Carl von Ossietzky Universität Oldenburg
Fakultät II
Finance and Banking

Introduction to Corporate Finance: How to Value Bonds and Shares

Readings:

Hillier et al., Chapter 5.1-5.4

Overview of Lecture

- Definition and Example of A Bond
- How to Value Bonds
- Interest Rates and Bond Prices
- Yield to Maturity
- The Present Value of Equity
- Equity Valuation: Three Scenarios

Bond and Equity Valuation in the News

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Stoxx Europe 50 See Full Interactive Chart

Major Stock Indexes 8:58 a.m. EDT 05/18/11

* at close	Last	Change	% Chg
UK: FTSE 100	5893.18	32.18	0.55
Germany: DAX	7277.78	21.13	0.29
France: CAC 40	3963.40	21.82	0.55
Stoxx Europe 600	277.41	0.13	0.05
Hong Kong: Hang Seng*	23011.14	110.06	0.48
Japan: Nikkei Average*	9662.08	95.06	0.99
DJIA*	12479.58	-68.79	-0.55
Global Dow	2159.90	6.20	0.29

GLOBAL GOVERNMENT BONDS

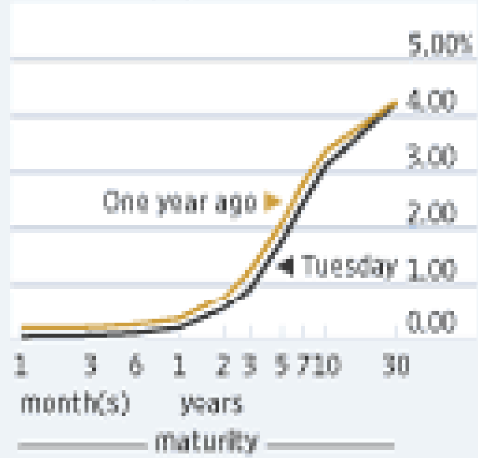
Tuesday, May 17, 2011

Coupon (%)	Country	Maturity	Yield (%)	Latest Spread Over Treasurys*	Previous Yield (%)
5.750	Australia	10	5.387	226.6	5.372
3.750	France	10	3.468	34.7	3.476
3.250	Germany	10	3.098	-2.3	3.110
1.100	Japan	10	1.157	-196.4	1.135
3.750	U.K.	10	3.368	24.7	3.387
3.125	U.S.	10	3.121	...	3.153

*in basis points

Source: Thomson Reuters

Treasury yield curve



Source: http://europe.wsj.com/mdc/public/page/marketsdata_europe.html?mod=WSJEUROPE_hpp_marketdata, May 18, 2011

Definition of a Bond

- A bond is a certificate showing that a borrower owes a specified sum

- To repay the money, the borrower has agreed to make interest and principal payments on designated dates

Example of A Bond

Kreuger Enterprises just issued 100,000 bonds for 10,000 Rand each, where the bonds have a coupon rate of 5 percent and a maturity of two years. Interest on the bonds is to be paid yearly.

R1 billion has been borrowed by the firm.

The firm must pay interest of R50 million at the end of one year.

The firm must pay both R50 million of interest and R1 billion of principal at the end of two years.

International Bond Issues

Borrower	Amount m.	Coupon %	Price	Maturity
■ Euros				
ABN AMRO	300	3,5	96.795	jan 2018
Brambles	500	4,625	99.701	apr 2018
Gea Group	400	4,25	99.565	apr 2016
OBI AG	100	5,5	100.000	apr 2016
Red Electrica	300	4,875	99.814	apr 2020
SCBC	1.000	3,375	99.535	apr 2016
Slovak Republic	1.000	4	95.209	apr 2020
■ Swiss Francs				
Kanton Basel	100	2,625	101.250	maj 2030
Kanton Basel	100	2,625	101.350	maj 2029
KNOC	325	2,625	100.523	maj 2016
■ Norwegian Krone				
EIB	500	4,25	98.925	maj 2017

Announcement date: April 14, 2011. Prices are quoted as a percentage of the face value.

Source: http://markets.ft.com/research/Markets/Bonds, April 14, 2011

How to Value Bonds

- Types of bonds:
  - Pure discount bonds / zero coupon bonds
  - Level coupon bonds
  - Perpetual bonds (UK: “Consols”)

- Comparison of cash flows (*C* = coupon, *F* = face value):

	Year 1		Year 2		Year 3		Year 4		. . .	
Months	6	12	18	24	30	36	42	48	. . .	
Pure discount bonds								F		
Coupon bonds	C	C	C	C	C	C	C	$F + C$		
Consols	C	C	C	C	C	C	C	C	C	C

Bond Valuation: Zero Coupon Bonds

- Value of a zero coupon bond: $PV = \dfrac{F}{(1+r)^T}$

where *F* face value
r interest rate
T maturity

- Example: Suppose that the interest rate is 10 percent. What is the value of a bond with face value of €1 million that matures in 20 years?

$$PV = \frac{€1m}{1.1^{20}} = €148{,}644$$

Bond Valuation: Level Coupon Bond

- Value of a level coupon bond:

$$PV = \frac{C}{1+r} + \frac{C}{(1+r)^2} + \ldots + \frac{C}{(1+r)^T} + \frac{F}{(1+r)^T}$$

- Alternatively, this could be written as:

$$PV = C \cdot A_r^T + \frac{F}{(1+r)^T}$$

where A_r^T is the annuity factor for an annuity of €1 per period for T periods at an interest rate per period of r

Example 5.1: Bond Prices

- Consider the OBI AG bond issued on April 28, 2011. The coupon is 5.5 percent and the face value is €50,000.

Borrower	Amount m.	Coupon %	Price	Maturity
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ABN AMRO	300	3,5	96.795	jan2018
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Norwegian Krone				
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- Interest is paid once a year in April, so the annual coupon payment is €50,000 x 5.5% = €2,750. The face value is paid out on April 28, 2016, 5 years from the issue date.

- At an interest rate of 5.5%, what is the present value of this bond as of April 28, 2011?

Example 5.1: Bond Prices

$$PV = \frac{€2{,}750}{1.055} + \frac{€2{,}750}{1.055^2} + \frac{€2{,}750}{1.055^3} + \frac{€2{,}750}{1.055^4} + \frac{€2{,}750}{1.055^5} + \frac{€50{,}000}{1.055^5}$$

$$= €2{,}750 \cdot A_{0.055}^{5} + \frac{€50{,}000}{1.055^5} = €2{,}750 \cdot \left[\frac{1-\frac{1}{1.055^5}}{0.055}\right] + \frac{€50{,}000}{1.055^5}$$

$$= €50{,}000$$

Example 5.2:
Interest Rates and Bond Prices

Assume a two year bond, face value €100, with a 10% annual coupon. Market interest rates *r* are 10%, 12%, or 8%, respectively. What are the bond's respective present values?

- *r* = 10% (i.e., coupon rate equals market interest rate)

$$\frac{€10}{1.10}+\frac{€100+€10}{1.10^2}=€100$$

⇨ bond sells at face value ("at par")

- *r* = 12% (i.e., coupon rate is less than market interest rate)

$$\frac{€10}{1.12}+\frac{€100+€10}{1.12^2}=€96.62$$

⇨ bond sells at a discount

- *r* = 8% (i.e., coupon rate is more than market interest rate)

$$\frac{€10}{1.08}+\frac{€100+€10}{1.08^2}=€103.57$$

⇨ bond sells at a premium

Yield to Maturity

- The rate of return a bondholder receives taking into account the bond's actual market price is called "yield to maturity" (YTM).

- E.g., in the following equation, *y* is the yield to maturity:

$$€103.57 = \frac{€10}{1+y} + \frac{€100 + €10}{(1+y)^2}$$

- What is this bond's yield to maturity?

⇨ Using "trial and error", we find that *y* = 8 percent

Bond Valuation: Perpetual Bonds

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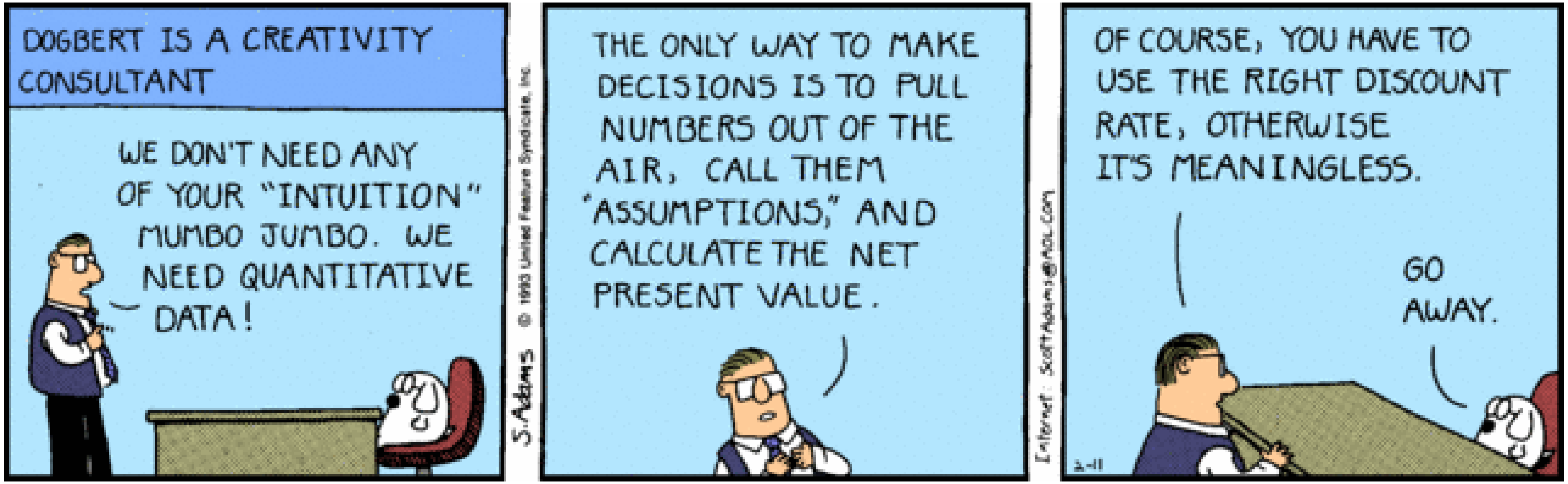
- Perpetual bonds (e.g., Consols):
  - Same as perpetuity
  - Use perpetuity formula

- Example: If the market-wide interest rate is 10 percent, what is the value of a perpetual bond with a yearly interest payment of €50?

$$\frac{€50}{0.10} = €500$$

- Might apply to preference shares with fixed dividends as well, if the level dividend stream is assumed to be certain (Is this a reasonable assumption?)

The Present Value of Equity



- From the previous chapter, we know that the value of an asset is determined by the present value of its future cash flows.
- What if we want to determine the value of a company's equity? Which are the relevant cash flows?

The Present Value of Equity

- Potential cash flows to equity investors:
  - Future dividends paid by the company, D_t
  - Future cash flow from selling the equity, P_t

- Thus, we could express the equity's value in $t = 0$, P_0, as:

$$P_0 = \frac{D_1}{1+r} + \frac{P_1}{1+r}$$

- Analogously, P_1 is: $P_1 = \dfrac{D_2}{1+r} + \dfrac{P_2}{1+r}$

The Present Value of Equity

- Replacing P_1 in the first equation by the latter term yields:

$$P_0 = \frac{1}{1+r}\left(D_1 + \frac{D_2 + P_2}{1+r}\right) = \frac{D_1}{1+r} + \frac{D_2}{(1+r)^2} + \frac{P_2}{(1+r)^2}$$

- We could repeat this procedure for P_2, and then for P_3, and then for P_4, etc.

- Finally, assuming $\lim_{n\to\infty} \frac{P_n}{(1+r)^n} = 0$ yields: (Why?)

$$\boxed{P_0 = \frac{D_1}{1+r} + \frac{D_2}{(1+r)^2} + \frac{D_3}{(1+r)^3} + \ldots = \sum_{t=1}^{\infty} \frac{D_t}{(1+r)^t}}$$

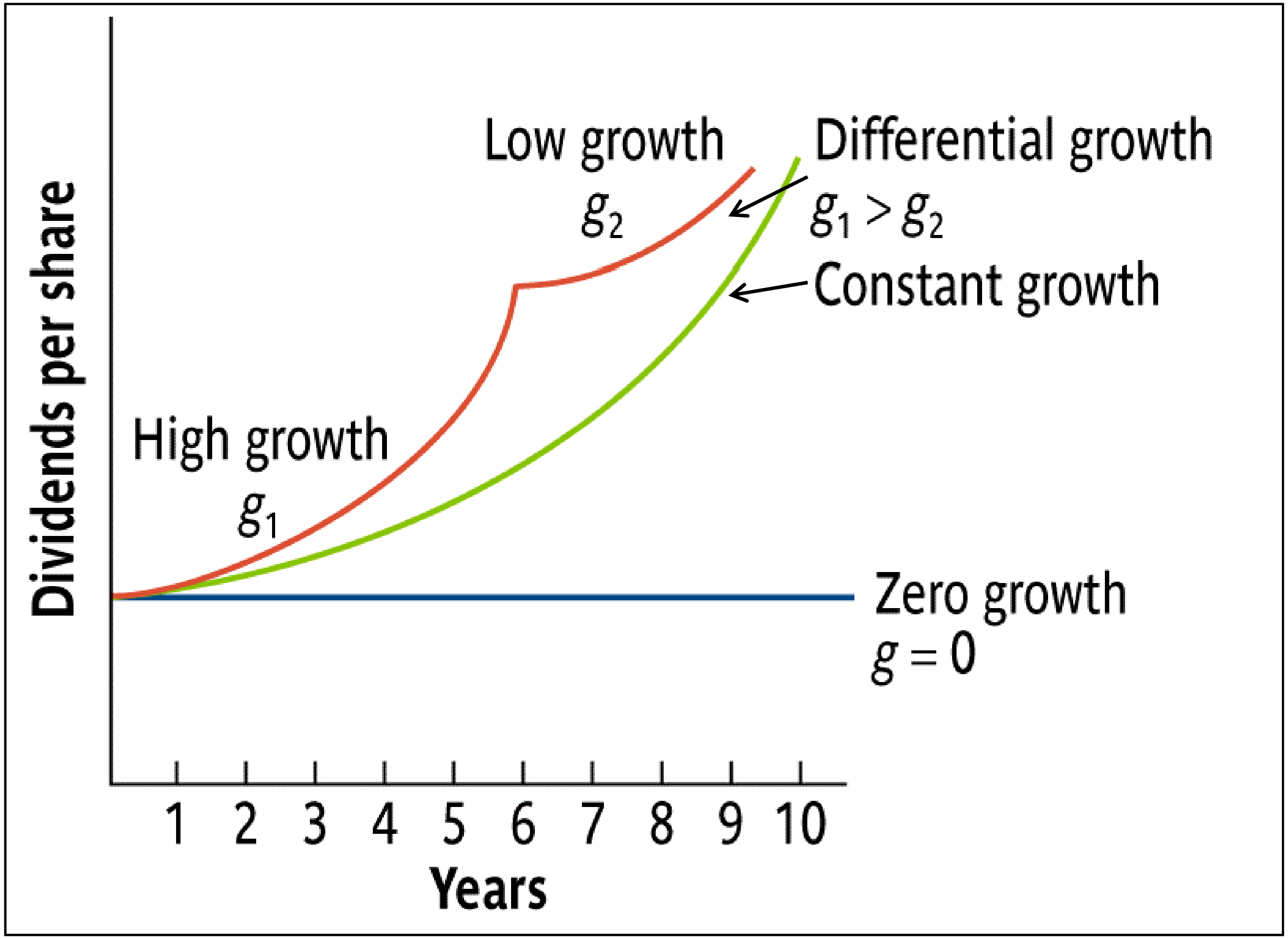
Equity Valuation

- However, we cannot discount an unlimited number of dividends

- To get around this problem, we have to make an assumption regarding the behaviour of future dividends

- Three scenarios:
  - Zero growth
  - Constant growth
  - Differential growth

Equity Valuation: Three Scenarios



Equity Valuation: Three Scenarios

Dividend growth models:

- Zero growth: $$P_0 = \frac{D_1}{r}$$
- Constant growth: $$P_0 = \frac{D_1}{r - g}$$
- Differential growth: $$P_0 = \sum_{t=1}^{T} \frac{D_1(1+g_1)^t}{(1+r)^t} + \frac{\frac{D_{T+1}}{r - g_2}}{(1+r)^T}$$

Example 5.3: Projected Dividends

- Hampshire Products will pay a dividend of £4 per share a year from now. Financial analysts believe that dividends will rise at 6 percent per year for the foreseeable future.
- What is the dividend per share at the end of each of the first five years?

1	2	3	4	5
£4.00	**£4 x (1.06) = £4.24**	**£4 x $(1.06)^2$ = £4.4944**	**£4 x $(1.06)^3$ = £4.7641**	**£4 x $(1.06)^4$ = £5.0499**

Example 5.4: Share Valuation

- Suppose an investor is considering the purchase of a share of the Avila Mining Company.
- The equity will pay a €3 dividend a year from today.
- This dividend is expected to grow at 10 percent per year (*g* = 10%) for the foreseeable future.
- The investor thinks that the required return (*r*) on this equity is 15 percent, given her assessment of Avila Mining's risk.
- What is the share price of Avila Mining Company?

$$P_0 = \frac{€3}{0.15 - 0.1} = €60$$

Example 5.5: Differential Growth

- Consider the equity of Mint Drug Company, which has a new massage ointment and is enjoying rapid growth.
- The dividend per share a year from today will be €1.15.
- During the following four years (t_2 to t_5) the dividend will grow at 15% per year (g_1 = 15%). After that, growth (g_2) will equal 10% per year.
- What is the present value of the equity if the required return (r) is 15%?

Step 1
- Calculate the present value of the dividends growing at 15 percent per annum

Step 2
- Calculate the present value of the dividends that begin at the end of year 6

Step 3
- Sum up the present values from steps 1 & 2

Example 5.5: Differential Growth

Step 1: Calculate the present value of the first five dividends

Future year	Growth rate (g_1)	Expected dividend (€)	Present value (€)
1	0.15	1.1500	1
2	0.15	1.3225	1
3	0.15	1.5209	1
4	0.15	1.7490	1
5	0.15	2.0114	1

Years 1–5 present value of dividends = €5

Example 5.5: Differential Growth

Step 2: Calculate the present value of the dividends beginning at end of year 6

6	7	8	9
D_5 x (1 + g_2) **€2.0114 x (1.10)** **= €2.2125**	**D_5 x (1 + g_2)^2** **€2.0114 x (1.10)^2** **= €2.4338**	**D_5 x (1 + g_2)^3** **€2.0114 x (1.10)^3** **= €2.6772**	**D_5 x (1 + g_2)^4** **€2.0114 x (1.10)^4** **= €2.9449**

$$P_5 = \frac{D_6}{r - g_2} = \frac{€2.2125}{0.15 - 0.10} = €44.25$$

$$\frac{P_5}{(1+r)^5} = \frac{€44.25}{1.15^5} = €22$$

Example 5.5: Differential Growth

Step 1

- Present value of first five dividends: €5

Step 2

- Present value of dividends beginning end of year 6: €22

Step 3

- Value of equity: €5 + €22 = €27

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