Tennessee
TECH

Bonds: Overview

What is a bond?

- A **bond** is a long-term debt instrument-a long-term contract under which a borrower agrees to make payments of interest and principal on specific dates to the holders of the bond.

*Bonds are traded in capital markets. **Capital markets** are financial markets for stocks and for intermediate or long-term debt (1 year and longer) unlike **money markets** which are financial markets in which funds are borrowed or loaned for a short period of time (less than 1 year) like commercial paper or Treasury bills

Bond Vocabulary	
Par value	Face value of a bond, which the borrower pays at maturity
Maturity Date	Date when a bond's life ends and the borrower must make the final interest payment and repay the principal Original maturity: the number of years to maturity at the time a bond is issued Effective maturity: declines each year after it has been issued
Coupon payment	Periodic interest payment that a bond pays to investors
Coupon rate	Rate derived by dividing the bond's annual coupon by its par value
Indenture	Legal contract, between the borrower and investor stating the conditions under which a bond has been issued

Types of Bonds

(1) Coupon Bond	pay a series of periodic payments called coupon payments plus a principal amount/par value at maturity
(2) Zero Coupon Bond	Bonds that pay no annual interest but are sold at a discount below par, thus compensating investors in the form of capital appreciation.
(3) Fixed Rate Bonds	Coupon bonds with fixed coupon throughout bond's life
(4) Floating Rate/ Variable Rate Bonds	Coupon bonds with variable coupon through time—payment is usually tied to interest rate fluctuations.
(5) Convertible bonds	Bonds that give investors the option to convert it into the issuer's common stock
(6) Exchangeable bonds	Bonds issued by corporations which can be converted into stock of a company other than the bond issuer (often a subsidiary)
(7) Corporate Bonds	Bonds issued by corporations
(8) Municipal bonds/ munis	Bonds issued by U.S. state and local governments
(9)Treasury bonds	Bonds issued by the U.S. federal government that mature in 30 years
(10) Agency bonds	Bonds issued by federal government agencies
(11) Foreign bonds	Bonds issued by foreign corporations

Bonds & Interest Rates: Bond Valuation

Bond Valuation

- The value of ANY financial asset is the **present value** of the cash flows the asset is expected to produce.

Bond Valuation

- Coupon Bonds
  - The price of a coupon bond is the present value of the coupon payments and the par value.

$$P_{CB} = \frac{INT}{(1+r_d)} + \frac{INT}{(1+r_d)^2} + \ldots + \frac{INT}{(1+r_d)^N} + \frac{M}{(1+r_d)^N}$$

PCB=price of the coupon bond

INT=coupon payment

M=par value

N=number of years

r_d=market rate of interest on the bond, not the coupon rate

- Zero coupon bonds:
  - The price of a zero coupon bond is the PV of the par value payment.

$$P_{ZCB} = \frac{M}{(1+r_d)^N}$$

Example

Jackson Corporation's bonds have 12 years remaining to maturity. Interest is paid annually, the bonds have $1,000 par value, and the coupon interest rate is 8%. The bonds have a yield to maturity of 9%. What is the current market price of these bonds.

Independent Practice

- Bond Z has an 8% annual coupon rate, a par value of $1,000 and 10 years left to maturity. If the bond pays interest annually, and market rates are 3%, what is Bond Z's current price?

Independent Practice Solution

Bonds & Interest Rates: Bond Valuation-Semiannual Coupons

Pricing Bonds with semiannual coupons

1. Divide the coupon payment by 2.
2. Find the periodic interest rate ($I_{per}=I_{nom}/2$)
3. Find the number of compounding periods (N*2).

EXAMPLE

- You are considering a 10-year, $1,000 par value bond. Its coupon rate is 9%, and interest is paid semiannually. If you require an annual nominal interest rate of 8%, how much should you be willing to pay for the bond?

Independent Practice

- Morin Company's bonds mature in 15 years. They have a 5% annual coupon rate and par value of 1,000. If Morin makes *semiannual* coupon payments and market interest rates are 10%, what is the current price of their bonds?

Independent Practice Solution

Bonds & Interest Rates: Bond Pricing Relationships

Bond Pricing Relationships

The Garraty Company has two bond issues outstanding. Both bonds pay $100 annual interest plus $1,000 at maturity. Bond L has a maturity of 15 years and Bond S has a maturity of 1 year.

a. What will the value of each bond be if the going interest rate is 5%, 8%, 10% and 12%?

Interest rate	Price of Bond S	Price of Bond L
5%		
8%		
10%		
12%		

Bond Pricing Relationships

The Garraty Company has two bond issues outstanding. Both bonds pay $100 annual interest plus $1,000 at maturity. Bond L has a maturity of 15 years and Bond S has a maturity of 1 year.

a. What will the value of each bond be if the going interest rate is 5%, 8%, 10% and 12%?

Interest rate	Price of Bond S	Price of Bond L
5%	$1,047.62	$1,518.98
8%	$1,018.52	$1,171.19
10%	$1000	$1,000
12%	$982.14	$863.78

Bond Pricing Relationships

Notice what happens to the price of both bonds as interest rates rise from 5% to 12%.
We have the following relationship:

1. There is an inverse relationship between bond prices and interest rates. As interest rates rise, bond prices fall. As interest rates fall, bond prices rise. This is known as interest rate risk.

Now notice that the changes in price are bigger for Bond L than for Bond S, despite the fact that both have the same coupon rate. This brings us to the following relationship:

2. Interest rate risk is higher for bonds with longer maturities, holding coupon rates constant.

Bond Pricing Relationships

More definitions:

When interest rates (YTM)=coupon rates, both bonds have a price of $1,000. In other words, when the interest rate = the bond's coupon rate, the bond trades **at par**.

When the coupon rate > interest rate (YTM), both bonds have a price that is higher than the par value of $1,000. We say that the bonds trade at a **premium**.

When the coupon rate < interest rate (YTM), both bonds have a price that is lower than the par value of $1,000. We say that the bonds trade at a **discount**.

Bonds & Interest Rates: Bond Yields-YTM

Bond Yields

- When we talk about yields, all we mean is the rate of return earned on the bond, or the interest rate.
- Yield to Maturity (YTM)-the rate of return earned on a bond if it is held to maturity
  - Can be viewed as the bond's promised rate of return, which is the return that investors will receive if all of the promised payments are made
  - This is the rate that is generally discussed by investors and analysts when they discuss bond rates of return.

Bond Yields

- Yield to Maturity (YTM)-the rate of return earned on a bond if it is held to maturity.
  - An investor who buys a "new issue" bond and holds the bond from issue through maturity will receive the YTM that existed on the purchase date. **This YTM will equal the coupon rate**. ***Therefore, new issue bonds sell close to par.***
  - An investor who buys an "old" or outstanding/seasoned bond will earn YTM but that YTM typically does not equal the coupon rate. It fluctuates when economic conditions change. Because YTM on outstanding bonds does not typically equal the coupon rate, these bonds do not usually sell at par.

Example

- Office Supplies Inc. has outstanding bonds with 15 years to maturity, a par value of $1,000 and an annual coupon payment of 5%. If the bonds current price is $985, what is their yield to maturity?

Independent Practice

Fun Company just issued a 10-year 12% coupon bond. The face value of the bond is $1,000 and the bond makes semiannual coupon payments. If the bond is trading at $867.25, what is the bond's yield to maturity?

Independent Practice Solution

Bonds & Interest Rates: Bond Yields-YTC

Yield to Call

- What if you CANNOT hold the bond until maturity?
  - **Callable bonds:** Bonds that the issuer can repurchase from investors at a predetermined price, called the call price
  - If you own a callable bond, then the firm can choose to call the bond and you must relinquish it
    - A call provision in a bond contract that gives the issuer the right to redeem the bonds under specified terms prior to the normal maturity date
    - Generally the issuer must pay the bondholder an amount greater than par value if the bond is called. This is the call premium
    - Deferred call-when bonds have call protection and they are not allowed to be called until after several years (usually 5-10)

Yield to Call

- If you hold a callable bond, and the issuing firm decides to call the bond, you do not earn YTM. Instead you earn the **Yield to Call (YTC):**the rate of return earned on a bond when its is called before its maturity date
  - A callable bond is likely to be called and investors will expect the rate of return to be the YTC only if current interest rates are well below an outstanding bond's coupon rate
  - **Companies do not usually call bonds unless interest rates have fallen significantly**. If interest rates drop, the company could issue new low-yield bonds and use the proceeds to call the high-yield bonds and thus reduce its interest expense. This is called a **refunding operation**.

Example

It is now 2/21/2024 and you are considering the purchase of an outstanding bond that was issued in 2/21/2022. It has a 9.5% annual coupon and had a 30-year original maturity (2/21/2052). There are 5 years of call protection (2/21/2027) after which it can be called at 109—that is 109% of par, or $1090. Interest rates have declined since it was issued, and it is now selling at 116.575 of par, or $1,165.75

a. What is the yield to maturity? What is the yield to call?

b. If you bought this bond, which return would you actually earn?

c. Suppose the bond had been selling at a discount rather than a premium. Which return would you expect to earn (YTM or YTC)?

Independent Practice

1. DM Inc.'s outstanding, callable bonds were issued 5 years ago with a coupon rate of 2%, **original** maturity of 10 years, par value of $1,000, call price of $1,250 and 7 years of call protection. The bonds are currently selling for $970. Interest rates are expected to remain stable or increase in the next seven years. What return should an investor purchasing the bond today expect to earn?

Independent Practice Solution

Additional Practice

1. Netflix Inc. (NFLX) has outstanding bonds with 2 years left to maturity, coupon of 5.4%, paid annually, par value of $1,000 and yield to maturity of 2.45%. What should be price of this NFLX bond?
2. Apple Inc. (AAPL) currently has outstanding bonds with *an* annual coupon rate of 2.40%, paid semiannually, and a yield to maturity of 1.88%. If the bonds mature in three years, what should be their price today?
3. Suppose you hold 2 bonds in your portfolio—Bond X and Bond Z. Each bond has a coupon rate of 10%. Bond X matures in 25 years and Bond Z matures in 5 years. If market interest rates increase from 5% to 8%,then
4. Suppose you hold 2 bonds with 10 years to maturity. Bond A has a coupon rate of 5% and Bond B has a coupon rate of 8%. If the prevailing interest rate is 9%, then do these bonds trade at a premium or discount?
5. Tesla, Inc. (TSLA) has an outstanding bond with 8 years original maturity, 7 years effective maturity, a coupon rate of 5.30% and a current price of $864.20. What is this bond's yield to maturity?
6. DM Inc.'s outstanding, callable bonds were issued 3 years ago, with a coupon rate of 5%, original maturity of 25 years, par value of $1,000, call price of $1,050 and 10 years of call protection. The bonds are currently selling for $975. Interest rates are expected to remain stable or increase in the next seven years.

   a) Calculate the YTM and YTC of these bonds. Which rate should an investor expect to earn?

Additional Practice Solutions

Investor should expect to earn YTM. The bond's current price is $975 so they are trading at a discount. That means since issuance, prices have fallen which means interest rates have gone up. If interest rates rise, the firm has no incentive to call the bonds and the investor earns YTM.

Bonds & Interest Rates
Fundamental Factors

The cost of borrowing=interest rate

- The cost of money/borrowing is affected by several fundamental factors including:
  - Production opportunities-the investment opportunities in productive assets
  - Time preferences for consumption-the preferences for current consumption as opposed to saving for future consumption

The cost of borrowing=interest rate

- The cost of money/borrowing is affected by several fundamental factors including:
  - Inflation-the amount by which prices increase over time
  - Risk-the chance that an investment will provide a low or negative return

Interest rates: the real risk-free rate

- Embedded in EVERY interest rate is the **real, risk-free rate of interest (r*)**: the rate of interest that would exist on a riskless security if no inflation were expected.
  - The cost of money is never zero because it changes over time in response to
    - the availability of productive opportunities
    - people's time preferences for consumption

Interest rates and inflation

- Because inflation erodes purchasing power, interest rates also reflect an **inflation premium (IP)**.
  - Savers expect to be compensated for loss of purchasing power over time so they demand a higher interest rate from borrowers.
  - The inflation premium will vary depending on the time span of the loan and the inflation rate expected during that time.

Interest rates and inflation

- You'll often hear reference to the risk-free rate. This rate reflects the real rate of interest and an inflation premium but no risk.
  - To approximate the short-term risk-free rate, use the T-bill (Treasury bill) rate

$$r_{rf} = r^* + IP$$

Risk

- **Risk**-the chance that an investment will provide a low or negative return
  - **Default risk**: the risk that the borrower will not make scheduled interest or principal payments
  - **Liquidity Risk**: A liquid asset can be converted into cash quickly at a "fair market value."
  - **Maturity Risk**: Loans with longer maturities are more risky than loans of shorter maturity.

Default Risk

- A **default risk premium (DRP)** is the additional return required by savers to lend to a risky borrower.
  - The greater the borrower's risk of default, the higher the rate on the loan because savers expect to be compensated for bearing the default risk.
  - For corporations and governments, default risk is assessed by rating agencies.

	Investment Grade				Junk Bonds			
Moody's	Aaa	Aa	A	Baa	Ba,	B	Caa	C
S & P	AAA	AA	A	BBB	BB	B	CCC	C
	Highest Quality	High Quality	Upper Medium	Medium	Non-investment grade	Speculative	Highly speculative	Very risky, default

A brief note on Bond Ratings

- Ratings are based on
  - Financial factors: Rating agencies examine financial ratios. All ratios play a role but debt and interest coverage ratios are particularly important.
  - Other Factors
    - Bond Contract Terms
    - Sensitivity of firm's earnings to changes in the economy
      - Labor problems, international operations, environmental problems, geopolitical risk

Liquidity Risk

- Investors value liquidity so a **liquidity premium (LP)** is included in the rates charged on different debt securities.
    - The less liquid the asset, the higher the rate on the loan because savers expect to be compensated for bearing the liquidity risk.

Maturity Risk

- The longer the term to maturity, the higher the yields that savers require—again, because they expect to be compensated for the additional risk. The additional premium required is the **maturity risk premium (MRP)**.

- The risk arises for two reasons:
  - Uncertainty about the future
  - Interest rate risk: the prices of bonds decline whenever interest rates rise and this relationship is stronger for bonds with longer maturities
    - » Thus, investors face the risk of capital losses due to rising interest rates.

Example

Asset 1	Asset 2	Which should have the higher yield? Why?
10-year T-note	10-year corporate bond	
5-year bond of Company A	10 year bond of Company A	
10-year T-note	3-month T-bill	
10-year bond of Procter & Gamble	10-year bond of Pioneer Energy Resources, an oil fracking company	

Bonds & Interest Rates: Interest Rates-Macro Factors

Macroeconomic factors that influence interest rate levels

- Monetary policy conducted by the Fed

- Federal budget deficit or surplus

Additional Practice

1. Suppose you observe the following 2 companies issue bonds on the same day:
   - Beautiful! Cosmetics issued a 10-year bond with a coupon rate of 6%
   - HardWork Industrials issued a 10-year bond with a coupon rate of 4%

Which of the following most likely explains the difference in coupon rates?

   A. Higher inflation expectations for Beautiful! than Hardwork.
   B. Higher default risk for Beautiful! than Hardwork.
   C. Higher maturity risk for Hardwork than Beautiful!
   D. Higher liquidity for Beautiful! bonds than HardWork bonds.

2. Which of the following is consistent with lower interest rates?
   2. An increase in inflation expectations
   3. Increased preference for deferred consumption
   4. More productive opportunities in the economy
   5. Contractionary monetary policy

Additional Practice

3. Which of the following should lead to an increase in interest rates?
    a. Less productive opportunities in the economy.
    b. Consumer preferences shift toward delayed consumption.
    c. Expansionary monetary policy
    d. Budget deficits

4. Imagine that Happy Smiles, producer of dental equipment recently issued a 10-year bond with a coupon rate of 4.5% while Wacky Hats, retailer of novelty apparel, also issued a 5-year bond with a coupon rate of 7%. Which of the following might explain the differences in interest rates?
    a. Happy Smiles has a BBB bond-rating while Wacky Hats has an A+ bond rating.
    b. Difference in maturity risk between Happy Smiles and Wacky Hats.
    c. Greater liquidity in government bond markets than corporate bond markets.
    d. Higher inflation expected over the next 10 years than over the next 5 years.
    e. None of the above explain the difference in coupon rates.

Additional Practice Solutions

1. B
2. B
3. D
4. E