B

APPENDIX

KEY EQUATIONS

CHAPTER 2

1. The balance sheet identity or equation:

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

2. The income statement equation:

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

3. The cash flow identity:

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

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:

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

2. The quick or acid-test ratio:

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

3. The cash ratio:

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

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

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

5. The interval measure:

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

6. The total debt ratio:

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

7. The debt-equity ratio:

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

8. The equity multiplier:

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

9. The long-term debt ratio:

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

10. The times interest earned (TIE) ratio:

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

11. The cash coverage ratio:

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

12. The inventory turnover ratio:

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

13. The average days' sales in inventory:

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

14. The receivables turnover ratio:

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

15. The days' sales in receivables:

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

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

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

17. The fixed asset turnover ratio:

$$\text{Fixed asset turnover} = \frac{\text{Sales}}{\text{Net fixed assets}} \quad \textbf{[3.17]}$$

18. The total asset turnover ratio:

$$\text{Total asset turnover} = \frac{\text{Sales}}{\text{Total assets}} \quad \textbf{[3.18]}$$

19. Profit margin:

$$\text{Profit margin} = \frac{\text{Net income}}{\text{Sales}} \quad \textbf{[3.19]}$$

20. Return on assets (ROA):

$$\text{Return on assets} = \frac{\text{Net income}}{\text{Total assets}} \quad \textbf{[3.20]}$$

21. Return on equity (ROE):

$$\text{Return on equity} = \frac{\text{Net income}}{\text{Total equity}} \quad \textbf{[3.21]}$$

22. The price-earnings (PE) ratio:

$$\text{PE ratio} = \frac{\text{Price per share}}{\text{Earnings per share}} \quad \textbf{[3.22]}$$

23. The market-to-book ratio:

$$\text{Market-to-book ratio} = \frac{\text{Market value per share}}{\text{Book value per share}} \quad \textbf{[3.23]}$$

24. The Du Pont identity:

$$\text{ROE} = \underbrace{\frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Assets}}}_{\text{Return on assets}} \times \frac{\text{Assets}}{\text{Equity}} \quad \textbf{[3.24]}$$

$$\text{ROE} = \text{Profit margin} \times \text{Total asset turnover} \times \text{Equity multiplier}$$

CHAPTER 4

1. The dividend payout ratio:

$$\text{Dividend payout ratio} = \text{Cash dividends}/\text{Net income} \quad \textbf{[4.1]}$$

2. The internal growth rate:

$$\text{Internal growth rate} = \frac{\text{ROA} \times b}{1 - \text{ROA} \times b} \quad \textbf{[4.2]}$$

3. The sustainable growth rate:

$$\text{Sustainable growth rate} = \frac{\text{ROE} \times b}{1 - \text{ROE} \times b} \quad \textbf{[4.3]}$$

4. The capital intensity ratio:

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

CHAPTER 5

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

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

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

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

3. The relationship between future value and present value (the basic present value equation):

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

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:

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

2. The future value factor for an annuity:

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

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

4. Present value for a perpetuity:

$$\text{PV for a perpetuity} = C/r = C \times (1/r) \quad \textbf{[6.4]}$$

5. Growing annuity present value

$$= C\left[\frac{1 - \left(\frac{1 + g}{1 + r}\right)^t}{r - g}\right] \quad \textbf{[6.5]}$$

6. Growing perpetuity present value

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

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

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

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

$$\text{EAR} = e^q - 1$$

CHAPTER 7

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:

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

$$\text{Bond value} = \text{Present value of the coupons} + \text{Present value of the face amount}$$

2. The Fisher effect:

$$1 + R = (1 + r) \times (1 + h) \quad \textbf{[7.2]}$$
$$R = r + h + r \times h \quad \textbf{[7.3]}$$
$$R \approx r + h \quad \textbf{[7.4]}$$

CHAPTER 8

1. The dividend growth model:

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

2. Required return:

$$R = D_1/P_0 + g \quad \textbf{[8.7]}$$

CHAPTER 9

1. Net present value (NPV):

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

2. Payback period:

$$\text{Payback period} = \text{Number of years that pass before the sum of an investment's cash flows equals the cost of the investment}$$

3. Discounted payback period:

$$\text{Discounted payback period} = \text{Number of years that pass before the sum of an investment's } \textit{discounted} \text{ cash flows equals the cost of the investment}$$

4. The average accounting return (AAR):

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

5. Internal rate of return (IRR):

$$\text{IRR} = \text{Discount rate of required return such that the net present value of an investment is zero}$$

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):

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

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

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

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

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

CHAPTER 11

1. Accounting break-even level:

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

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

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

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):

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

CHAPTER 12

1. Variance of returns, Var(R) or σ^2:

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

2. Standard deviation of returns, SD(R) or σ:

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

CHAPTER 13

1. Risk premium:

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

2. Expected return on a portfolio:

$$\text{E}(R_p) = x_1 \times \text{E}(R_1) + x_2 \times \text{E}(R_2) + \cdots + x_n \times \text{E}(R_n) \quad \textbf{[13.2]}$$

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):

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

CHAPTER 14

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

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

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

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

3. Required return on preferred stock, R_P:

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

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

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

5. Weighted average flotation cost, f_A:

$$f_A = \frac{E}{V} \times f_E + \frac{D}{V} \times f_D \quad \textbf{[14.8]}$$

CHAPTER 15

1. Rights offerings:

a. Number of new shares:

$$\text{Number of new shares} = \frac{\text{Funds to be raised}}{\text{Subscription price}} \quad \textbf{[15.1]}$$

b. Number of rights needed:

$$\text{Number of rights needed to buy a share of stock} = \frac{\text{Old shares}}{\text{New shares}} \quad \textbf{[15.2]}$$

c. Value of a right:

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

CHAPTER 16

1. Modigliani-Miller propositions (no taxes):

a. Proposition I:

$$V_L = V_U$$

b. Proposition II:

$$R_E = R_A + (R_A - R_D) \times (D/E) \quad \textbf{[16.1]}$$

2. Modigliani-Miller propositions (with taxes):

a. Value of the interest tax shield:

$$\text{Present value of the interest tax shield} = (T_C \times D \times R_D)/R_D = T_C \times D \quad \textbf{[16.2]}$$

b. Proposition I:

$$V_L = V_U + T_C \times D \quad \textbf{[16.3]}$$

c. Proposition II:

$$R_E = R_U + (R_U - R_D) \times (D/E) \times (1 - T_C) \quad \textbf{[16.4]}$$

CHAPTER 18

1. The operating cycle:

$$\text{Operating cycle} = \text{Inventory period} + \text{Accounts receivable period} \quad \textbf{[18.4]}$$

2. The cash cycle:

$$\text{Cash cycle} = \text{Operating cycle} - \text{Accounts payable period} \quad \textbf{[18.5]}$$

CHAPTER 19

1. Float measurement:

a. Average daily float:

$$\text{Average daily float} = \frac{\text{Total float}}{\text{Total days}} \quad \textbf{[19.1]}$$

b. Average daily float:

$$\text{Average daily float} = \text{Average daily receipts} \times \text{Weighted average delay} \quad \textbf{[19.2]}$$

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

a. Opportunity costs:

$$\text{Opportunity costs} = (C/2) \times R \quad \textbf{[19A.1]}$$

b. Trading costs:

$$\text{Trading costs} = (T/C) \times F \quad \textbf{[19A.2]}$$

c. Total cost:

$$\text{Total cost} = \text{Opportunity costs} + \text{Trading costs} \quad \textbf{[19A.3]}$$

d. The optimal initial cash balance:

$$C^* = \sqrt{(2T \times F)/R} \quad \textbf{[19A.4]}$$

3. The Miller-Orr model:

a. The optimal cash balance:

$$C^* = L + (3/4 \times F \times \sigma^2/R)^{1/3} \quad \textbf{[19A.5]}$$

b. The upper limit:

$$U^* = 3 \times C^* - 2 \times L \quad \textbf{[19A.6]}$$

CHAPTER 20

1. The size of receivables:

$$\text{Accounts receivable} = \text{Average daily sales} \times \text{ACP} \quad \textbf{[20.1]}$$

2. NPV of switching credit terms:

   a. Present value of switching:

   $$\text{PV} = [(P - v)(Q' - Q)]/R \quad [20.4]$$

   b. Cost of switching:

   $$\text{Cost of switching} = PQ + v(Q' - Q) \quad [20.5]$$

   c. NPV of switching:

   $$\text{NPV of switching} = -[PQ + v(Q' - Q)] + [(P - v) \times (Q' - Q)]/R \quad [20.6]$$

3. NPV of granting credit:

   a. With no repeat business:

   $$\text{NPV} = -v + (1 - \pi)P/(1 + R) \quad [20.8]$$

   b. With repeat business:

   $$\text{NPV} = -v + (1 - \pi)(P - v)/R \quad [20.9]$$

4. The economic order quantity (EOQ) model:

   a. Total carrying costs:

   $$\text{Total carrying costs} = \text{Average inventory} \times \text{Carrying costs per unit} = (Q/2) \times \text{CC} \quad [20.10]$$

   b. Total restocking costs:

   $$\text{Total restocking costs} = \text{Fixed cost per order} \times \text{Number of orders} = F \times (T/Q) \quad [20.11]$$

   c. Total costs:

   $$\text{Total costs} = \text{Carrying costs} + \text{Restocking costs} = (Q/2) \times \text{CC} + F \times (T/Q) \quad [20.12]$$

   d. The optimal order size Q^*:

   $$Q^* = \sqrt{\frac{2T \times F}{\text{CC}}} \quad [20.15]$$

CHAPTER 21

1. Purchasing power parity (PPP):

   $$\text{E}(S_t) = S_0 \times [1 + (h_{FC} - h_{US})]^t \quad [21.3]$$

2. Interest rate parity (IRP):

   a. Exact, single period:

   $$F_1/S_0 = (1 + R_{FC})/(1 + R_{US}) \quad [21.4]$$

   b. Approximate, multiperiod:

   $$F_t = S_0 \times [1 + (R_{FC} - R_{US})]^t \quad [21.7]$$

3. Uncovered interest parity (UIP):

   $$\text{E}(S_t) = S_0 \times [1 + (R_{FC} - R_{US})]^t \quad [21.9]$$

4. International Fisher effect (IFE):

   $$R_{US} - h_{US} = R_{FC} - h_{FC} \quad [21.10]$$

CHAPTER 24

1. Value of a call option at maturity:

   a. $C_1 = 0$ if $(S_1 - E) \le 0$ [24.1]

   b. $C_1 = S_1 - E$ if $(S_1 - E) > 0$ [24.2]

2. Bounds on the value of a call option:

   a. Upper bound:

   $$C_0 \le S_0 \quad [24.3]$$

   b. Lower bound:

   $$C_0 \ge 0 \text{ if } S_0 - E < 0 \quad [24.4]$$
   $$C_0 \ge S_0 - E \text{ if } S_0 - E \ge 0$$

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

   $C_0 = S_0 - E/(1 + R_f)$ [24.5]

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

   $$\text{Call option value} = \text{Stock value} - \text{Present value of the exercise price}$$
   $$C_0 = S_0 - E/(1 + R_f)^t \quad [24.6]$$

CHAPTER 25

1. Put-call parity condition:

   $$S + P = \text{PV}(E) + C \quad [25.2]$$

2. The Black-Scholes call option formula:

   $$\text{C} = S \times \text{N}(d_1) - E \times e^{-Rt} \times \text{N}(d_2) \quad [25.5]$$

   where

   $$d_1 = [\ln(S/E) + (R + \sigma^2/2) \times t]/(\sigma \times \sqrt{t}) \quad [25.6]$$
   $$d_2 = d_1 - \sigma \times \sqrt{t}$$

3. Value of a risk-free bond:

   $$\text{Value of risky bond} + \text{Put option} \quad [25.7]$$

CHAPTER 26

4. The NPV of a merger:

   $$\text{NPV} = V_B^* - \text{Cost to Firm A of the acquisition} \quad [26.1]$$