Reading #33 DCF-Discounted Dividend Model (DDM)

General Discounted Dividend Model (DDM)

Idea of John Burr Williams' DDM (1938)

$$V_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+r)^t} = \sum_{t=1}^{\infty} \frac{D_{t-1}(1+g_t)}{(1+r)^t} = \sum_{t=1}^{T-1} \frac{D_t}{(1+r)^t} + \frac{D_T + V_T}{(1+r)^T}$$

Where V_0 is initial fundamental value of equity, D_t is dividend payment at each time t, r is required return of equity, and V_T stand for terminal value at time T

Example 1: Calculating value with irregular CFs [with BAII +'s CFs function]

ABC shares are expected to pay dividends of $1.50, $1.60, and $1.75 at the end of each of the next three years, respectively. During the 3-year holding period, the investor expects the price of the shares at the end of 3rd year to be $54.00. The investors required rate of return is 15%. Calculate the current value of ABC shares.

Solution:

The value of ABC shares can be determined with a multi-period DDM as:

$$V_0 = \frac{1.5}{1.15^1} + \frac{1.6}{1.15^2} + \frac{1.75+54}{1.15^3} = 39.17$$

To find V_0 of irregular cash flows, the [CF Functions] of TI BA II Plus is helpful to save calculation time.

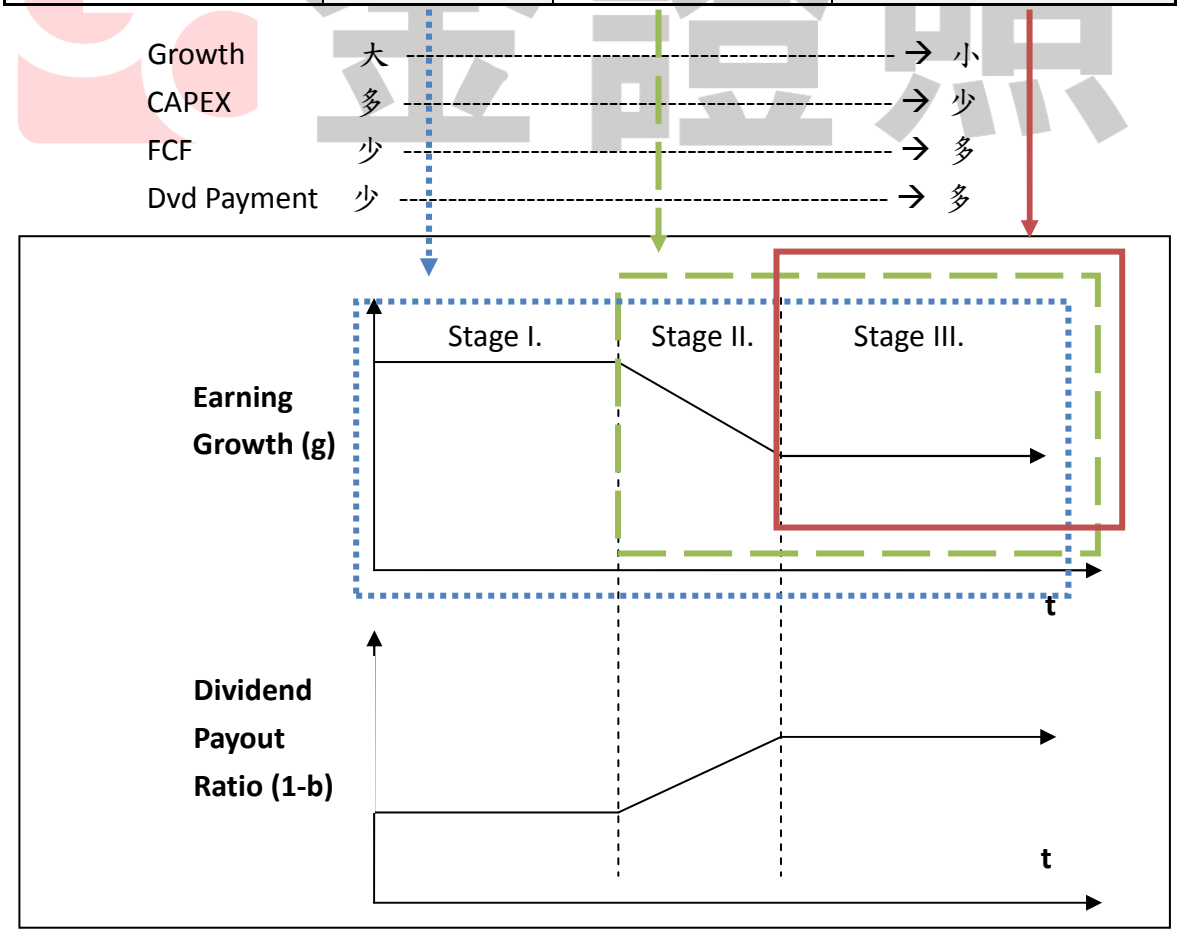
Key Strokes	Explanation	Display
[CF1] →[2nd] →[CLR WORK]	Clear memory registers	CF0 = 0
[ENTER]	Initial cash outlay	CF0 = 0
[↓]→ 1.50→[ENTER]	Year 1 cash flow	C01= 1.50
[↓]	Frequency of cash flow 1	F01= 1
[↓]→ 1.60→[ENTER]	Year 2 cash flow	C02= 1.60
[↓]	Frequency of cash flow 2	F02 = 1
[↓]→ 55.75→[ENTER]	Year 3 cash flow	C03= 55.75
[↓]	Frequency of cash flow 3	F03 =1
[↓]→[NPV] →15→ [ENTER]	15% discount rate	I = 15
[↓]→[CPT]	Calculate NPV of all CFs	NPV 39.17

Note that you can also type [IRR] then [CPT] to calculate required return.

In reality, dividend payment growth may change during different growth phase of a firm. *Therefore, to evaluate a firm with DDM requires appropriate future cash flow which closely matches the expected dividend growth of it*.

Most firms go through a pattern of growth that includes several phases including *initial growth phase*, *transition phase*, and *mature phase*.

Variable	**Growth Phase**		
	Initial Growth	*Transition*	*Maturity*
Earning Growth	Very High	Above average But falling	Stable at long-run leve
Capital Investment	Sifnificant requirements	Decreasing	Stable at long-run leve
Profit Margin	High	Above average But falling	Stable at long-run leve
FCFE	Negative	May be positive, and growing	Stable at long-run leve
ROE vs r	ROE > r	ROE approaching r	ROE = r
DP or (1-b)	Low or zero	Increasing	Stable at long-run leve
Appropriate Method	Three-Stage	Two-Stage	Gordon Model



Single Stage Model (Gordan Growth Model, GGM)

GGM assume dividend grows at a constant rate **g,** and therefore

$$V_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+r)^t} = \frac{D_0(1+g)}{(1+r)^1} + \frac{D_0(1+g)^2}{(1+r)^t} + \cdots = \frac{D_0(1+g)}{(r-g)} = \frac{D_1}{(r-g)}$$

Note that GGM formula works as long r > g (even if g <0)

Advantage of GGM	Disadvantage/ Limits of GGM
• Appropriate to stable, mature, dvd-paying firms, and market indices. • Easy to use& communicate. • Theoretical support and can be used to supplement other methods. • Help determine r, g, and PVGO	• Sensitive to g and r (which is varying over time) • not apply to non-dvd paying firms • not apply to firms with unpredictable dvd growth pattern

Note. Empirically (long term) g often set = real GDP growth + long term inflation

Example 2: Calculating Value with Gordon Model

BCD Financial recently paid a dividend of 1.80 Australian dollars (As). An analyst has examined the financial statements and historical dividend policy of BCD and expects that the firm's dividend rate will grow at a constant rate of *3.5%* indefinitely. The analyst also determines BCD's beta is 1.5, the risk-free rate is 4%, and the expected return on the market portfolio is 8%. Calculate the current value of BCD's shares.

Solution:

First use the capital asset pricing model (CAPM) to estimate BCD' required return. r= 4% + [1.5*(8%-4%)] = 10%. Then use the Gordon growth model to estimate share value. $V_0 = \frac{1.8*(1+3.5\%)}{10\%-3.5\%} = 28.66$

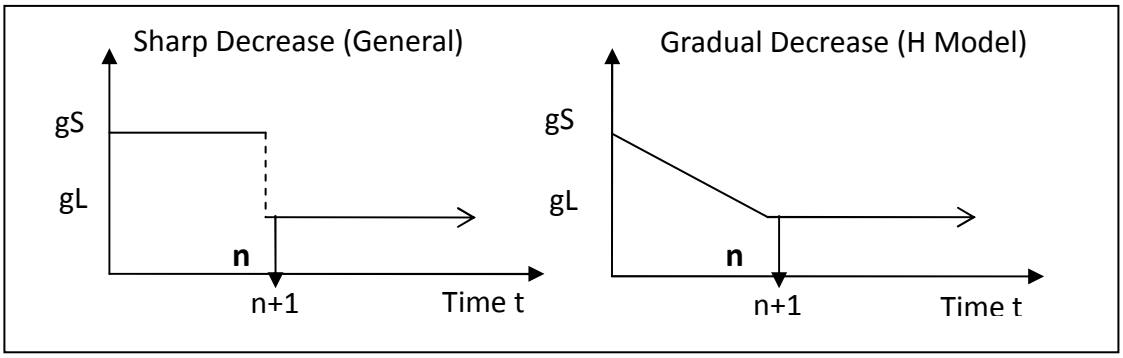
Example 2-2 So, if the current share price of BCD is A$ 30, based on GGM, the current price is overvalued.

Example 2-3 If BCD sotck is a non-callable/puttable perpetual preferred stock with g = 0, i.e. a perpetuity, then $V_0 = \frac{D_0}{(r)} = \frac{1.8}{(0.1)} = 18.$

Multistage of Dividend Model

To evaluate a firm, it requires appropriate future cash flow closely matched the expected dividend. Multistage models assume that there is some temporary short-term growth period followed by a stable long-term growth period.

■ **Two Stage Model**



Quick Formula for 2 Stage（用面積觀念來思考）	
General Type（只供參考）	$V_0 \cong \frac{D_0}{r-g_L} * [(1+g_L) + n*(g_S - g_L)]$
H-Model Type(考試必用)	$V_0 \cong \frac{D_0}{r-g_L} * \left[(1+g_L) + \frac{n}{2}*(g_S - g_L)\right]$

General Formla $V_0 = \frac{D_0(1+g_S)}{(1+r)^1} + \frac{D_1(1+g_S)}{(1+r)^2} \cdots \frac{D_{n-1}(1+g_S)}{(1+r)^n} + \frac{V_n}{(1+r)^n}$

Example 7 : Estimating terminal value

GHI currently pays a dividend of$ 1.00. An analyst forecasts growth of 10% for the next three years, followed by 4% growth in perpetuity thereafter. The required return is 12%. Calculate the current value per share..,

Solution:

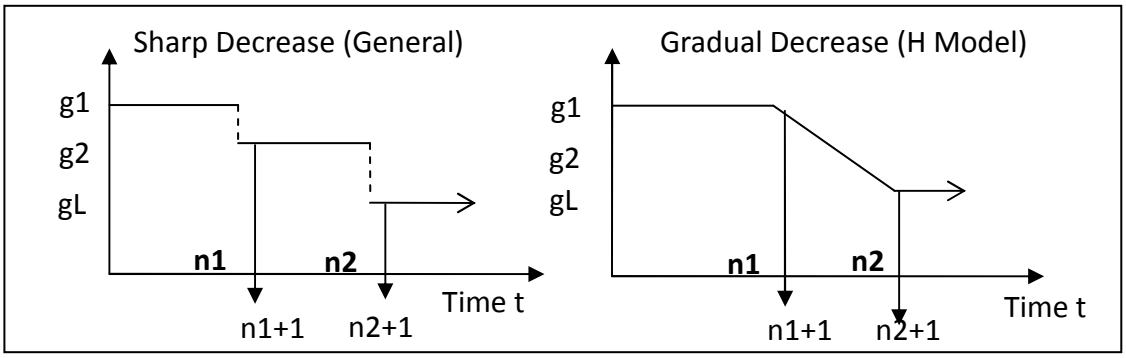
$V_0 = \left[\sum_{t=1}^{3} \frac{1*(1+10\%)^t}{(1+12\%)^t}\right] + \left[\frac{1*1(+10\%)^3)}{1.12^3*(12\%-4\%)}\right] = 15.21.\ (V_3 = 17.3)$Then, Use calculator's CFs (or TVM function) to get first part and GGM formula to find V_n.

For TVM Function → let i = (1.12/1.04 - .08), then use ***TVM (3, 1, i*100)*** = *2.894*.

Example 7-2

If the growth rate decreases gradually from 10% to 4%, then *H-Model formula* can be used. $V_0 \cong \frac{1}{12\%-4\%} * \left[(1+4\%) + \frac{3}{2}*(10\%-4\%)\right] = \$14.125$

■ Three Stage Model



Useful Formula for 3 Stage	
General (參考用)	$V_0 \cong \frac{D_0}{r - g_L} * [(1 + g_L) + n1 * (g_1 - g_L) + (n2 - n1) * (g_2 - g_L)]$
H-Model (參考用)	$V_0 \cong \frac{D_0}{r - g_L} * \left[(1 + g_L) + n1 * (g_1 - g_L) + \frac{(n2 - n1)}{2} * (g_1 - g_L)\right]$

Example 8 : Calculating value with the three-stage DDM

GHI currently pays a dividend of$ 1.00. An analyst forecasts growth of 15% for the next two years, followed by a three years, followed by 10% growth rate for next for years, and then 4% growth in perpetuity thereafter. The required return is 12%. Calculate the current value per share..,

Solution:

Time	Value	Calculation	D_t or V_t
1	D1	$1.00 * 1.15	$1.15
2	D2	$1.15 * 1.15	$1.323
3	D3	$1.323 * 1.10	$1.455
4	D4	$1.455 * 1.10	$1.600
5	05	$1.600 * 1.10	$1.760
6	D	$1.760 * 1.10	$1.936
6	V6	$1.936 * 1.04/ (0.12 -0.04)	$25.168

By calculator CFs Function =$18.864. Check the approximate value by formula

$V_0 \cong \frac{1}{12-4\%} * [(1 + 4\%) + 2 * (15\% - 4\%) + (6 - 2) * (10\% - 4\%)] = \$18.75$

Example. 8-2

If the growth rate decrease gradaully from 15% to 4%, by *H-Model* formula

$V_2 \cong \frac{1.15^2}{.12-.04} * \left[(1 + .04) + \frac{4}{2} * (.15 - .04)\right] = 20.8294$, V0=$18.69,(approximate $18.5)