CHAPTER 7:
FIXED-INCOME SECURITIES: PRICING AND TRADING

Topic One: Bond Pricing Principles

1. Present Value.

A. The present-value calculation is used to estimate how much an investor should pay for a bond; present value calculates the value today of an amount that will be received in the future.

B. The present value of a bond is calculated using the:

(1) Discount rate.

(a) The discount rate is the yield of the bond; it is estimated by the yield on similar bonds, taking into account their coupon rate, term, and quality.

(b) The discount rate is not the coupon rate. The discount rate fluctuates, while the coupon rate is determined when the bond is issued and does not change.

(2) Present value of the income stream.

(a) These are the coupon payments received over the term of the bond.

(3) Present value of the principal at maturity.

(4) Total the two present-values.

(a) The total of these two present-value amounts is known as the fair price of a bond.

2. Calculate the Present Value of a Bond.

A. **The question:** What is the present value for an 8% Government of Canada (GOC) bond, due in five years, with interest paid semi-annually? GOC bonds are yielding 6% today.

B. Calculate the present value of a bond using a financial calculator:

(1) A faster and simpler way to calculate the present value of a bond is by using a financial calculator. **Note**: for the following example, we used an HP 10 BII financial calculator and the data from the example above:

(a) Press 100 (the future value and then press the FV key. Displays 100

(b) Press 4 (a coupon payment) and then press the PMT key. Displays 4

(c) Press 3 (the interest rate—do not use the decimal equivalent), and then press the I/YR key. Displays 3

(d) Press 10 (the number of compounding periods), and then press the N key. Displays 10.

(e) Press the PV key. Displays –108.53 (the present value of the bond).

3. Calculating Treasury Bill Yield.

A. The return on a Treasury bill is the difference between its purchase price and its sale price at maturity.

(1) The formula for calculating a Treasury bill yield is:

$$\frac{100 - \text{price}}{\text{price}} \times \frac{365}{\text{term}} \times 100 = \text{Yield (as \%)}$$

For example: A 66-day T-bill costing 98.5 would have a yield of:

$$\frac{100 - 98.5}{98.5} \times \frac{365}{66} \times 100 = 8.42\%$$

4. Calculating Current Yield on a Bond.

A. The formula to calculate the ***current yield*** for bonds or stocks is:

$$\frac{\text{Annual Cash Flow}}{\text{Current Market Price}} \text{ X } 100 = \text{Current Yield}$$

For example: An 8%, $1,000 bond trading at 105 would have a current yield of:

$$\frac{80 \text{ (8\% annual yield x \$1,000 bond)}}{1{,}050 \text{ (1.05 current value x \$1,000 bond)}} \times 100$$

= 7.62%

5. Calculating the Yield to Maturity on a Bond.

A. The yield to maturity (YTM) reflects the annual rate of return a bondholder receives if the bond is held until maturity, with the capital gain or loss received depending on whether the bond was purchased at a discount or a premium if all coupons are reinvested at the interest rate provided when the bond was purchased.

Relationship of Price to Yield

Bond purchase price	**Purchase price in relation to coupon rate**	**Yield**
discount	> coupon rate	interest income + capital gain
premium	< coupon rate	interest income – capital loss
par	@ coupon rate	interest income

B. Approximate yield to maturity is calculated using this formula:

$$\frac{\text{interest + annual price change}}{\text{(purchase price + 100)} \div 2} \times 100 = \text{YTM}$$

C. The interest rate for yield-to-maturity calculations is always the coupon rate expressed as a dollar amount (i.e., the coupon times par). This is adjusted for the compounding period (normally, semi-annual). Example: An 8% coupon would have an interest rate of $4 (0.08 x 100 ÷ 2).

D. The annual price change is calculated with this formula:

$$\frac{\text{FV} - \text{PP}}{\text{\# of compounding periods}}$$

Where:

FV = future value or redemption price (100 or par).

PP = the purchase or cost price of the bond.

# of compounding periods = years multiplied by the number of compounding periods per year

Example: A bond is purchased at 97 and matures at par in 5 years with semi-annual compounding. Annual price change is 0.3 (100 – 97 = 3 ÷ 10 compounding periods = 0.3).

Therefore, the formula is:

$$\frac{\text{Interest} + \left(\frac{\text{FV - PP}}{\text{\# of compounding periods}}\right)}{\text{(purchase price + 100)} \div 2} \times 100 \times 2 = \text{YTM}$$

For example:

An 8% bond costing 101.50 and maturing in two years and six months with semi-annual compounding would have a yield to maturity of:

$$\frac{4 + \left(\frac{100 - 101.5}{5}\right)}{[101.5 + 100] \div 2} \times 100 \times 2$$

$$= \frac{4 + [-0.3]}{100.75} \times 100 \times 2$$

$$= \frac{3.7}{100.75} \times 100 \times 2$$

$$= 3.67 \times 2$$

$$= 7.34\%$$

Remember to round bond yields to two decimal places, except for T-bills and money-market securities (which are rounded to three or more decimal places).

E. The importance of YTM:

(1) The yield to maturity is the best measure of the return on a bond.

(2) The YTM assumes all coupons are reinvested at a rate equal to the YTM, and that the bond will be held to maturity.

(3) The actual return may vary from the YTM if coupons cannot be reinvested at the assumed rate.

6. Reinvestment Risk.

A. Reinvestment risk is the risk that interest rates will decline and coupons must be reinvested at a lower rate.

B. The longer the term to maturity, the more time interest rates have to fluctuate. It becomes less likely that the yield to maturity (YTM) that was quoted when the bond was bought will hold true.

(1) If coupon payments are reinvested at an interest rate lower than the bond's fixed coupon rate, there will be a decrease in overall return.

(a) The YTM quoted at time of purchase would be higher than the amount the investor receives.

(2) If coupon payments are reinvested at a higher interest rate, the overall return on the bond will increase.

(a) The YTM quoted at the time of purchase would be lower than the amount the investor receives.

C. Zero-coupon bonds have no reinvestment risk.

Topic Two: Term Structure of Interest Rates

1. Overview.

A. The price of a bond is affected both by the rate of interest when the bond is issued and the anticipated interest rates during its term to maturity.

B. Interest rates vary according to the term to maturity.

(1) The relationship between interest rates and term to maturity is called the term structure of interest rates and is depicted in a yield-curve graph.

2. Real Rate of Interest.

A. The inflation rate/real rate of return theorizes that all investment returns are a function of the real rate of return and the inflation rate.

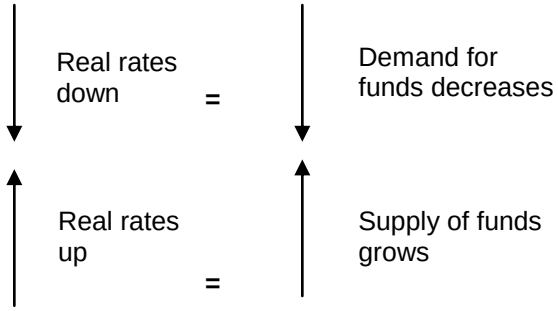
B. Since inflation reduces the value of a dollar, the actual rate of return (i.e., the nominal rate) received from a bond must be reduced by the inflation rate to provide the real rate of return.

nominal rate – inflation rate = real rate of return

C. The real rate of return parallels the business cycle.

(1) During a recession, the real rate falls, because the demand for funds falls.

(2) Conversely, the real rate rises during an expansion, since the demand for funds increases.

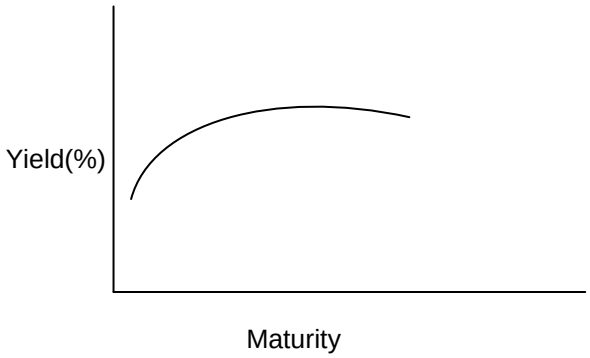


D. Investors expect their returns to exceed the rate of inflation. If inflation is higher than anticipated during the term to maturity, the real return is decreased.

(1) For example: if the nominal rate of return is 5%, and the inflation rate is 3%, the investor's real rate of return is 2%. If inflation increases to 4%, the real rate of return falls to 1%.

3. The Yield Curve.

A. The yield curve represents the relationship between short-term and long-term bond yields.



B. The following theories are offered as to why rates will vary for different terms and change the slope of the yield curve.

(1) Expectations theory assumes that the interest rate for a bond is the average of expected future interest rates:

(a) An upward-sloping yield curve indicates an expectation by the markets that rates will be higher in the future.

(b) A downward-sloping yield curve indicates an expectation by the markets that rates will be lower in the future.

(c) A humped curve indicates an expectation by the market that rates will rise and then fall in the future.

(2) Liquidity-preference theory assumes that investors prefer the liquidity and lower volatility of short-term bonds. An investor who conforms to this theory will purchase longer-term bonds only if there is additional compensation for assuming the additional risk.

(a) On the yield curve, the upward slope represents the additional return for assuming additional risk. This theory does not explain a downward-sloping yield curve.

(3) Market-segmentation theory suggests that the yield curve represents the supply and demand for bonds by the major financial institutions.

(a) Banks are strongest in short-term products; life insurance companies in long-term bonds.

Topic Three: Bond Pricing Properties

1. **Basic Principle.**
   A. The higher the credit rating for a borrower, the lower the cost to borrow.

2. **Bond Prices and Interest Rates.**
   A. There is an inverse relationship between bond prices and interest rates.

   B. Yields follow interest rates.

When …	interest rates move	prices go	yields go	volatility
	↓	↑	↓	↑
	↑	↓	↑	↓

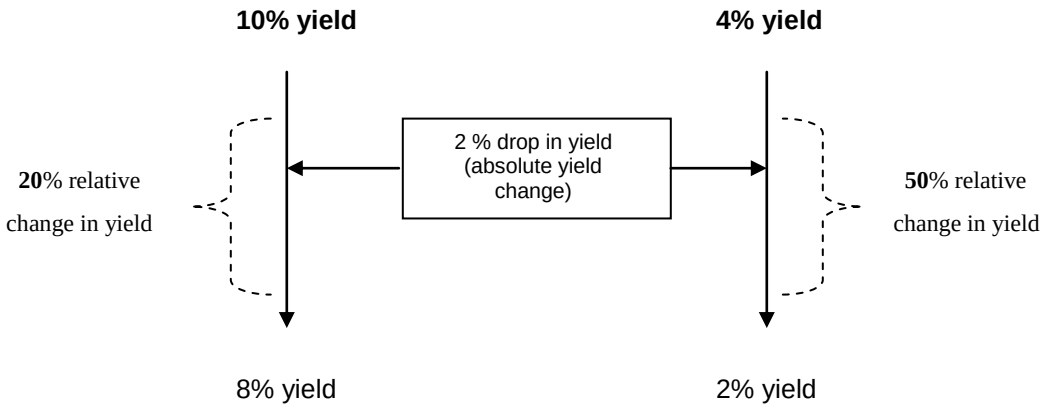
3. **Term to Maturity.**
   A. The price of longer-term bonds is more volatile than that of short-term bonds.

   B. When a bond comes close to maturity, its price becomes less volatile because it has a shorter term (e.g., in the 17th year of a 20-year bond, the bond is priced and traded as a three-year bond, and is therefore less volatile than when it had a 20-year or 15-year term remaining).

4. **The Coupon.**
   A. When yields change, the price for bonds with either low or high coupons will change in the same direction.
      (1) The price for the bond with the lower coupon rate will change more than the price for the high coupon bond.

5. **Yield Changes.**
   A. A change in yield has more impact on a lower-yield bond than on a higher-yield bond.

B. In the following example, both yields drop 2% (i.e., an absolute yield change), but the decrease is more significant for the bond with the lower yield.



C. If the bond with the 4% yield had a 2% increase in yield, rather than a decrease, the change in price would not necessarily be the same; this difference in price change is called ***convexity***.

6. Duration.

A. Duration measures how interest rates affect the price of bonds.

(1) The duration calculation helps investors predict the value of bonds and their coupons as interest rates rise and fall, and facilitates comparisons between bonds.

(2) Duration is calculated as approximately the duration x interest rate = % change.

(3) A higher duration indicates a greater reaction to interest rates. For instance, a duration of 20 = 20 x 1% change in interest rates = 20% change.

(4) As duration decreases, the impact of a change in interest rates lessens. A lower duration shows a duration of 10 = 10 x 1% change in interest rates = 10% change.

B. If interest rates are expected to decline, the investor will seek a high duration. If interest rates are increasing, then a low duration will be preferred.

Topic Four: Bond Switching Strategies

1. Switching bonds can benefit investors.

A. Successful switching requires the investor to accurately predict factors that affect the price of bonds, such as future interest rates.

(1) Typically, investors and advisors alike have been proven bad at making predictions. Thus, bond switching should be entertained cautiously, bearing in mind the transaction costs the investor can incur.

B. There are three circumstances in which yields can be improved by switching:

(1) To align the investor's tax bracket with the appropriate type of return.

(a) A person in a high tax bracket may switch to a deeply discounted (below par) bond and benefit from paying capital-gains tax on the yield instead of income tax on interest from coupons.

(b) Investors in a lower tax bracket may benefit from a high-coupon bond, since they pay interest at a lower rate.

(2) By extending or reducing the term to maturity by switching to bonds with similar prices and coupons but longer or shorter terms.

(3) Moving to a riskier bond.

B. There are two other circumstances in which bond switching can benefit the investor:

(1) When prices have changed or cash is added or taken from the portfolio.

(2) If bonds in a portfolio are sold and proceeds are greater than the purchase price of new bonds, cash can be taken out, sometimes without affecting the portfolio's yield or quality.

Topic Five: Bond Market Trading

1. **Basics of the transaction.**

A. When a bond is sold and the transaction confirmed, ownership changes immediately; this is the transaction date.

B. The time between the transaction date and the date the payment and delivery of the security is due is called the ***settlement period.***

Bond Settlement Periods

Type of Security	Settlement
T-Bill	Same day
All G of C bonds and G of C guaranteed bonds with a maturity of three years or less.	two clearing (business) days (following the trade day).
All other bonds: provincial, municipal, and corporate regardless of maturity date (except as described below) and G of C with a maturity beyond three years.	three clearing days following the trade day.
A trade in a mortgage-backed security made from the 3rd clearing day before month-end to the 11th calendar day of the following month	1st clearing day on or after the 15th calendar day of the month

2. Clearing and Settlement.

A. Bearer bonds are physical certificates with coupons attached.

B. Registered bonds are bearer bonds with the owner's name printed on them for further security.

C. Very few bearer or registered bond certificates are issued today. Instead, a computerized book-based system is used which is administered by the Canadian Depository for Securities Limited (CDS).

3. Calculating Accrued Interest.

A. ***Accrued interest*** is interest that has accumulated since the day after the last interest payment, up to and including settlement.

(a) Accrued interest is paid by the buyer to the seller.

(b) The buyer recovers the accrued interest at the next interest date.

B. Three factors determine the amount of accrued interest:

(a) Principal.

(b) Coupon rate.

(c) Time period

C. Interest accrues at the coupon rate of the bond, based on the par value.

(1) It is calculated using the following formula:

$$\text{Face value of the bond} \times \text{the interest rate} \times \frac{\text{days accrued interest}}{365}$$

(2) For example: A $10,000, 7.5% corporate bond due on September 15, 2010, was purchased on Tuesday, April 6, at a price of 106.75. What was the total amount paid for the bond?

(a) Determine the settlement date: Friday, April 9.

(b) Determine the period during which interest was accrued: Interest is paid every September 15 and March 15. The last interest payment was March 15, therefore the accrued interest period is from March 16 to April 9.

(c) Determine the number of days for which interest is due: March 16 to March 31 is 16 days and there are 9 days in April for which interest is due for a total of 25 days.

(d) Perform the calculation to determine the accrued interest owed:

$$\$10{,}000 \times 0.075 \times \frac{25}{365} = \$51.37$$

(e) Determine the face value: the face value costs $10,000 x 1.0675 = $10,675.

(f) The total cost of the bond is face value + accrued interest: $10,726.37 ($10,675 + $51.37).

Topic Six: Bond Indexes

1. Overview.

A. An index is a statistical indicator that represents the value of the securities within that index. Because indexes measure performance and value they are frequently used as benchmarks for the purpose of comparison.

B. Bond indexes:

(1) Reflect the performance of the bond market.

(2) Are used to measure the performance of bond portfolio managers.

(3) Are the basis of bond index funds.

2. Canadian Bond Market Indexes.

A. The two best-known bond indexes in Canada are:

(1) The DEX Universe Bond Index provided by PC Bond represents government and corporate bonds.

(2) Bonds on the Index must be:

(a) in a Canadian-dollar denomination

(b) investment grade

(c) have a term of one or more years to maturity.

B. The Universe Bond Index weights bonds according to their market value.

3. Global Indexes.

A. Merrill Lynch has a number of bond market indexes that track U.S. bond markets as well as bond markets in other countries such as Canada, Japan, Australia, markets in Europe, and emerging markets.

B. Other Canadian and international bond market indexes are maintained by Canadian and US firms.