APPENDIX – FORMULAS

Chapter 3:

General NPV formula: $NPV = C_0 + \sum_{t=1}^{\infty} \frac{C_t}{(1+r_t)^t}$

Perpetuity: $PV = \sum_{t=1}^{\infty} \frac{C}{(1+r)^t} = \frac{C}{r}$

Growing perpetuity: $PV = \sum_{t=1}^{\infty} \frac{C(1+g)^{t-1}}{(1+r)^t} = \frac{C}{r-g}$

Annuity: $PV = \sum_{t=1}^{N} \frac{C}{(1+r)^t} = C\left(\frac{1}{r} - \frac{1}{r(1+r)^N}\right)$

Growing annuity: $PV = \sum_{t=1}^{N} \frac{C(1+g)^{t-1}}{(1+r)^t} = C\left(\frac{1}{r-g} - \frac{1}{r-g}\frac{(1+g)^N}{(1+r)^N}\right)$

Chapter 4:

The value of a common stock:

- $P_0 = \frac{D_1}{1+r} + \frac{D_2}{(1+r)^2} + \ldots + \frac{D_N + P_N}{(1+r)^N} = \sum_{t=1}^{N} \frac{D_t}{(1+r)^t} + \frac{P_N}{(1+r)^N}$
- $P_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+r)^t}$
- $P_0 = \frac{D_1}{r-g}$

Present value of growth opportunities: $P_0 = \frac{EPS_1}{r} + PVGO$

Chapter 5:

The value of a bond: $P_0 = C\left[\frac{1}{r} - \frac{1}{r(1+r)^T}\right] + \frac{P_T}{(1+r)^T}$

Duration: $D = \sum_{t=1}^{T} t \times w_t$, where $w_t = \frac{CF_t / (1+y)^t}{P_0}$ and CF_t is the cash flow of the bond at time t, y is the yield to maturity, P_0 is the bond price and T is the time-to-maturity.

Duration rule: $\frac{\Delta P}{P} = -D^* \Delta y$, where $D^* = \frac{D}{1+y}$.

Chapter 6:

$$\text{CF to firm} = \text{EBIT}(1-\tau_c) + \text{Dep} - \text{CWC} - \text{CE}$$

$$\text{CF to equity} = \text{NI} + \text{Dep} - \text{CWC} - \text{CE} + (\text{New debt} - \text{Debt repayments})$$

Chapter 7:

Return on capital:

$$\text{Return on capital (pre-tax)} = \frac{\text{Earnings before interest and taxes}}{\text{Average book value of total investment in project}}$$

$$\text{Return on capital (after-tax)} = \frac{\text{Earnings before interest and taxes} \times (1-\tau_c)}{\text{Average book value of total investment in project}}$$

Return on equity: $\text{ROE} = \frac{\text{Net income}}{\text{Average book value of equity investment in project}}$

Chapter 8:

$$\begin{aligned}\text{EVA} &= (\text{after-tax interest} + \text{net income}) - \text{total capital} \times \text{cost of capital} \\ &= (\text{return on capital} - \text{cost of capital}) \times \text{total capital}\end{aligned}$$

$$\text{ROC} = \frac{\text{after-tax interest} + \text{net income}}{\text{total capital}}$$

$$\text{ROE} = \frac{\text{net income}}{\text{book value of equity}}$$

$$\text{ROA} = \frac{\text{after-tax interest} + \text{net income}}{\text{total assets}}$$

$$\text{Asset turnover} = \frac{\text{sales}}{\text{total assets (start of year)}}$$

$$\text{Profit margin} = \frac{\text{net income}}{\text{sales}}$$

$$\text{Operating profit margin} = \frac{\text{after-tax interest} + \text{net income}}{\text{sales}}$$

Du Pont formula: $\text{ROA} = \text{asset turnover} \times \text{operating profit margin}$

$$\text{Long-term debt ratio} = \frac{\text{Long-term debt}}{\text{Long-term debt} + \text{equity}}$$

$$\text{Long-term debt-equity ratio} = \frac{\text{long-term debt}}{\text{equity}}$$

$$\text{Total debt ratio} = \frac{\text{total liabilities}}{\text{total assets}}$$

$$\text{Times-interest-earned ratio} = \frac{\text{EBIT}}{\text{interests}}$$

$$\text{Cash coverage ratio} = \frac{\text{EBIT} + \text{Dep}}{\text{interests}}$$

$$\text{Net-working capital-to-total-assets ratio} = \frac{\text{net working capital}}{\text{total assets}}$$

$$\text{Current ratio} = \frac{\text{current assets}}{\text{current liabilities}}$$

$$\text{Quick ratio} = \frac{\text{cash} + \text{marketable securities} + \text{receivables}}{\text{current liabilities}}$$

$$\text{Cash ratio} = \frac{\text{cash} + \text{marketable securities}}{\text{current liabilities}}$$

Chapter 9:

Baumol model:

$$\text{optimal cash balance} = \sqrt{\frac{2 \times \text{cash usage rate} \times \text{cost per sale of securities}}{\text{interest rate}}}$$

Chapter 10:

The expected return of a portfolio: $E(R) = x_1 E(R_1) + x_2 E(R_2)$

The variance of a portfolio:

$$\begin{aligned} \text{Var}(R) &= x_1^2\sigma_1^2 + x_2^2\sigma_2^2 + 2x_1x_2\text{Cov}(R_1, R_2) = \\ &= x_1^2\sigma_1^2 + x_2^2\sigma_2^2 + 2x_1x_2\rho_{12}\sigma_1\sigma_2 \end{aligned}$$

The definition of beta: $\beta_i = \frac{\sigma_{im}}{\sigma_m^2}$, where σ_{im} is the covariance between the stock returns and the market portfolio returns and $\sigma_m{}^2$ is the variance of the market portfolio returns.

Market risk and unique risk: $\sigma_i^2 = \beta_i^2\sigma_m^2 + \sigma_\varepsilon^2$

The CAPM: $r - r_f = \beta(r_m - r_f)$

The WACC: $\text{WACC} = \frac{D}{V}r_D + \frac{E}{V}r_E$

Chapter 11:

Modigliani – Miller proposition 2:

$$r_E = WACC + (WACC - r_D)\frac{D}{E}$$

$$\beta_E = \beta_{WACC} + (\beta_{WACC} - \beta_D)\frac{D}{E}$$

The value of the firm given corporate taxes: $V_L = V_U + PV_{ts} = V_U + \tau_c D$

The value of the firm given corporate and personal taxes:

$$V_L = V_U + \left[1 - \frac{(1-\tau_c)(1-\tau_{pS})}{(1-\tau_{pB})}\right] D$$

where τ_c is the corporate tax rate, τ_{pS} is the personal tax rate for stockholders and τ_{pB} the personal tax rate for bondholders.

Chapter 12:

The after-tax WACC: after-tax $WACC = r_D(1-\tau_c)\frac{D}{V} + r_E\frac{E}{V}$

Levered beta: $\beta_L = \beta_U\left(1 + (1-\tau_c)\frac{D}{E}\right)$