Topic: Bonds and Their Valuation

I. Definitions:

Bond:	An IOU. - A security that obligates the issuer to make specified payments to the bondholder.
Maturity:	Date when the bond principal is repaid.
Face Value:	Payment at maturity, usually $1,000 (par value).
Coupon Rate:	Annual interest payment as a percent of the face value

Example: 10 year $1,000 US Treasury Bond paying 7%. New Issue

Maturity:	September 2010
Face Value:	$1,000
Coupon Rate:	7%
Coupon Payments:	$70/yr. (Note they actually come semi-annually.)

-1000	70	70	70	70	70	70	70	70	70	70+1000
0	1	2	3	4	5	6	7	8	9	10

Who issues Bonds?

US Government - bills(< lyr.), notes(1-10 yrs) and bonds(10-30 yrs)
Corporations
States
Cities
School Districts
Hospitals
Churches

Note the last 5 are tax free.
Who buys Bonds? Anyone can. Explain primary and secondary market.

II. Bond Pricing (The Discounted Cash Flow Model)

(1) Price of Bond = Present Value of its future cash flows, discounted at the **appropriate** current interest rate (appropriate based on risk) (not necessarily the coupon rate).

Example: 10-year, 7% ($1,000) US Treasury bond. Assume comparable investments elsewhere are paying 7%. What is the bond price?

(7%, 10 yr. Annuity)

Interest: $PVA = C\left[\frac{1}{r} - \frac{1}{r(1+r)^t}\right] = \$70 \left[\frac{1}{.07} - \frac{1}{.07(1.07)^{10}}\right] = \$70\ (7.024) = \$491.68$

Principal: $\frac{FV}{(1+r)^t} = \frac{\$1{,}000}{(1.07)^{10}}$

Total: $ 491.68
+ 508.35
$ 1,000.03 - note rounding

Note 1: Price = face value when coupon rate = discount rate.
Note 2: For a fixed coupon rate bond, the coupon rate stays the same throughout the life of the bond.
Note 3: The coupon rate is the market rate, or the discount rate, at the time the bond is issued.

(2) Bond Price vs. Interest Rate

Example: If you hold the bond for 2 years and the interest rate is still 7%, what is the bond's value?

Interest: $PVA = C\left[\frac{1}{r} - \frac{1}{r(1+r)^t}\right] = \$70 \left[\frac{1}{.07} - \frac{1}{.07(1.07)^8}\right] = \$70\ (5.971) = \$417.97$

Principal: $PV = \frac{FV}{(1+r)^t} = \frac{\$1{,}000}{(1.07)^8} = \frac{\$1{,}000}{(1.718)} = \$582.01$

Total: $ 417.97
+ 582.01
$ *999.98* - note rounding

Note: Each year the PV of the interest payments decreases (due to fewer payments) but the PV of the principal increases (because you are closer to the time you get it).

Example: Now suppose we hold the bond for 2 years and comparable investments elsewhere are now paying *5%*.

Interest: $PVA = C\left[\frac{1}{r} - \frac{1}{r(1+r)^t}\right] = \$70 \left[\frac{1}{.05} - \frac{1}{.05(1.05)^8}\right] = \$70\ (6.463) = \$452.41$

Principal: $PV = \frac{FV}{(1+r)^t} = \frac{\$1{,}000}{(1.05)^8} = \frac{\$1{,}000}{(1.48)} = \$676.84$

Total: $ 452.41
+ 676.84
$*1,129.25* - Note that the price went up

Why did the price of the bond go up?
Example: Look at the same thing, but comparable investments are now 9%.

Interest: $PVA = C\left[\frac{1}{r} - \frac{1}{r(1+r)^t}\right] = \$70 \left[\frac{1}{.09} - \frac{1}{.09(1.09)^8}\right] = \$70\ (5.535) = \$387.45$

Principal: $PV = \frac{FV}{(1+r)^t} = \frac{\$1{,}000}{(1.09)^8} = \frac{\$1{,}000}{1.99} = \$501.87$

Total:	$	387.45
	+	501.87
	$	889.32

Note that the price went down

Why did the price of the bond go down?

Note 1: Bond price and interest rate move in opposite directions

Note 2: When coupon rate	> discount rate,	price	> face value	(premium)
	=		=	(par)
	<		<	(discount)

Bond prices are usually expressed as a percentage of their face value.

Example:	**#1:**	100	Selling atpar
	#2:	112	Selling at a premium
	#3:	88	Selling atadiscount

Premium - Above the face value
Discount - Below the face value

Is it better to buy a bond at a discount or a premium?
Either way, you' ll get the same effective interest rate.

Bonds pay interest semi-annually. Our 7% bond actually pays $35 every 6 months. This actually increases the effective annual rate. 7% is the APR and EAR> APR Coupon Rate is always APR. We' ll assume annual payments to simplify.

(3) **Current Yield** - Annual coupon payments divided by the market value

Example of Current Yield: 7% 10 year bond

After 2 yrs, the interest rates are now *5%*
Market value of bond = $1,129.25 (we just did)

$$\text{Current Yield} = \frac{70}{1{,}129.25} = 6.20\%$$

Note: This 6.20% is the return I get immediately, but it is not my yield to maturity since I don' t get back my $1,129.25. I get back $1,000 at maturity. Actually the YTM is *5%*.

(4) Quotations: Bond prices are quoted as % of their face value.

Bid: Price investors receive if they **sell** an asset. Sell at the Bid.
Ask: Price investors pay if they **buy** an asset. Buy at the Ask.

Ask > Bid

Note:Think of the broker who holds the bonds bidding for new bonds or asking you for money for his current bonds.

(a) Government Bonds: Prices are quoted in 32^{nds} after the decimal

Rate:	Coupon rate
Current Yld:	coupon / closing price
Maturity:	Month and year
Bid/Ask:	The difference is the spread – The profit to the broke. Spread is usually 2/32 of 1%. Note that if the Ask Y1d is above the Rate, the price is below 100 and vise versa.
Change:	Change in price (in 32^{nds}) from the previous day's close (+ or -). Note that if the prices went up, it probably becauses interest rates (expectations) dropped.
Ask Y1d:	Yield to maturity based on the ask price. Note that the longer maturities on the government bonds show higher yields.

Example:	"Ask"	115:28	[=115 28/32 % of face value (=$1,158.75)]
	"Chg"	-3	[declined by 3/32 % (or 0.094%)]

If you had bought the bond yesterday, you would have paid $1,159.69 (94 cents loss).

(b) Corporate Bonds: Prices are quoted in 8^{ths} after the decimal

III. Yield to Marturity (YTM)

→ Also know as IRR (Internal Rate of return): The interest rate for which the PV of the bond's payments equals the bond price.
→ The rate of retrun you get if you hold the bond to maturity.
→ The true return loong at all cash flows.
→ It should equal the rate for comparable bonds.

→ Similar bonds (in terms of risk and maturity) should have the same YTM.
For similar bonds, market wiqll adjust the prices to give you the same YTM. – If a bond has a higher yield, people buy it which bids up the price, and the yield falls.

Example: $10,000 10-year bond with 4 years remaining. Coupon Rate=7%
Price = $10,346.52 What is the yield to maturity?

$$\$10{,}346.52 = \frac{700}{(1+r)} + \frac{700}{(1+r)^2} + \frac{700}{(1+r)^3} + \frac{700}{(1+r)^4} + \frac{10{,}000}{(1+r)^4}$$

Trail and Error: If the price is > $10,000, the interest rates went down from 7%. In this case, the answer is 6%