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Fifth Edition

Fixed Income Analysis Workbook

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FIXED INCOME ANALYSIS WORKBOOK

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FIXED INCOME ANALYSIS WORKBOOK

Fifth Edition

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WILEY

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Published by John Wiley & Sons, Inc., Hoboken, New Jersey.
The First, Second, Third, and Fourth Editions of this book were published by Wiley in 2000, 2011, 2015, and 2019, respectively.
Published simultaneously in Canada.

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ISBN 978-1-119-85299-5 (Paper)
ISBN 978-1-119-85300-8 (ePDF)
ISBN 978-1-119-85301-5 (ePub)

Printed in the United States of America.

10 9 8 7 6 5 4 3 2 1

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PART I

LEARNING OBJECTIVES,
SUMMARY OVERVIEW,
AND PROBLEMS

FIXED-INCOME SECURITIES: DEFINING ELEMENTS

LEARNING OUTCOMES

The candidate should be able to:

- describe basic features of a fixed-income security;
- describe content of a bond indenture;
- compare affirmative and negative covenants and identify examples of each;
- describe how legal, regulatory, and tax considerations affect the issuance and trading of fixed-income securities;
- describe how cash flows of fixed-income securities are structured;
- describe contingency provisions affecting the timing and/or nature of cash flows of fixed-income securities and whether such provisions benefit the borrower or the lender.

SUMMARY OVERVIEW

This chapter introduces the salient features of fixed-income securities while noting how these features vary among different types of securities. Important points include the following:

- The three important elements that an investor needs to know when investing in a fixed-income security are: (1) the bond's features, which determine its scheduled cash flows and thus the bondholder's expected and actual return; (2) the legal, regulatory, and tax considerations that apply to the contractual agreement between the issuer and the bondholders; and (3) the contingency provisions that may affect the bond's scheduled cash flows.
- The basic features of a bond include the issuer, maturity, par value (or principal), coupon rate and frequency, and currency denomination.
- Issuers of bonds include supranational organizations, sovereign governments, non-sovereign governments, quasi-government entities, and corporate issuers.
- Bondholders are exposed to credit risk and may use bond credit ratings to assess the credit quality of a bond.

- A bond's principal is the amount the issuer agrees to pay the bondholder when the bond matures.
- The coupon rate is the interest rate that the issuer agrees to pay to the bondholder each year. The coupon rate can be a fixed rate or a floating rate. Bonds may offer annual, semi-annual, quarterly, or monthly coupon payments depending on the type of bond and where the bond is issued.
- Bonds can be issued in any currency. Such bonds as dual-currency bonds and currency option bonds are connected to two currencies.
- The yield-to-maturity is the discount rate that equates the present value of the bond's future cash flows until maturity to its price. Yield-to-maturity can be considered an estimate of the market's expectation for the bond's return.
- A plain vanilla bond has a known cash flow pattern. It has a fixed maturity date and pays a fixed rate of interest over the bond's life.
- The bond indenture or trust deed is the legal contract that describes the form of the bond, the issuer's obligations, and the investor's rights. The indenture is usually held by a financial institution called a trustee, which performs various duties specified in the indenture.
- The issuer is identified in the indenture by its legal name and is obligated to make timely payments of interest and repayment of principal.
- For asset-backed securities, the legal obligation to repay bondholders often lies with a separate legal entity—that is, a bankruptcy-remote vehicle that uses the assets as guarantees to back a bond issue.
- How the issuer intends to service the debt and repay the principal should be described in the indenture. The source of repayment proceeds varies depending on the type of bond.
- Collateral backing is a way to alleviate credit risk. Secured bonds are backed by assets or financial guarantees pledged to ensure debt payment. Examples of collateral-backed bonds include collateral trust bonds, equipment trust certificates, mortgage-backed securities, and covered bonds.
- Credit enhancement can be internal or external. Examples of internal credit enhancement include subordination, overcollateralization, and reserve accounts. A bank guarantee, a surety bond, a letter of credit, and a cash collateral account are examples of external credit enhancement.
- Bond covenants are legally enforceable rules that borrowers and lenders agree on at the time of a new bond issue. Affirmative covenants enumerate what issuers are required to do, whereas negative covenants enumerate what issuers are prohibited from doing.
- An important consideration for investors is where the bonds are issued and traded, because it affects the laws, regulation, and tax status that apply. Bonds issued in a country in local currency are domestic bonds if they are issued by entities incorporated in the country and foreign bonds if they are issued by entities incorporated in another country. Eurobonds are issued internationally, outside the jurisdiction of any single country and are subject to a lower level of listing, disclosure, and regulatory requirements than domestic or foreign bonds. Global bonds are issued in the Eurobond market and at least one domestic market at the same time.
- Although some bonds may offer special tax advantages, as a general rule, interest is taxed at the ordinary income tax rate. Some countries also implement a capital gains tax. There may be specific tax provisions for bonds issued at a discount or bought at a premium.
- An amortizing bond is a bond whose payment schedule requires periodic payment of interest and repayment of principal. This differs from a bullet bond, whose entire payment of principal occurs at maturity. The amortizing bond's outstanding principal amount is reduced to

- zero by the maturity date for a fully amortized bond, but a balloon payment is required at maturity to retire the bond's outstanding principal amount for a partially amortized bond.
- Sinking fund agreements provide another approach to the periodic retirement of principal, in which an amount of the bond's principal outstanding amount is usually repaid each year throughout the bond's life or after a specified date.
 - A floating-rate note, or floater, is a bond whose coupon is set based on a market reference rate (MRR) plus a spread. FRNs can be floored, capped, or collared. An inverse FRN is a bond whose coupon has an inverse relationship to the reference rate.
 - Other coupon payment structures include bonds with step-up coupons, which pay coupons that increase by specified amounts on specified dates; bonds with credit-linked coupons, which change when the issuer's credit rating changes; bonds with payment-in-kind coupons, which allow the issuer to pay coupons with additional amounts of the bond issue rather than in cash; and bonds with deferred coupons, which pay no coupons in the early years following the issue but higher coupons thereafter.
 - The payment structures for index-linked bonds vary considerably among countries. A common index-linked bond is an inflation-linked bond, or linker, whose coupon payments and/or principal repayments are linked to a price index. Index-linked payment structures include zero-coupon-indexed bonds, interest-indexed bonds, capital-indexed bonds, and indexed-annuity bonds.
 - Common types of bonds with embedded options include callable bonds, puttable bonds, and convertible bonds. These options are "embedded" in the sense that there are provisions provided in the indenture that grant either the issuer or the bondholder certain rights affecting the disposal or redemption of the bond. They are not separately traded securities.
 - Callable bonds give the issuer the right to buy bonds back prior to maturity, thereby raising the reinvestment risk for the bondholder. For this reason, callable bonds have to offer a higher yield and sell at a lower price than otherwise similar non-callable bonds to compensate the bondholders for the value of the call option to the issuer.
 - Puttable bonds give the bondholder the right to sell bonds back to the issuer prior to maturity. Puttable bonds offer a lower yield and sell at a higher price than otherwise similar non-puttable bonds to compensate the issuer for the value of the put option to the bondholders.
 - A convertible bond gives the bondholder the right to convert the bond into common shares of the issuing company. Because this option favors the bondholder, convertible bonds offer a lower yield and sell at a higher price than otherwise similar non-convertible bonds.

PROBLEMS

1. A 10-year bond was issued four years ago. The bond is denominated in US dollars, offers a coupon rate of 10% with interest paid semi-annually, and is currently priced at 102% of par. The bond's:
 - A. tenor is six years.
 - B. nominal rate is 5%.
 - C. redemption value is 102% of the par value.
2. A sovereign bond has a maturity of 15 years. The bond is *best* described as a:
 - A. perpetual bond.
 - B. pure discount bond.
 - C. capital market security.

3. A company has issued a floating-rate note with a coupon rate equal to the three-month MRR + 65 bps. Interest payments are made quarterly on 31 March, 30 June, 30 September, and 31 December. On 31 March and 30 June, the three-month MRR is 1.55% and 1.35%, respectively. The coupon rate for the interest payment made on 30 June is:
 - A. 2.00%.
 - B. 2.10%.
 - C. 2.20%.
4. The legal contract that describes the form of the bond, the obligations of the issuer, and the rights of the bondholders can be *best* described as a bond's:
 - A. covenant.
 - B. indenture.
 - C. debenture.
5. Which of the following is a type of external credit enhancement?
 - A. Covenants
 - B. A surety bond
 - C. Overcollateralization
6. An affirmative covenant is *most likely* to stipulate:
 - A. limits on the issuer's leverage ratio.
 - B. how the proceeds of the bond issue will be used.
 - C. the maximum percentage of the issuer's gross assets that can be sold.
7. Which of the following *best* describes a negative bond covenant? The issuer is:
 - A. required to pay taxes as they come due.
 - B. prohibited from investing in risky projects.
 - C. required to maintain its current lines of business.
8. A South African company issues bonds denominated in pound sterling that are sold to investors in the United Kingdom. These bonds can be *best* described as:
 - A. Eurobonds.
 - B. global bonds.
 - C. foreign bonds.
9. Relative to domestic and foreign bonds, Eurobonds are *most likely* to be:
 - A. bearer bonds.
 - B. registered bonds.
 - C. subject to greater regulation.
10. An investor in a country with an original issue discount tax provision purchases a 20-year zero-coupon bond at a deep discount to par value. The investor plans to hold the bond until the maturity date. The investor will *most likely* report:
 - A. a capital gain at maturity.
 - B. a tax deduction in the year the bond is purchased.
 - C. taxable income from the bond every year until maturity.
11. A bond that is characterized by a fixed periodic payment schedule that reduces the bond's outstanding principal amount to zero by the maturity date is *best* described as a:
 - A. bullet bond.
 - B. plain vanilla bond.
 - C. fully amortized bond.
12. If interest rates are expected to increase, the coupon payment structure *most likely* to benefit the issuer is a:
 - A. step-up coupon.
 - B. inflation-linked coupon.
 - C. cap in a floating-rate note.

13. Investors who believe that interest rates will rise *most likely* prefer to invest in:
 - A. inverse floaters.
 - B. fixed-rate bonds.
 - C. floating-rate notes.
14. A 10-year, capital-indexed bond linked to the Consumer Price Index (CPI) is issued with a coupon rate of 6% and a par value of 1,000. The bond pays interest semi-annually. During the first six months after the bond's issuance, the CPI increases by 2%. On the first coupon payment date, the bond's:
 - A. coupon rate increases to 8%.
 - B. coupon payment is equal to 40.
 - C. principal amount increases to 1,020.
15. The provision that provides bondholders the right to sell the bond back to the issuer at a predetermined price prior to the bond's maturity date is referred to as:
 - A. a put provision.
 - B. a make-whole call provision.
 - C. an original issue discount provision.
16. Which of the following provisions is a benefit to the issuer?
 - A. Put provision
 - B. Call provision
 - C. Conversion provision
17. Relative to an otherwise similar option-free bond, a:
 - A. puttable bond will trade at a higher price.
 - B. callable bond will trade at a higher price.
 - C. convertible bond will trade at a lower price.
18. Which type of bond *most likely* earns interest on an implied basis?
 - A. Floater
 - B. Conventional bond
 - C. Pure discount bond
19. Clauses that specify the rights of the bondholders and any actions that the issuer is obligated to perform or is prohibited from performing are:
 - A. covenants.
 - B. collaterals.
 - C. credit enhancements.
20. Which of the following type of debt obligation *most likely* protects bondholders when the assets serving as collateral are non-performing?
 - A. Covered bonds
 - B. Collateral trust bonds
 - C. Mortgage-backed securities
21. Which of the following *best* describes a negative bond covenant? The requirement to:
 - A. insure and maintain assets.
 - B. comply with all laws and regulations.
 - C. maintain a minimum interest coverage ratio.
22. Contrary to positive bond covenants, negative covenants are *most likely*:
 - A. costlier.
 - B. legally enforceable.
 - C. enacted at time of issue.

FIXED-INCOME MARKETS: ISSUANCE, TRADING, AND FUNDING

LEARNING OUTCOMES

The candidate should be able to:

- describe classifications of global fixed-income markets;
- describe the use of interbank offered rates as reference rates in floating-rate debt;
- describe mechanisms available for issuing bonds in primary markets;
- describe secondary markets for bonds;
- describe securities issued by sovereign governments;
- describe securities issued by non-sovereign governments, quasi-government entities, and supranational agencies;
- describe types of debt issued by corporations;
- describe structured financial instruments;
- describe short-term funding alternatives available to banks;
- describe repurchase agreements (repos) and the risks associated with them.

SUMMARY OVERVIEW

Debt financing is an important source of funds for households, governments, government-related entities, financial institutions, and non-financial companies. Well-functioning fixed-income markets help ensure that capital is allocated efficiently to its highest and best use globally. Important points include the following:

- The most widely used ways of classifying fixed-income markets include the type of issuer; the bonds' credit quality, maturity, currency denomination, and type of coupon; and where the bonds are issued and traded.

- Based on the type of issuer, the four major bond market sectors are the household, non-financial corporate, government, and financial institution sectors.
- Investors distinguish between investment-grade and high-yield bond markets based on the issuer's credit quality.
- Money markets are where securities with original maturities ranging from overnight to one year are issued and traded, whereas capital markets are where securities with original maturities longer than one year are issued and traded.
- The majority of bonds are denominated in either euros or US dollars.
- Investors distinguish between bonds that pay a fixed rate versus a floating rate of interest. The coupon rate of floating-rate bonds is often expressed as a reference rate plus a spread. Interbank offered rates, such as Libor, historically have been the most commonly used reference rates for floating-rate debt and other financial instruments but are being phased out to be replaced by alternative reference rates.
- Based on where the bonds are issued and traded, investors distinguish between domestic and international bond markets. The latter includes the Eurobond market, which falls outside the jurisdiction of any single country and is characterized by less reporting, regulatory, and tax constraints. Investors also distinguish between developed and emerging bond markets.
- Investors and investment managers use fixed-income indexes to describe bond markets or sectors and to evaluate performance of investments and investment managers.
- The largest investors in bonds include central banks; institutional investors, such as pension funds, hedge funds, charitable foundations and endowments, insurance companies, mutual funds and ETFs, and banks; and retail investors, typically by means of indirect investments.
- Primary markets are markets in which issuers first sell bonds to investors to raise capital. Secondary markets are markets in which existing bonds are subsequently traded among investors.
- There are two mechanisms for issuing a bond in primary markets: a public offering, in which any member of the public may buy the bonds, or a private placement, in which only an investor or small group of investors may buy the bonds either directly from the issuer or through an investment bank.
- Public bond issuing mechanisms include underwritten offerings, best-efforts offerings, shelf registrations, and auctions.
- When an investment bank underwrites a bond issue, it buys the entire issue and takes the risk of reselling it to investors or dealers. In contrast, in a best-efforts offering, the investment bank serves only as a broker and sells the bond issue only if it is able to do so. Underwritten and best-efforts offerings are frequently used in the issuance of corporate bonds.
- The underwriting process typically includes six phases: the determination of the funding needs, the selection of the underwriter, the structuring and announcement of the bond offering, pricing, issuance, and closing.
- A shelf registration is a method for issuing securities in which the issuer files a single document with regulators that describes and allows for a range of future issuances.
- An auction is a public offering method that involves bidding and is helpful both in providing price discovery and in allocating securities. Auctions are frequently used in the issuance of sovereign bonds.
- Most bonds are traded in OTC markets, and institutional investors are the major buyers and sellers of bonds in secondary markets.
- Sovereign bonds are issued by national governments primarily for fiscal reasons. These bonds take different names and forms depending on where they are issued, their maturities, and

their coupon types. Most sovereign bonds are fixed-rate bonds, although some national governments also issue floating-rate bonds and inflation-linked bonds.

- Local governments, quasi-government entities, and supranational agencies issue bonds, which are named non-sovereign, quasi-government, and supranational bonds, respectively.
- Companies raise debt in the form of bilateral loans, syndicated loans, commercial paper, notes, and bonds.
- Commercial paper is a short-term unsecured security that companies use as a source of short-term and bridge financing. Investors in commercial paper are exposed to credit risk, although defaults are rare. Many issuers roll over their commercial paper on a regular basis.
- Corporate bonds and notes take different forms depending on the maturities, coupon payment, and principal repayment structures. Important considerations also include collateral backing and contingency provisions.
- Medium-term notes are securities that are offered continuously to investors by an agent of the issuer. They can have short-term or long-term maturities.
- The structured finance sector includes asset-backed securities, collateralized debt obligations, and other structured financial instruments. All of these seemingly disparate financial instruments share the common attribute of repackaging risks.
- Many structured financial instruments are customized instruments that often combine a bond and at least one derivative. The redemption and often the coupons of these structured financial instruments are linked via a formula to the performance of the underlying asset(s). Thus, the bond's payment features are replaced with non-traditional payoffs derived not from the issuer's cash flows but from the performance of the underlying asset(s). Capital protected, yield enhancement, participation and leveraged instruments are typical examples of structured financial instruments.
- Financial institutions have access to additional sources of funds, such as retail deposits, central bank funds, interbank funds, large-denomination negotiable certificates of deposit, and repurchase agreements.
- A repurchase agreement is similar to a collateralized loan. It involves the sale of a security (the collateral) with a simultaneous agreement by the seller (the borrower) to buy back the same security from the purchaser (the lender) at an agreed-on price in the future. Repurchase agreements are a common source of funding for dealer firms and are also used to borrow securities to implement short positions.

PROBLEMS

1. The distinction between investment-grade debt and non-investment-grade debt is *best* described by differences in:
 - A. tax status.
 - B. credit quality.
 - C. maturity dates.
2. A bond issued internationally, outside the jurisdiction of the country in whose currency the bond is denominated, is *best* described as a:
 - A. Eurobond.
 - B. foreign bond.
 - C. municipal bond.

3. When classified by type of issuer, asset-backed securities are part of the:
 - A. corporate sector.
 - B. structured finance sector.
 - C. government and government-related sector.
4. Compared with developed market bonds, emerging market bonds *most likely*:
 - A. offer lower yields.
 - B. exhibit higher risk.
 - C. benefit from lower growth prospects.
5. With respect to floating-rate bonds, a reference rate (such as MRR) is *most likely* used to determine the bond's:
 - A. spread.
 - B. coupon rate.
 - C. frequency of coupon payments.
6. The variability of the coupon rate on a Libor-based floating-rate bond is *most likely* caused by:
 - A. periodic resets of the reference rate.
 - B. market-based reassessments of the issuer's creditworthiness.
 - C. changing estimates by the Libor administrator of borrowing capacity.
7. Which of the following statements is *most accurate*? An interbank offered rate:
 - A. is a single reference rate.
 - B. applies to borrowing periods of up to 10 years.
 - C. is used as a reference rate for interest rate swaps.
8. An investment bank that underwrites a bond issue *most likely*:
 - A. buys and resells the newly issued bonds to investors or dealers.
 - B. acts as a broker and receives a commission for selling the bonds to investors.
 - C. incurs less risk associated with selling the bonds than in a best-efforts offering.
9. In major developed bond markets, newly issued sovereign bonds are *most* often sold to the public via a(n):
 - A. auction.
 - B. private placement.
 - C. best-efforts offering.
10. Which of the following describes privately placed bonds?
 - A. They are non-underwritten and unregistered.
 - B. They usually have active secondary markets.
 - C. They are less customized than publicly offered bonds.
11. A mechanism by which an issuer may be able to offer additional bonds to the general public without preparing a new and separate offering circular *best* describes:
 - A. the grey market.
 - B. a shelf registration.
 - C. a private placement.
12. Which of the following statements related to secondary bond markets is *most accurate*?
 - A. Newly issued corporate bonds are issued in secondary bond markets.
 - B. Secondary bond markets are where bonds are traded between investors.
 - C. The major participants in secondary bond markets globally are retail investors.
13. A bond market in which a communications network matches buy and sell orders initiated from various locations is *best* described as an:
 - A. organized exchange.
 - B. open market operation.
 - C. over-the-counter market.

14. A liquid secondary bond market allows an investor to sell a bond at:
 - A. the desired price.
 - B. a price at least equal to the purchase price.
 - C. a price close to the bond's fair market value.
15. Corporate bond secondary market trading *most often* occurs:
 - A. on a book-entry basis.
 - B. on organized exchanges.
 - C. prior to settlement at $T + 1$.
16. Sovereign bonds are *best* described as:
 - A. bonds issued by local governments.
 - B. secured obligations of a national government.
 - C. bonds backed by the taxing authority of a national government.
17. Which factor is associated with a more favorable quality sovereign bond credit rating?
 - A. Issued in local currency, only
 - B. Strong domestic savings base, only
 - C. Issued in local currency of country with strong domestic savings base
18. Which type of sovereign bond has the lowest interest rate risk for an investor?
 - A. Floaters
 - B. Coupon bonds
 - C. Discount bonds
19. Agency bonds are issued by:
 - A. local governments.
 - B. national governments.
 - C. quasi-government entities.
20. The type of bond issued by a multilateral agency such as the International Monetary Fund (IMF) is *best* described as a:
 - A. sovereign bond.
 - B. supranational bond.
 - C. quasi-government bond.
21. A bond issued by a local government authority, typically without an explicit funding commitment from the national government, is *most likely* classified as a:
 - A. sovereign bond.
 - B. quasi-government bond
 - C. non-sovereign government bond.
22. Which of the following statements relating to commercial paper is *most accurate*?
 - A. There is no secondary market for trading commercial paper.
 - B. Only the strongest, highly rated companies issue commercial paper.
 - C. Commercial paper is a source of interim financing for long-term projects.
23. Eurocommercial paper is *most likely*:
 - A. negotiable.
 - B. denominated in euros.
 - C. issued on a discount basis.
24. For the issuer, a sinking fund arrangement is *most similar* to a:
 - A. term maturity structure.
 - B. serial maturity structure.
 - C. bondholder put provision.

25. When issuing debt, a company may use a sinking fund arrangement as a means of reducing:
 - A. credit risk.
 - B. inflation risk.
 - C. interest rate risk.
26. Which of the following is a source of wholesale funds for banks?
 - A. Demand deposits
 - B. Money market accounts
 - C. Negotiable certificates of deposit
27. A characteristic of negotiable certificates of deposit is:
 - A. they are mostly available in small denominations.
 - B. they can be sold in the open market prior to maturity.
 - C. a penalty is imposed if the depositor withdraws funds prior to maturity.
28. A repurchase agreement is *most* comparable to a(n):
 - A. interbank deposit.
 - B. collateralized loan.
 - C. negotiable certificate of deposit.
29. The repo margin is:
 - A. negotiated between counterparties.
 - B. established independently of market-related conditions.
 - C. structured on an agreement assuming equal credit risks to all counterparties.
30. The repo margin on a repurchase agreement is *most likely* to be lower when:
 - A. the underlying collateral is in short supply.
 - B. the maturity of the repurchase agreement is long.
 - C. the credit risk associated with the underlying collateral is high.

INTRODUCTION TO FIXED-INCOME VALUATION

LEARNING OUTCOMES

The candidate should be able to:

- calculate a bond's price given a market discount rate;
- identify the relationships among a bond's price, coupon rate, maturity, and market discount rate (yield-to-maturity);
- define spot rates and calculate the price of a bond using spot rates;
- describe and calculate the flat price, accrued interest, and the full price of a bond;
- describe matrix pricing;
- calculate annual yield on a bond for varying compounding periods in a year;
- calculate and interpret yield measures for fixed-rate bonds and floating-rate notes;
- calculate and interpret yield measures for money market instruments;
- define and compare the spot curve, yield curve on coupon bonds, par curve, and forward curve;
- define forward rates and calculate spot rates from forward rates, forward rates from spot rates, and the price of a bond using forward rates;
- compare, calculate, and interpret yield spread measures.

SUMMARY OVERVIEW

We have covered the principles and techniques that are used in the valuation of fixed-rate bonds, as well as floating-rate notes and money market instruments. These building blocks are used extensively in fixed-income analysis. The following are the main points made:

- The market discount rate is the rate of return required by investors given the risk of the investment in the bond.
- A bond is priced at a premium above par value when the coupon rate is greater than the market discount rate.