EQUATION SHEET

Principles of Finance

Exam 3

Capital Budgeting

Evaluation techniques:

$$\text{Payback} = \left(\begin{array}{c}\text{Number of years just}\\ \text{before full recovery of}\\ \text{original investment}\end{array}\right) + \left(\frac{\begin{array}{c}\text{Amount of the initial investment that is}\\ \text{unrecovered at the start of therecovery year}\end{array}}{\begin{array}{c}\text{Total cash flow generated}\\ \text{during the recovery year}\end{array}}\right)$$

Traditional payback—unadjusted cash flows are used
Discounted payback—discounted cash flows, or present values, are used

$$NPV = CF_0 + \frac{\hat{CF}_1}{(1+r)^1} + L + \frac{\hat{CF}_n}{(1+r)^n} = \sum_{t=0}^{n} \frac{\hat{CF}_t}{(1+r)^t}$$

$$CF_0 + \frac{\hat{CF}_1}{(1+IRR)^1} + L + \frac{\hat{CF}_n}{(1+IRR)^n} = \sum_{t=0}^{n} \frac{\hat{CF}_t}{(1+IRR)^t} = 0$$

IRR = internal rate of return

$$\text{MIRR: PV of cash outflows} = \frac{\text{FV of cash inflows}}{(1+MIRR)^n} = \frac{TV}{(1+MIRR)^n} \quad ; \quad \sum_{t=0}^{n} \frac{COF_t}{(1+r)^t} = \frac{\sum_{t=0}^{n} CIF_t(1+r)^t}{(1+MIRR)^n}$$

Cash Flow Estimation

Net cash flow = Net income + Depreciation = Return *on* capital + Return *of* capital

$$\begin{aligned}\text{Supplemental operating cash flow}_t &= \Delta\text{Cash revenues}_t - \Delta\text{Cash expenses}_t - \Delta\text{Taxes}_t\\ &= \Delta NOI_t \times (1-T) + \Delta Depr_t\\ &= (\Delta NOI_t + \Delta Depr_t) \times (1-T) + T(\Delta Depr_t)\end{aligned}$$

Cost of Capital

$$\text{After-tax component cost of debt} = \left(\begin{array}{c}\text{Bondholders' required}\\ \text{rate of return}\end{array}\right) - \left(\begin{array}{c}\text{Tax savings}\\ \text{associated with debt}\end{array}\right) = r_d - r_d \times T = r_d(1-T)$$

$$\text{Component cost of preferred stock} = r_{ps} = \frac{D_{ps}}{P_0(1-F)} = \frac{D_{ps}}{NP_0}$$

$$\text{Component cost of retained earnings} = r_s = r_{RF} + (r_M - r_{RF})\beta_s = \frac{\hat{D}_1}{P_0} + g = \hat{r}_s$$

$$\text{Component cost of new equity} = r_e = \frac{\hat{D}_1}{P_0(1 - F)} + g = \frac{\hat{D}_1}{NP} + g$$

$$\text{WACC} = \left[\begin{pmatrix}\text{Proportion}\\ \text{of}\\ \text{debt}\end{pmatrix} \text{x} \begin{pmatrix}\text{After-tax}\\ \text{cost of}\\ \text{debt}\end{pmatrix}\right] + \left[\begin{pmatrix}\text{Proportion}\\ \text{of preferred}\\ \text{stock}\end{pmatrix} \text{x} \begin{pmatrix}\text{Cost of}\\ \text{preferred}\\ \text{stock}\end{pmatrix}\right] + \left[\begin{pmatrix}\text{Proportion}\\ \text{of common}\\ \text{equity}\end{pmatrix} \text{x} \begin{pmatrix}\text{Cost of}\\ \text{common}\\ \text{equity}\end{pmatrix}\right]$$

$$= \quad w_{dT}r_{dT} \quad + \quad w_{ps}r_{ps} \quad + \quad w_s(r_s \text{ or } r_e)$$

$$\text{WACC Break Point} = \frac{\text{Total dollar amount of lower cost of capital of a given type}}{\text{Proportion of this type of capital in the capital structure}}$$

Planning and Control

$$\text{Full capacity sales} = \frac{\text{Sales level}}{\begin{pmatrix}\text{Percent of capacity used}\\ \text{to generate sales level}\end{pmatrix}}$$

Operating Breakeven Analysis

$$\text{Sales revenues} = \text{Total operating costs} = \text{Total variable costs} + \text{Total fixed costs}$$

$$(P \times Q) = \text{TOC} = (V \times Q) + F$$

$$Q_{OpBE} = \frac{F}{P\text{-}V} = \frac{F}{\text{Contribution margin}} \qquad S_{OpBE} = \frac{F}{1 - \left(\frac{V}{P}\right)} = \frac{F}{\text{Gross profit margin}}$$

$$\text{Degree of operating leverage} = \text{DOL} = \frac{\text{Percentage change in NOI}}{\text{Percentage change in sales}} = \frac{\left(\frac{\Delta NOI}{NOI}\right)}{\left(\frac{\Delta Sales}{Sales}\right)} = \frac{\left(\frac{\Delta EBIT}{EBIT}\right)}{\left(\frac{\Delta Sales}{Sales}\right)} = \frac{\left(\frac{\Delta EBIT}{EBIT}\right)}{\left(\frac{\Delta Q}{Q}\right)}$$

$$\text{DOL} = \frac{(Q \times P) - (Q \times V)}{(Q \times P) - (Q \times V) - F} = \frac{S - VC}{S - VC - F} = \frac{\text{Gross profit}}{EBIT}$$

Financial Breakeven Analysis

$$EPS = \frac{\text{Earnings available to common stockholders}}{\text{Number of common shares outstanding}} = \frac{(EBIT\text{-}I)(1\text{-}T)\text{-}D_{ps}}{Shrs_C} = 0$$

$$EBIT_{FinBE} = I + \frac{D_{ps}}{(1 - T)}$$

$$\text{Degree of financial leverage} = \text{DFL} = \frac{\text{Percent change in EPS}}{\text{Percent change in EBIT}} = \frac{\left(\frac{\Delta EPS}{EPS}\right)}{\left(\frac{\Delta EBIT}{EBIT}\right)}$$

$$\text{DFL} = \frac{EBIT}{EBIT - I} = \frac{EBIT}{EBIT - [\text{Financial BEP}]} \qquad \text{Financial BEP} = I + \frac{Dps}{(1 - T)}$$

$$DFL = \frac{EBIT}{EBIT - I}$$

When there is no preferred stock.

$$\text{Degree of total leverage} = DTL = \frac{\left(\frac{\Delta EPS}{EPS}\right)}{\left(\frac{\Delta Sales}{Sales}\right)} = \frac{\left(\frac{\Delta EBIT}{EBIT}\right)}{\left(\frac{\Delta Sales}{Sales}\right)} x \frac{\left(\frac{\Delta EPS}{EPS}\right)}{\left(\frac{\Delta EBIT}{EBIT}\right)} = DOL \times DFL$$

$$DTL = \frac{\text{Gross Profit}}{EBIT} \times \frac{EBIT}{EBIT - [\text{Financial BEP}]} = \frac{\text{Gross Profit}}{EBIT - [\text{Financial BEP}]}$$

$$= \frac{S - VC}{EBIT - I} = \frac{Q(P - V)}{[Q(P - V) - F\,] - I}$$

When there is no preferred stock.