

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) Operating cash flow = Earnings before interest and taxes (EBIT) + Depreciation – Taxes
- (2) Net capital spending = Ending net fixed assets – Beginning net fixed assets + Depreciation
- (3) Change in net working capital = Ending NWC – Beginning NWC
- b. Cash flow to creditors = Interest paid – Net new borrowing
- c. Cash flow to stockholders = Dividends paid – Net new equity raised

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:

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

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:

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

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

$$\text{NWC turnover} = \frac{\text{Sales}}{\text{NWC}}$$

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:

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

24. The Du Pont identity:

$$\begin{aligned} \text{ROE} &= \underbrace{\frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}}}_{\text{Return on assets}} \times \frac{\text{Assets}}{\text{Equity}} \\ \text{ROE} &= \text{Profit margin} \\ &\times \text{Total asset turnover} \\ &\times \text{Equity multiplier} \end{aligned}$$

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:

$$\begin{aligned} \text{Capital intensity ratio} &= \frac{\text{Total assets}}{\text{Sales}} \\ [3.15] \quad &= \frac{1}{\text{Total asset turnover}} \end{aligned}$$

CHAPTER 5

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

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

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. 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

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
- :

$$\begin{aligned} \text{Annuity present value} \\ &= C \times \left(\frac{1 - \text{Present value factor}}{r} \right) \\ [3.21] \quad &= C \times \left\{ \frac{1 - [1/(1 + r)^t]}{r} \right\} \end{aligned} \quad [6.1]$$

2. The future value factor for an annuity:

$$\begin{aligned} \text{Annuity FV factor} \\ &= (\text{Future value factor} - 1)/r \\ [3.22] \quad &= [(1 + r)^t - 1]/r \end{aligned} \quad [6.2]$$

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

$$[3.23] \quad [6.3]$$

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:

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

$$\begin{aligned} \text{Bond value} \\ &= \text{Present value of the coupons} + \text{Present value of the face amount} \end{aligned}$$

2. The Fisher effect:

$$1 + R = (1 + r) \times (1 + h)$$

$$R = r + h + r \times h$$

$$R \approx r + h$$

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):

NPV = Present value of future cash flows – 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):

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

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):

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

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

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

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

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

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:

$$Q = \text{FC}/(P - v) \quad [7.2]$$

4. Financial break-even level:

$$Q = (\text{FC} + \text{OCF}^*)/(P - v) \quad [7.3]$$

where

OCF* = 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:

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

b. $C_1 = S_1 - E$ if $(S_1 - E) > 0$ [14.2]

2. Bounds on the value of a call option:

- a. Upper bound:

$$C_0 \leq S_0 \quad [14.3]$$

- b. Lower bound:

$$C_0 \geq 0 \text{ if } S_0 - E < 0 \quad [14.4]$$

$$C_0 \geq S_0 - E \text{ if } S_0 - E \geq 0$$

3. $S_0 = C_0 + E/(1 + R_f)$

$$C_0 = S_0 - E/(1 + R_f) \quad [14.5]$$

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

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

CHAPTER 15

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

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

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):

$$\begin{aligned} \text{WACC} & = (E/V) \times R_E + (D/V) \times R_D \\ & \quad \times (1 - T_c) \end{aligned} \quad [15.6]$$

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:

$$\begin{aligned} R_E & = R_U + (R_U - R_D) \times (D/E) \\ & \quad \times (1 - T_c) \end{aligned} \quad [17.4]$$

CHAPTER 19

1. The operating cycle:

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

2. The cash cycle:

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

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:

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

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:

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

- 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:

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

3. NPV of granting credit:
- With no repeat business:

$$\text{NPV} = -v + (1 - \pi)P/(1 + R)$$
 - With repeat business:

$$\text{NPV} = -v + (1 - \pi)(P - v)/R$$
4. The economic order quantity (EOQ) model:
- Total carrying costs:
 Total carrying costs
 = Average inventory
 × Carrying costs per unit
 = $(Q/2) \times CC$
 - Total restocking costs:
 Total restocking costs
 = Fixed cost per order
 × Number of orders = $F \times (T/Q)$
 - Total costs:
 Total costs = Carrying costs
 + Restocking costs
 = $(Q/2) \times CC$
 + $F \times (T/Q)$
 - The optimal order size Q^* :

$$Q^* = \sqrt{\frac{2TF}{CC}}$$

CHAPTER 22

1. Purchasing power parity (PPP):

$$E(S_t) = S_0 \times [1 + (h_{FC} - h_{US})]^t$$
[22.3]

2. Interest rate parity (IRP):
- Exact, single period:

$$F_1/S_0 = (1 + R_{FC})/(1 + R_{US})$$
[22.4]
 - Approximate, multiperiod:

$$F_t = S_0 \times [1 + (R_{FC} - R_{US})]^t$$
[22.7]
3. Uncovered interest parity (UIP):

$$E(S_t) = S_0 \times [1 + (R_{FC} - R_{US})]^t$$
[22.9]
4. International Fisher effect (IFE):

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

CHAPTER 24

1. Put-call parity condition:

$$S + P = \text{PV}(E) + C$$
[24.2]
2. The Black-Scholes call option formula:

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

$$d_1 = [1n(S/E) + (R + \sigma^2/2) \times t]/(\sigma \times \sqrt{t})$$
[24.6]

$$d_2 = d_1 - \sigma \times \sqrt{t}$$
3. Value of a risk-free bond:
 Value of risky bond + put option [24.7]
- [21.10] [21.11] [21.12] [21.16]

CHAPTER 25

1. The NPV of a merger:

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

