

9. To compare a tax-exempt bond with a taxable issue, use either of the following:
after-tax yield = taxable yield \times (1 – marginal tax rate), and compare it to tax-exempt yield, or
the taxable-equivalent yield = $\frac{\text{tax-free yield}}{(1 - \text{marginal tax rate})}$, and compare it to a taxable yield.
10. LIBOR is determined from rates on bank CDs in London in several important currencies and is the most important reference rate globally for floating-rate debt and short-term loans.

CONCEPT CHECKERS: UNDERSTANDING YIELD SPREADS

1. Under the pure expectations theory, an inverted yield curve is interpreted as evidence that:
 - A. demand for long term bonds is falling.
 - B. inflation is expected to rise in the future.
 - C. short-term rates are expected to fall in the future.
 - D. investors have very little demand for liquidity.
2. According to the liquidity preference theory, which of the following statements is FALSE?
 - A. All else equal, investors prefer short-term securities over long-term securities.
 - B. Long-term rates should be higher than short-term rates because of the added risks.
 - C. Investors perceive little risk differential between short-term and long-term securities.
 - D. Borrowers will pay a premium for long-term funds to avoid having to roll over short-term debt.
3. With respect to the term structure of interest rates, the market segmentation theory holds that:
 - A. an increase in demand for long-term borrowings could lead to an inverted yield curve.
 - B. expectations about the future of short-term interest rates are the major determinants of the shape of the yield curve.
 - C. the yield curve reflects the maturity demands of financial institutions and investors.
 - D. the shape of the yield curve is independent of the relationship between long- and short-term interest rates.
4. The most commonly used tool of the Fed to control interest rates is:
 - A. the discount rate.
 - B. the bank reserve requirement.
 - C. open market operations.
 - D. persuading banks to alter their lending policies.
5. For two bonds that are alike in all respects except maturity, the relative yield spread is 7.14%. The yield ratio is *closest* to:
 - A. 92.85.
 - B. 0.714.
 - C. 1.0714.
 - D. 107.14.
6. Assume the following yields for different bonds issued by a corporation:
 - 1-year bond: 5.50%.
 - 2-year bond: 6.00%.
 - 3-year bond: 7.00%.If a 3-year U.S. Treasury is yielding 5%, then what is the *absolute* yield spread on the 3-year corporate issue?
 - A. 0.40.
 - B. 1.40.
 - C. 100 bp.
 - D. 200 bp.

7. Assume the following corporate yield curve:
- 1-year bond: 5.00%.
 - 2-year bond: 6.00%.
 - 3-year bond: 7.00%.
- If a 3-year U.S. Treasury is yielding 6%, the *relative* yield spread on the 3-year corporate is:
- A. 16.67%.
 - B. 1.167.
 - C. 14.28%.
 - D. 100bp.
8. If a U.S. investor is forecasting that the yield spread between U.S. Treasury bonds and U.S. corporate bonds is going to widen, which of the following beliefs would he be also *most likely* to hold?
- A. The economy is going to expand.
 - B. The economy is going to contract.
 - C. There will be no change in the economy.
 - D. The U.S. dollar will weaken.
9. For two bonds that are alike in all respects except credit risk, the yield ratio is 1.0833. If the yield on the higher yield bond is 6.5%, the lower yield bond yield is *closest* to:
- A. 8.33%.
 - B. 5.50%.
 - C. 7.04%.
 - D. 6.00%.
10. Given two bonds that are equivalent in all respects except tax status, the marginal tax rate that will make an investor indifferent between an 8.2% taxable bond and a 6.2% tax-exempt bond is *closest* to:
- A. 24.39%.
 - B. 76.61%
 - C. 37.04%.
 - D. 43.47%.
11. Which of the following statements *most accurately* describes the relationship between the economic health of a nation and credit spreads?
- A. Credit spreads and economic well-being are not correlated.
 - B. Credit spreads decrease during an expanding economy because corporate cash flows are expected to rise.
 - C. Credit spreads increase during an expanding economy because corporations invest in more speculative projects.
 - D. Credit spreads increase during an expanding economy because corporations are expected to have volatile earnings.
12. Which of the following *most accurately* describes the relationship between liquidity and yield spreads relative to Treasury issues? All else being equal, bonds with:
- A. less liquidity have lower yield spreads to Treasuries.
 - B. greater liquidity have higher yield spreads to Treasuries.
 - C. less liquidity have higher yield spreads to Treasuries.
 - D. greater liquidity have negative yield spreads to Treasuries.

13. A narrowing of credit spreads would *least* impact the value of which of the following investments?
- A. AAA corporate bond.
 - B. 30-year Treasury bond.
 - C. BB+ rated corporate bond.
 - D. Callable corporate bond.
14. Assume an investor is in the 31% marginal tax bracket. She is considering the purchase of either a 7.5% corporate bond that is selling at par or a 5.25% tax-exempt municipal bond that is also selling at par. Given that the two bonds are comparable in all respects except their tax status, the investor should buy the:
- A. corporate bond, since it has the higher yield of 7.50%.
 - B. municipal bond, since the taxable-equivalent yield on it is 10.87%.
 - C. municipal bond, since its taxable-equivalent yield is 7.61%.
 - D. corporate bond, since its after-tax yield is higher.

ANSWERS – CONCEPT CHECKERS: UNDERSTANDING YIELD SPREADS

1. C An inverted or downward-sloping yield curve, under the pure expectations theory, indicates that short-term rates are expected to decline in the future.
2. C Rational investors feel that long-term bonds have more risk exposure than short-term securities (i.e., long-term securities are less liquid and subject to more price volatility). The other statements are correct.
3. C The market segmentation theory holds that certain types of financial institutions and investors prefer to confine (most of) their investment activity to certain maturity ranges of the fixed-income market and that supply and demand forces within each segment ultimately determine the shape of the yield curve.
4. C Open market operations are carried on frequently. The Fed's selling of Treasuries in the open market takes money out of the economy, reducing the amount of loanable funds and increasing interest rates. The opposite occurs when the Fed buys Treasuries in the open market.
5. C The yield ratio is $1 + \text{relative yield spread}$, or $1 + 0.0714 = 1.0714$.
6. D Absolute yield spread = yield on the 3-year corporate issue – yield on the on-the-run 3-year Treasury issue
 $= 7.00\% - 5.00\% = 2.00\%$ or 200 bp.
7. A The yield on the corporate is 7%, so the relative yield is $\frac{7\% - 6\%}{6\%}$, which is $1/6$ or 16.67% of the 3-year Treasury yield.
8. B A contracting economy means lower corporate earnings which increases the probability of default on debt and increases yield spreads between corporate issues and Treasuries at a particular maturity.
9. D $\text{yield ratio} = \frac{\text{higher yield bond}}{\text{lower yield bond}} = 1.0833$. Given the higher yield is 6.5%, the lower yield can be calculated as:
 $\frac{6.5\%}{1.0833} = \text{lower yield bond} = 6.0\%$.
10. A The tax rate that makes investors indifferent between two otherwise equivalent bonds is determined by solving for the tax rate in the equation: tax-exempt yield = $(1 - \text{tax rate}) \times \text{taxable yield}$. Rearranging this relationship, we have:

$$\text{marginal tax rate} = 1 - \frac{\text{tax-exempt rate}}{\text{taxable rate}} = 1 - \frac{6.2}{8.2} = 24.39\%.$$
11. B As an economy expands, credit spreads decline as expected corporate earnings rise. This is because, with stronger earnings, corporations are less likely to default on their debt.
12. C The less liquidity a bond has, the higher its yield spread relative to Treasuries. This is because investors require a higher yield to compensate them for giving up liquidity, which results in a greater spread over Treasury issues, which are very liquid.
13. B Since we usually speak of credit spreads as yield spreads to Treasuries, a change in the yield spread does not imply any change in the values of Treasuries.
14. C The taxable-equivalent yield on this municipal bond is $\frac{5.25}{(1 - 0.31)} = \frac{5.25}{0.69} = 7.61\%$. Since this is higher than the yield on the (taxable) corporate bond, the municipal bond is preferred. Alternatively, the after-tax yield on the corporate is $7.5\% (1 - 0.31) = 5.175\%$, which is less than the tax-exempt yield, leading to the same decision.

The following is a review of the Analysis of Fixed Income Investments principles designed to address the learning outcome statements set forth by CFA Institute. This topic is also covered in:

MONETARY POLICY IN AN ENVIRONMENT OF GLOBAL FINANCIAL MARKETS

Study Session 15

EXAM FOCUS

This topic review focuses on the relationship between central bank (monetary) policy and financial markets. The review examines the transmission mechanism by which central bank actions affect short-term rates, expectations of price stability, and longer term rates. Through its effect on these, central bank monetary policy can also affect real economic variables such as investment, real output, and employment. The key idea here is that when central bank policy decisions

are predictable, transparent, and credible because of a commitment to long-term price stability, the implementation of policy decisions will be smoother. Make sure you understand how the predictability of central bank policy actions is measured and why. Predictability is less when there is information asymmetry between the central bank and financial markets.

LOS 69.a: Identify how central bank behavior affects financial markets, including the role of short-term interest rates, systemic liquidity and market expectations.

Central banks can control short-term interest rates by providing systemic liquidity (increasing the money supply) to decrease rates or by reducing liquidity to increase them. Decisions by consumers and businesses, however, are based largely on longer term rates which are beyond the direct control of the central bank. Rates that commercial banks charge on longer term loans will depend to a significant degree on expectations about future funding costs and inflation expectations.

We can think of commercial banks as the mechanism by which central bank policy influences the financial markets and the economy. Therefore, the expectations of private banks about the future course of monetary policy and the central bank's level of commitment to long-term price stability will be key factors in the determination of interest rates.

While private banks have been the primary financing source for businesses in the euro zone, direct financing through bonds offered in the financial markets is becoming more prevalent, as it has been in U.S. markets for some time. This raises the question of how this evolution of business financing will affect the ability of a central bank to directly influence economic activity.

LOS 69.b: Describe the importance of communication between a central bank and the financial markets.

When the financial markets receive new information that suggests risks to price stability, how the markets react depends on how clearly participants understand how the central bank will likely respond to that information. Poor communication of the intent of the central bank can lead to uncertainty, instability in financial markets, and policy decisions that surprise markets.

Financial market data communicates useful information to the central bank. The term structure in the bond market gives policymakers a view of expected interest rates. Bond derivatives prices will reflect the market's level of uncertainty about expected future interest rates. Equity markets also provide the central bank with important

information both as a leading indicator of economic growth and as a transmitter of economic shocks (sudden, sharp drops in equity prices reduce shareholder wealth, which reduces consumption spending). However, because markets are subject to fads and bubbles, exhibit herding behavior, and often overreact, the central bank should not follow the markets but guide them.

LOS 69.c: Discuss the importance of predictability, credibility, and transparency of monetary policy, measures of predictability, and the problem of information asymmetry.

If the central bank has established and communicated a clear and credible commitment to price stability, the markets will adjust quickly to the expected change in monetary policy in response to an event, as well as to the event itself. In fact, interest rates can reflect (an anticipated) policy action even before the central bank announces it. Such anticipation can lead to a smoother implementation of policy. Thus, predictability can be an important asset to central bank policy makers. When the central bank's commitment to price stability is highly credible, banks and financial markets can react to the central bank's expected response to events suggesting inflationary pressures, rather than to the events themselves. Sophisticated financial markets can react to clear signalling of intent by the central bank, even in the absence of immediate changes in liquidity to influence short-term rates. For these reasons, a predictable, credible, and transparent monetary policy is most effective in bringing about smooth implementation of monetary policy changes.

Overnight interest rates and short-term forward rates can be used as measures of predictability. When central bank policy decisions are less predictable, we would expect greater changes in overnight rates in response to policy change announcements. Another way to assess predictability is to use short-term forward rates as indicators of anticipated monetary policy changes. Studies in Europe from 1999 to 2001 have shown that overnight rates did not change appreciably after the European Central Bank announced policy moves, and that forward rates anticipated most of the moves correctly.

The markets cannot forecast every monetary policy change. Economic shocks or extraordinary events can require that the central bank act quickly in ways that could not have been well anticipated. The central bank will sometimes have information that financial markets do not. When there is information asymmetry of this type, even transparent decision making by the central bank and a credible commitment to long-term price stability may not be enough to prevent markets from being surprised by central bank policy changes.

KEY CONCEPTS

1. Financial markets and private banks are the channels by which monetary policy decisions are transmitted to the real economy. The central bank can control short-term rates and systemic liquidity, but financial markets' expectations for future interest rates and inflation determine the longer-term rates that influence lending decisions by banks and the investment decisions of businesses.
2. If the central bank communicates its policy strategy clearly, establishes the credibility of its commitment to price stability, and creates a transparent decision-making process, markets will be able to anticipate the central bank's reaction to new data about risks to price stability, leading to smoother implementation of policy decisions.
3. Market expectations give central banks useful information about the consensus outlook for interest rates and inflation, but central banks should lead, not follow the markets, because markets exhibit a herding behavior and are subject to fads, bubbles, and overreaction.
4. To operate smoothly and achieve its objectives efficiently, monetary policy should be:
 - *Credible*. The financial markets should believe in the central bank's commitment to price stability.
 - *Predictable*. Markets should be able to anticipate correctly how the central bank will react to new information.
 - *Transparent*. A policy move should not change the markets' beliefs about the central bank's objectives.
5. The predictability of central bank policy decisions can be measured by the consequent change in overnight rates and by how well forward rates anticipate actual future policy decisions.
6. Information asymmetry may cause a central bank to make policy moves that are unanticipated by financial markets, even when policy reactions to information known to financial markets are predictable and the decision making process is transparent.

CONCEPT CHECKERS: MONETARY POLICY IN AN ENVIRONMENT OF GLOBAL FINANCIAL
MARKETS

1. A central bank's monetary policy decisions should *least likely* be:
 - A. driven by observable financial market data.
 - B. communicated promptly to the markets.
 - C. consistent with its stated long-term policy goals.
 - D. arrived at through a process market participants understand.
2. The predictability of a central bank's reactions to current shocks can *best* be measured by:
 - A. the price of gold in the central bank's currency.
 - B. the spread between straight and inflation-indexed bond yields.
 - C. actual consumer price inflation relative to economists' forecasts.
 - D. changes in overnight interest rates after a bank announces its policy changes.
3. Because market interest rates reflect both current and anticipated monetary policy, it is *most likely* that:
 - A. to have the desired effect, monetary policy changes must surprise the markets.
 - B. the market will absorb monetary policy changes smoothly if the changes are predictable.
 - C. communicating well-anticipated monetary policy changes is of little value.
 - D. the central bank should establish a credible anti-inflation policy based on spot and future commodity prices.
4. In order to be most effective and produce smooth implementation of policy decisions, central bank monetary policy should be all of the following EXCEPT:
 - A. credible.
 - B. predictable.
 - C. transparent.
 - D. infrequently changed.

ANSWERS – CONCEPT CHECKERS: MONETARY POLICY IN AN ENVIRONMENT OF GLOBAL FINANCIAL MARKETS

1. A Although financial market data can be useful for monetary policy decision making, the central bank should not let the markets drive policy because markets are subject to fads and bubbles and herding behavior and often overreact. Prompt communication, a transparent process, and adherence to stated goals are all elements of effective policy.
2. D If the central bank's policy moves are predictable, they will largely be reflected in short-term rates before they are announced. The other three choices are measures of the central bank's success at achieving price stability.
3. B Policy changes that surprise the markets can be counterproductive if they undermine the central bank's credibility. Communicating all policy changes promptly and clearly aids the transparency of the central bank's decision making. Choice D is a non sequitur. Some schools of economic thought advocate targeting commodity prices, but that opinion is not directly related to the issue of expectations about policy changes being reflected in market interest rates.
4. D Monetary policy should be credible, predictable, and transparent. Whether it should be infrequently changed depends on the economic situation, the arrival of new information, and the frequency and significance of shocks to the financial system.