PART I—Chapters 9-11 & 17

Capital Budgeting

Evaluation techniques:

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

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

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

\[
IRR = \text{internal rate of return}
\]

Cash Flow Estimation

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

Incremental operating cash flow

\[
\Delta \text{Cash revenues}_t - \Delta \text{Cash expenses}_t - \Delta \text{Taxes}_t = \Delta \text{NOI}_t \times (1-T) + \Delta \text{Depr}_t = (\Delta \text{EBITDA}_t) \times (1-T) + T(\Delta \text{Depr}_t)
\]

Cost of Capital

After-tax component cost of debt

\[
\text{cost of debt} = \left( \frac{\text{Bondholders' required rate of return}}{\text{Tax savings associated with debt}} \right) = r_d \times \frac{1}{1+T} = r_d (1-T)
\]

Component cost of preferred stock

\[
\hat{r}_{ps} = \frac{D_{ps}}{P_0(1-F)} = \frac{D_{ps}}{NP_0}
\]

Component cost of retained earnings

\[
r_s = r_{RF} + (r_{M} \times \beta_s) = \hat{r}_s + g = \hat{r}_s
\]
Component cost of new equity = \( r_e = \frac{\hat{D}_1}{P_0(1 - F)} + g = \frac{\hat{D}_1}{NP} + g \)

\[
WACC = \left[ \text{Proportion of debt} \right] \times \left( \text{After-tax cost of debt} \right) + \left[ \text{Proportion of preferred stock} \right] \times \left( \text{Cost of preferred stock} \right) + \left[ \text{Proportion of common equity} \right] \times \left( \text{Cost of common equity} \right)
\]

\[
= w_d r_d + w_p r_p + w_s (r_s \text{ or } r_e)
\]

\[
WACC = \frac{\text{Break Point}}{\text{Proportion of this type of capital in the capital structure}}
\]

**Planning and Control**

**Operating Breakeven Analysis**

Sales = Total operating costs = Total variable costs + fixed costs

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

\[Q_{\text{OpBE}} = \frac{F}{P - V} \]

\[S_{\text{OpBE}} = \frac{F}{1 - \left( \frac{V}{P} \right)}\]

\[\Delta \text{NOI} = \frac{\Delta \text{EBIT}}{\Delta \text{Sales}} \]

\[\Delta \text{EBIT} = \frac{\Delta \text{EBIT}}{\Delta Q}\]

Degree of operating leverage = \( DOL = \frac{\Delta \text{EBIT}}{\Delta \text{Sales}} \)

\[DOL = \frac{(Q \times P) - (Q \times V)}{(Q \times P) - (Q \times V) - F} \]

\[\frac{\text{Gross profit}}{\text{EBIT}}\]

**Financial Breakeven Analysis**

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

\[\text{EBIT}_{\text{FinBE}} = I + \frac{D_{ps}}{1 - T}\]

Degree of financial leverage = \( DFL = \frac{\Delta \text{EPS}}{\Delta \text{EBIT}} \)

\[DFL = \frac{\text{EBIT}}{\text{EBIT} - I} = \frac{\text{EBIT}}{\text{EBIT} - [\text{Financial BEP}]}\]

\[\text{Financial BEP} = I + \frac{D_{ps}}{1 - T}\]
\[ DFL = \frac{EBIT}{EBIT - I} \]

When there is no preferred stock.

Degree of total leverage
\[ = DTL = \frac{\frac{\Delta EPS}{\Delta Sales}}{\frac{\Delta EBIT}{\Delta Sales}} \times \frac{\Delta EPS}{\Delta EBIT} = DOL \times DFL \]

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

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

When there is no preferred stock.

\[ \text{PART II—Chapters 1-8} \]

\[ \text{FINANCIAL STATEMENT ANALYSIS} \]

Net cash flow = Net income + Depreciation and amortization

DuPont equation: ROA = Net profit margin × Total assets turnover
\[ = \frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Total assets}} \]

DuPont equation: ROE = ROA × Equity multiplier
\[ = \frac{\text{Net income}}{\text{Total assets}} \times \frac{\text{Total assets}}{\text{Common equity}} \]
\[ = \left[ \frac{\text{Profit margin}}{\text{Total assets turnover}} \right] \times \text{Equity multiplier} \]
\[ = \left[ \frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Total assets}} \right] \times \frac{\text{Total assets}}{\text{Common equity}} \]

\[ \text{THE FINANCIAL ENVIRONMENT} \]

Net amount of funds from issue = (Amount of issue) x (1 – Flotation costs)

Issue amount = \( \frac{\text{Amount needed}}{1 – \text{Flotation costs}} \)

\[ \text{TIME VALUE OF MONEY} \]

\[ \text{Lump-sum (single) payments:} \]
\[ FV_n = PV(1+r)^n \]
\[ PV = \frac{FV_n}{(1+r)^n} = FV_n \left[ \frac{1}{(1+r)^n} \right] \]
**Annuity payments:**

\[
FVA_n = PMT \left[ \sum_{t=0}^{n-1} (1+r)^t \right] = PMT \left[ \frac{(1+r)^n - 1}{r} \right]
\]

\[
FVA(DUE)_n = PMT \left[ \sum_{t=1}^{n} \frac{1}{(1+r)^t} \right] \times (1+r) = PMT \left[ \frac{1 - \frac{1}{(1+r)^n}}{r} \right] \times (1+r)
\]

\[
PVA_n = PMT \left[ \sum_{t=1}^{n} \frac{1}{(1+r)^t} \right] = PMT \left[ \frac{1 - \frac{1}{(1+r)^n}}{r} \right]
\]

\[
PVA(DUE)_n = PMT \left[ \sum_{t=1}^{n} \frac{1}{(1+r)^t} \right] \times (1+r) = PMT \left[ \frac{1 - \frac{1}{(1+r)^n}}{r} \right] \times (1+r)
\]

**Perpetuities:**

Present value of a perpetuity = \(PVP = \frac{\text{Payment}}{\text{Interest rate}} = \frac{PMT}{r}\)

**Uneven cash flow streams:**

\[
FV \text{ CF}_n = CF_1(1+r)^{n-1} + \ldots + CF_n(1+r)^0 = \sum_{t=0}^{n-1} CF_t(1+r)^t
\]

\[
PV \text{ CF}_n = CF_1 \left[ \frac{1}{(1+r)^1} \right] + \ldots + CF_n \left[ \frac{1}{(1+r)^n} \right] = \sum_{t=1}^{n} CF_t \left[ \frac{1}{(1+r)^1} \right]
\]

**Interest rates (yields):**

Periodic rate = \(r_{PER} = \frac{\text{Stated annual interest rate}}{\text{Number of interest payments per year}} = \frac{r_{\text{SIMPLE}}}{m}\)

Number of interest periods = \(n_{PER} = (\text{Number of years}) \times (\text{Number of interest payments per year}) = n_{\text{YRS}} \times m\)

Effective annual rate = \(r_{\text{EAR}} = \left(1 + \frac{r_{\text{SIMPLE}}}{m}\right)^m - 1.0 = (1 + r_{\text{PER}})^m - 1.0\)

Annual percentage rate = \(APR = r_{\text{PER}} \times m\)

**Cost of Money**

Dollar return = \((\text{Dollar income}) + (\text{Capital gains})\) = \((\text{Dollar income}) + (\text{Ending value} - \text{Beginning value})\)

\[
\text{Yield} = \frac{\text{Dollar return}}{\text{Beginning value}} = \frac{\text{Dollar income} + \text{Capital gains}}{\text{Beginning value}}
\]

\[
= \frac{\text{Dollar income} + (\text{Ending value} - \text{Beginning value})}{\text{Beginning value}}
\]
Rate of return = \( r = \text{Risk-free rate} + \text{Risk premium} = r_{RF} + \text{RP} \)

Rate of return = \( r = r_{RF} + \text{RP} = r_{RF} + [\text{DRP} + \text{LP} + \text{MRP}] \)

\( r_{Treasury} = r_{RF} + \text{MRP} = [r^{*} + \text{IP}] + \text{MRP} \)

\[ \text{Yield on a 2-year bond} = \frac{r_{1} + r_{2}}{2} \]

**Valuation Concepts**

**General valuation model:**

Value of an asset:

\[ V_{0} = \text{PV of \( CF \text{ of} \sum_{t=0}^{n} \frac{CF_{t}}{(1+r)^{t}} \)} \]

**Bond Valuation:**

Bond value:

\[ V_{d} = \frac{\text{INT}}{(1+r_{d})^{1}} + \ldots + \frac{\text{INT} + \text{M}}{(1+r_{d})^{N}} = \text{INT} \left[ \frac{1 - \frac{1}{(1+r_{d})^{N}}}{r_{d}} \right] + \text{M} \left[ \frac{1}{(1+r_{d})^{N}} \right] \]

\[ r_{d} = \text{YTM} = \text{Bond yield} = \text{Current yield} + \text{Capital gains yield} = \frac{\text{INT}}{V_{d0}} + \frac{V_{d1} - V_{d0}}{V_{d0}} \]

**Stock Valuation:**

Stock value:

\[ V_{s} = \hat{P}_{0} = \frac{\hat{D}_{1}}{(1+r_{s})^{1}} + \ldots + \frac{\hat{D}_{\infty}}{(1+r_{s})^{\infty}} = \sum_{t=1}^{\infty} \frac{\hat{D}_{t}}{(1+r_{s})^{t}} \]

Constant growth stock:

\[ P_{0} = \frac{D_{0}(1+g)}{r_{s} - g} = \frac{\hat{D}_{1}}{r_{s} - g} \]

Nonconstant growth stock:

\[ P_{0} = \frac{\hat{D}_{1}}{(1+r_{s})^{1}} + \frac{\hat{D}_{2}}{(1+r_{s})^{2}} + \ldots + \frac{\hat{D}_{n} + \hat{P}_{n}}{(1+r_{s})^{n}} ; \quad \text{where} \; \hat{P}_{n} = \frac{\hat{D}_{n}(1+g_{\text{norm}})}{r_{s} - g_{\text{norm}}} \]

\[ r_{s} = \text{Stock yield} = \left( \text{Dividend yield} \right) + \left( \text{Capital gains yield} \right) = \frac{\hat{D}_{1}}{P_{0}} + g = \left( \hat{D}_{1}P_{0} \right) + \left( \hat{P}_{1} - P_{0} \right) P_{0} \]

\[ \text{Economic value added} = \text{EVA} = \text{EBIT(1-T)} - \left[ \left( \text{Average cost of funds} \right) \times \left( \text{Invested capital} \right) \right] \]
Risk and Rates of Return

Expected rate of return $\hat{r} = \sum_{i=1}^{n} P_{i} \hat{r}_{i}$

Variance $\sigma^2 = \sum_{i=1}^{n} (r_i - \hat{r})^2 P_{i}$

Standard deviation $\sigma = \sqrt{\sum_{i=1}^{n} (r_i - \hat{r})^2 P_{i}}$

Estimated $\sigma = s = \sqrt{\frac{\sum_{i=1}^{n} (r_i - \bar{r})^2 P_{i}}{n-1}}$

Coefficient of variation $CV = \frac{\text{Risk}}{\text{Return}} = \frac{\sigma}{\bar{r}}$

$\hat{r}_p = \sum_{j=1}^{N} w_j \hat{r}_j$

$\beta_p = \sum_{j=1}^{N} w_j \beta_j$

Return $= \text{Risk-free return} + \text{Risk Premium} = r_{RF} + RP$

$RP = \text{Return} - r_{RF}$

$RP_{\text{Investment}} = RP_M \times \beta_{\text{Investment}}$

$r_{\text{Investment}} = r_{RF} + RP_{\text{Investment}}$

$= r_{RF} + (RP_M)\beta_{\text{Investment}}$

$= r_{RF} + (r_M - r_{RF})\beta_{\text{Investment}}$