LECTURE 1
BOND PRICES, YIELDS AND INTEREST RATES

Bond Prices, Yields and Portfolio Management (Chapters 14 & 15)

Bond Basics – The Four (4) Money Terms

1. **Amount/Principal**
   - Face Value / Par Value ($1,000)
   - Market Value quoted as a % of Par or the Face Value (priced at 98 or 98% of $1,000 = $980.

2. **Cost of Borrowing/ Interest rates:**
   - Coupon Rate (Interest Rate) or Coupon Payment
   - Semi Annual Payments (interest payments) – 8.0% or $40 payment every 6 months
     - J&J (Jan & July)
     - F&A (Feb & Aug)
     - M&S (Mar & Sep)
     - A&O (April & Oct)
     - M&N (May & Nov)
     - J&D (June & Dec)
       - Or J&J 15 means paid on the 15ht of January and July.
   - Accrued Interest and Quoted Bond Prices
     - Interest due on the bond sold between coupon dates
       - Municipal/Corporate Bonds on 30/360 basis and T+3days
       - Treasury Bonds on actual days/365 days and T+1 day
       - Accrued days calculated between last Coupon Day and Settlement Day

Example:

If 98:07 + it means 98 + 7/32 + 1/64

8% F&A 15 Corporate Bond - Par Value = $1,000
Coupon = 8% therefore bond payment is $80 per year in $40 every 6 months
Purchased: Monday, November 1st.
The Bid Price = 98:07 or 98 and 7/32 or 98.21875 % or MV = $982.19

8/15 ⟶ 11/1 → 11/4 ⟶ 2/15

The purchase price = $982.19 + $3.73 = $985.92 (Invoice Price)
Based on 30/360 basis:

Aug: 15 days + Sep: 30 days + Oct: 30 days + Nov: 3 days* = 79 days
*3 days is calculated Nov 1 purchased to Nov 4 settlement.
Accrued interest= 79/360 * $80 = $17.56
Invoice Price = Purchase Price + Accrued Interest = $982.19 + $17.56 = $999.75

3. Maturity/Term and 4. Payments

- Bond Maturity Terminology
  - Term Bond (0,0,0,0, 100) or Bullet maturity (Most common)
  - Serial Bond (20,20,20,20,20)
  - Balloon Bond (10,10,10,10,60)

- Bond Redemption Features
  - Refunding Debt
  - Call protection
  - Put Feature
  - Sinking Fund

Types of Bonds:

- Treasury Bonds (10-30yr) & Notes (10 yr)
- Corporate Bonds
  - Call Provisions on Corporate Bonds– Call Price / Call Protection
  - Convertible Bonds – option to convert to common stock
    - Conversion Ratio – number of shares for each bond

Example:
Bond Par Value = $1,000
Convertible ratio = Par Value / Conversion Price = 40 shares
At Current Stock = $20 per share so the option to convert is no profitable ($20 x 40 = $800 or *Market Conversion Value*
At Current Stock = $30 per share so the option to convert is profitable ($30 x 40 = $1,200 or *Market Conversion Value*

- Conversion Parity is the point at which neither a profit nor loss is made at conversion –
  - Parity Price of the Stock = MV of Bond / Conversion Ratio
  - Parity Price of the Bond = MV of Stock x Conversion Ratio

- Conversion Premium is the excess of the bond price over its conversion value. If the bond were selling currently $950, the stock is $20 then its premium would be $150 ($950 – $800)

OTHER TYPES OF BONDS

- Zero Coupon Bonds
- Puttable Bonds (option to the bond holders to put the bonds to the Issuer)
- Floating-rate Bonds – T + 2.0%
- PIK Bonds (Paid-in-Kind)
- Preferred Stock (Dividends – Waterfall ahead of the Common Stock)
- Other Domestic Bonds (Municipal, local governments, Tax exempt)
- International Bonds
- Foreign Bonds
- Eurobonds (Issued in the currency of one country but sold in other national market) – Eurodollar – dollar-denominated bonds sold outside the U.S.
- Yankee Bonds (foreign bonds sold in the US)
- Samurai Bonds (Yen-denominated bonds sold in Japan by non-Japanese issuers
- Bulldog Bonds (British Pound-denominated foreign bonds sold in the U.K.)
- Other exotic bonds (Inverse Floaters, Asset-Backed Bonds, Catastrophe Bonds, Index Bonds)

Bond Yields

- **Nominal Yield = Coupon Rate**
- **Current Yield = Coupon Payment / Market Value**
- **Yield to Maturity (YTM)**
- **Yield to Call (YTC)**

Yield to Worse (YTW)

Bond Value = PV of Coupons + PV of Par Value at Maturity

$$\text{Bond Value} = \sum (\text{Coupon Pmt} / (1 + r)^t) + (\text{Par Value} / (1 + r)^T$$

Where,
Maturity Date = T – (using PV Factor tables)
Discount Rate = r

Years (t) – (using Annuity Factor tables)

Coupon x (1/r) [1 – (1 / ((1+r)^T)]] + Par Value x (1 / ((1+r)^T)
or
Coupon x Annuity Factor (r, T) + Par Value x PV Factor (r, T)

Table:

Example
Par Value: $1,000
Coupon: 8.0% (4% or $40 coupon payment every six months)
Maturity: 30 years (60 payments)

Price = Σ [$40 / (1.04) ^t] + [1000 / (1.04) ^ 60]

Price = $40 x Annual Factor (4%, 60) + $1000 x PV Factor (4%, 60)

Price = $ 904.94 + 95.06 = $1,000

If the interest rates will rise to 10%

1	B	C	D	E	F	G	H
2	**BOND PRICING**						
3							
4	Par/Face Value	$ 1,000.00		Semi-Annual Coupon =		4.00%	
5	Coupon % =	8.00%		Semi-Annual Payment =	$	40.00	every 6 mnts
6	Maturity/Term =	30 yrs		Semi-Annual # Paymants =		60	pmts
7							
8	Present Value of Coupon Pmts=			$904.94	*=PV(B4/2,G5,-G4)*		
9	Present Value of Principal Pmt=			$95.06	*=PV(B4/2,G5,0,-B3,0)*		
10	Total			$1,000.00			

11	11	B	C	D	E
12	Net Present Value		$904.94	$95.06	$1,000.00
13			=NPV(B4/2,C16:C75)		
14		Long-Form			
15		Period	Coupon Payment	Principal Payment	Total Payment
16		0			$ (1,000.00)
17		1	$ 40.00	$ -	$ 40.00
18		2	$ 40.00	$ -	$ 40.00
19		3	$ 40.00	$ -	$ 40.00
20		4	$ 40.00	$ -	$ 40.00
21		5	$ 40.00	$ -	$ 40.00
22		6	$ 40.00	$ -	$ 40.00
23		7	$ 40.00	$ -	$ 40.00
24		8	$ 40.00	$ -	$ 40.00
25		9	$ 40.00	$ -	$ 40.00
26		10	$ 40.00	$ -	$ 40.00
27		11	$ 40.00	$ -	$ 40.00
28		12	$ 40.00	$ -	$ 40.00
29		13	$ 40.00	$ -	$ 40.00
30		14	$ 40.00	$ -	$ 40.00
31		15	$ 40.00	$ -	$ 40.00
32		16	$ 40.00	$ -	$ 40.00
33		17	$ 40.00	$ -	$ 40.00
34		18	$ 40.00	$ -	$ 40.00
35		19	$ 40.00	$ -	$ 40.00
36		20	$ 40.00	$ -	$ 40.00
37		21	$ 40.00	$ -	$ 40.00
38		22	$ 40.00	$ -	$ 40.00
39		23	$ 40.00	$ -	$ 40.00
40		24	$ 40.00	$ -	$ 40.00
41		25	$ 40.00	$ -	$ 40.00
42		26	$ 40.00	$ -	$ 40.00
43		27	$ 40.00	$ -	$ 40.00
44		28	$ 40.00	$ -	$ 40.00
45		29	$ 40.00	$ -	$ 40.00
46		30	$ 40.00	$ -	$ 40.00
47		31	$ 40.00	$ -	$ 40.00
48		32	$ 40.00	$ -	$ 40.00
49		33	$ 40.00	$ -	$ 40.00
50		34	$ 40.00	$ -	$ 40.00
51		35	$ 40.00	$ -	$ 40.00
52		36	$ 40.00	$ -	$ 40.00
53		37	$ 40.00	$ -	$ 40.00
54		38	$ 40.00	$ -	$ 40.00
55		39	$ 40.00	$ -	$ 40.00
56		40	$ 40.00	$ -	$ 40.00
57		41	$ 40.00	$ -	$ 40.00
58		42	$ 40.00	$ -	$ 40.00
59		43	$ 40.00	$ -	$ 40.00
60		44	$ 40.00	$ -	$ 40.00
61		45	$ 40.00	$ -	$ 40.00
62		46	$ 40.00	$ -	$ 40.00
63		47	$ 40.00	$ -	$ 40.00
64		48	$ 40.00	$ -	$ 40.00
65		49	$ 40.00	$ -	$ 40.00
66		50	$ 40.00	$ -	$ 40.00
67		51	$ 40.00	$ -	$ 40.00
68		52	$ 40.00	$ -	$ 40.00
69		53	$ 40.00	$ -	$ 40.00
70		54	$ 40.00	$ -	$ 40.00
71		55	$ 40.00	$ -	$ 40.00
72		56	$ 40.00	$ -	$ 40.00
73		57	$ 40.00	$ -	$ 40.00
74		58	$ 40.00	$ -	$ 40.00
75		59	$ 40.00	$ -	$ 40.00
76		60	$ 40.00	$ 1,000.00	$ 1,040.00
77		IRR =			4.00%

Valuing the Bonds

1	K	L	M	N	O	P
2	**VALUING BONDS**					
3						
4	Settlement Date=		1/15/2007			
5	Maturity Date=		1/15/2011			
6	Coupon Rate=		4.250%			
7	Yield to Maturity=		4.740%			
8	Redemption value %=		100			
9	Coupon Pmts per year=		2			
10						
11	Flat Price (% Par)		98.234	*=PRICE(M4,M5,M6,M7,M8,M9)*		
12	Day since last coupon=		0	*=COUPDAYBS(M4,M5,2,1)*		
13	Days in coupon period=		181	*=COUPDAYS(M4,M5,2,1)*		
14	Accrued Interest=		0	*=(M12/M13)*M6*100/2*		
15	Invoice Price=		98.234	*=+M11+M14*		
16						
17						
18	Settlement Date=		**2/15/2007**			
19	Maturity Date=		1/15/2011			
20	Coupon Rate=		4.250%			
21	Yield to Maturity=		4.740%			
22	Redemption value %=		100			
23	Coupon Pmts per year=		2			
24						
25	Flat Price (% Par)		98.264			
26	Day since last coupon=		**31**			
27	Days in coupon period=		181			
28	Accrued Interest=		0.36395028			
29	Invoice Price=		98.628			
30						

Yield to Maturity

YIELD TO MATURITY

Settlement Date=	1/1/2000
Maturity Date=	1/1/2010
Coupon Rate=	8.000%
Bond Pricing=	110
Redemption Value=	100
Coupon pmts per yr=	2
Yield to Maturity=	6.617%

=YIELD(D84,D85,D86,D87,D88,D89)

Long-Form

Period	Coupon Payment	Principal Payment	Total Payment
0			**$ (1,100.00)**
1	$ 40.00	$ -	$ 40.00
2	$ 40.00	$ -	$ 40.00
3	$ 40.00	$ -	$ 40.00
4	$ 40.00	$ -	$ 40.00
5	$ 40.00	$ -	$ 40.00
6	$ 40.00	$ -	$ 40.00
7	$ 40.00	$ -	$ 40.00
8	$ 40.00	$ -	$ 40.00
9	$ 40.00	$ -	$ 40.00
10	$ 40.00	$ -	$ 40.00
11	$ 40.00	$ -	$ 40.00
12	$ 40.00	$ -	$ 40.00
13	$ 40.00	$ -	$ 40.00
14	$ 40.00	$ -	$ 40.00
15	$ 40.00	$ -	$ 40.00
16	$ 40.00	$ -	$ 40.00
17	$ 40.00	$ -	$ 40.00
18	$ 40.00	$ -	$ 40.00
19	$ 40.00	$ -	$ 40.00
20	$ 40.00	$ 1,000.00	$ 1,040.00
IRR =			**3.3085%** 6.617%

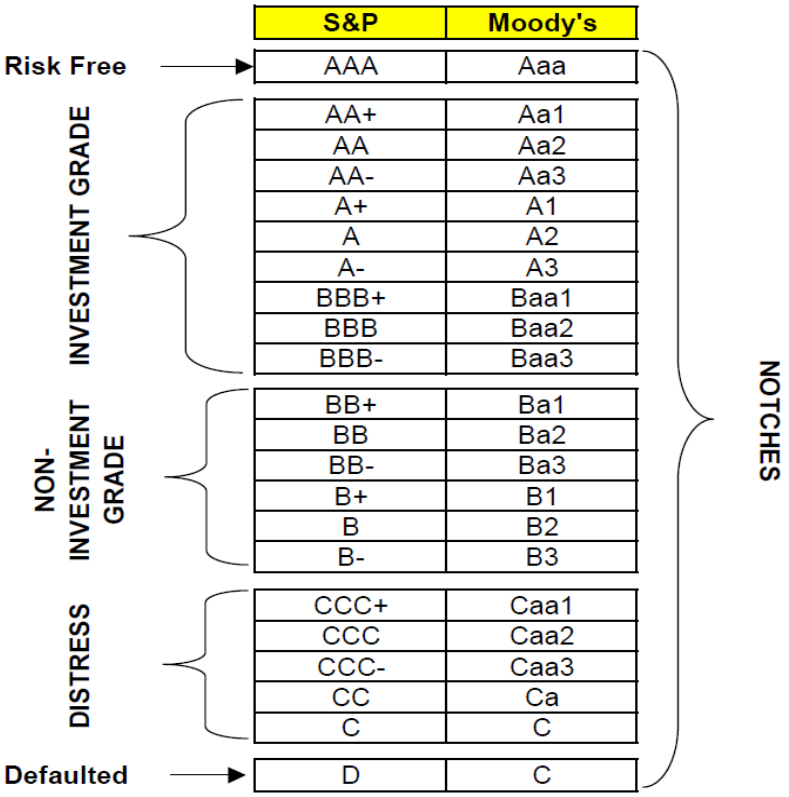
YIELD TO CALL Vs YIELD TO MATURITY

	YTC	YTM
Settlement Date=	1/1/2000	1/1/2000
Maturity Date=	1/1/2010	1/1/2030
Coupon Rate=	8.00%	8.00%
Coupon Pmt =	$ 40.00	$ 40.00
Number of semiannual	20 periods	60 periods
Call Provision	110.00	1,000.00
Final Payment	1,100.00	1,000.00
Price	1,150.00	1,150.00
YIELD =	6.6434%	6.8192%

=YIELD(M85,M86,M87,M92/10,M91/10,2)

Bond Risks

Ratings

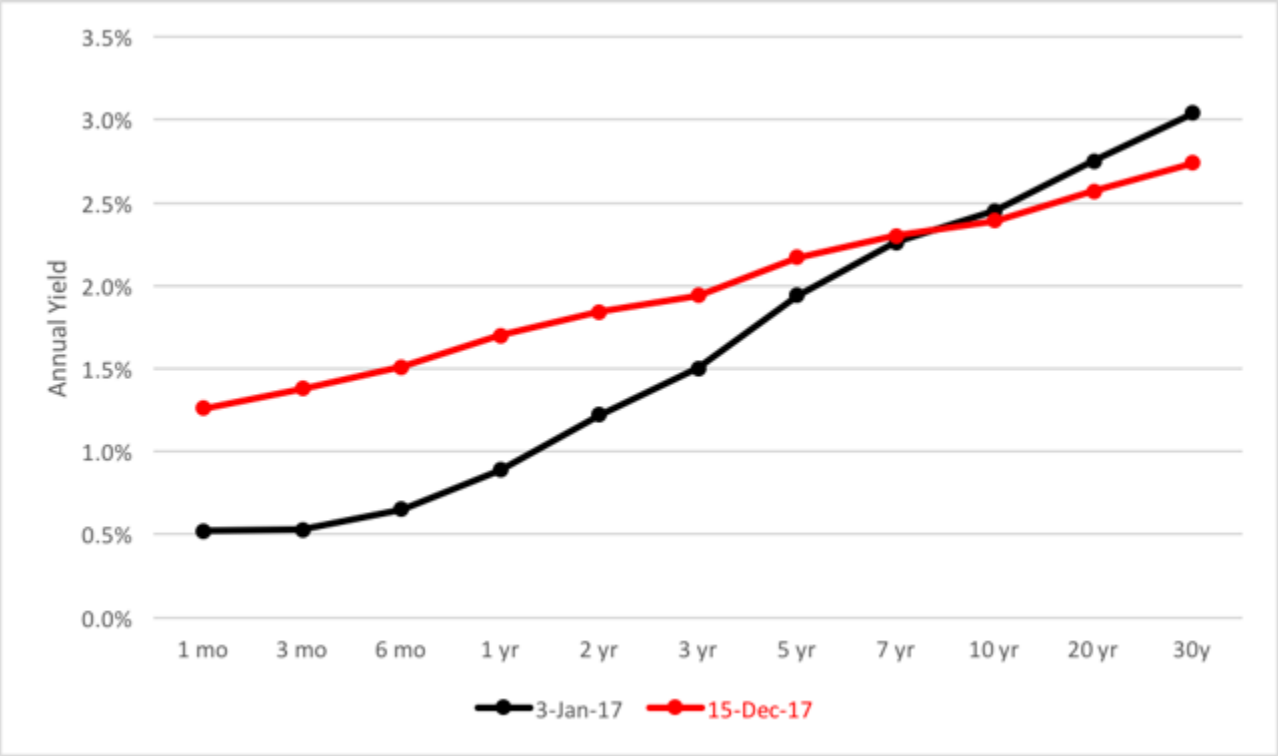


- Credit Risk
- Interest Rate Risk
- Refinancing/Repayment Risk
- Liquidity Risk
- CDS/CDOs – Hedging and Diversifying

THE TERM STRUCTURE OF INTEREST RATES

Initial Concepts of Interest Rates and Timing:

- The pattern of Interest Rates
- The Yield Curve and Future Interest Rates
- HPR / IRR
- Forward Rates (FRAs and IROs) – Hedging the uncertainty



$$\text{Formula for payment to the long at settlement} = \left(\text{notional principal}\right) \times \frac{(\text{floating rate} - \text{forward rate})\left(\frac{\text{days}}{360}\right)}{1 + (\text{floating rate})\left(\frac{\text{days}}{360}\right)}$$