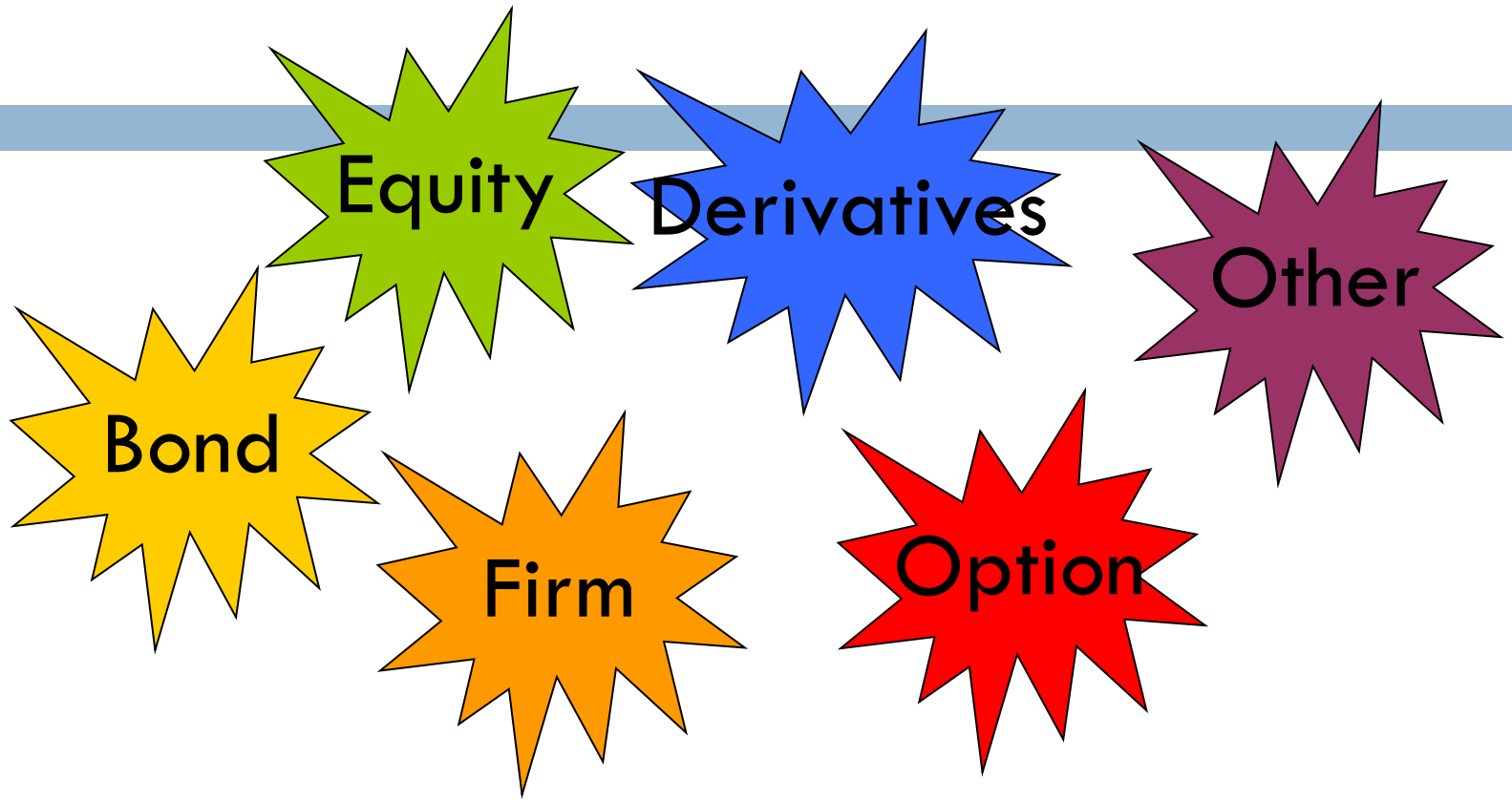
FN 201 BUSINESS FINANCE

Lecture 7

Asset Valuation



(Any) Financial products are valued as sum of discounted (expected) cash flow

Bond Valuation

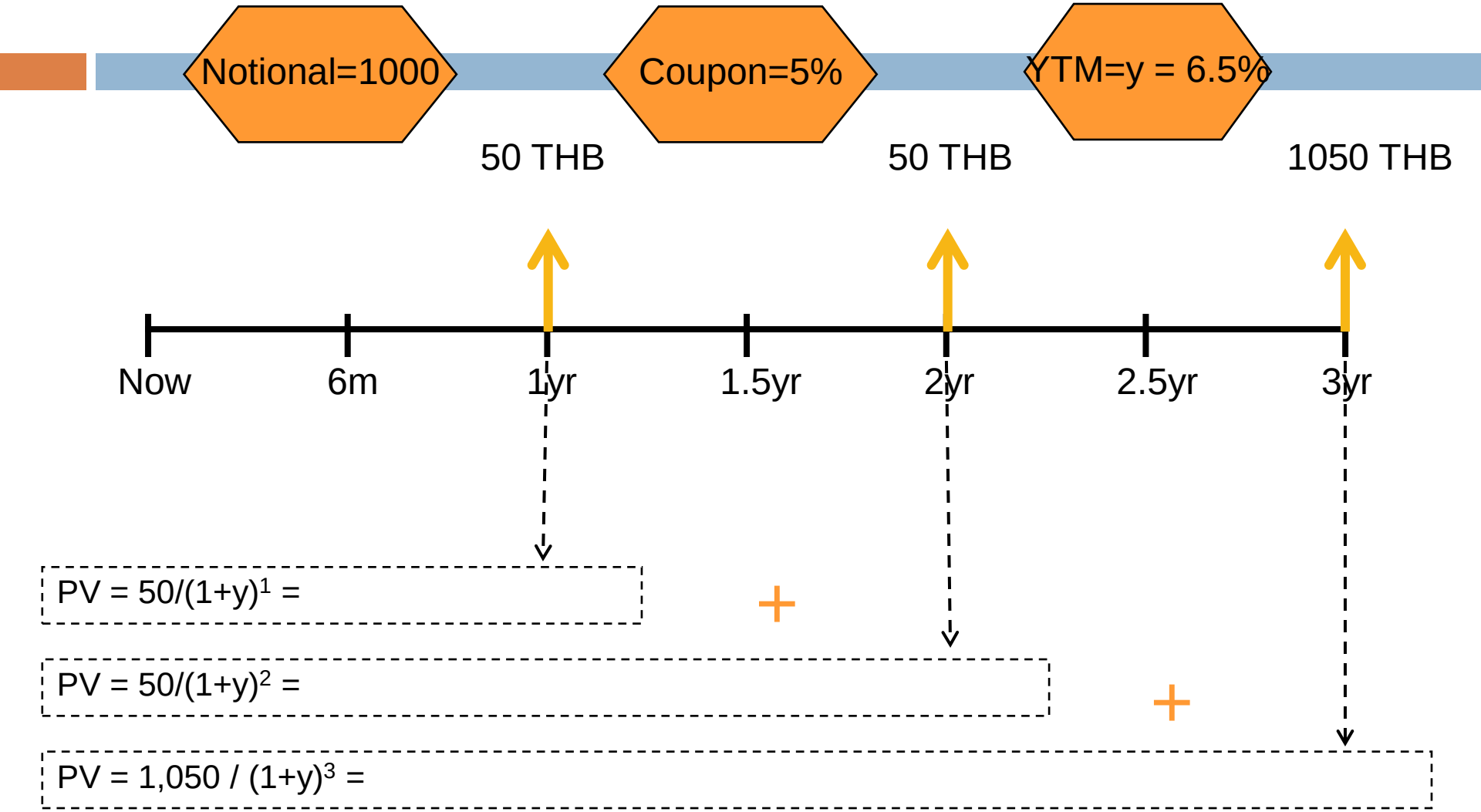
What is Bond?

- Bond is Legal contract that specifies the rights and obligations of the bond issuer and the bond holders

- Debt instrument that pay pre-determined interest rate (coupon rate) over the life until maturity
- It becomes an important source of funding for firms in addition to bank loan
- Bond Features:
  - Face or Par Value
  - Coupon rate
  - Frequency of coupon payment
  - Maturity
  - Others covenants (rules and restrictions on the bond issuer and holders)


10
X16201
10
INTERNATIONAL MERCANTILE MARINE
COMPANY
INCORPORATED UNDER THE LAWS OF THE STATE OF NEW JERSEY
This Certifies that
William R. Osborne
16
is the owner of
6% Cumulative Preferred Capital Stock
of International Mercantile Marine Company
APR 23


PENN CENTRAL COMPANY
PENN CENTRAL COMPANY


Notional=1000
Coupon=5%
YTM=y = 6.5%
50 THB
50 THB
1050 THB
Now
6m
1yr
1.5yr
2yr
2.5yr
3yr
PV = 50/(1+y)1 =
+
PV = 50/(1+y)2 =
+
PV = 1,050 / (1+y)3 =

Bond Price = PV of coupons + PV of par value

$$Bond\ \text{Price} = \sum_{t=1}^{T} \frac{C}{(1+y)^t} + \frac{Par\ value}{(1+y)^T}$$

Bond Price = C*Annuity factor(y,T) + Par*discount factor(y,T)

Yield to Maturity (YTM)

- Yield to maturity (YTM) is the rate of return (or yield) if bond is hold until maturity
- It is the single discount rate that is used to calculate the present value of cash flows, and therefore used to calculate the bond price.
- There is 1:1 relationship between bond price and yield to maturity.
- This is how bond price get quoted in the market.

Bond Quote

Treasury Bills | Government Bonds | State Owned Enterprise Bonds | State Agency Bonds | Corporate Bonds | Foreign Bonds

State Owned Enterprise Bonds Quoted Yields Historical Quoted Yield >> 08/09/2008 Go! (dd/mm/yyyy)

08 September 2008

Bond	Coupon	Maturity	TTM (Yrs.)	Quoted Date	Quoted Yield(%)
BMTA08DA	3.85	15/12/2008	0.27	08/09/2008	3.882471
BMTA08NA	3.78	04/11/2008	0.16	08/09/2008	3.880473
BMTA09DA	4.14	04/12/2009	1.24	08/09/2008	4.084864
BMTA090A	4.225	28/10/2009	1.14	08/09/2008	4.046865
BMTA10DA	5.86	13/12/2010	2.26	08/09/2008	4.232227
BMTA10NA	4.53	04/11/2010	2.16	08/09/2008	4.216950
BMTA100A	4.6	15/10/2010	2.10	08/09/2008	4.209115
BMTA111A	5.325	25/01/2011	2.38	08/09/2008	4.255625
BMTA11DA	6	13/12/2011	3.26	08/09/2008	4.385197
BMTA110A	4.72	15/10/2011	3.10	08/09/2008	4.360696
BMTA122A	5.345	08/02/2012	3.42	08/09/2008	4.431282
BMTA128A	4.598	29/08/2012	3.98	08/09/2008	4.502289
BMTA12DA	4.77	13/12/2012	4.27	08/09/2008	4.549463
BMTA131A	4.95	25/01/2013	4.38	08/09/2008	4.581162
BMTA133A	4.1	26/03/2013	4.55	08/09/2008	4.622401
BMTA136A	3.4968	01/06/2013	4.73	08/09/2008	4.655081
BMTA136B	3.8668	14/06/2013	4.77	08/09/2008	4.661422
BMTA13DA	4.967	17/12/2013	5.28	08/09/2008	4.722664
BMTA130A	4.738	29/10/2013	5.14	08/09/2008	4.708707
BMTA144A	4.17	10/04/2014	5.59	08/09/2008	4.764885
BMTA144B	4.12	24/04/2014	5.63	08/09/2008	4.772772
BMTA146A	3.808	07/06/2014	5.75	08/09/2008	4.799477
BMTA14DA	4.83	13/12/2014	6.27	08/09/2008	4.858313
BMTA152A	4.79	08/02/2015	6.42	08/09/2008	4.866520
BMTA156A	3.6468	01/06/2015	6.73	08/09/2008	4.882792
BMTA156B	4.03	14/06/2015	6.77	08/09/2008	4.884663
BMTA150A	4.94	29/10/2015	7.14	08/09/2008	4.895778

Source : Thaibma.or.th

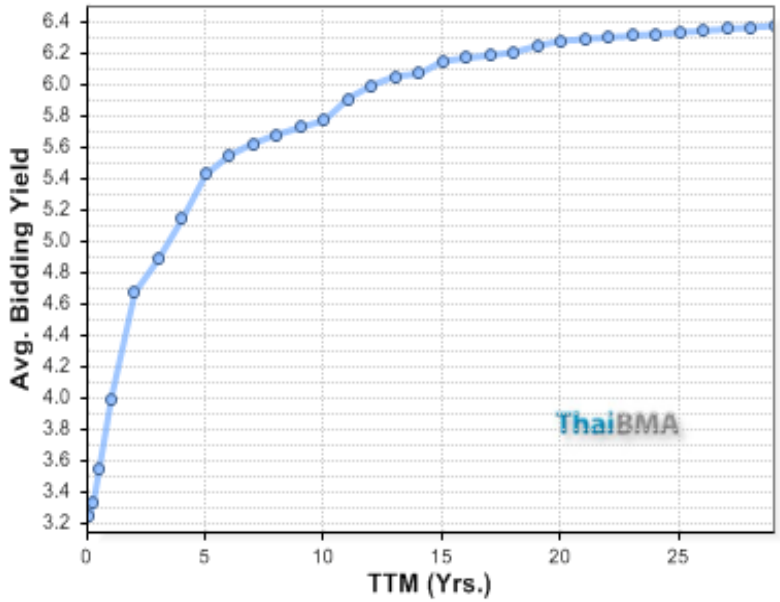
Curve from Thai BMA

ThaiBMA
THE THAI BOND MARKET ASSOCIATION

(dd/mm/yyyy)

ThaiBMA Government Bond Yield Curve

As of 11 Jul 2008



TTM (Yrs.)	Yield (%)
0.08	3.26
0.25	3.35
0.50	3.56
1	4.01
2	4.68
3	4.90
4	5.15
5	5.43
6	5.56
7	5.63
8	5.69
9	5.73
10	5.78
11	5.92
12	6.00
13	6.06
14	6.07
15	6.15
16	6.17
17	6.19
18	6.21
19	6.25
20	6.28

Ex.1

- A government bond issued in Germany has a coupon rate of 5%, face value of euros 100 and maturing in five years. The interest payments are made annually. Calculate the price of the bond (in euros) if the yield to maturity is 3.5%.

  a. 100 b. 106.77 c. 106.33

  d. None of the above

Ex. 2:

- 8% coupon, 30-yrs maturity bond with par value of $1,000 paying 60 semiannual coupon of $40 each.
- If YTM is 8% annually, or 4% per 6-month period, what is the price of this bond?

- If YTM is 10% annually, or 5% per 6-month period, what is the price of this bond?

Ex.3 : What can you get out from this result?

- Bond prices at different interest rates
- 8% coupon bond with par value of $1,000, coupons paid semiannually

	Bond Price at Given Market Interest Rates				
Time to Maturit	4%	6%	8%	10%	12%
1 yr	1038.83	1029.13	1000.00	981.41	963.33
10 yr	1327.03	1148.77	1000.00	875.35	770.6
20 yr	1547.11	1231.15	1000.00	828.41	699.07
30 yr	1695.22	1276.76	1000.00	810.71	676.77

Ex. 4: True or False

- Which of the following statements about the relationship between interest rates and bond prices is true?

  I) There is an inverse relationship between bond prices and interest rates

  II) There is a direct relationship between bond prices and interest rates

  III) The price of short-term bonds fluctuates more than the price of long-term bonds for a given change in interest rates. (Assuming that coupon rate is the same for both)

  IV) The price of long-term bonds fluctuates more than the price of short-term bonds for a given change in interest rates. (Assuming that the coupon rate is the same for both)

Ex. 5

- What would you expect the market price of the following bond to be? Which bond has higher price?
- 1) Notional =100, 1yr maturity, 8% annual coupon
  - 1.1) When the yield available on comparable bonds is 8%
  - 1.2) When the yield available on comparable bonds is 5%
- 2) Notional =100, 7yr maturity, 8% annual coupon
  - 1.3) When the yield available on comparable bonds is 8%
  - 1.4) When the yield available on comparable bonds is 5%
- 3) Notional = 100, 7yr maturity, zero coupon
  - 1.5) When the yield available on comparable bonds is 8%
  - 1.6) When the yield available on comparable bonds is 5%

Bond Price through Times

Bond Pricing

Bond Price = PV of coupons + PV of par value

$$Bond\ \text{Price} = \sum_{t=1}^{T} \frac{C}{(1+y)^t} + \frac{Par\ value}{(1+y)^T}$$

Bond Price = C*Annuity factor(y,T) + Par*discount factor(y,T)

Where return comes from?

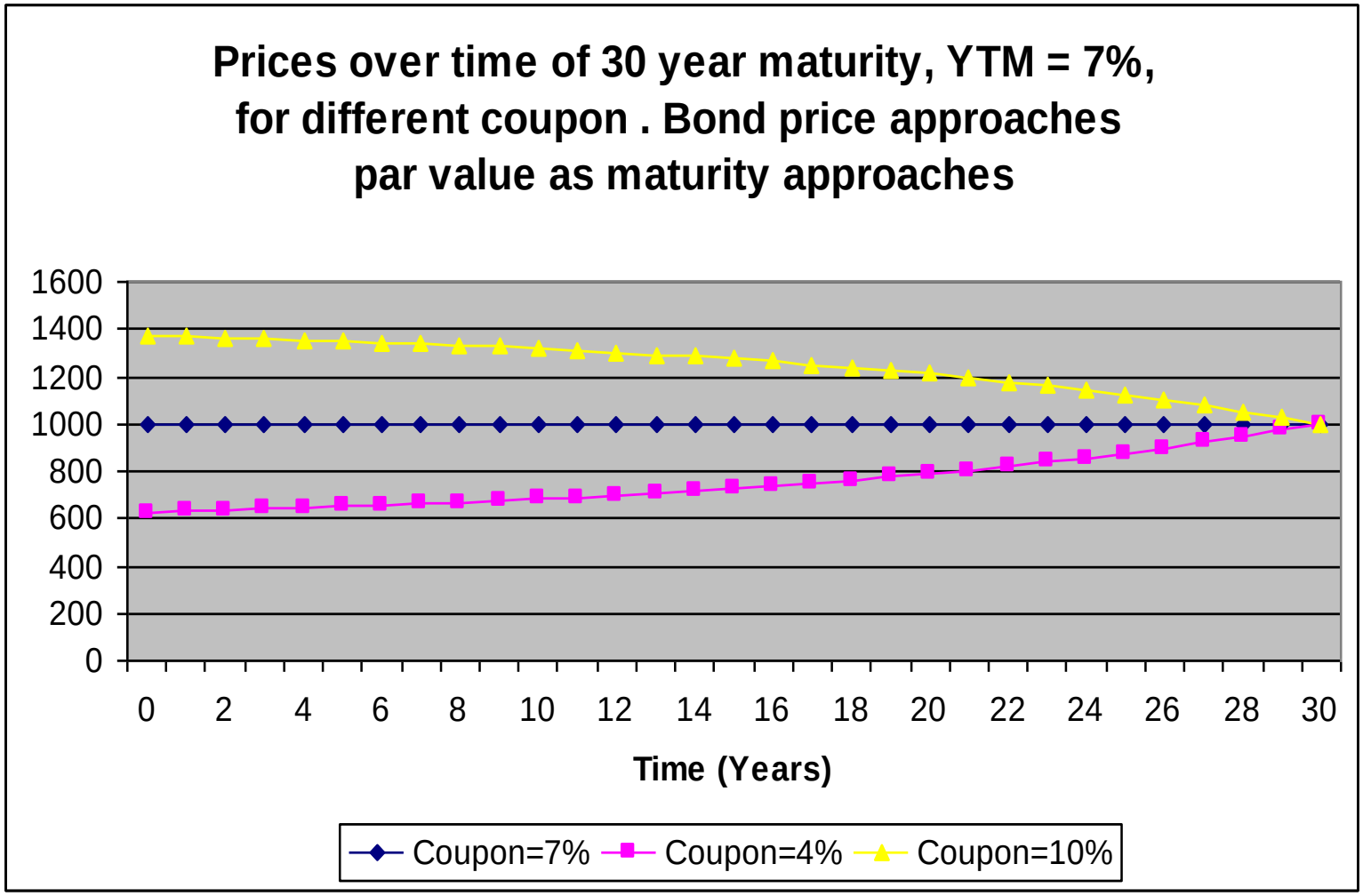
- Bond
  - Coupon payment & Capital gains (losses)
- Stock
  - Dividends & Capital gains (losses)

Bond Price Through Time

- Find price of bond with coupon C (THB 70) paid annually, 30 yrs maturity, yield to maturity is 4%

- At time 0: Bond Price = C*Annuity factor(4%,30) + Par*discount factor(4%,30)
- At time 1: Bond Price = C*Annuity factor(4%,29) + Par*discount factor(4%,29)
- At time 2: Bond Price = C*Annuity factor(4%,28) + Par*discount factor(4%,28)
- ……
- At time 30: Bond Price = C*Annuity factor(4%,0) + Par*discount factor(4%,0) = face value

Price determined by YTM – Same YTM Diff Coupon

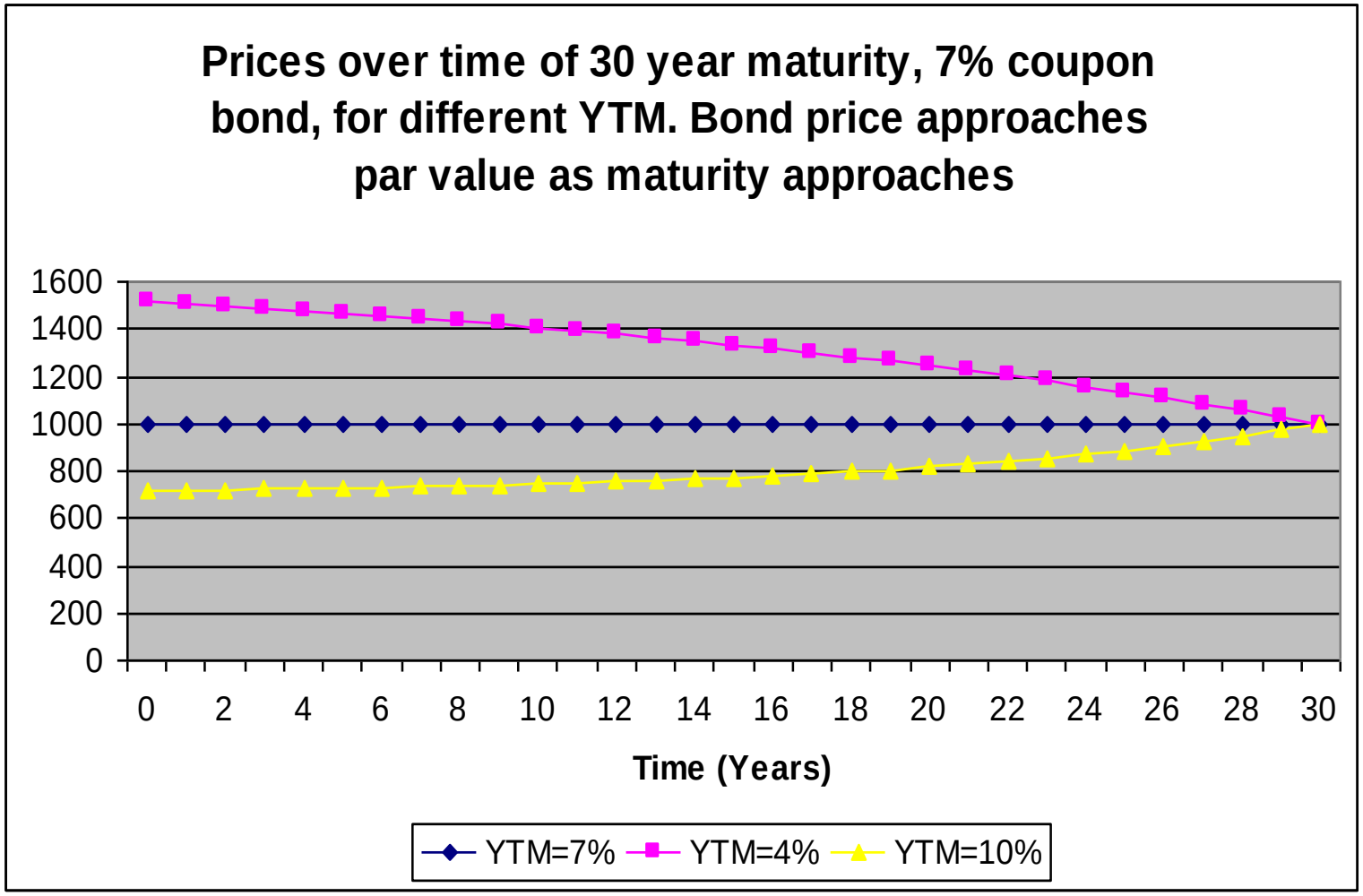


How can bond with coupon 4% and 10% give same return of 7%?

Face	1000
Coupon	

		Coupon=7%			Coupon=4%			Coupon=10%		
		YTM=7%			YTM=7%			YTM=7%		
Time	TTM (Yrs)	Formula 7%	Hold and Sell	Return	Formula 7%	Hold and Sell	Return	Formula 7%	Hold and Sell	Return
0	30	1000.00			627.73			1372.27		
1	29	1000.00	1070	7%	631.67	672	7%	1368.33	1468	7%
2	28	1000.00	1070	7%	635.89	676	7%	1364.11	1464	7%
3	27	1000.00	1070	7%	640.40	680	7%	1359.60	1460	7%
4	26	1000.00	1070	7%	645.23	685	7%	1354.77	1455	7%
5	25	1000.00	1070	7%	650.39	690	7%	1349.61	1450	7%
6	24	1000.00	1070	7%	655.92	696	7%	1344.08	1444	7%
7	23	1000.00	1070	7%	661.83	702	7%	1338.17	1438	7%
8	22	1000.00	1070	7%	668.16	708	7%	1331.84	1432	7%
9	21	1000.00	1070	7%	674.93	715	7%	1325.07	1425	7%
10	20	1000.00	1070	7%	682.18	722	7%	1317.82	1418	7%
11	19	1000.00	1070	7%	689.93	730	7%	1310.07	1410	7%
12	18	1000.00	1070	7%	698.23	738	7%	1301.77	1402	7%
13	17	1000.00	1070	7%	707.10	747	7%	1292.90	1393	7%
14	16	1000.00	1070	7%	716.60	757	7%	1283.40	1383	7%
15	15	1000.00	1070	7%	726.76	767	7%	1273.24	1373	7%
16	14	1000.00	1070	7%	737.64	778	7%	1262.36	1362	7%
17	13	1000.00	1070	7%	749.27	789	7%	1250.73	1351	7%
18	12	1000.00	1070	7%	761.72	802	7%	1238.28	1338	7%
19	11	1000.00	1070	7%	775.04	815	7%	1224.96	1325	7%
20	10	1000.00	1070	7%	789.29	829	7%	1210.71	1311	7%
21	9	1000.00	1070	7%	804.54	845	7%	1195.46	1295	7%
22	8	1000.00	1070	7%	820.86	861	7%	1179.14	1279	7%
23	7	1000.00	1070	7%	838.32	878	7%	1161.68	1262	7%
24	6	1000.00	1070	7%	857.00	897	7%	1143.00	1243	7%
25	5	1000.00	1070	7%	876.99	917	7%	1123.01	1223	7%
26	4	1000.00	1070	7%	898.38	938	7%	1101.62	1202	7%
27	3	1000.00	1070	7%	921.27	961	7%	1078.73	1179	7%
28	2	1000.00	1070	7%	945.76	986	7%	1054.24	1154	7%
29	1	1000.00	1070	7%	971.96	1012	7%	1028.04	1128	7%
30	0	1000.00	1070	7%	1000.00	1040	7%	1000.00	1100	7%

Price determined by YTM (2) – Same Coupon Diff Yield



How can bond with coupon 7% give different return of 4% and 10%?

Face	1000
Coupon	7%

		YTM=7%			YTM=4%			YTM=10%		
Time	TTM (Yrs)	Formula 7%	Hold and Sell	Return	Formula 4%	Hold and Sell	Return	Formula 10%	Hold and Sell	Return
0	30	1000.00			1518.76			717.19		
1	29	1000.00	1070	**7%**	1509.51	1580	**4%**	718.91	789	**10%**
2	28	1000.00	1070	**7%**	1499.89	1570	**4%**	720.80	791	**10%**
3	27	1000.00	1070	**7%**	1489.89	1560	**4%**	722.88	793	**10%**
4	26	1000.00	1070	**7%**	1479.48	1549	**4%**	725.17	795	**10%**
5	25	1000.00	1070	**7%**	1468.66	1539	**4%**	727.69	798	**10%**
6	24	1000.00	1070	**7%**	1457.41	1527	**4%**	730.46	800	**10%**
7	23	1000.00	1070	**7%**	1445.71	1516	**4%**	733.50	804	**10%**
8	22	1000.00	1070	**7%**	1433.53	1504	**4%**	736.85	807	**10%**
9	21	1000.00	1070	**7%**	1420.87	1491	**4%**	740.54	811	**10%**
10	20	1000.00	1070	**7%**	1407.71	1478	**4%**	744.59	815	**10%**
11	19	1000.00	1070	**7%**	1394.02	1464	**4%**	749.05	819	**10%**
12	18	1000.00	1070	**7%**	1379.78	1450	**4%**	753.96	824	**10%**
13	17	1000.00	1070	**7%**	1364.97	1435	**4%**	759.35	829	**10%**
14	16	1000.00	1070	**7%**	1349.57	1420	**4%**	765.29	835	**10%**
15	15	1000.00	1070	**7%**	1333.55	1404	**4%**	771.82	842	**10%**
16	14	1000.00	1070	**7%**	1316.89	1387	**4%**	779.00	849	**10%**
17	13	1000.00	1070	**7%**	1299.57	1370	**4%**	786.90	857	**10%**
18	12	1000.00	1070	**7%**	1281.55	1352	**4%**	795.59	866	**10%**
19	11	1000.00	1070	**7%**	1262.81	1333	**4%**	805.15	875	**10%**
20	10	1000.00	1070	**7%**	1243.33	1313	**4%**	815.66	886	**10%**
21	9	1000.00	1070	**7%**	1223.06	1293	**4%**	827.23	897	**10%**
22	8	1000.00	1070	**7%**	1201.98	1272	**4%**	839.95	910	**10%**
23	7	1000.00	1070	**7%**	1180.06	1250	**4%**	853.95	924	**10%**
24	6	1000.00	1070	**7%**	1157.26	1227	**4%**	869.34	939	**10%**
25	5	1000.00	1070	**7%**	1133.55	1204	**4%**	886.28	956	**10%**
26	4	1000.00	1070	**7%**	1108.90	1179	**4%**	904.90	975	**10%**
27	3	1000.00	1070	**7%**	1083.25	1153	**4%**	925.39	995	**10%**
28	2	1000.00	1070	**7%**	1056.58	1127	**4%**	947.93	1018	**10%**
29	1	1000.00	1070	**7%**	1028.85	1099	**4%**	972.73	1043	**10%**
30	0	1000.00	1070	**7%**	1000.00	1070	**4%**	1000.00	1070	**10%**

Actual return might be higher / lower if sell before maturity

- If sell it before maturity for extra capital gain / loss
- YTM implies return in case of holding until maturity (as the name suggests)

Bond Special Features

Bond Special Features

- Who gains from these features? Who should be compensated?

- Callable
  - Provisions allowing issuer to repurchase the bond at a specified (call) price before maturity date

- Puttable
  - Provisions allowing holder to reclaim principal at a specified (put) price before maturing date

- Convertible
  - Provisions allowing holder to converted bond into stocks at fixed price on fixed date

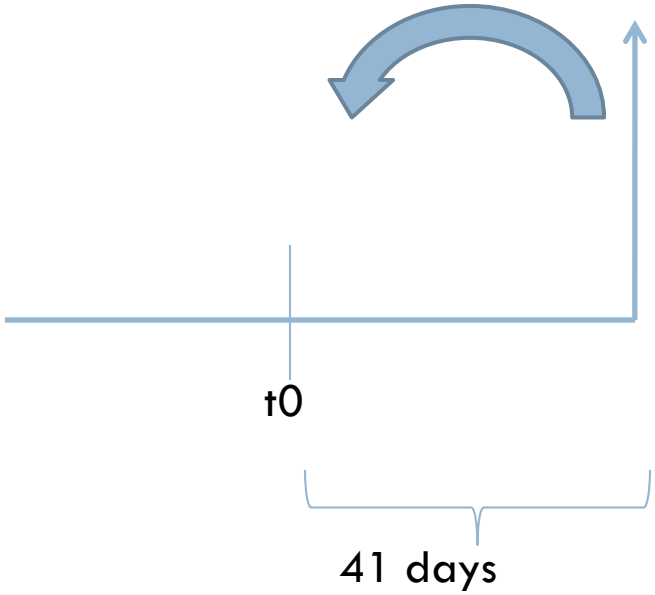
Bond Special Features

- Asset-Backed Bond :
  - Coupon rate tied with performance of asset
  - Walt Disney -> performance of its films
  - David Bowie Bond -> royalties on his album
- Index Bond :
  - Payment tied to a general price index or commodity
  - US -> Treasury Inflation Protected Securities (TIPS)
  - Mexico -> 20 yrs bonds with payments depend on oil price
- Inverse Floaters :
  - Let's double the risk
  - Coupon rate falls when rate rises -> suffer or gain doubly

Bond Pricing in Practice

Ex6: Treasury Bill (TB)

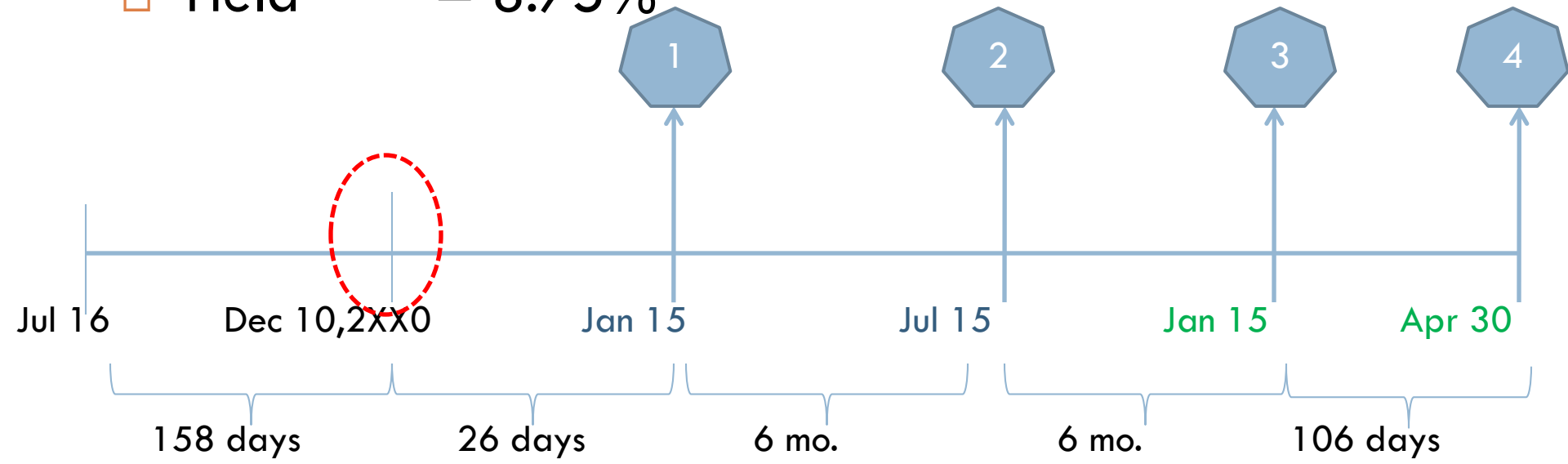
- Maturity = 41 days
- Yield = 6.41%
- Face = B100
- What is the price? (Hint: TB sold at discount)



- P*(1+6.41%*41/365) = 100
- P = 100 / (1+6.41%*41/365)
- P = 99.2851

Ex7: Coupon Bond

- Bond pay interest every 6 months (Jul & Jan 15)
- Today = Dec 10, 2XX0, Maturity = Apr 30, 2XX2
- Face = B100
- Coupon = 11.25%
- Yield = 8.75%



- CF1 discount 26 days
- CF2 discount 6mo. + 26 days
- CF3 discount 12mo. + 26 days
- CF4 discount 12mo. + 26 days + 106 days
- Yield = 4.375% / 6 mo. Or 182.5 days
- We use actual / 365 days count convention

  - PV-CF1 $= 5.625 / (1+ 4.375\%)^{26/182.5} = 5.5908$
  - PV-CF2 $= 5.625 / (1+ 4.375\%)^{1+ 26/182.5} = 5.3564$

- PV-CF3 = $5.625 / (1+ 4.375\%)^{2+ 26/182.5} = 5.1319$
- PV-CF4 = $100 + 3.2671 / (1+ 4.375\%)^{2+ 132/182.5} = 91.9006$
- Price = PV-CF1 + PV-CF2 + PV-CF3 + PV-CF4
- Price = 107.9798

- Gross (Dirty) Price = 107.9798
- But the first 158 days of interest belongs to first holder
- If this is dirty price, what is the clean price?

Accrues interest – Coupon bonds

- But the first 158 days of interest belongs to first holder
- If that is dirty price, what is the clean price (price net of accrued interest)?

- **Accrued interest:** The portion of the coupon payment accrued between the last coupon payment and the settlement day

Dirty price (full price) = Clean price + Accrued interest

$$AI = \frac{INT}{2} \times \frac{Actual\ number\ of\ days\ since\ last\ coupon\ payment}{Actual\ number\ of\ days\ in\ coupon\ period}$$

Dirty vs Clean price

- Clean Price = Gross (Dirty / full) Price – Accrued IR
- Clean Price = 107.9798 – 5.625x158/182.5
- Clean Price = 107.9798 – 4.8699 = 103.109
- Clean / Quoted price = 103.109
- Dirty / Gross / Full price = 107.9798

- Now we want to use Annuity Factor, and it should be exactly the same
- Gross Price = Disc.Factor(4.375%, 26 days)*CF1
  + Disc.Factor(4.375%, 26 days)* C*annuity factor (4.375%,2)
  + Disc.Factor(4.375%, 2+132/182.5 days)* Face

  - Disc.Factor = $1 / (1+4.375\%)^{26/182.5} = 0.9939$
  - (1) = 0.9939*5.625 = 5.5908
  - (2) = 0.9939 *5.625 * 1/r * (1-1/(1+r)^2) = 10.4884
  - (3) = $100 + 5.625 / (1+ 4.375\%)^{2+ 132/182.5} =$ 91.9006
  - Gross Price = 5.5908 + 10.4884 + 91.9006 = 107.9798

Q & A