Equity Valuation

(1) Using Present Value Methods to value equity

Equity → Residual claim on the assets of a corporation.

P_0 - current price / share

P_1 - price / share next year

D_1 - dividend / share next year

Prices are considered after dividend of that year has been paid out.

Holding period return (HPR) : $r = \frac{V_1 - V_0}{V_0}$

$$= \frac{D_1 + P_1 - P_0}{P_0}$$

$$= \underbrace{\frac{D_1}{P_0}}_{\text{dividend yield}} + \underbrace{\frac{P_1 - P_0}{P_0}}_{\text{\% price appreciation (\% capital gain)}}$$

If P_1 and D_1 are given, we can rearrange the formula to get

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

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

makes sense in terms of present value reasoning. Price today is present discounted value of payments one period from now.

However, we don't know what P_1 is

Thus $$P_1 = \frac{D_2 + P_2}{1+r}$$

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

Similarly, for high t.

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

Formula for share price given stream of future dividends.

P_0 is price/share. but we can also value entire firm if given total dividends.

Dividends → any cash flow from corporation to investors.

→ if company liquidates, liquidation value is one big dividend.

→ if another company buys shares for cash, that is also a dividend in this analysis.

⇒ we value equities by discounting future cash flows. However, equity cash flows are uncertain unlike bonds. So, we actually use expected dividends in numerator.

→ r we use here is also different from bonds. For now, we take r as rate of return on an investment of comparable risk. Typically, this r would be higher than for bonds.

(2) Applying Infinite Horizon formulas

(i) Constant dividend growth model

$D_1 \rightarrow$ expected dividends next year

$g \rightarrow$ growth rate of expected dividends

$$D_2 = D_1(1+g)$$
$$D_3 = D_2(1+g) = D_1(1+g)^2$$
$$\vdots$$

Thus, price today P_0

$$P_0 = \frac{D_1}{1+r} + \frac{D_1(1+g)}{(1+r)^2} + \frac{D_1(1+g)^2}{(1+r)^3} \cdots$$

$$= \frac{D_1}{(1+r)} \cdot \frac{(1+r)}{(1+r)-(1+g)} = \frac{D_1}{r-g}$$

$$\left\{ P_0 = \frac{D_1}{r-g} \right.$$ possible. when $r > g$

eg. $D_1 = 3\,\$$, $g = 10\%$, $r = 15\%$ $P_0 = ?$

$$P_0 = \frac{3}{0.15-0.1} = \frac{3}{0.05} = 60\,\$$$

~~Different~~

(3) Determining Dividend Growth (g)

We will try to relate g to firm's profitability.

$$\text{Earnings} = \text{Dividends} + \text{Retained Earnings}$$

→ Plowback ratio (b) {Retention ratio}

↳ the proportion of earnings plowed back into the company.

$$b = \frac{\text{Retained Earnings}}{\text{Earnings}}$$

→ Let E = Earnings per share

$\Rightarrow$ bE = Retained earnings per share

$$\Rightarrow E = D + bE$$

$$\Rightarrow D = (1-b)E$$

Thus, dividends are part of earnings not plowed back. To understand dividends, we need to understand earnings.

A firm's earning is determined by amount of investment and how profitable the investment is.

A useful measure of profitability is ROE.

$$\text{Return on Equity (ROE)} = \frac{\text{Earnings}}{\text{Book value of equity}}$$

Book value $\rightarrow$ Equity of company or amount that can be distributed among shareholders after all debt is paid.

Assuming ROE doesn't change from one year to next i.e (g_{t+1} is growth rate between t and $t+1$ we need $ROE_t = ROE_{t+1}$), we can then relate ROE to earnings growth:

Claim $\quad g = ROE \cdot b.$

Proof

$$\text{Equity}_{t+1} = \text{Equity}_t + \left(\begin{matrix}\text{Retained}\\ \text{Earnings}\end{matrix}\right)_t$$

$$\text{Equity}_{t+1} = \text{Equity}_t + bE_t$$

$$ROE \cdot Equity_{t+1} = ROE \cdot Equity_t + (ROE)\, b\, E_t$$

$$E_{t+1} = E_t + b \cdot ROE \cdot E_t$$

$$\Rightarrow \frac{E_{t+1}}{E_t} = 1 + b \cdot ROE$$

- Thus $g = b \cdot ROE$ where g is earnings growth.

$\Rightarrow$ Growth in a firm is equal to fraction of money plowed back, multiplied by profitability of these earnings.

Eg. Assume $ROE = 15\%$, 100 \$ invested (at $t=1$), $b = 0.6$

$$E_1 = 100 \times 0.15 = 15$$

$$\text{Retained Earnings} = 0.6 \times 15 = 9$$

$$\therefore Equity_2 = 100 + 9 = 109.$$

$$E_2 = 109 \times 0.15 = 16.35$$

$$g = \frac{E_2}{E_1} - 1 = \frac{16.35}{15} - 1 = 9\% = 0.6 \times .15 = b \cdot ROE$$

Assume b and ROE are constant, then earnings growth $g = b \cdot ROE$ is also equal to dividend growth. This is obvious.

$$E_{t+1} = (1+g) E_t$$

$$\Rightarrow \quad (1-b) E_{t+1} = (1+g)(1-b) E_t$$

$$\Rightarrow \quad D_{t+1} = (1+g) D_t$$

For constant growth, we had

$$P_0 = \frac{D_1}{r-g} = \frac{E_1 (1-b)}{r - b \cdot ROE}$$

$$\Rightarrow \quad \frac{P_0}{E_1} = \frac{(1-b)}{r - b \cdot ROE} \quad \Bigg\} \text{ (Price-earning) PE ratio}$$

→ If $b = 0$ (nothing is plowed back into the company) we have $P_0 = \frac{E_1}{r}$. and we have zero growth.

Such a company is called a cash cow. ROE represents firm's internal return capability whereas r represents external return.

when $ROE = r$, it doesn't matter if the money is kept in firm or not.

→ ~~B~~ ~~...~~ ~~to~~ Increasing b can have several effects on price.

$b \uparrow \Rightarrow P_0 \downarrow$ because you are paying out less cash

$b \uparrow \Rightarrow P_0 \uparrow$ because of higher growth earnings

→ $$\frac{\partial P}{\partial b} = \frac{E_1 (ROE - r)}{(r - b \cdot ROE)^2}$$

→ $ROE > r \Rightarrow$ value increases with increasing plowback (b)

→ $ROE = r \Rightarrow$ doesn't matter

→ $ROE < r \Rightarrow$ value decreases with increasing plowback (b)

⇒ Intuition : r is the rate of return on a \$ invested outside the bank and ROE is the rate of return on \$ invested inside the firm.

eg. Suppose $r = 12\%$. ROE = 10%. $b = 0.6$ $E_1 = 10$

$$P_0 = \frac{(1-b) \cdot E_1}{r - b \cdot ROE} = \frac{0.4 \cdot 10}{0.12 - 0.6 \times 0.1}$$

$$= \frac{4}{0.06} = 66.67 \$$$

Now, suppose you are a manager and you want to raise the stock price. set $b = 0$ so nothing is retained. Then $P_0 = \frac{10}{0.12} = 83.33 \$$

Here, manager is returning earned cash back to investors. This firm is also a takeover target because a raider can raise the price by just changing the amount it pays out.

→ This tells us not to confuse growth of a company with higher value.

(4) Net Present value of Growth opportunities (NPVGO)

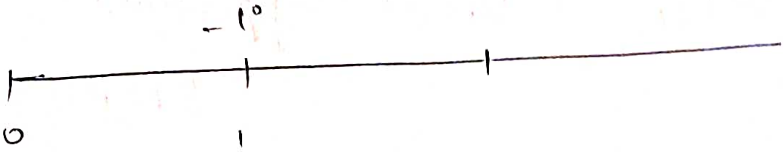
→ Growth doesn't necessarily lead to higher value. Only when growth comes in form of positive NPV investments does it increase value. We want to show that

$$P_0 = \underbrace{\frac{E}{r}}_{\text{cash cow value}} + NPVGO$$

NPVGO equation is very general - it holds whether b and ROE are constants or not. We will apply NPVGO formula in two cases.

Case 1: Single Growth opportunity

eg. Assume firm makes $E = 10\$$ (per share) in perpetuity if no investment done. Let's say we have a single investment opportunity at $t=1$ (Cost $= 10\$$ / share) and earnings are expected to increase by 2.10 \$ / share in all subsequent periods. Assume $r = 10\%$.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