Formulas

1. Present Value of a Single Cash Flow
   \[ PV = \frac{CF}{(1+i)^n} \]

2. Future Value of a Single Cash Flow
   \[ FV = CF(1+i)^n \]

3. Present Value of an Ordinary Annuity
   \[ PV = PMT \left[ \frac{1 - (1+i)^{-n}}{i} \right] \]

4. Future Value of an Ordinary Annuity
   \[ FV = PMT \left[ \frac{(1+i)^{-1}}{i} \right] \]

5. Present Value of an Annuity-Due
   \[ PV = PMT \left[ \frac{1 - (1+i)^{-n}}{i} \right] (1+i) \]

6. Future Value of an Annuity-Due
   \[ FV = PMT \left[ \frac{(1+i)^{-1}}{i} \right] (1+i) \]

7. Present Value of a Perpetuity
   \[ PV = \frac{PMT}{i} \]

8. Effective Annual Rate (EAR)
   \[ EAR = \left[ 1 + \frac{APR}{M} \right]^{M} - 1 \]
   - APR: Annual percentage rate
   - M: The number of interest conversion per year

9. Bond’s Price
   \[ P_0 = \sum_{t=1}^{\infty} \frac{C}{(1+r)^t} + \frac{PAR}{(1+r)^n} \]
   - \( P_0 \): Bond’s price
   - C: Bond’s coupon
   - PAR: Bond’s par (face) value

10. Bond’s Current Yield
    \[ CY = \frac{Coupon}{Price} \]

11. Stock’s Constant Growth
    \[ P_0 = \frac{D_1(1+g)}{r-g} = \frac{D_0}{r-g} \]
    \[ r = \frac{D_1}{P_0} + g \]
    \[ g = ROE \times Retention (Plowback) Ratio \]
    - \( P_0 \): Stock’s price
    - \( D_1 \): Dividend in year 1
    - r: Required rate of return
    - g: Dividend growth rate
12. Stock’s Non-constant Growth

\[ P_0 = \sum_{t=1}^{N} \frac{D_t}{(1+r)^t} + \frac{H_0}{(1+r)^g} \quad \text{where} \quad H_0 = \frac{D_{N+1}}{r-g} \]

13. Sample Average Return, Standard Deviation, and Covariance

\[ \bar{r} = \frac{1}{N} \sum_{t=1}^{N} r_t, \quad s = \sqrt{\frac{\sum_{t=1}^{N} (r_t - \bar{r})^2}{N-1}} \]

\[ s_o = \frac{1}{N-1} \sum_{j=1}^{N} (x_j - \bar{x})(y_j - \bar{y}) \]

N: The number of sample data

14. Expected Rate of Return, Standard Deviation, and Covariance

\[ E(r) = \sum_{j=1}^{N} p_j r_j, \quad \sigma = \sqrt{\sum_{j=1}^{N} p_j (r_j - E(r))^2} \]

\[ \sigma_o = \sum_{j=1}^{N} p_j (x_j - E(x))(y_j - E(y)) \]

p: Probability of outcome i

15. Portfolio’s Expected Rate of Return and Standard Deviation

\[ E(r_p) = \sum_{j=1}^{N} w_j E(r_j) \quad \sigma_p = \sqrt{\sum_{j=1}^{N} w_j^2 \sigma_j^2 + \sum_{j=1}^{N} \sum_{i=1}^{N} 2w_j w_i \sigma_j \sigma_i} \]

w_i: Weight for asset i’s value

16. Correlation

\[ \rho_{xy} = \frac{\sigma_{xy}}{\sigma_x \sigma_y} \]

17. Beta

\[ \beta_i = \frac{\sigma_{im}}{\sigma_m^2} = \frac{\rho_{im} \sigma_i}{\sigma_m^2} \]

\( \sigma_i \): Standard deviation on asset i’s return

\( \sigma_m \): Standard deviation on the market portfolio’s return

18. Capital Asset Pricing Model

\[ r_i = r_f + \beta_i (r_m - r_f) \]

r_i: Risk-free rate of return

r_m: Market portfolio’s rate of return

\( \beta_i \): Asset i’s beta

19. Net Present Value

\[ NPV = \sum_{t=1}^{N} \frac{CF_t}{(1+i)^t} - \text{Investment} \]

20. Internal Rate of Return

\[ \text{Investment} = \sum_{t=1}^{N} \frac{CF_t}{(1+\text{IRR})^t} \]

21. Modified Internal Rate of Return

\[ (1+\text{MIRR})^{N+1} = \sum_{t=1}^{N} \frac{CF_t (1+i)^t}{\text{Investment}} \]

22. Interest Rate Parity

\[ p = \frac{(1+i_h)}{(1+i_f)} - 1 \]

p: Forward premium or discount

i_h: Home interest rate

i_f: Foreign interest rate
23. Purchasing Power Parity

\[ e_f = \frac{(1 + I_h)}{(1 + I_f)} - 1 \]

e_f: the percentage change in the value of the foreign currency.
I_h: Home inflation rate
I_f: Foreign inflation rate

24. International Fisher Effect

\[ e_f = \frac{(1 + i_h)}{(1 + i_f)} - 1 \]

25. Additional Funds Needed

\[ AFN = \left( \frac{A_0}{S_0} \right) (S_1 - S_0) - \left( \frac{L_0}{S_0} \right) (S_1 - S_0) - MS_1R \]

A_0: The amount of assets required to support sales
S_0: Sales during the past year
S_1: Forecasted sales
M: Profit margin
R: Retention ratio (= 1 – payout ratio)

26. Degree of Operating Leverage, Degree of Financial Leverage, and Degree of Total (Combined) Leverage

\[ DOL = \frac{(S - VC)}{(S - VC - FC)} \]

\[ DFL = \frac{EBIT}{(EBIT - I)} \]

\[ DT(C)L = DOL \times DFL \]

S: Sales
VC: Variable costs
FC: Fixed costs
EBIT: Earnings before interests and taxes
I: Interest expenses

27. Cash Conversion Cycle

\[ CCC = \frac{(Inventory/\text{Cost of goods sold per day}) + (Receivables/Sales per day)}{(Payables/\text{Cost of goods sold per day})} - \]

28. Nominal Annual Cost of Trade Credit and Effective Annual Cost of Trade Credit

Nominal annual cost of trade credit = Discount% / (100 – Discount%) x [365/(Days credit is outstanding – Discount period)]

Effective annual cost of trade credit = [1 + Discount% / (100 – Discount%)]^365/(Days credit is outstanding – Discount period)]

29. Black-Scholes Option Pricing Model

\[ Call = S_o N(d_1) - X e^{-r \cdot t} N(d_2) \]

\[ Put = X e^{-r \cdot t} N(-d_2) - S_o N(-d_1) \]

\[ d_1 = \frac{\ln \left( \frac{S_o}{X} \right) + \left( r + \frac{\sigma^2}{2} \right) t}{\sigma \sqrt{t}} \]

\[ d_2 = d_1 - \sigma \sqrt{t} \]

S_o: Stock’s price
X: Exercise (Strike) price
t: Option’s maturity
N(.): Cumulative probability of standard normal distribution
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Summary of Financial Ratios

1. Current ratio = Current assets/Current liabilities
2. Quick (Acid) ratio = (Current assets – Inventories)/Current liabilities
3. Inventory Turnover = Sales/Inventories
4. Days Sales Outstanding (DSO) = Receivables/(Annual sales/365)
5. Fixed Asset Turnover = Sales/Net fixed assets
6. Total Assets Turnover = Sales/Total assets
7. Debt Ratio = Total debt/Total assets
8. Times Interest Earned = Earnings before interest and taxes (EBIT)/Interest charges
9. Operating Margin = Operating income (EBIT)/Sales
10. Profit Margin = Net income/Sales
11. Return on Assets = Net income/Total assets
12. Basin Earning Power = Earnings before interest and taxes (EBIT)/Total assets
13. Return on Equity = Net income/Common equity
14. Price/Earnings = Price per share/Earnings per share
15. Market/Book = Market price per share/Book value per share
16. After-Tax Salvage Value = Sale Price – Tax Rate x (Sale Price – Book Value)
17. DuPont Equation

Return on Equity = Profit Margin x Total Assets Turnover x Equity Multiplier

Equity Multiplier = Total assets/Total common equity = 1/(1 - Debt Ratio)