Feldstrasse 80
CH - 8180 Bülach
✆ 01-872 35 40
Fax 01-872 35 32

Association suisse des analystes financiers
et gestionnaires de fortune
Schweizerische Vereinigung für Finanzanalyse
und Vermögensverwaltung

Formulae

Foundation Examination

Financial Accounting and Financial Statement Analysis

♦

Equity Analysis and Valuation

♦

Corporate Finance

Table of contents

1. Financial Accounting and Financial Statement Analysis

1.1 Depreciation Methods

1.1.1 Straight Line Method

Depreciation per Year = (Original Cost – Salvage Value) / Useful Life

1.1.2 Accelerated Method

Double-Declining-Balance-Depreciation

Depreciation = 2·Straight Line Rate · Book Value at the Beginning of the Year

where:

straight-line rate 1 / Estimated Useful Life

Sum-of-the-Years Method (SYD)

Depreciation = (Original Cost – Salvage Value) · Applicable Fraction

where:

Applicable Fraction number of years of estimated useful life remaining / *SYD*, where

$$SYD = \frac{n \cdot (n+1)}{2}$$

and n= estimated useful life

1.2 Financial Reporting and Financial Statement Analysis

1.2.1 Earning per Share

$$EPS = \frac{Earnings\ available\ to\ the\ common\ stockholders}{Number\ of\ shares\ of\ common\ stock\ outstanding}$$

With a change in the number of shares outstanding during the year, the formula is modified as follows:

$$EPS = \frac{Earnings\ available\ to\ the\ common\ stockholders}{Weighted\ average\ number\ of\ common\ shares\ outstanding}$$

1.2.2 Using EPS to value Firm

Constant Dividend Growth Model (Gordon-Shapiro)

$$EPS = \frac{P_0 \cdot (k_e - g)}{\pi \cdot (1 + g)}$$

where:

P_0	initial market price
g	growth rate
k_e	cost of equity
π	payout ratio

1.3 Analytical tools for Assessing Profitability and Risk

1.3.1 Return on Assets

Annual Return

$$Annual\ Return = \frac{Annual\ profit}{Invested\ capital}$$

Return on Assets

$$ROA = return\ on\ assets = \frac{Earnings\ before\ interests\ and\ tax\ (EBIT)}{Assets}$$

$$ROA = \frac{EBIT}{Sales} \cdot \frac{Sales}{Assets} = EMR \cdot ATR$$

where:

EMR = economic margin ratio = $\frac{EBIT}{Sales}$

ATR = asset turnover ratio = $\frac{Sales}{Assets}$

Return on Total Assets

$$ROTA = \frac{EBIT}{Total\ assets}$$

Return on Operating Assets

$$ROOA = \frac{OEBIT}{Operating\ assets}$$

Return on Non-Operating Assets

$$RONOA = \frac{EBIT - OEBIT}{Assets - Operating\ assets}$$

where:

OEBIT	operating earnings before interests and tax
ROOA	return on operating assets
RONOA	return on non-operating assets

Let ROTA be an average return of the two parts:

$$ROTA = ROOA \cdot x1 + RONOA \cdot x2$$

where:

x1	weight of the operating assets (Operating assets/Total assets)
x2	weight of the non-operating assets (x2 = 1 - x1)

1.3.2 ROCE

Return on Equity (ROE) or Return on Common Equity (ROCE)

$$ROE = \frac{Net\ Profit}{Equity} = \frac{(1-t)(EBIT - Interest)}{Equity}$$

which can be written:

$$\begin{aligned} ROE &= (1-t)\cdot\left[\frac{EBIT - Interest}{Equity}\right] \\ &= (1-t)\cdot\left[\frac{ROA\cdot Assets - i\cdot Debt}{Equity}\right] \\ &= (1-t)\cdot\left[ROA\cdot\frac{Equity + Debt}{Equity} - i\cdot\frac{Debt}{Equity}\right] \\ &= (1-t)\cdot\left[ROA + (ROA - i)\cdot\frac{Debt}{Equtiy}\right] \\ &= (1-t)\cdot ROEbT \end{aligned}$$

ROE can be decomposed as follows:

$$ROE = \frac{Net\ profit}{Earning\ before\ tax}\cdot\frac{Earning\ before\ tax}{EBIT}\cdot\frac{EBIT}{Sales}\cdot\frac{Sales}{Assets}\cdot\frac{Assets}{Equity}$$

Return on Equity before tax

$$ROEbT = \frac{EBT}{Equity} = ROA + (ROA - i)\cdot\frac{Debt}{Equity}$$

where:

i	average interest rate on total debts = $\frac{\text{Interest expenses}}{\text{Total debts}}$
EBT	earnings before income tax

1.4 Risk Analysis

1.4.1 Liquidity Ratio

Current Ratio

$$\frac{Current\ assets}{Current\ liabilities}$$

Quick Ratio

$$\frac{Current\ assets - Inventory}{Current\ liabilities} \text{ or}$$

$$\frac{Cash + Marketable\ securities + Receivables}{Current\ liabilities}$$

Working Capital Activity Ratio

$$\frac{Sales\ revenue}{Average\ Working\ Capital}$$

1.4.2 Solvency Ratio

Leverage ratio

$$\frac{Debt}{Equity}$$

Interest Coverage Ratio

$$\frac{EBIT}{Interest\ Expenses}$$

2. Equity Analysis and Valuation

2.1 Net income, Free cash flows (FCF)

2.1.1 Net income (Net profit)

	Net Sales
–	Cost of goods sold
–	Selling, general + administrative expenses
–	Depreciation
=	EBIT = Earnings before interest and taxes
–	Interest
=	EBT = Earnings before taxes
–	Taxes
=	Net Income

2.1.2 Free cash flows (FCF)

	Earnings from operations before interest and taxes (EBIT)
−	Taxes (calculated as EBIT · tax rate)
+	non cash relevant expenses (depreciation, provisions for doubtful debt, etc.)
–	non cash relevant revenues (adjustments for currency changes, etc.)
=	Gross cash flow
–	Increase in net working capital
+	Reduction in net working capital
–	Capital expenditure (buildings, equipment, …)
+	Liquidation of fixed assets
=	Free cash flow from operations

2.2 Security valuation

2.2.1 Zero growth model

$$P_0 = \frac{Div}{k_E}$$

where

P_0	price of share
Div	dividend (assumed constant)
k_E	cost of equity capital

2.2.2 Constant growth model

$$P_0 = \frac{Div_1}{k_E - g}$$

where

P_0	price of share
Div_1	$Div_0 \cdot (1+g)$ = expected dividend in period 1
k_E	cost of equity capital
g	growth rate of dividend (assumed constant)

2.2.3 Gordon Shapiro model

$$P_0 = \frac{\text{EPS}_1 \cdot \pi}{k_E - (1-\pi) \cdot r}$$

where

P_0	price of share
EPS_1	earnings per share in $t = 1$
π	payout ratio
k_E	cost of equity capital
$1 - \pi$	earnings retention rate
r	return on equity (ROE)

2.2.4 Price Earnings Ratio

$$P_0 = \text{EPS} \cdot \frac{P}{E}$$

where

P_0	price of the share
EPS	earnings per share
P/E	price-earnings ratio

3. Corporate Finance

3.1 Fundamentals of Corporate Finance

3.1.1 Compounding and Discounting an Ordinary Annuity

The present value of an annuity is given by

$$\text{Present value} = \sum_{t=1}^{n} \frac{CF}{(1+k)^t} = \frac{CF}{k} \cdot \left(1 - \frac{1}{(1+k)^n}\right)$$

where

CF	constant Cash flow
k	discount rate, assumed to be constant over time
n	number of cash flows

The future value of an annuity is given by

$$\text{Future value} = CF \cdot \left(\frac{(1+k)^n - 1}{k}\right)$$

3.1.2 Project Valuation

Project Value

$$\text{NPV} = -I_0 + \sum_{t=1}^{N} \frac{E(FCF_t)}{(1+WACC_t)^t}$$

where

I_0	initial investment
$\text{E}(\text{FCF}_\text{t})$	expected free cash flows in period t
$WACC_t$	weighted average cost of capital in period t
N	number of cash flows

3.2 Cost of Equity Capital

3.2.1 CAPM

$$k_E = R_F + (R_M - R_F) \cdot \beta_E$$

where

k_E	cost of equity capital
R_F	risk-free return
$R_M - R_F$	expected return on the market portfolio – risk-free return, expected Risk premium
β_E	beta debt = systematic or market risk of debt

3.2.2 The beta of the firm's assets

$$\beta_A = \beta_D \frac{D(1-t_c)}{D(1-t_c)+E} + \beta_E \frac{E}{D(1-t_c)+E}$$

where

β_A	beta asset
β_D	beta debt
β_E	beta equity
t_c	marginal corporate tax rate for the firm being valued
D	market value of interest-bearing debt
E	market value of equity

If we assume that the debt is riskless ($\beta_D = 0$) the beta of the firm's asset can be written as:

$$\beta_A = \beta_E \frac{E}{D(1-t_c)+E}$$

In this case, the equity beta (β_E) can be written as:

$$\beta_E = \beta_A \left(1 + (1-t_c) \cdot \frac{D}{E}\right)$$

3.2.3 Cost of Equity Capital: Modigliani-Miller

$$k_E = k_u + (k_u - k_d)(1-T) \cdot \frac{D}{E}$$

where

k_E	cost of equity (required return on equity)
k_u	equity rate of return were the company 100% equity
k_d	cost of debt (required return on debt)
T	statutory marginal tax rate
D	debt (market value)
E	equity (market value)

3.2.4 Zero Growth Model

$$k_E = \frac{Div}{P_0}$$

where

k_E	cost of equity capital
Div	dividend (assumed constant)
P_0	price of share

3.2.5 Constant Growth Model

$$k_E = \frac{Div_1}{P_0} + g$$

where

k_E	cost of equity capital
g	growth rate of dividend
Div_1	$\text{Div}_0 \cdot (1+\text{g})$= expected dividend in period 1
P_0	market price of share

3.2.6 Earnings-Price Ratio Approach

$$k_E = \frac{EPS_1}{P}$$

where

k_E	cost of equity capital
EPS_1	expected earnings per share in t=1
P	current market price of share

3.2.7 Gordon Shapiro model

$$k_E = \frac{\text{EPS}_1 \cdot \pi}{P_0} + (1 - \pi) \cdot \text{ROE}$$

where

k_E	cost of equity capital
EPS_1	earnings per share in t=1
π	payout ratio
P_0	price of share
ROE	return on equity

3.3 Cost of Debt Capital

3.3.1 Cost of Debt Capital before Taxes

CAPM

$$k_D = R_f + \left(R_M - R_f\right) \cdot \beta_D$$

where

k_D	cost of debt capital (expected return on debt)
R_f	risk-free return
$R_M - R_f$	expected excess return on the market portfolio
β_D	beta debt = systematic or market risk of debt

Yield to maturity

$$k_D = \sum_{i=1}^{N} w_i \cdot YTM_i$$

where

k_D	cost of debt capital
w_i	weight of debt *i*
YTM_i	yield to maturity of debt *i*

3.3.2 Cost of Debt Capital after Taxes

$$k_{DA} = k_D \cdot (1 - t_c)$$

where

k_{DA}	cost of debt capital after taxes
k_D	cost of debt capital before taxes
t_c	marginal corporate tax rate

3.4 Weighted Average Cost of Capital (WACC)

$$WACC = k_D(1 - t_c)\frac{D}{V} + k_E \frac{E}{V}$$

where

k_D	pre (corporate) tax cost of debt
k_E	cost of equity
t_c	marginal corporate tax rate for the entity being valued
D	market value of interest-bearing debt
E	market value of equity
V	$=E + D$

If the firm has preferred stock, *WACC* becomes:

$$WACC = k_D(1 - t_c)\frac{D}{V} + k_E \frac{E}{V} + k_P \frac{P}{V}$$

where

k_P	after tax cost of preferred stock
P	market value of preferred stock
V	$= E + D + P$ (here)

3.5 Ratios

Average tax rate

$$t = average\ tax\ rate = \frac{Taxes}{Earnings\ before\ taxes}$$

Average interest rate

$$\underline{i} = \text{average interest rate} = \frac{\text{Interest payments}}{\text{Debt}}$$

3.6 Short / Long-Term Finance Decisions

3.6.1 Net Working Capital

Current assets (cash + receivable + inventories)– Current liabilities

3.7 Capital Structure and Dividend Policy

3.7.1 Firm Valuation

Firm value

$$V = D + E$$

where

V	value of the firm
D	debt (market values)
E	equity (market values)

MM proposition I (assuming no taxes)

$$V = V_L = V_U = D + E = \frac{EBIT}{k_A}$$

where

V_L	value of levered firm
V_U	value of unlevered firm
D	debt (market values)
E	equity (market values)
EBIT	earning before interest and taxes (assumed permanent)
k_A	constant overall cost of capital (return on assets)

Free Cash Flow Approach

$$V = -I_0 + \sum_{t=1}^{N} \frac{E(FCF_t)}{(1+WACC_t)^t}$$

where

V	value of the firm
$E(FCF_t)$	expected free cash flows in period t
$WACC_t$	weighted average cost of capital in period t

With the continuing value of the firm at time T equal to:

$$Continuing\ value\ at\ time\ T = \frac{FCF_{T+1}}{WACC - g}$$

where

T	point in time where the explicit free cash flow forecasting horizon ends.
FCF_{T+1}	level of expected free cash flow in the first year after the explicit forecast period; then assumed to grow at rate g.
$WACC$	weighted average cost of capital (assumed constant)
g	expected growth rate of free cash flows after T (assumed constant)

Value of Tax Shield

$$\text{Value of tax shield} = \frac{k_D \cdot D \cdot t_c}{k_D} = D \cdot t_c$$

where

D	market value of debt
k_D	cost of debt
t_c	marginal average corporate tax rate