KEY EQUATIONS

CHAPTER 2
1. The balance sheet identity or equation:
   \[ \text{Assets} = \text{Liabilities} + \text{Shareholders' equity} \]  
   [2.1]
2. The income statement equation:
   \[ \text{Revenues} - \text{Expenses} = \text{Income} \]  
   [2.2]
3. The cash flow identity:
   \[ \text{Cash flow from assets} = \text{Cash flow to creditors} + \text{Cash flow to stockholders} \]
   [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

4. The ratio of net working capital to total assets:
   \[ \frac{\text{Net working capital}}{\text{Total assets}} \]
   [2.4]
5. The interval measure:
   Interval measure
   \[ = \frac{\text{Current assets}}{\text{Average daily operating costs}} \]  
   [2.5]
6. The total debt ratio:
   \[ \frac{\text{Total debt}}{\text{Total assets}} \]
   [2.6]
7. The debt-equity ratio:
   \[ \frac{\text{Total debt}}{\text{Total equity}} \]
   [2.7]
8. The equity multiplier:
   \[ \frac{\text{Total assets}}{\text{Total equity}} \]
   [2.8]
9. The long-term debt ratio:
   \[ \frac{\text{Long-term debt}}{\text{Total equity}} \]
   [2.9]
10. The times interest earned (TIE) ratio:
    \[ \frac{\text{EBIT}}{\text{Interest}} \]
    [2.10]
11. The cash coverage ratio:
    \[ \frac{\text{Cash coverage ratio}}{\text{EBIT} + \text{Depreciation}} \]
    [2.11]
12. The inventory turnover ratio:
    \[ \frac{\text{Inventory turnover}}{\text{Cost of goods sold}} \]
    [2.12]
13. The average days’ sales in inventory:
    \[ \frac{\text{Days' sales in inventory}}{\text{365 days}} \]
    [2.13]
APPENDIX B  Key Equations

14. The receivables turnover ratio:
   Receivables turnover = \frac{\text{Receivables turnover}}{\text{Sales turnover}}
   \tag{3.14}

15. The days’ sales in receivables:
   Days’ sales in receivables = \frac{\text{Net fixed assets}}{\text{Sales turnover}}
   \tag{3.15}

16. The net working capital (NWC) turnover ratio:
   NWC turnover = \frac{\text{Sales turnover}}{\text{NWC}}
   \tag{3.16}

17. The fixed asset turnover ratio:
   \text{Fixed asset turnover} = \frac{\text{Sales turnover}}{\text{Net fixed assets}}

18. The total asset turnover ratio:
   \text{Total asset turnover} = \frac{\text{Sales turnover}}{\text{Total assets}}

19. Profit margin:
   \text{Profit margin} = \frac{\text{Net income}}{\text{Sales turnover}}

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} = \frac{\text{Net income}}{\text{Sales turnover}} \times \frac{\text{Sales turnover}}{\text{Assets turnover}} \times \frac{\text{Assets turnover}}{\text{Equity turnover}}
   \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} = \frac{\text{Cash dividends}}{\text{Net income}}
   \tag{4.1}

2. The internal growth rate:
   \text{Internal growth rate} = \frac{\text{ROA} \times b}{1 - \text{ROA} \times b}
   \tag{4.2}

3. The sustainable growth rate:
   \text{Sustainable growth rate} = \frac{\text{ROE} \times b}{1 - \text{ROE} \times b}
   \tag{4.3}

4. The capital intensity ratio:
   \text{Capital intensity ratio} = \frac{\text{Total assets turnover}}{\text{Sales}}

CHAPTER 5

1. The future value of $1 invested for t periods at rate of r per period:
   \text{Future value} = \text{PV} = \frac{\text{S}(1 + r)^t}{1 + r}
   \tag{5.1}

2. The present value of $1 to be received t periods in the future at a discount rate of r:
   \text{PV} = \frac{\text{S}}{(1 + r)^t}
   \tag{5.2}

3. The relationship between future value and present value (the basic present value equation):
   \text{PV} = \frac{\text{S}}{(1 + r)^t} = \frac{\text{S}}{(1 + r)^t} \times 1/(1 + r)^t
   \tag{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:
   \text{Annuity present value} = \frac{C \times 1 - \frac{1}{1 + r}^t}{r}
   \tag{6.1}

2. The future value factor for an annuity:
   \text{Annuity FV factor} = \frac{1}{1 + r}^t - 1
   \tag{6.2}

3. Annuity due value = Ordinary annuity value \times (1 + r)
   \tag{6.3}

4. Present value for a perpetuity:
   \text{PV for a perpetuity} = \frac{C}{r} = C \times \frac{1}{r}
   \tag{6.4}

5. Growing annuity present value:
   \text{Growing annuity present value} = \frac{1 - \left(\frac{1 + g}{1 + r}\right)}{r - g}
   \tag{6.5}

6. Growing perpetuity present value:
   \text{Growing perpetuity present value} = \frac{C}{r - g}
   \tag{6.6}
7. Effective annual rate (EAR), where \( m \) is the number of times the interest is compounded during the year:

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

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

\[
EAR = e^q - 1
\]

**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:

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

[7.1]

2. The Fisher effect:

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

[7.2]

\[
R = r + h + r \times h
\]

[7.3]

\[
R \approx r + h
\]

[7.4]

**CHAPTER 8**

1. The dividend growth model:

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

[8.3]

2. Required return:

\[
R = D_1 / P_0 + g
\]

[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:

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

4. The average accounting return (AAR):

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

5. Internal rate of return (IRR):

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

**APPENDIX B** Key Equations

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):

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

[10.1]

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

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

[10.2]

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

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

[10.3]

**CHAPTER 11**

1. Accounting break-even level:

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

[11.1]

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

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

[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):

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

[11.4]

**CHAPTER 12**

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

\[
\text{Var}(R) = \frac{1}{n} \left[ (R_1 - \bar{R})^2 + \ldots + (R_n - \bar{R})^2 \right]
\]

[12.3]

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

\[
\text{SD}(R) = \sqrt{\text{Var}(R)}
\]

**CHAPTER 13**

1. Risk premium:

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

[13.1]

2. Expected return on a portfolio:

\[
\text{E}(R_p) = x_1 \times \text{E}(R_1) + x_2 \times \text{E}(R_2) + \ldots + x_n \times \text{E}(R_n)
\]

[13.2]
3. The reward-to-risk ratio:

\[
\text{Reward-to-risk ratio} = \frac{\text{E}(R_p) - R_f}{\beta_p}\]

4. The capital asset pricing model (CAPM):

\[
\text{E}(R_p) = \beta_p \times \text{E}(R_m) - \beta_p \times \text{E}(\sigma_p) + \text{E}(R_f)
\]

\[\text{CAPM:} \quad \text{E}(R_p) = \beta_p \times \text{E}(R_m) + (\text{E}(R_p) - \beta_p \times \text{E}(\sigma_p)) \times (1 - \text{E}(R_f))\]

**CHAPTER 14**

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

\[
R_e = \frac{D_1}{P_0} + g
\]

[14.1]

2. Required return on equity, \( R_e \) (CAPM):

\[
R_e = R_f + \beta_e \times (R_m - R_f)
\]

[14.2]

3. Required return on preferred stock, \( R_p \):

\[
R_p = \frac{D}{P}
\]

[14.3]

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

\[
\text{WACC} = \left(\frac{E}{V}\right) \times R_e + \left(\frac{D}{V}\right) \times R_d \times (1 - T_c)
\]

[14.6]

5. Weighted average flotation cost, \( f_A \):

\[
f_A = \frac{E}{V} \times f_f + \frac{D}{V} \times f_d
\]

[14.8]

**CHAPTER 15**

1. Rights offerings:

   a. Number of new shares:

   \[
   \text{Number of new shares} = \text{Funds to be raised} / \text{Subscription price}
   \]

   [15.1]

   b. Number of rights needed:

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

   [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:

   \[
   R_e = R_f + (R _f - R_d) \times (D/E)
   \]

   [16.1]

2. Modigliani-Miller propositions (with taxes):

   a. Value of the interest tax shield:

   \[
   \text{Present value of the interest tax shield} = \frac{(T_c \times D \times R_d)}{R_d}
   = T_c \times D
   \]

   [16.2]

**CHAPTER 18**

1. The operating cycle:

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

   [18.4]

2. The cash cycle:

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

   [18.5]

**CHAPTER 19**

1. Float measurement:

   a. Average daily float:

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

   [19.1]

   b. Average daily float:

   \[
   \text{Average daily float} = \frac{\text{Average daily receipts}}{\text{Average weighted average delay}}
   \]

   [19.2]

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

   a. Opportunity costs:

   \[
   \text{Opportunity costs} = (C/2) \times R
   \]

   [19A.1]

   b. Trading costs:

   \[
   \text{Trading costs} = (T/C) \times F
   \]

   [19A.2]

   c. Total cost:

   \[
   \text{Total cost} = \text{Opportunity costs} + \text{Trading costs}
   \]

   [19A.3]

   d. The optimal initial cash balance:

   \[
   C^* = \sqrt{(2T \times F)/R}
   \]

   [19A.4]

3. The Miller-Orr model:

   a. The optimal cash balance:

   \[
   C^* = L + (3/4 \times F \times \sigma^2/R)^{1/3}
   \]

   [19A.5]

   b. The upper limit:

   \[
   U^* = 3 \times C^* - 2 \times L
   \]

   [19A.6]

**CHAPTER 20**

1. The size of receivables:

   Accounts receivable = Average daily sales \times ACP

   [20.1]
APPENDIX B  Key Equations  B-5

CHAPTER 21

1. Purchasing power parity (PPP):
   \[ E((S_t^0)) = S_t^0 \times [1 + (h_{FC} - h_{US})] \]  
   \[ \text{[21.3]} \]

2. Interest rate parity (IRP):
   a. Exact, single period:
      \[ F_t/S_0 = (1 + R_{FC})/(1 + R_{US}) \]  
      \[ \text{[21.4]} \]
   b. Approximate, multiperiod:
      \[ F_t = S_0 \times [1 + (R_{FC} - R_{US})] \]  
      \[ \text{[21.7]} \]

3. Uncovered interest parity (UIP):
   \[ E((S_t^0)) = S_t^0 \times [1 + (R_{FC} - R_{US})] \]  
   \[ \text{[21.9]} \]

4. International Fisher effect (IFE):
   \[ R_{US} - h_{US} = R_{FC} - h_{FC} \]  
   \[ \text{[21.10]} \]

CHAPTER 24

1. Value of a call option at maturity:
   a. \[ C_t = 0 \text{ if } (S_t - E) \leq 0 \]  
      \[ \text{[24.1]} \]
   b. \[ C_t = S_t - E \text{ if } (S_t - E) > 0 \]  
      \[ \text{[24.2]} \]

2. Bounds on the value of a call option:
   a. Upper bound:
      \[ C_0 \leq S_0 \]  
      \[ \text{[24.3]} \]
   b. Lower bound:
      \[ C_0 \geq S_0 - E \text{ if } S_0 - E \geq 0 \]  
      \[ C_0 \geq S_0 - E \text{ if } S_0 - E < 0 \]  
      \[ \text{[24.4]} \]

3. \[ S_0 = C_0 + E/(1 + R_f) \]
4. Value of a call that is certain to finish in-the-money:
   \[ C_0 = S_0 - E/(1 + R_f) \]  
   \[ \text{[24.6]} \]

CHAPTER 25

1. Put-call parity condition:
   \[ S + P = PV(E) + C \]  
   \[ \text{[25.2]} \]

2. The Black-Scholes call option formula:
   \[ C = S \times N(d_1) - E \times e^{-rt} \times N(d_2) \]  
   where
   \[ d_1 = \frac{\ln(S/E) + (R + \sigma^2/2) \times t}{\sigma \times \sqrt{t}} \]  
   \[ d_2 = d_1 - \sigma \times \sqrt{t} \]  
   \[ \text{[25.5]} \]

3. Value of a risk-free bond:
   \[ C_0 = S_0 - E/(1 + R_f) \]  
   Value of risky bond + Put option  
   \[ \text{[25.7]} \]

CHAPTER 26

4. The NPV of a merger:
   \[ NPV = V_a - \text{Cost to Firm A of the acquisition} \]  
   \[ \text{[26.1]} \]