Lecture 4 - Valuation of Stocks and Bonds

4A. Valuation of a Firm

There are two perspectives on how to calculate the market value of a firm:

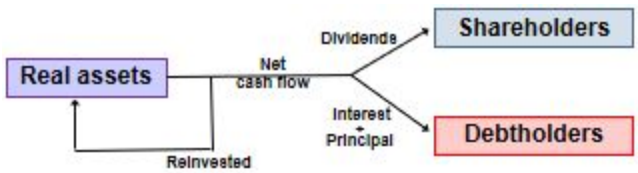
1. Take all future net ('free') cashflows, after allowing for reinvestment (back into the company and its assets) and taxation, and discount them to their present value.

Formula. $V = \sum_{t=1}^{n} \frac{F_t}{(1+r)^t}$

F_t = net cashflow of firm in period t (less reinvestment and taxation)

r = required rate of return (i.e. company cost of capital)

2. **Formula.** PV of real asset cashflows = PV of debt cashflows + PV of equity cashflows



These are the same, because the ***net cash flow*** - the cash that a firm is left with after reinvestment into real assets and taxation - can only go to shareholders or debtholders.

We're going to come back to method 1 in a few weeks, and focus on debt and equity.

4B. Debt Valuation

You get two types of *future cash flows* from debt:

- ***Coupon*** (C) = dollar amount of interest paid periodically
  - C = coupon rate x face value
- ***Face value*** (B) = lump sum paid at end of life of debt security

Often, C takes the form of an annuity. So,

Formula. $D = C[\frac{1-(1+r_d)^{-n}}{r_d}] + \frac{B}{(1+r_d)^n}$

D = present value of debt cashflows, the ***price of the bond***

r_d = required rate of return on debt, the ***yield (to maturity)***

n = number of coupon periods

Note that r_d is NOT the coupon rate.

- You use the coupon rate to find C.
  - C is determined by the bond issuer and is unlikely to change
- You use r_d to discount C to the present value.
  - r_d is determined in the marketplace

r_d is heavily determined by bond ratings (e.g. Standard & Poor's).

- If the debtor is more likely to default, then bond buyers need a higher rate of return.
- AAA-BBB are investment grade, BB and below are junk
- Typically only governments get AAA ratings since they can raise revenue easily

Commonwealth conventions:

- All Commonwealth bonds make interest payments and mature on the 15th of every month
- **For all bonds from now on, assume r_d is compounded semi-annually**
    - Just divide r per annum by 2

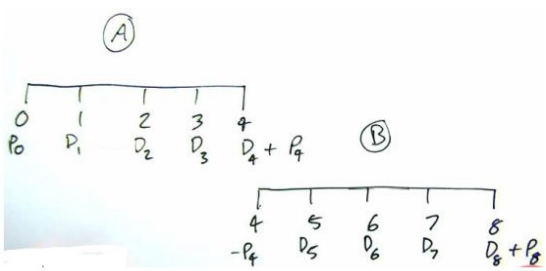
Intuitively,

- Higher r_d → lower D. You make back larger returns with high interest rates, so the bond doesn't need to be priced as high. **Price and yield (to maturity) are inversely related.**
- If coupon rate > r_d, then price > face value → priced at a 'premium'
- If coupon rate < r_d, then price < face value → priced at a 'discount'
- If coupon rate = r_d, then price = face value → priced at its 'par value'

<u>4C. Share Valuation</u>

You get two types of *future cash flows* from shares:

- ***Dividends*** (d) - often in the form of annuities
- ***Share price once sold*** (P)



However, because shares have an infinite life, **P is not important in determining the value of the share itself, as opposed to the value for a certain shareholder**. Instead of bonds, which count the face value as an inherent part of their value, shares are simply transferred between investors.

P is therefore a sort of transfer cost, and is in fact valued like the present value of an annuity with regular cash flow d .

Formula. $E = \sum_{n=1}^{\infty} \frac{d_n}{(1+r_e)^n}$

E = present value of equity cashflows

r_e = the ***expected return,*** the discount rate to the equity of the firm *given its risk* - expect r_e to be higher than r_d (due to the risky nature of shares)

n = number of periods where dividends are paid

r_e is the yield that an investor forecasts from a specific investment over a set period of time. It's sometimes called the ***market capitalisation rate***.

Formula. $r_e = \frac{d_1 + P_1 - P_0}{P_0}$ (for one period)

For P_1, we can use the amount at which the investment is "expected to sell", or find P_1 for a similar company with similar risk.

Note: due to limited liability, there cannot be a negative share price (i.e. owing money), as shareholders are not liable for the company.

- ***Constant dividend model*** assumes that dividends per period are constant.
  - **Formula.** $P_0 = d/r_e$
  - This is like an ordinary perpetuity
  - Acceptable to use this if there are only small changes in future cash flow (especially when discounted)

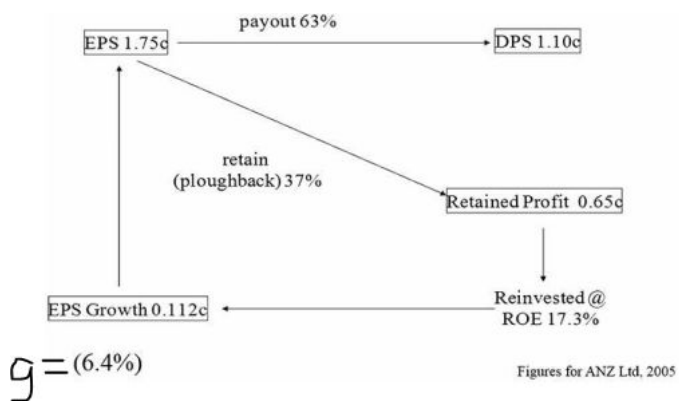
<u>4D. Constant Growth Model</u> (a.k.a. ***Gordon's Growth Model***, where dividends grow by a constant rate g per period.

Formula. $P_0 = \frac{d_1}{r_e - g} = \frac{d_0(1+g)}{r_e - g}$ (assuming $r_e > g$)

- If the company "paid" a dividend, or paid today, it is d_0. If the company "expects" to pay a dividend, it is d_1, as this is the dividend in the *next* time period.
- We can rearrange to solve for r_e: also called the ***cost of equity capital***

How do dividends grow?

- A proportion of earnings per share (EPS) is paid to shareholders (the ***payout ratio***). Some is retained.
- That *retained profit* is reinvested into the company at a certain rate, ***ROE*** (return on book equity), contributing to earnings.
- This EPS growth is transferred into EPS for the next year.



Formulas.

$EPS = ROE \times book\ equity\ per\ share$

$d = payout\ ratio \times EPS$

$g = (1 - payout\ ratio) \times ROE$.

➜ intuitively, g also applies to EPS growth. (If dividends grow, EPS grows in same proportion)

- Note that ROE is an internal measure of the return a company gets in investing in its own assets. It is NOT r_e (which is external).
- **Assume** that payout ratio and ROE are constant.

To determine if company X and company Y are appropriately valued (in relation to each other):

1. Determine the r_e applied by X's shareholders: $g = (1 - payout\ ratio) \times ROE$, $P_{0X} = \frac{d_{1X}}{r_{eX} - g}$
2. **Value Y's shares using X's r_e** (since we want to see if the two companies are priced similarly and face similar risk): $P_{0Y} = \frac{d_{1Y}}{r_{eX} - g}$

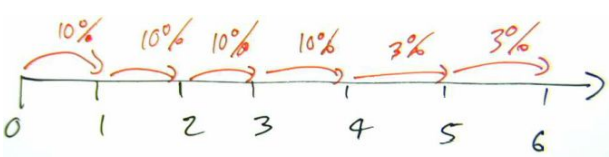
- Different values may just mean that our assumptions were incorrect:
  - g and payout ratio stays constant
  - ROE stays constant and sustainable
  - Forecasted dividend is accurate
- **If the above assumptions are not met, it is incorrect to apply Gordon's Growth Model**

<u>4E. Supernormal Growth</u>

To price the present value of a security where there is ***supernormal growth*** (where dividends grow rapidly, often due to industry-wide boom), you **add** (1) the temporary supernormal period and (2) the constant growth period after the supernormal growth.

1. Temporary supernormal period: Add dividends until the point where there is constant growth: $d_n = d_0(1 + g_S)^n$ (g_S = supernormal growth rate)
   a. Because the price is determined by *future* cash flows, we **do not count flows in the present period**
2. Constant growth period: Use the constant growth model to calculate the (discounted) price when the constant growth starts: $P_n = \frac{d_n(1+g)}{r_e - g}$
3. Discount all cash flows back to time 0.

Question. *SpaceX just paid a dividend of $1 per share. Because the spaceship industry is booming right now, Elon anticipates that dividends per share will grow at 10% until 4 years into the future, where it will settle at 3%. SpaceX has a required rate of return on equity of 12%. What should Elon value the price of each security at?*



Solution.

Step 1: Forecast *future* dividends, discounted: 1.10/1.12 + $(1.10/1.12)^2$ + $(1.10/1.12)^3$ + $(1.10/1.12)^4$

Step 2: Find price where there is constant growth, discounted: $P_n = \frac{d_n(1+g)}{r_e - g} / (1.12)^4$

$$= \frac{(1.10)^4(1+0.03)}{0.12 - 0.03} / (1.12)^4$$

Adding those two together = $14.47

4F. Price Earnings Ratio

The ***PE ratio*** is the price of a share divided by earnings per share. PE ratios can be used for comparison and to value shares in relation to similar companies.

› Start with Gordon's Growth Model

$$P_t = \frac{d_{t+1}}{r_e - g}$$

› Divide both sides by next years EPS:

$$\frac{P_t}{EPS_{t+1}} = \frac{\frac{d_{t+1}}{EPS_{t+1}}}{r_e - g}$$

So, $PE\ ratio = (payout\ ratio)/r_e - g$. (Assume EPS stays constant.)

- Different PE ratios may not mean that a company is mispriced. It may mean that there are different payout ratios, r_e and g.

If the P/E ratio of a stock > industry P/E ratio, the stock is ***overvalued***, and you should sell.
If the P/E ratio of a stock < industry P/E ratio, the stock is ***undervalued***, and you should buy.