Fundamentals of Corporate Finance

Sixth Canadian Edition

by Ross, Westerfield, Jordan, and Roberts

Formula Sheet

		page #
Assets = Liabilities + Shareholders' equity	[2.1]	28
Revenues – Expenses = Income	[2.2]	32
Cash flow from assets = Cash flow to bondholders + Cash flow to shareholders	[2.3]	34
Current ratio = Current assets/Current liabilities	[3.1]	64
Quick ratio = $\frac{\text{Current assets – Inventory}}{\text{Current liabilities}}$	[3.2]	65
Cash ratio = Cash/Current liabilities	[3.3]	65
Net working capital to total assets = Net working capital/Total assets	[3.4]	65
Interval measure = Current assets/Average daily operating costs	[3.5]	66
Total debt ratio = [Total assets – Total equity]/Total assets = [$3,588 – 2,591]/$3,588 = .28	[3.6]	66
Debt/equity ratio = Total debt/Total equity = $.28/$.72 = .39	[3.7]	66
Equity multiplier = Total assets/Total equity = $1/$.72 = 1.39	[3.8]	66
Long-term debt ratio = $\frac{\text{Long-term debt}}{\text{Long-term debt + Total equity}}$ = $457/[$457 + 2,591] = $457/$3,048 = .15	[3.9]	67
Times interest earned ratio = EBIT/Interest = $691/$141 = 4.9 times	[3.10]	67
Cash coverage ratio = [EBIT + Depreciation]/Interest = [$691 + 276]/$141 = $967/$141 = 6.9 times	[3.11]	67
Inventory turnover = Cost of goods sold/Inventory = $1,344/$422 = 3.2 times	[3.12]	68
Days' sales in inventory = 365 days/Inventory turnover = 365/3.2 = 114 days	[3.13]	68
Receivables turnover = Sales/Accounts receivable = $2,311/$188 = 12.3 times	[3.14]	68
Days' sales in receivables = 365 days/Receivables turnover = 365/12.3 = 30 days	[3.15]	68

NWC turnover = Sales/NWC [3.16] 69
= $2,311/($708 – $540) = 13.8 times

Fixed asset turnover = Sales/Net fixed assets [3.17] 69
= $2,311/$2,880 = .80 times

Total asset turnover = Sales/Total assets [3.18] 69
= $2,311/$3,588 = .64 times

Profit margin = Net income/Sales [3.19] 69
= $363/$2,311 = 15.7%

Return on assets = Net income/Total assets [3.20] 70
= $363/$3,588 = 10.12%

Return on equity = Net income/Total equity [3.21] 70
= $363/$2,591 = 14%

P/E ratio = Price per share/Earnings per share [3.22] 71
= $157/$11 = 14.27 times

Market-to-book ratio = Market value per share/Book value per share [3.23] 71
= $157/($2,591/33) = $157/$78.5 = 2 times

ROE = Net income/Sales × Sales/Assets × Assets/Equity [3.24] 73
= Profit margin × Total asset turnover × Equity multiplier

Dividend payout ratio = Cash dividends/Net income [4.1] 93
= $44/$132
= 33⅓%

EFN = Increase in total assets – Addition to retained earnings [4.2] 98
$= A(g) - p(S)R \times (1 + g)$

$EFN = -p(S)R + [A - p(S)R] \times g$ [4.3] 99

$EFN = -p(S)R + [A - p(S)R] \times g$ [4.4] 99
$g = pS(R)/[A - pS(R)]$
= .132($500)(2/3)/[$500 – .132($500)(2/3)]
= 44/[500 – 44]
= 44/456 = 9.65%

Internal growth rate $= \frac{ROA \times R}{1 - ROA \times R}$ [4.5] 100

EFN = Increase in total assets – Addition to retained earnings [4.6] 100
– New borrowing
$= A(g) - p(S)R \times (1 + g) - pS(R) \times (1 + g)[D/E]$
EFN = 0

$g^{\star} = ROE \times R/[1 - ROE \times R]$ [4.7] 100

$g^{\star} = \frac{p(S/A)(1 + D/E) \times R}{1 - p(S/A)(1 + D/E) \times R}$ [4.8] 102

EFN = Increase in total assets – Addition to retained earnings [4B.1] 116
– New borrowing
$= A(g) - p(S)R \times (1 + g) - pS(R) \times (1 + g)[D/E]$

$$\text{ROE} = p(S/A)(1 + D/E) \quad \textbf{[4B.2]} \quad \textbf{116}$$

$$\text{Future value} = \$1 \times (1 + r)^t \quad \textbf{[5.1]} \quad \textbf{121}$$

$$\text{PV} = \$1 \times [1/(1 + r)^t] = \$1/(1 + r)^t \quad \textbf{[5.2]} \quad \textbf{129}$$

$$\text{PV} \times (1 + r)^t = \text{FV}_t \quad \textbf{[5.3]} \quad \textbf{131}$$
$$\text{PV} = \text{FV}_t/(1 + r)^t = \text{FV}_t \times [1/(1 + r)^t]$$

$$\text{Annuity present value} = C \times \left(\frac{1 - \text{Present value factor}}{r} \right) \quad \textbf{[6.1]} \quad \textbf{147}$$
$$= C \times \left\{ \frac{1 - 1/(1 + r)^t}{r} \right\}$$

$$\text{Annuity FV factor} = (\text{Future value factor} - 1)/r \quad \textbf{[6.2]} \quad \textbf{152}$$
$$= ((1 + r)^t - 1)/r$$

$$\text{Annuity due value} = \text{Ordinary annuity value} \times (1 + r) \quad \textbf{[6.3]} \quad \textbf{153}$$

$$\text{Perpetuity present value} \times \text{Rate} = \text{Cash flow} \quad \textbf{[6.4]} \quad \textbf{154}$$
$$PV \times r = C$$

$$\text{Annuity present value factor} = (1 - \text{Present value factor})/r \quad \textbf{[6.5]} \quad \textbf{154}$$
$$= (1/r) \times (1 - \text{Present value factor})$$

$$\text{PV} = \frac{C}{r - g} \quad \textbf{[6.6]} \quad \textbf{156}$$

$$\text{EAR} = [1 + (\text{Quoted rate}/m)]^m - 1 \quad \textbf{[6.7]} \quad \textbf{159}$$

$$\text{EAR} = e^q - 1 \quad \textbf{[6.8]} \quad \textbf{161}$$

$$\text{Bond value} = C \times (1 - 1/(1 + r)^t)/r + F/(1 + r)^t \quad \textbf{[7.1]} \quad \textbf{180}$$

$$1 + R = (1 + r) \times (1 + h) \quad \textbf{[7.2]} \quad \textbf{197}$$

$$1 + R = (1 + r) \times (1 + h) \quad \textbf{[7.3]} \quad \textbf{197}$$
$$R = r + h + r \times h$$

$$R \approx r + h \quad \textbf{[7.4]} \quad \textbf{197}$$

$$\text{NPV} = (c_o - c_N)/c_N \times \$1{,}000 - CP \quad \textbf{[7B.1]} \quad \textbf{211}$$

$$P_0 = (D_1 + P_1)/(1 + r) \quad \textbf{[8.1]} \quad \textbf{217}$$

$$P_0 = D/r \quad \textbf{[8.2]} \quad \textbf{218}$$

$$P_0 = \frac{D_0 \times (1 + g)}{r - g} = \frac{D_1}{r - g} \quad \textbf{[8.3]} \quad \textbf{219}$$

$$P_t = \frac{D_t \times (1 + g)}{r - g} = \frac{D_{t+1}}{r - g} \quad \textbf{[8.4]} \quad \textbf{219}$$

$$(r - g) = D_1/P_0 \quad \textbf{[8.5]} \quad \textbf{222}$$
$$r = D_1/P_0 + g$$

$$\text{OCF} = \text{EBIT} + D - \text{Taxes} \quad \textbf{[10.1]} \quad \textbf{281}$$
$$= (S - C - D) + D - (S - C - D) \times T_c$$
$$= \$200 + 600 - 80 = \$720$$

$$\begin{aligned}\text{OCF} &= (S - C - D) + D - (S - C - D) \times T_c \\ &= (S - C - D) \times (1 - T_c) + D \\ &= \text{Project net income} + \text{Depreciation} \\ &= \$120 + 600 \\ &= \$720\end{aligned}$$ [10.2] 281

$$\begin{aligned}\text{OCF} &= (S - C - D) + D - (S - C - D) \times T_c \\ &= (S - C) - (S - C - D) \times T_c \\ &= \text{Sales} - \text{Costs} - \text{Taxes} \\ &= \$1{,}500 - 700 - 80 = \$720\end{aligned}$$ [10.3] 281

$$\begin{aligned}\text{OCF} &= (S - C - D) + D - (S - C - D) \times T_c \\ &= (S - C) \times (1 - T_c) + D \times T_c\end{aligned}$$ [10.4] 282

$$\begin{aligned}S - VC &= FC + D \\ P \times Q - v \times Q &= FC + D \\ (P - v) \times Q &= FC + D \\ Q &= (FC + D)/(P - v)\end{aligned}$$ [11.1] 319

$$\begin{aligned}\text{OCF} &= [(P - v) \times Q - FC - D] + D \\ &= (P - v) \times Q - FC\end{aligned}$$ [11.2] 321

$$Q = (FC + OCF)/(P - v)$$ [11.3] 322

$$\text{Total dollar return} = \text{Dividend income} + \text{Capital gain (or loss)}$$ [12.1] 340

$$\begin{aligned}\text{Total cash if stock is sold} &= \text{Initial investment} + \text{Total return} \\ &= \$3{,}700 + 518 \\ &= \$4{,}218\end{aligned}$$ [12.2] 340

$$Var(R) = (1/(T - 1)) \left[(R_1 - \overline{R})^2 + \ldots + (R_T - \overline{R})^2\right]$$ [12.3] 350

$$\text{Geometric average return} = \left[(1 + R_1) \times (1 + R_2) \times \cdots \times (1 + R_T)\right]^{1/T} - 1$$ [12.4] 355

$$\begin{aligned}\text{Risk premium} &= \text{Expected return} - \text{Risk-free rate} \\ &= \text{E}(R_U) - R_f \\ &= 20\% - 8\% \\ &= 12\%\end{aligned}$$ [13.1] 371

$$\text{E}(R) = \sum_j O_j \times P_j$$ [13.2] 371

where

O_j = value of the jth outcome
P_j = associated probability of occurrence
$\sum_j$ = the sum over all j

$$\begin{aligned}\sigma^2 &= \sum_j [O_j - \text{E}(R)]^2 \times P_j \\ \sigma &= \sqrt{\sigma^2}\end{aligned}$$ [13.3] 372

$$\text{E}(R_P) = x_1 \times \text{E}(R_1) + x_2 \times \text{E}(R_2) + \ldots + x_n \times \text{E}(R_n)$$ [13.4] 374

$$\sigma^2_P = x^2_L \sigma^2_L + x^2_U \sigma^2_U + 2x_L \, x_U \text{CORR}_{L,U} \sigma_L \sigma_U$$ [13.5] 376

$$\sigma_P = \sqrt{\sigma^2_P}$$

$$\begin{aligned}\text{Total return} &= \text{Expected return} + \text{Unexpected return} \\ R &= \text{E}(R) + U\end{aligned}$$ [13.6] 381

Announcement = Expected part + Surprise **[13.7]** **382**

R = E(R) + Systematic portion + Unsystematic portion **[13.8]** **383**

Total risk = Systematic risk + Unsystematic risk **[13.9]** **386**

$$E(R_i) = R_f + [E(R_M) - R_f] \times \beta_i \quad \textbf{[13.10]} \quad \textbf{397}$$

$$R = E(R) + \beta_I F_I + \beta_{GNP} F_{GNP} + \beta_r F_r + \epsilon \quad \textbf{[13.11]} \quad \textbf{399}$$

$$E(R) = R_F + E[(R_1) - R_F]\beta_1 + E[(R_2) - R_F]\beta_2 + E[(R_3) - R_F]\beta_3 + \ldots E[(R_K) - R_F]\beta_K \quad \textbf{[13.12]} \quad \textbf{399}$$

$$\sigma^2{}_P = x^2{}_L \sigma^2{}_L + x^2{}_U \sigma^2{}_U + 2x_L x_U \text{CORR}_{L,U} \sigma_L \sigma_U \quad \textbf{[13A.1]} \quad \textbf{407}$$

$$\sigma^2{}_P \sum_{i=1}^{N} \sum_{j=1}^{N} x_j \sigma_{ij} \quad \textbf{[13A.2]} \quad \textbf{408}$$

$$\frac{\delta \sigma^2{}_P}{\delta x_2} = 2 \sum_{j=1}^{N} x_j \sigma_{i2} = 2[x_1 \text{COV}(R_1, R_2) + x_2 \sigma^2{}_2 + x_3 \text{ COV}(R_3, R_2) + \ldots + x_N \text{COV}(R_N, R_2)] \quad \textbf{[13A.3]} \quad \textbf{408}$$

$$\beta_2 = \frac{\text{COV}(R_2, R_M)}{\sigma^2(R_M)} \quad \textbf{[13A.4]} \quad \textbf{408}$$

$$R_E = (D_1/P_0) + g \quad \textbf{[14.1]} \quad \textbf{414}$$

$$R_E = R_f + \beta_E \times [R_M - R_f] \quad \textbf{[14.2]} \quad \textbf{416}$$

$$R_P = D/P_0 \quad \textbf{[14.3]} \quad \textbf{419}$$

$$V = E + D \quad \textbf{[14.4]} \quad \textbf{420}$$

$$100\% = E/V + D/V \quad \textbf{[14.5]} \quad \textbf{420}$$

$$\text{WACC} = (E/V) \times R_E + (P/V) \times R_P + (D/V) \times R_D \times (1 - T_C) \quad \textbf{[14.6]} \quad \textbf{421}$$

$$f_A = (E/V) \times f_E + (D/V) \times f_D = 60\% \times .10 + 40\% \times .05 = 8\% \quad \textbf{[14.7]} \quad \textbf{428}$$

$$\beta_{Portfolio} = \beta_{Levered\ firm} = \frac{\text{Debt}}{\text{Debt + Equity}} \times \beta_{Debt} + \frac{\text{Equity}}{\text{Debt + Equity}} \times \beta_{Equity} \quad \textbf{[14A.1]} \quad \textbf{441}$$

$$\beta_{Unlevered\ firm} = \frac{\text{Equity}}{\text{Debt + Equity}} \times \beta_{Equity} \quad \textbf{[14A.2]} \quad \textbf{442}$$

$$\beta_{Unlevered\ firm} = \frac{\text{Equity}}{\text{Equity} + (1 - T_C) \times \text{Debt}} \times \beta_{Equity} \quad \textbf{[14A.3]} \quad \textbf{442}$$

Number of new shares = Funds to be raised/Subscription price = \$5,000,000/\$10 = 500,000 shares **[15.1]** **466**

Number of rights needed to buy a share of stock = Old shares/New shares = 1,000,000/500,000 = 2 rights **[15.2]** **466**

$$R_o = (M_o - S)/(N + 1) \quad [15.3] \quad 468$$

where

M_o = common share price during the rights-on period
S = subscription price
N = number of rights required to buy one new share

$$M_e = M_o - R_o \quad [15.4] \quad 469$$

$$R_e = (M_e - S)/N \quad [15.5] \quad 469$$

$$\text{Degree of financial leverage} = \frac{\text{Percentage change in EPS}}{\text{Percentage change in EBIT}} \quad [16.1] \quad 482$$

$$\text{DFL} = \frac{\text{EBIT}}{\text{EBIT} - \text{Interest}} \quad [16.2] \quad 483$$

$$V_u = EBIT/R_E{}^u = V_L = E_L + D_L \quad [16.3] \quad 486$$

where

V_u = Value of the unlevered firm
V_L = Value of the levered firm
EBIT = Perpetual operating income
$R_E{}^u$ = Equity required return for the unlevered firm
E_L = Market value of equity
D_L = Market value of debt

$$R_E = R_A + (R_A - R_D) \times (D/E) \quad [16.4] \quad 487$$

$$\beta_E = \beta_A \times (1 + D/E) \quad [16.5] \quad 489$$

$$\text{Value of the interest tax shield} = (T_C \times R_D \times D)/R_D = T_C \times D \quad [16.6] \quad 491$$

$$V_L = V_U + T_C \times D \quad [16.7] \quad 491$$

$$R_E = R_U + (R_U - R_D) \times (D/E) \times (1 - T_C) \quad [16.8] \quad 492$$

$$V_L = V_U + \left[1 - \frac{(1 - T_C) \times (1 - T_S)}{(1 - T_b)}\right] \times B \quad [16A.1] \quad 512$$

$$\text{Net working capital} + \text{Fixed assets} = \text{Long-term debt} + \text{Equity} \quad [18.1] \quad 547$$

$$\text{Net working capital} = (\text{Cash} + \text{Other current assets}) - \text{Current liabilities} \quad [18.2] \quad 547$$

$$\text{Cash} = \text{Long-term debt} + \text{Equity} + \text{Current liabilities} - \text{Current assets (other than cash)} - \text{Fixed assets} \quad [18.3] \quad 547$$

$$\text{Operating cycle} = \text{Inventory period} + \text{Accounts receivable period} \quad [18.4] \quad 549$$
$$105 \text{ days} = 60 \text{ days} + 45 \text{ days}$$

$$\text{Cash cycle} = \text{Operating cycle} - \text{Accounts payable period} \quad [18.5] \quad 549$$
$$75 \text{ days} = 105 \text{ days} - 30 \text{ days}$$

$$\text{Cash collections} = \text{Beginning accounts receivable} + 1/2 \times \text{Sales} \quad [18.6] \quad 561$$

$$\text{Average daily float} = \text{Average daily receipts} \times \text{Weighted average delay} = \$266{,}666.67 \times 7.50 \text{ days} = \$2{,}000{,}000 \quad [19.1] \quad 586$$

Opportunity costs = $(C/2) \times R$	[19A.1]	600
Trading costs = $(T/C) \times F$	[19A.2]	600
Total cost = Opportunity costs + Trading costs $= (C/2) \times R + (T/C) \times F$	[19A.3]	600
$C^* = \sqrt{(2T \times F)/R}$	[19A.4]	601
$C^* = L + (3/4 \times F \times \sigma^2/R)^{1/3}$	[19A.5]	603
$U^* = 3 \times C^* - 2 \times L$	[19A.6]	603
Average cash balance = $(4 \times C^* - L)/3$	[19A.7]	603
Accounts receivable = Average daily sales × ACP	[20.1]	608
Cash flow (old policy) = $(P - v)Q$ = ($49 – 20) × 100 = $2,900	[20.2]	613
Cash flow (new policy) = $(P - v)Q'$ = ($49 – 20) × 110 = $3,190	[20.3]	614
$PV = [(P - v)(Q' - Q)]/R$	[20.4]	614
Cost of switching = $PQ + v(Q' - Q)$	[20.5]	614
NPV of switching = $-[PQ + v(Q' - Q)] + (P - v)(Q' - Q)/R$	[20.6]	614
NPV = $0 = -[PQ + v(Q' - Q)] + (P - v)(Q' - Q)/R$	[20.7]	615
NPV = $-v + (1 - \pi)P'/(1 + R)$	[20.8]	617
NPV = $-v + (1 - \pi)(P - v)/R$	[20.9]	618
Score = Z = 0.4 × [Sales/Total assets] + 3.0 × EBIT/Total assets	[20.10]	620
Total carrying costs = Average inventory × Carrying costs per unit $= (Q/2) \times CC$	[20.11]	627
Total restocking cost = Fixed cost per order × Number of orders $= F \times (T/Q)$	[20.12]	629
Total costs = Carrying costs + Restocking costs $= (Q/2) \times CC + F \times (T/Q)$	[20.13]	629
Carrying costs = Restocking costs $(Q^*/2) \times CC = F \times (T/Q^*)$	[20.14]	629
$Q^{*2} = \frac{2T \times F}{CC}$	[20.15]	629
$Q^* = \sqrt{\frac{2T \times F}{CC}}$	[20.16]	629
$Q^* = \sqrt{\frac{2T \times F}{CC}}$	[20.17]	629
Net incremental cash flow = $P'Q \times (d - \pi)$	[20A.1]	642

$\text{NPV} = -PQ + P'Q \times (d - \pi)/R$	[20A.2]	642
$(\text{E}[S_1] - S_0)/S_0 = h_{FC} - h_{CDN}$	[21.1]	656
$\text{E}[S_1] = S_0 \times [1 + (h_{FC} - h_{CDN})]$	[21.2]	656
$\text{E}[S_t] = S_0 \times [1 + (h_{FC} - h_{CDN})]^t$	[21.3]	656
$F_1/S_0 = (1 + R_{FC})/(1 + R_{CDN})$	[21.4]	659
$(F_1 - S_0)/S_0 = R_{FC} - R_{CDN}$	[21.5]	659
$F_1 = S_0 \times [1 + (R_{FC} - R_{CDN})]$	[21.6]	659
$F_t = S_0 \times [1 + (R_{FC} - R_{CDN})]^t$	[21.7]	659
$\text{E}[S_1] = S_0 \times [1 + (R_{FC} - R_{CDN})]$	[21.8]	660
$\text{E}[S_t] = S_0 \times [1 + (R_{FC} - R_{CDN})]^t$	[21.9]	660
$R_{CDN} - h_{CDN} = R_{FC} - h_{FC}$	[21.10]	660
$C_1 = 0$ if $(S_1 - E) \leq 0$	[25.1]	760
$C_1 = S_1 - E$ if $(S_1 - E) > 0$	[25.2]	760
$C_0 \leq S_0$	[25.3]	760
$C_0 \geq 0$ if $S_0 - E < 0$ $C_0 \geq S_0 - E$ if $S_0 - E \geq 0$	[25.4]	761
$S_0 = C_0 + E/(1 + R_f)$ $C_0 = S_0 - E/(1 + R_f)$	[25.5]	763
Call option value = Stock value – Present value of the exercise price $C_0 = S_0 - E/(1 + R_f)^t$	[25.6]	764
$C_0 = S_0 \times N(d_1) - E/(1 + R_f)^t \times N(d_2)$	[25A.1]	790
$d_1 = [\ln(S_0/E) + (R_f + 1/2 \times \sigma^2) \times t]/[\sigma \times \sqrt{t}]$ $d_2 = d_1 - \sigma \times \sqrt{t}$	[25A.2]	792