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Terminal Value Equations

Overview:

I. The Fundamental Equation: $TEV_n = \frac{ECF_{n+1}}{Ke - g}$

A. $TEV_n = ECF_{n+1}\left[\sum_{j=1}^{\infty}\frac{(1+g)^{j-1}}{(1+Ke)^j}\right]$

B. $\sum_{j=1}^{\infty}\frac{(1+g)^{j-1}}{(1+Ke)^j} = \frac{1}{Ke - g}$

II. Forecasting Incremental ROE

$$TEV_n = \frac{NI_n(1+g)\left[1 - \frac{g}{dROE}\right]}{Ke - g}$$

III. Forecasting Average ROE

$$TEV_n = B_n \cdot \frac{ROE_{n+1} - g}{Ke - g}$$

IV. The Relationship between the Average and Incremental Methods

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Step I: $TEV_n = \frac{ECF_{n+1}}{Ke - g}$

A. $TEV_n = ECF_{n+1}\left[\sum_{j=1}^{\infty} \frac{(1+g)^{j-1}}{(1+Ke)^j}\right]$

1. $TEV_n = \frac{ECF_{n+1}}{1+Ke} + \frac{ECF_{n+2}}{(1+Ke)^2} + \frac{ECF_{n+3}}{(1+Ke)^3} + \ldots + \frac{ECF_{n+\infty}}{(1+Ke)^{\infty}}$
2. $TEV_n = \frac{ECF_{n+1}}{1+Ke} + \frac{ECF_{n+1}(1+g)}{(1+Ke)^2} + \frac{ECF_{n+1}(1+g)^2}{(1+Ke)^3} + \ldots + \frac{ECF_{n+1}(1+g)^j}{(1+Ke)^{j+1}}$
3. $TEV_n = ECF_{n+1}\left[\frac{1}{1+Ke} + \frac{(1+g)}{(1+Ke)^2} + \frac{(1+g)^2}{(1+Ke)^3} + \ldots + \frac{(1+g)^j}{(1+Ke)^{j+1}}\right]$
4. $TEV_n = ECF_{n+1}\left[\sum_{j=1}^{\infty} \frac{(1+g)^{j-1}}{(1+Ke)^j}\right]$
5. $TEV_n = \frac{ECF_{n+1}}{Ke - g}$ See Step I. B for why $\sum_{j=1}^{\infty} \frac{(1+g)^{j-1}}{(1+Ke)^j} = \frac{1}{Ke - g}$

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Step I. $TEV_n = \frac{ECF_{n+1}}{Ke-g}$ (continued)

B. $\sum_{j=1}^{\infty} \frac{(1+g)^{j-1}}{(1+Ke)^j} = \frac{1}{Ke-g}$

1. $\sum_{j=1}^{\infty} \frac{(1+g)^{j-1}}{(1+Ke)^j} = \sum_{j=1}^{\infty} \frac{(1+g)^{j-1}}{(1+Ke)^j}$

2. $\sum_{j=1}^{\infty} \frac{(1+g)^{j-1}}{(1+Ke)^j} = \frac{1}{1+Ke} + \frac{(1+g)}{(1+Ke)^2} + \frac{(1+g)^2}{(1+Ke)^3} + \ldots + \frac{(1+g)^j}{(1+Ke)^{j+1}}$

3. $\sum_{j=1}^{\infty} \frac{(1+g)^{j-1}}{(1+Ke)^j} = \frac{1+g}{1+Ke}\left(\frac{1}{1+g} + \frac{1}{1+Ke} + \frac{1+g}{(1+Ke)^2} + \ldots + \frac{(1+g)^{j-1}}{(1+Ke)^j}\right)$

4. Let $x = \sum_{j=1}^{\infty} \frac{(1+g)^{j-1}}{(1+Ke)^j}$

5. $x = \frac{1+g}{1+Ke}\left(\frac{1}{1+g} + x\right)$

6. $x = \frac{1}{1+Ke} + \frac{x(1+g)}{1+Ke}$

7. $x - \frac{x(1+g)}{1+Ke} = \frac{1}{1+Ke}$

8. $x\left(1 - \frac{1+g}{1+Ke}\right) = \frac{1}{1+Ke}$

9. $x\left(\frac{1+Ke}{1+Ke} - \frac{1+g}{1+Ke}\right) = \frac{1}{1+Ke}$

10. $x\left(\frac{(1+Ke)-(1+g)}{1+Ke}\right) = \frac{1}{1+Ke}$

11. $x\left(\frac{Ke-g}{1+Ke}\right) = \frac{1}{1+Ke}$

12. $x = \frac{1}{1+Ke}\left(\frac{1+Ke}{Ke-g}\right)$

13. $x = \frac{1}{Ke-g}$

14. $\sum_{j=1}^{\infty} \frac{(1+g)^{j-1}}{(1+Ke)^j} = \frac{1}{Ke-g}$

Step II. Forecasting ECF using Net Income: Incremental Spread

$$TEV_n = \frac{NI_n(1+g)\left[1-\frac{g}{dROE}\right]}{Ke-g}$$

1. $TEV_n = \frac{ECF_{n+1}}{Ke-g}$
2. $ECF_{n+1} = NI_{n+1} - \Delta B$
3. $ECF_{n+1} = NI_{n+1} - \Delta B\left[\frac{NI_{n+1}}{NI_{n+1}}\right]$
4. $ECF_{n+1} = NI_{n+1}\left[1-\frac{\Delta B}{NI_{n+1}}\right]$ Note that $\frac{\Delta B}{NI_{n+1}}$ is the reinvestment ratio
5. $ECF_{n+1} = NI_{n+1}\left[1-\left[\frac{\Delta B}{NI_{n+1}}\times\frac{\Delta NI}{\Delta NI}\right]\right]$
6. $ECF_{n+1} = NI_{n+1}\left[1-\left[\frac{\Delta NI}{NI_{n+1}}\times\frac{\Delta B}{\Delta NI}\right]\right]$
7. $ECF_{n+1} = NI_{n+1}\left[1-\left[\frac{\Delta NI}{NI_{n+1}}\Big/\frac{\Delta NI}{\Delta B}\right]\right]$
8. $ECF_{n+1} = NI_{n+1}\left[1-\left[g/dROE\right]\right]$
9. $ECF_{n+1} = NI_n(1+g)\left[1-\frac{g}{dROE}\right]$
10. $TEV_n = \frac{NI_n(1+g)\left[1-\frac{g}{dROE}\right]}{Ke-g}$

III. Forecasting Average ROE

$$TEV_n = B_n \cdot \frac{ROE_{n+1} - g}{Ke - g}$$

1. $TEV_n = \frac{ECF_{n+1}}{Ke - g}$
    2. $ECF_{n+1} = NI_{n+1} - \Delta B$
    3. $ECF_{n+1} = NI_{n+1} - (B_{n+1} - B_n)$
    4. $ECF_{n+1} = (B_n \cdot ROE_{n+1}) - [B_n(1+g) - B_n]$
    5. $ECF_{n+1} = (B_n \cdot ROE_{n+1}) - B_n[(1+g) - 1]$
    6. $ECF_{n+1} = (B_n \cdot ROE_{n+1}) - B_n[g]$
    7. $ECF_{n+1} = B_n(ROE_{n+1} - g)$
8. $TEV_n = B_n \cdot \frac{ROE_{n+1} - g}{Ke - g}$

IV. The Relationship between the Average and Incremental Methods

1. $$TEV_n = \frac{NI_n(1+g)\left[1-\frac{g}{dROE}\right]}{Ke-g}$$

2. $$TEV_n = \frac{B_n \cdot ROE_{n+1}\left[\frac{dROE-g}{dROE}\right]}{Ke-g}$$

3. $$TEV_n = \frac{B_n\left[\frac{ROE_{n+1}}{dROE}\right](dROE-g)}{Ke-g}$$

4. $TEV_n = B_n \cdot \frac{ROE_{n+1}-g}{Ke-g}$ (If ROE_{n+1}=dROE)

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$$TEV = \frac{NI(1+g)\left(1 - \frac{g}{\partial ROE}\right)}{k_e - g}$$

$$NI(1+g)\left(1 - \frac{g}{\partial ROE}\right) = TEV\left(k_e - g\right)$$

$$\left(1 - \frac{g}{\partial ROE}\right) = \frac{TEV}{NI(1+g)}(k_e - g)$$

$$\frac{g}{\partial ROE} = 1 - \frac{TEV}{NI(1+g)}(k_e - g)$$

$$\frac{1}{\partial ROE} = \frac{1}{g} - \frac{\frac{TEV}{NI(1+g)}(k_e - g)}{g}$$

$$= \frac{NI(1+g) - TEV(k_e - g)}{NI\, g(1+g)}$$

$$\partial ROE = \frac{NI\, g(1+g)}{NI(1+g) - TEV(k_e - g)}$$