

Econ 330: Money and Banking

Fall 2014, Handout 2

Chapter 4 : Understanding interest rate

- Math Joke:

A mathematician organizes a raffle in which the prize is an infinite amount of money paid over an infinite amount of time. Of course, with the promise of such a prize, his tickets sell like hot cakes. When the winning ticket is drawn, and the jubilant winner comes to claim his prize, the mathematician explains the mode of payments: “1 dollar now, 1/2 dollar next week, 1/3 dollar the week after that ... ”

- Present Value (Present Discounted Value)

- The two rationales of discounting
 - * Time preference (people are impatient)
 - * Opportunity cost of forgone investment

- Present value : $PV = \frac{CF}{(1+i)^n}$,

- CF = cash flow
- n = number of periods
- i = interest rate

- Yield to Maturity

- The interest rate that equates the present value of cash flow payments received from a debt instrument with its value today.

- Measuring yield to maturity of four basic credit market instruments

- Simple loan

- * Loans which must be repaid at the maturity date along with an additional payment for the interest
- * $PV = \frac{CF}{(1+i)^n}$

- Fixed payment loan

- * Loans which must be repaid by making the same payment every periods
- * Loan value : $LV = \frac{FP}{1+i} + \frac{FP}{(1+i)^2} + \dots + \frac{FP}{(1+i)^n} = FP \frac{1 - \frac{1}{(1+i)^n}}{i}$

- Coupon bond

- * Pays a fixed interest payment (coupon payment) every period until the maturity date, when a specified final amount (**face value**) is repaid

$$* P = \frac{C}{1+i} + \frac{C}{(1+i)^2} + \dots + \frac{C}{(1+i)^n} + \frac{F}{(1+i)^n}$$

* Special case : consol or perpetuity

- No maturity date and no repayment of principal ($n = \infty$)
- Fixed coupon payments of $\$C$
- $P_c = \frac{C}{i_c}$

– Discount bond (zero-coupon bond)

- * is bought at a price below its face value (at a discount) and the face value is repaid at the maturity date.
- * $P = \frac{F}{1+i}$ or $i = \frac{F-P}{P}$

• Note

- Current **bond prices** and **interest rates** are **negatively** related
- Style of questions that can be tested could be either :
 - * How to calculate the yield to maturity of each credit market instruments?, or
 - * How to calculate yearly payment?

• Interest rates vs Returns

- How well a person does by holding a bond or any other security over a particular period of time.
 - * **Rate of return = current yield + rate of capital gain**
 - * $R = i_c + g = \frac{C}{p_t} + \frac{P_{t+1}-P_t}{P_t}$, where $i_c = \frac{C}{p_t}$ is the current yield (the coupon payment over the purchase price), and $g = \frac{P_{t+1}-P_t}{P_t}$ is the rate of capital gain (the change in the bond's price relative to the initial price).
- Interest-rate Risk:
 - * When interest rates change, a bond with a longer term to maturity has a larger change in its price and hence more interest-rate risk than a bond with a shorter term to maturity.
 - * Duration, also called the effective maturity measures the average lifetime of a debt security's stream of payments. It is a measure of interest rate risk.
 - * No interest-rate risk for any discount (zero-coupon) bond whose time to maturity matches the holding period.

• Real vs Nominal Interest Rates

- Real Interest Rate: the interest rate that is adjusted by subtracting expected changes in the price level
- Why real? It more accurately reflects the true cost of borrowing
- Fisher Equation : $i = r + \pi^e$

Practice questions:

The best way to solve yield to maturity questions involve the following steps

1. Read the question and identify the type of credit market instrument being tested.
2. Identify the variables that are given
3. Identify the unknowns that need to be solved
4. Recall the appropriate formula
5. Substitute in the given values and obtain your answer

Fall 2010

[Q6] If a security pays \$55 in one year and \$133 in three years, its present value is \$150 if the interest rate is _____.

- A. 5 percent.
- B. 10 percent.
- C. 12.5 percent.
- D. 15 percent.

[Q7] If you own a \$1,000 face value bond with one year remaining to maturity and a five percent coupon rate and new bonds are paying 12 percent, what is the most you can get for your old bond?

- A. \$1,200
- B. \$1,100
- C. \$937.50
- D. \$1157.60
- E. \$867.99

[Q8] Which of the following bonds would you prefer to be buying?

- A) A \$10,000 face-value security with a 10 percent coupon selling for \$10,000
- B) A \$10,000 face-value security with a 9 percent coupon selling for \$10,000
- C) A \$10,000 face-value security with a 10 percent coupon selling for \$9,000
- D) A \$10,000 face-value security with a 7 percent coupon selling for \$10,000

[Q9] Which of the following are true for a coupon bond?

- A) The yield to maturity is greater than the coupon rate when the bond price is above the par value.
- B) The yield is less than the coupon rate when the bond price is below the par value.
- C) The price of a coupon bond and the yield to maturity are positively related.
- D) When the coupon bond is priced at its face value, the yield to maturity equals the coupon rate.

[H25] Assume you just deposited \$1,000 into a bank account. The current real interest rate is 2%, and inflation is expected to be 6% over the next year. What nominal rate would you require from the bank over the next year? How much money will you have at the end of one year? If you are saving to buy a fancy bicycle that currently sells for \$1,050, will you have enough to buy it?