

>> Key Equations

Chapter 2

1. The balance sheet identity or equation:

$$\text{Assets} = \text{Liabilities} + \text{Shareholders' equity} \quad [2.1]$$

2. The income statement equation:

$$\text{Revenues} - \text{Expenses} = \text{Income} \quad [2.2]$$

3. The cash flow identity:

$$\begin{aligned} \text{Cash flow from assets} \\ = \text{Cash flow to creditors} \\ + \text{Cash flow to stockholders} \end{aligned} \quad [2.3]$$

where

- a. Cash flow from assets = Operating cash flow (OCF) – Net capital spending – Change in net working capital (NWC)

$$(1) \text{ Operating cash flow} = \text{Earnings before interest and taxes (EBIT)} + \text{Depreciation} - \text{Taxes}$$

$$(2) \text{ Net capital spending} = \text{Ending net fixed assets} - \text{Beginning net fixed assets} + \text{Depreciation}$$

$$(3) \text{ Change in net working capital} = \text{Ending NWC} - \text{Beginning NWC}$$

- b. Cash flow to creditors = Interest paid – Net new borrowing

- c. Cash flow to stockholders = Dividends paid – Net new equity raised

6. The total debt ratio:

$$\begin{aligned} \text{Total debt ratio} \\ = \frac{\text{Total assets} - \text{Total equity}}{\text{Total assets}} \end{aligned} \quad [3.6]$$

7. The debt-equity ratio:

$$\begin{aligned} \text{Debt-equity ratio} \\ = \text{Total debt} / \text{Total equity} \end{aligned} \quad [3.7]$$

8. The equity multiplier:

$$\begin{aligned} \text{Equity multiplier} \\ = \text{Total assets} / \text{Total equity} \end{aligned} \quad [3.8]$$

9. The long-term debt ratio:

$$\begin{aligned} \text{Long-term debt ratio} \\ = \frac{\text{Long-term debt}}{\text{Long-term debt} + \text{Total equity}} \end{aligned} \quad [3.9]$$

10. The times interest earned (TIE) ratio:

$$\text{Times interest earned ratio} = \frac{\text{EBIT}}{\text{Interest}} \quad [3.10]$$

11. The cash coverage ratio:

$$\begin{aligned} \text{Cash coverage ratio} \\ = \frac{\text{EBIT} + \text{Depreciation}}{\text{Interest}} \end{aligned} \quad [3.11]$$

12. The inventory turnover ratio:

$$\begin{aligned} \text{Inventory turnover} \\ = \frac{\text{Cost of goods sold}}{\text{Inventory}} \end{aligned} \quad [3.12]$$

13. The average days' sales in inventory:

$$\begin{aligned} \text{Days' sales in inventory} \\ = \frac{365 \text{ days}}{\text{Inventory turnover}} \end{aligned} \quad [3.13]$$

14. The receivables turnover ratio:

$$\begin{aligned} \text{Receivables turnover} \\ = \frac{\text{Sales}}{\text{Accounts receivable}} \end{aligned} \quad [3.14]$$

15. The days' sales in receivables:

$$\begin{aligned} \text{Days' sales in receivables} \\ = \frac{365 \text{ days}}{\text{Receivables turnover}} \end{aligned} \quad [3.15]$$

16. The net working capital (NWC) turnover ratio:

$$\text{NWC turnover} = \frac{\text{Sales}}{\text{NWC}} \quad [3.16]$$

Chapter 3

1. The current ratio:

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}} \quad [3.1]$$

2. The quick or acid-test ratio:

$$\text{Quick ratio} = \frac{\text{Current assets} - \text{Inventory}}{\text{Current liabilities}} \quad [3.2]$$

3. The cash ratio:

$$\text{Cash ratio} = \frac{\text{Cash}}{\text{Current liabilities}} \quad [3.3]$$

4. The ratio of net working capital to total assets:

$$\begin{aligned} \text{Net working capital to total assets} \\ = \frac{\text{Net working capital}}{\text{Total assets}} \end{aligned} \quad [3.4]$$

5. The interval measure:

$$\begin{aligned} \text{Interval measure} \\ = \frac{\text{Current assets}}{\text{Average daily operating costs}} \end{aligned} \quad [3.5]$$

B-2 APPENDIX B Key Equations

17. The fixed asset turnover ratio:

$$\text{Fixed asset turnover} = \frac{\text{Sales}}{\text{Net fixed assets}}$$

18. The total asset turnover ratio:

$$\text{Total asset turnover} = \frac{\text{Sales}}{\text{Total assets}}$$

19. Profit margin:

$$\text{Profit margin} = \frac{\text{Net income}}{\text{Sales}}$$

20. Return on assets (ROA):

$$\text{Return on assets} = \frac{\text{Net income}}{\text{Total assets}}$$

21. Return on equity (ROE):

$$\text{Return on equity} = \frac{\text{Net income}}{\text{Total equity}}$$

22. The price-earnings (PE) ratio:

$$\text{PE ratio} = \frac{\text{Price per share}}{\text{Earnings per share}}$$

23. The market-to-book ratio:

$$\text{Market-to-book ratio} = \frac{\text{Market value per share}}{\text{Book value per share}}$$

24. The Du Pont identity:

$$\text{ROE} = \underbrace{\frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}}}_{\text{Return on assets}} \times \frac{\text{Assets}}{\text{Equity}}$$

$$\begin{aligned} \text{ROE} &= \text{Profit margin} \\ &\times \text{Total asset turnover} \\ &\times \text{Equity multiplier} \end{aligned}$$

Chapter 4

1. The dividend payout ratio:

$$\begin{aligned} \text{Dividend payout ratio} \\ &= \text{Cash dividends}/\text{Net income} \end{aligned}$$

2. The internal growth rate:

$$\text{Internal growth rate} = \frac{\text{ROA} \times b}{1 - \text{ROA} \times b}$$

3. The sustainable growth rate:

$$\text{Sustainable growth rate} = \frac{\text{ROE} \times b}{1 - \text{ROE} \times b}$$

4. The capital intensity ratio:

$$\begin{aligned} \text{Capital intensity ratio} &= \frac{\text{Total assets}}{\text{Sales}} \\ &= \frac{1}{\text{Total asset turnover}} \end{aligned}$$

Chapter 5

- [3.17] 1. The future value of \$1 invested for
- t
- periods at rate of
- r
- per period:

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

- [3.18] 2. The present value of \$1 to be received
- t
- periods in the future at a discount rate of
- r
- :

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

- [3.19] 3. The relationship between future value and present value (the basic present value equation):

$$\begin{aligned} \text{PV} \times (1 + r)^t &= \text{FV}_t \\ \text{PV} &= \text{FV}_t/(1 + r)^t = \text{FV}_t \times [1/(1 + r)^t] \end{aligned} \quad [5.3]$$

Chapter 6

- [3.20] 1. The present value of an annuity of
- C
- dollars per period for
- t
- periods when the rate of return or interest rate is
- r
- :

$$\begin{aligned} \text{Annuity present value} \\ &= C \times \left(\frac{1 - \text{Present value factor}}{r} \right) \end{aligned}$$

$$[3.22] \quad = C \times \left\{ \frac{1 - [1/(1 + r)^t]}{r} \right\} \quad [6.1]$$

- [3.23] 2. The future value factor for an annuity:

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

- [3.24] 3. Annuity due value = Ordinary annuity value
- $\times (1 + r)$
- [6.3]

- [3.24] 4. Present value for a perpetuity:
-
- $$\text{PV for a perpetuity} = C/r = C \times (1/r) \quad [6.4]$$

5. Effective annual rate (EAR), where
- m
- is the number of times the interest is compounded during the year:

$$\text{EAR} = [1 + (\text{Quoted rate}/m)]^m - 1 \quad [6.5]$$

6. Effective annual rate (EAR), where
- q
- stands for the continuously compounded quoted rate:

$$\text{EAR} = e^q - 1 \quad [6.6]$$

Chapter 7

- [4.1] 1. Bond value if bond has (1) a face value of
- F
- paid at maturity, (2) a coupon of
- C
- paid per period, (3)
- t
- periods to maturity, and (4) a yield of
- r
- per period:

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

$$[4.3] \quad \text{Bond value} = \text{Present value of the coupons} + \text{Present value of the face amount}$$

2. The Fisher effect:

$$1 + R = (1 + r) \times (1 + h) \quad [7.2]$$

$$R = r + h + r \times h \quad [7.3]$$

$$R \approx r + h \quad [7.4]$$

Chapter 8

1. The dividend growth model:

$$P_0 = \frac{D_0 \times (1 + g)}{R - g} = \frac{D_1}{R - g}$$

2. Required return:

$$R = D_1/P_0 + g$$

Chapter 9

1. Net present value (NPV):

$$\text{NPV} = \text{Present value of future cash flows} \\ - \text{Investment cost}$$

2. Payback period:

Payback period = Number of years that pass before the sum of an investment's cash flows equals the cost of the investment

3. Discounted payback period:

Discounted payback period = Number of years that pass before the sum of an investment's *discounted* cash flows equals the cost of the investment

4. The average accounting return (AAR):

$$\text{AAR} = \frac{\text{Average net income}}{\text{Average book value}}$$

5. Internal rate of return (IRR):

IRR = Discount rate of required return such that the net present value of an investment is zero

6. Profitability index:

$$\text{Profitability index} = \frac{\text{PV of cash flows}}{\text{Cost of investment}}$$

Chapter 10

1. Bottom-up approach to operating cash flow (OCF):

$$\text{OCF} = \text{Net income} + \text{Depreciation} \quad [10.1]$$

2. Top-down approach to operating cash flow (OCF):

$$\text{OCF} = \text{Sales} - \text{Costs} - \text{Taxes} \quad [10.2]$$

3. Tax shield approach to operating cash flow (OCF):

$$\text{OCF} = (\text{Sales} - \text{Costs}) \times (1 - T) \\ + \text{Depreciation} \times T \quad [10.3]$$

Chapter 11

1. Accounting break-even level:

$$Q = (\text{FC} + D)/(P - v) \quad [11.1]$$

2. Relationship between operating cash flow (OCF) and sales volume:

$$Q = (\text{FC} + \text{OCF})/(P - v) \quad [11.3]$$

3. Cash break-even level:

$$Q = \text{FC}/(P - v)$$

4. Financial break-even level:

$$Q = (\text{FC} + \text{OCF}^*)/(P - v)$$

where

$$\text{OCF}^* = \text{Zero NPV cash flow}$$

5. Degree of operating leverage (DOL):

$$\text{DOL} = 1 + \text{FC}/\text{OCF} \quad [11.4]$$

Chapter 12

1. Variance of returns, $\text{Var}(R)$ or σ^2 :

$$\text{Var}(R) = \frac{1}{T - 1} [(R_1 - \bar{R})^2 + \dots \\ + (R_T - \bar{R})^2] \quad [12.3]$$

2. Standard deviation of returns, $\text{SD}(R)$ or σ :

$$\text{SD}(R) = \sqrt{\text{Var}(R)}$$

Chapter 13

1. Risk premium:

$$\text{Risk premium} = \text{Expected return} \\ - \text{Risk-free rate} \quad [13.1]$$

2. Expected return on a portfolio:

$$E(R_p) = x_1 \times E(R_1) + x_2 \times E(R_2) + \dots \\ + x_n \times E(R_n) \quad [13.2]$$

3. The reward-to-risk ratio:

$$\text{Reward-to-risk ratio} = \frac{E[R_i] - R_f}{\beta_i}$$

4. The capital asset pricing model (CAPM):

$$E(R_i) = R_f + [E(R_M) - R_f] \times \beta_i \quad [13.7]$$

Chapter 14

1. Value of a call option at maturity:

$$\text{a. } C_1 = 0 \text{ if } (S_1 - E) \leq 0 \quad [14.1]$$

$$\text{b. } C_1 = S_1 - E \text{ if } (S_1 - E) > 0 \quad [14.2]$$

2. Bounds on the value of a call option:

$$\text{a. Upper bound:} \\ C_0 \leq S_0 \quad [14.3]$$

$$\text{b. Lower bound:} \\ C_0 \geq 0 \text{ if } S_0 - E < 0 \\ C_0 \geq S_0 - E \text{ if } S_0 - E \geq 0 \quad [14.4]$$

3. $S_0 = C_0 + E/(1 + R_f)$ [14.5]
 $C_0 = S_0 - E/(1 + R_f)$

4. Value of a call that is certain to finish in-the-money:

$$\text{Call option value} \\ = \text{Stock value} \\ - \text{Present value of the exercise price} \\ C_0 = S_0 - E/(1 + R_f)^t \quad [14.6]$$

Chapter 15

1. Required return on equity, R_E (dividend growth model):

$$R_E = D_1/P_0 + g \quad [15.1]$$

B-4 APPENDIX B Key Equations

2. Required return on equity,
- R_E
- (CAPM):

$$R_E = R_f + \beta_E \times (R_M - R_f) \quad [15.2]$$

3. Required return on preferred stock,
- R_P
- :

$$R_P = D/P_0 \quad [15.3]$$

4. The weighted average cost of capital (WACC):

$$\text{WACC} = (E/V) \times R_E + (D/V) \times R_D \times (1 - T_C) \quad [15.6]$$

5. Weighted average flotation cost,
- f_A
- :

$$f_A = \frac{E}{V} \times f_E + \frac{D}{V} \times f_D \quad [15.8]$$

Chapter 16

1. Rights offerings:

- a. Number of new shares:

$$\begin{aligned} &\text{Number of new shares} \\ &= \frac{\text{Funds to be raised}}{\text{Subscription price}} \end{aligned} \quad [16.1]$$

- b. Number of rights needed:

$$\begin{aligned} &\text{Number of rights needed to buy a share of stock} \\ &= \frac{\text{Old shares}}{\text{New shares}} \end{aligned} \quad [16.2]$$

- c. Value of a right:

$$\text{Value of a right} = \text{Rights-on price} - \text{Ex-rights price}$$

Chapter 17

1. Modigliani-Miller Propositions (no taxes):

- a. Proposition I:

$$V_L = V_U$$

- b. Proposition II:

$$R_E = R_A + (R_A - R_D) \times (D/E) \quad [17.1]$$

2. Modigliani-Miller propositions (with taxes):

- a. Value of the interest tax shield:

$$\begin{aligned} &\text{Value of the interest tax shield} \\ &= (T_C \times R_D \times D)/R_D \\ &= T_C \times D \end{aligned} \quad [17.2]$$

- b. Proposition I:

$$V_L = V_U + T_C \times D \quad [17.3]$$

- c. Proposition II:

$$R_E = R_U + (R_U - R_D) \times (D/E) \times (1 - T_C) \quad [17.4]$$

Chapter 19

1. The operating cycle:

$$\text{Operating cycle} = \text{Inventory period} + \text{Accounts receivable period} \quad [19.4]$$

2. The cash cycle:

$$\text{Cash cycle} = \text{Operating cycle} - \text{Accounts payable period} \quad [19.5]$$

Chapter 20

1. Float measurement:

- a. Average daily float:

$$\text{Average daily float} = \frac{\text{Total float}}{\text{Total days}} \quad [20.1]$$

- b. Average daily float:

$$\begin{aligned} &\text{Average daily float} \\ &= \text{Average daily receipts} \\ &\times \text{Weighted average delay} \end{aligned} \quad [20.2]$$

2. The Baumol-Allais-Tobin (BAT) model:

- a. Opportunity costs:

$$\text{Opportunity costs} = (C/2) \times R \quad [20A.1]$$

- b. Trading costs:

$$\text{Trading costs} = (T/C) \times F \quad [20A.2]$$

- c. Total cost:

$$\begin{aligned} &\text{Total cost} = \text{Opportunity costs} \\ &+ \text{Trading costs} \end{aligned} \quad [20A.3]$$

- d. The optimal initial cash balance:

$$C^* = \sqrt{(2T \times F)/R} \quad [20A.4]$$

3. The Miller-Orr model:

- a. The optimal cash balance:

$$C^* = L + (3/4 \times F \times \sigma^2/R)^{1/3} \quad [20A.5]$$

- b. The upper limit:

$$U^* = 3 \times C^* - 2 \times L \quad [20A.6]$$

Chapter 21

1. The size of receivables:

$$\begin{aligned} &\text{Accounts receivable} \\ &= \text{Average daily sales} \times \text{ACP} \end{aligned} \quad [21.1]$$

2. NPV of switching credit terms:

- a. Present value of switching:

$$\text{PV} = [(P - v)(Q' - Q)]/R \quad [21.4]$$

- b. Cost of switching:

$$\text{Cost of switching} = PQ + v(Q' - Q) \quad [21.5]$$

- c. NPV of switching:

$$\begin{aligned} &\text{NPV of switching} = -[PQ + v(Q' - Q)] \\ &+ (P - v) \\ &\times (Q' - Q)/R \end{aligned} \quad [21.6]$$

3. NPV of granting credit:

- a. With no repeat business:

$$\text{NPV} = -v + (1 - \pi)P/(1 + R) \quad [21.8]$$

- b. With repeat business:

$$\text{NPV} = -v + (1 - \pi)(P - v)/R \quad [21.9]$$

4. The economic order quantity (EOQ) model:

- a. Total carrying costs:

$$\begin{aligned} &\text{Total carrying costs} \\ &= \text{Average inventory} \\ &\times \text{Carrying costs per unit} \\ &= (Q/2) \times \text{CC} \end{aligned} \quad [21.10]$$

- b. Total restocking costs:

$$\begin{aligned} &\text{Total restocking costs} \\ &= \text{Fixed cost per order} \\ &\times \text{Number of orders} = F \times (T/Q) \end{aligned} \quad [21.11]$$

- c. Total costs:

$$\begin{aligned} \text{Total costs} &= \text{Carrying costs} \\ &\quad + \text{Restocking costs} \\ &= (Q/2) \times CC \\ &\quad + F \times (T/Q) \end{aligned}$$

- d. The optimal order size Q^* :

$$Q^* = \sqrt{\frac{2T \times F}{CC}}$$

Chapter 22

1. Purchasing power parity (PPP):

$$E(S_t) = S_0 \times [1 + (h_{FC} - h_{US})]^t$$

2. Interest rate parity (IRP):

- a. Exact, single period:

$$F_t/S_0 = (1 + R_{FC})/(1 + R_{US})$$

- b. Approximate, multiperiod:

$$F_t = S_0 \times [1 + (R_{FC} - R_{US})]^t$$

3. Uncovered interest parity (UIP):

$$E(S_t) = S_0 \times [1 + (R_{FC} - R_{US})]^t$$

4. International Fisher effect (IFE):

$$R_{US} - h_{US} = R_{FC} - h_{FC} \quad [22.10]$$

[21.12]

Chapter 24

1. Put-call parity condition:

$$S + P = PV(E) + C \quad [24.2]$$

[21.16]

2. The Black-Scholes call option formula:

$$C = S \times N(d_1) - E \times e^{-Rt} \times N(d_2) \quad [24.5]$$

where

$$d_1 = [ln(S/E) + (R + \sigma^2/2) \times t]/(\sigma \times \sqrt{t}) \quad [24.6]$$

$$d_2 = d_1 - \sigma \times \sqrt{t}$$

[22.3]

3. Value of a risk-free bond:

$$\text{Value of risky bond} + \text{put option} \quad [24.7]$$

[22.4]

Chapter 25

1. The NPV of a merger:

$$\text{NPV} = V_B^* - \text{Cost to Firm A of the acquisition} \quad [25.1]$$

[22.9]