EQUATION SHEET
Principles of Finance
Final Exam

FINANCIAL STATEMENT ANALYSIS

Net cash flow = Net income + Depreciation and amortization

DuPont equation: ROA = \( \frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Total assets}} \)

DuPont equation: ROE = \( \frac{\text{Net income}}{\text{Total assets}} \times \frac{\text{Total assets}}{\text{Common equity}} \)

\[ \text{Profit margin} \times \text{Total assets turnover} \times \text{Equity multiplier} \]

\[ \frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Total assets}} \times \frac{\text{Total assets}}{\text{Common equity}} \]

THE FINANCIAL ENVIRONMENT

Net proceeds from issue = Amount of issue – Flotation costs

\( \text{Amount of issue} = \frac{\text{Amount needed}}{1 - \text{Flotation costs}} = \frac{(\text{Net proceeds}) + (\text{Other costs})}{1 - \text{Flotation costs}} \)

TIME VALUE OF MONEY

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:

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

\[ \text{FVA(DUE)}_n = \text{PMT} \left[ \left( \sum_{t=0}^{n-1} (1+r)^t \right) \times (1+r) \right] = \text{PMT} \left[ \frac{(1+r)^n - 1}{r} \right] \times (1+r) \]

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

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

Perpetuities:

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

Uneven cash flow streams:

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

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

Interest rates (yields):

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

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

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 = \( \text{APR} = r_{\text{PER}} \times m \)
COST OF MONEY

Dollar return = (Dollar income) + (Capital gains)
= (Dollar income) + (Ending value - Beginning value)

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} + RP

Rate of return = \frac{r_{RF} + [\text{DRP} + \text{LP} + \text{MRP}]}{1} = \frac{[r^* + \text{IP}]}{1} + [\text{DRP} + \text{LP} + \text{MRP}]

r_{Treasury} = \frac{r_{RF} + \text{MRP} = [r^* + \text{IP}]}{1} + \text{MRP}

Yield on an n-year bond = \frac{\text{Interest rate in Year 1}}{n} + \frac{\text{Interest rate in Year 2}}{n} + ... + \frac{\text{Interest rate in Year n}}{n} = \frac{R_1 + R_2 + ... + R_n}{n}

Valuation Concepts

General valuation model:

Value of an asset = V_0 = \text{PV of CF} = \frac{\hat{C}_1}{(1+r)^1} + ... + \frac{\hat{C}_n}{(1+r)^n} = \sum_{t=1}^{n} \frac{\hat{C}_t}{(1+r)^t}

Bond Valuation:

Bond Value = V_d = \frac{\text{INT}}{(1+r_d)^N} + ... + \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]

YTM = Yield to maturity

YTC = Yield to call

\text{INT} = \frac{\text{INT}}{(1 + \text{YTM})^1} + ... + \frac{\text{INT}}{(1 + \text{YTM})^N} + \frac{\text{M}}{(1 + \text{YTM})^N}

\text{INT} = \frac{\text{INT}}{(1 + \text{YTC})^1} + ... + \frac{\text{INT}}{(1 + \text{YTC})^N} + \frac{\text{M}}{(1 + \text{YTC})^N}

r_d = \text{YTM} = \text{Bond yield yield} + \text{Capital gains yield} = \frac{\text{INT}}{V_d} + \frac{V_{d_1} - V_{d_0}}{V_{d_0}}

\text{Adjust } r_d, N, \text{ and INT if interest is paid more than once per year.}
Stock Valuation:

Stock value: \( V_s = \hat{P}_0 = \frac{\hat{D}_1}{(1+r_s)^1} + \frac{\hat{D}_2}{(1+r_s)^2} + \ldots + \frac{\hat{D}_n + \hat{P}_n}{(1+r_s)^n} = \sum_{t=1}^{\infty} \frac{\hat{D}_t}{(1+r_s)^t} \)

Constant growth stock: \( P_0 = \frac{D_0 (1+g)}{r_s - g} = \frac{\hat{D}_1}{r_s - g} \)

Nonconstant growth stock: \( P_0 = \frac{\hat{D}_1}{(1+r_s)^1} + \frac{\hat{D}_2}{(1+r_s)^2} + \ldots + \frac{\hat{D}_n + \hat{P}_n}{(1+r_s)^n} \), where \( \hat{P}_n = \frac{\hat{D}_n (1+g_{\text{norm}})}{r_s - g_{\text{norm}}} \)

\( \hat{r}_s = \text{Stock yield} = \left( \text{Dividend yield} \right) + \left( \text{Capital gains yield} \right) = \frac{\hat{D}_1}{P_0} + g = \left( \frac{\hat{D}_1}{P_0} \right) + \left( \frac{\hat{P}_1 - P_0}{P_0} \right) \)

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

Risk and Rates of Return

Expected rate of return: \( \hat{\gamma} = \sum P_{r_1} r_1 + P_{r_2} r_2 + \ldots + P_{r_n} r_n = \sum_{i=1}^{n} P_{r_i} r_i \)

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

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

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

Risk coefficient of variation: \( \text{CV} = \frac{\text{Risk}}{\text{Return}} = \frac{\sigma}{\hat{\gamma}} \)

\( \hat{r}_p = w_1 \hat{r}_1 + w_2 \hat{r}_2 + \ldots + w_N \hat{r}_N = \sum_{j=1}^{N} w_j \hat{r}_j \)

\( \beta_p = w_1 \beta_1 + w_2 \beta_2 + \ldots + w_N \beta_N = \sum_{j=1}^{N} w_j \beta_j \)
Return = Risk-free return + Risk Premium = r_{RF} + RP

\[ \text{RP} = \text{Return} - r_{RF} \]
\[ \text{RP}_{\text{Investment}} = \text{RP}_M \times \beta_{\text{Investment}} \]
\[ r_{\text{Investment}} = r_{RF} + \text{RP}_{\text{Investment}} \]
\[ = r_{RF} + (\text{RP}_M \beta_{\text{Investment}}) \]
\[ = r_{RF} + (r_M - r_{RF}) \beta_{\text{Investment}} \]

**Capital Budgeting**

**Evaluation techniques:**

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

Traditional payback—unadjusted cash flows are used

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

\[ \text{NPV} = \sum_{t=0}^{n} \frac{\hat{C}_t}{(1+r)^t} \]
\[ \text{CF}_0 + \frac{\hat{C}_t}{(1+\text{IRR})^t} + \ldots + \frac{\hat{C}_n}{(1+\text{IRR})^n} = \sum_{t=0}^{n} \frac{\hat{C}_t}{(1+\text{IRR})^t} = 0 \]

IRR = internal rate of return

\[ \text{MIRR: } \text{PV of cash outflows} = \frac{\text{FV of cash inflows}}{(1+\text{MIRR})^n} = \frac{\text{TV}}{(1+\text{MIRR})^n} ; \]
\[ \sum_{t=0}^{n} \text{COF}_t = \sum_{t=0}^{n} \frac{\text{CIF}_t(1+r)^t}{(1+\text{MIRR})^n} \]

**Cash Flow Estimation**

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

Supplemental operating cash flow \(_t\) = \(\Delta\text{Cash revenues}_t - \Delta\text{Cash expenses}_t - \Delta\text{Taxes}_t\)
\[ = \Delta\text{NOI}_t \times (1-T) + \Delta\text{Depr}_t \]
\[ = (\Delta\text{NOI}_t + \Delta\text{Depr}_t) \times (1-T) + T(\Delta\text{Depr}_t) \]
Cost of Capital

After-tax component of cost of debt = \( (\text{Bondholders' required rate of return}) \times (\text{Tax savings associated with debt}) = r_d - r_d \times T = r_d (1 - T) = \text{YTM}(1 - T) \)

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

Component cost of retained earnings = \( r_s = r_{RF} + (r_{M} - r_{RF}) \beta_s = \frac{\dot{D}_t}{P_0} + g = \dot{r}_s \)

Component cost of new equity = \( r_e = \frac{\dot{D}_t}{P_0(1 - F)} + g = \frac{\dot{D}_t}{NP} + g \)

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

\[
\text{WACC} = w_d r_d T + w_{ps} r_{ps} + w_s (r_s or r_e)
\]

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

Managing Short-Term Financing

Cash Conversion Cycle = (Inventory conversion + Receivables collection period) - (deferral period)

= (ICP + DSO) - DPO

Cost of short-term credit

Percentage cost per period = \( r_{\text{PER}} = \frac{\$ \text{cost of borrowing}}{\$ \text{amount of usable funds}} \)

\[
\text{EAR} = r_{\text{EAR}} = (1 + r_{\text{PER}})^m - 1.0
\]

\[
\text{APR} = r_{\text{PER}} \times m = r_{\text{SIMPLE}}
\]