APPENDIX C

Selected Equations and Data

CHAPTER 1

$$\text{Value} = \frac{FCF_1}{(1+WACC)^1} + \frac{FCF_2}{(1+WACC)^2} + \frac{FCF_3}{(1+WACC)^3} + \cdots + \frac{FCF_\infty}{(1+WACC)^\infty}$$

CHAPTER 2

EBIT = Earnings before interest and taxes = Sales revenues − Operating costs

$$\begin{aligned}\text{EBITDA} &= \text{Earnings before interest, taxes, depreciation and amortization}\\ &= \text{EBIT} + \text{Depreciation} + \text{Amortization}\end{aligned}$$

Net cash flow = Net income + Depreciation and amortization

$$\begin{aligned}\text{NOWC} &= \text{Net operating working capital}\\ &= \text{Operating current assets} - \text{Operating current liabilities}\\ &= \left(\begin{array}{c}\text{Cash} + \text{Accounts receivable}\\ + \text{Inventories}\end{array}\right) - \left(\begin{array}{c}\text{Accounts payable}\\ + \text{Accruals}\end{array}\right)\end{aligned}$$

Total net operating capital = Net operating working capital + Operating long-term assets

NOPAT = Net operating profit after taxes = EBIT(1 − Tax rate)

$$\begin{aligned}\text{Free cash flow (FCF)} &= \text{NOPAT} - \text{Net investment in operating capital}\\ &= \text{NOPAT} - \left(\begin{array}{c}\text{Current year's total}\\ \text{net operating capital}\end{array} - \begin{array}{c}\text{Previous year's total}\\ \text{net operating capital}\end{array}\right)\end{aligned}$$

Operating cash flow = NOPAT + Depreciation and amortization

$$\begin{array}{c}\text{Gross investment in}\\ \text{operating capital}\end{array} = \begin{array}{c}\text{Net investment}\\ \text{in operating capital}\end{array} + \text{Depreciation}$$

$$\text{FCF} = \text{Operating cash flow} - \frac{\text{Gross investment}}{\text{in operating capital}}$$

$$\text{Return on invested capital (ROIC)} = \frac{\text{NOPAT}}{\text{Total net operating capital}}$$

$$\begin{aligned}\text{MVA} &= \text{Market value of stock} - \text{Equity capital supplied by shareholders}\\ &= (\text{Shares outstanding})(\text{Stock price}) - \text{Total common equity}\\ \text{MVA} &= \text{Total market value} - \text{Total investor-supplied capital}\\ &= \begin{pmatrix}\text{Market value of stock}\\ + \text{Market value of debt}\end{pmatrix} - \text{Total investor-supplied capital}\end{aligned}$$

$$\begin{aligned}\text{EVA} &= \begin{pmatrix}\text{Net operating profit}\\ \text{after taxes(NOPAT)}\end{pmatrix} - \begin{pmatrix}\text{After-tax dollar cost of capital}\\ \text{used to support operations}\end{pmatrix}\\ &= \text{EBIT}(1-\text{Tax rate}) - (\text{Total net operating capital})(\text{WACC})\\ \text{EVA} &= (\text{Total net operating capital})(\text{ROIC} - \text{WACC})\end{aligned}$$

Chapter 3

$$\text{Current ratio} = \frac{\text{Current assets}}{\text{Current liabilities}}$$

$$\text{Quick, or acid test, ratio} = \frac{\text{Current assets} - \text{Inventories}}{\text{Current liabilities}}$$

$$\text{Inventory turnover ratio} = \frac{\text{Sales}}{\text{Inventories}}$$

$$\text{DSO} = \text{Days sales outstanding} = \frac{\text{Receivables}}{\text{Average sales per day}} = \frac{\text{Receivables}}{\text{Annual sales}/365}$$

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

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

$$\text{Debt ratio} = \frac{\text{Total liabilities}}{\text{Total assets}}$$

$$\text{Market debt ratio} = \frac{\text{Total liabilities}}{\text{Total liabilities} + \text{Market value of equity}}$$

$$\text{Debt-to-equity ratio} = \frac{\text{Total liabilities}}{\text{Total assets} - \text{Total liabilities}}$$

$$\text{Debt-to-equity} = \frac{\text{Debt ratio}}{1 - \text{Debt ratio}} \text{ and Debt ratio} = \frac{\text{Debt-to-equity}}{1 + \text{Debt-to-equity}}$$

$$\text{Equity multiplier} = \frac{\text{Total assets}}{\text{Common equity}}$$

$$\text{Debt ratio} = 1 - \frac{1}{\text{Equity multiplier}}$$

$$\text{Times-interest-earned (TIE) ratio} = \frac{\text{EBIT}}{\text{Interest charges}}$$

$$\text{EBITDA coverage ratio} = \frac{\text{EBITDA} + \text{Lease payments}}{\text{Interest} + \text{Principal payments} + \text{Lease payments}}$$

$$\text{Net profit margin} = \frac{\text{Net income available to common stockholders}}{\text{Sales}}$$

$$\text{Operating profit margin} = \frac{\text{EBIT}}{\text{Sales}}$$

$$\text{Gross profit margin} = \frac{\text{Sales} - \text{Cost of goods sold}}{\text{Sales}}$$

$$\text{Return on total assets (ROA)} = \frac{\text{Net income available to common stockholders}}{\text{Total assets}}$$

$$\text{Basic earning power (BEP) ratio} = \frac{\text{EBIT}}{\text{Total assets}}$$

$$\text{ROA} = \text{Profit margin} \times \text{Total assets turnover} = \frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Total assets}}$$

$$\text{Return on common equity (ROE)} = \frac{\text{Net income available to common stockholders}}{\text{Common equity}}$$

$$\begin{aligned}\text{ROE} &= \text{ROA} \times \text{Equity multiplier} \\ &= \text{Profit margin} \times \text{Total assets turnover} \times \text{Equity multiplier} \\ &= \frac{\text{Net income}}{\text{Sales}} \times \frac{\text{Sales}}{\text{Total assets}} \times \frac{\text{Total assets}}{\text{Common equity}}\end{aligned}$$

$$\text{Price/earnings (P/E) ratio} = \frac{\text{Price per share}}{\text{Earnings per share}}$$

$$\text{Price/cash flow ratio} = \frac{\text{Price per share}}{\text{Cash flow per share}}$$

$$\text{Book value per share} = \frac{\text{Common equity}}{\text{Shares outstanding}}$$

$$\text{Market/book (M/B) ratio} = \frac{\text{Market price per share}}{\text{Book value per share}}$$

Chapter 4

$$FV_N = PV(1 + I)^N$$

$$PV = \frac{FV_N}{(1 + I)^N}$$

$$FVA_N = PMT\left[\frac{(1+I)^N}{I} - \frac{1}{I}\right] = PMT\left[\frac{(1+I)^N - 1}{I}\right]$$

$$FVA_{due} = FVA_{ordinary}(1+I)$$

$$PVA_N = PMT\left[\frac{1}{I} - \frac{1}{I(1+I)^N}\right] = PMT\left[\frac{1 - \frac{1}{(1+I)^N}}{I}\right]$$

$$PVA_{Due} = PVA_{Ordinary}(1+I)$$

$$\text{PV of a perpetuity} = \frac{PMT}{I}$$

$$PV_{\text{Uneven stream}} = \sum_{t=1}^{N} \frac{CF_t}{(1+I)^t}$$

$$FV_{\text{Uneven stream}} = \sum_{t=1}^{N} CF_t(1+I)^{N-t}$$

$$I_{PER} = \frac{I_{NOM}}{M}$$

$$APR = (I_{PER})M$$

$$\text{Number of periods} = NM$$

$$FV_N = PV(1+I_{PER})^{\text{Number of periods}} = PV\left(1 + \frac{I_{NOM}}{M}\right)^{MN}$$

$$EFF\% = \left(1 + \frac{I_{NOM}}{M}\right)^{M} - 1.0$$

Chapter 5

$$V_B = \sum_{t=1}^{N} \frac{INT}{(1+r_d)^t} + \frac{M}{(1+r_d)^N}$$

$$\text{Semiannual payments: } V_B = \sum_{t=1}^{2N} \frac{INT/2}{(1+r_d/2)^t} + \frac{M}{(1+r_d/2)^{2N}}$$

$$\text{Yield to maturity: Bond price} = \sum_{t=1}^{N} \frac{INT}{(1+YTM)^t} + \frac{M}{(1+YTM)^N}$$

$$\text{Price of callable bond (if called at N)} = \sum_{t=1}^{N} \frac{INT}{(1+r_d)^t} + \frac{\text{Call price}}{(1+r_d)^N}$$

$$\text{Current yield} = \frac{\text{Annual interest}}{\text{Bond's current price}}$$

$$\text{Current yield} + \text{Capital gains yield} = \text{Yield to maturity}$$

$$r_d = r^* + IP + DRP + LP + MRP$$

$$r_{RF} = r^* + IP$$

$$r_d = r_{RF} + DRP + LP + MRP$$

$$IP_N = \frac{I_1 + I_2 + \cdots + I_N}{N}$$

CHAPTER 6

$$\text{Expected rate of return} = \hat{r} = \sum_{i=1}^{n} P_i r_i$$

$$\text{Historical average, } \bar{r}_{Avg} = \frac{\sum_{t=1}^{n} \bar{r}_t}{n}$$

$$\text{Variance} = \sigma^2 = \sum_{i=1}^{n} (r_i - \hat{r})^2 P_i$$

$$\text{Standard deviation} = \sigma = \sqrt{\sum_{i=1}^{n} (r_i - \hat{r})^2 P_i}$$

$$\text{Historical estimated } \sigma = S = \sqrt{\frac{\sum_{t=1}^{n} (\bar{r}_t - \bar{r}_{Avg})^2}{n-1}}$$

$$CV = \sigma / \hat{r}$$

$$\hat{r}_p = \sum_{i=1}^{n} w_i \hat{r}_i$$

$$\sigma_p = \sqrt{\sum_{i=1}^{n} (r_{pi} - \hat{r}_p)^2 P_i}$$

$$\text{Estimated } \rho = R = \frac{\sum_{t=1}^{n} (\bar{r}_{i,t} - \bar{r}_{i,Avg})(\bar{r}_{j,t} - \bar{r}_{j,Avg})}{\sqrt{\sum_{t=1}^{n} (\bar{r}_{i,t} - \bar{r}_{i,Avg})^2 \sum_{t=1}^{n} (\bar{r}_{j,t} - \bar{r}_{j,Avg})^2}}$$

$$COV_{iM} = \rho_{iM} \sigma_i \sigma_M$$

$$b_i = \left(\frac{\sigma_i}{\sigma_M} \right) \rho_{iM} = \frac{COV_{iM}}{\sigma_M^2}$$

$$b_p = \sum_{i=1}^{n} w_i b_i$$

Required return on stock market $= r_M$
Market risk premium $= RP_M = r_M - r_{RF}$
$RP_i = (r_M - r_{RF}) b_i = (RP_M) b_i$
$SML = r_i = r_{RF} + (r_M - r_{RF}) b_i = r_{RF} + RP_M b_i$

CHAPTER 7

$$\hat{P}_0 = \text{PV of expected future dividends} = \sum_{t=1}^{\infty} \frac{D_t}{(1 + r_s)^t}$$

$$\text{Constant growth: } \hat{P}_0 = \frac{D_0(1+g)}{r_s - g} = \frac{D_1}{r_s - g}$$

$$\hat{r}_s = \frac{D_1}{P_0} + g$$

$$\text{Capital gains yield} = \frac{\hat{P}_1 - P_0}{P_0}$$

$$\text{Dividend yield} = \frac{D_1}{P_0}$$

$$\text{For a zero growth stock, } \hat{P}_0 = \frac{D}{r_s}$$

$$\text{Horizon value} = \text{Terminal value} = \hat{P}_N = \frac{D_{N+1}}{r_s - g}$$

$$V_{ps} = \frac{D_{ps}}{r_{ps}}$$

$$\hat{r}_{ps} = \frac{D_{ps}}{V_{ps}}$$

$$\tilde{r}_s = \text{Actual dividend yield} + \text{Actual capital gains yield}$$

Chapter 8

$$\text{Exercise value} = \text{MAX}[\text{Current price of stock} - \text{Strike price}, 0]$$

$$\text{Number of stock shares in hedged portfolio} = N = \frac{C_u - C_d}{P_u - P_d}$$

$$V_C = P[N(d_1)] - Xe^{-r_{RF}t}[N(d_2)]$$

$$d_1 = \frac{\ln(P/X) + [r_{RF} + (\sigma^2/2)]t}{\sigma\sqrt{t}}$$

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

$$\text{Put–call parity: Put option} = V_C - P + Xe^{-r_{RF}t}$$

$$V \text{ of put} = P[N(d_1) - 1] - Xe^{-r_{RF}t}[N(d_2) - 1]$$

Chapter 9

$$\text{After-tax component cost of debt} = r_d(1 - T)$$

$$M(1\text{–}F) = \sum_{t=1}^{N} \frac{INT(1 - T)}{[1 + r_d(1 - T)]^t} + \frac{M}{[1 + r_d(1 - T)]^N}$$

$$r_{ps} = \frac{D_{ps}}{P_{ps}(1 - F)}$$

$$\text{Market equilibrium: } \begin{matrix}\text{Expected} \\ \text{rate of return}\end{matrix} = \hat{r}_M = \frac{D_1}{P_0} + g = r_{RF} + RP_M = r_M = \begin{matrix}\text{Required} \\ \text{rate of return}\end{matrix},$$

where D_1, P_0, and g are for the market, not an individual company

Rep/Div = ratio of payouts via repurchases to payouts via dividends

$r_M = \hat{r}_M = (1 + \text{Rep/Div})\frac{D_1}{P_0} + g$, where g is long-term growth rate in total payouts for the market and where D_1 and P_0 are for the market, not an individual company

CAPM: $r_s = r_{RF} + b_i(RP_M)$

DCF: $r_s = \hat{r}_s = \frac{D_1}{P_0}$ + Expected g in dividends per share

$$r_s = \begin{matrix}\text{Company's own} \\ \text{bond yield}\end{matrix} + \begin{matrix}\text{Judgmental} \\ \text{risk premium}\end{matrix}$$

g = (Retention rate)(ROE) = (1.0 – Payout rate)(ROE)

$$r_e = \hat{r}_e = \frac{D_1}{P_0(1-F)} + g$$

$WACC = w_d r_d(1 - T) + w_{ps}r_{ps} + w_s r_s$

Chapter 10

$$NPV = CF_0 + \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \cdots + \frac{CF_N}{(1+r)^N}$$

$$= \sum_{t=0}^{N} \frac{CF_t}{(1+r)^t}$$

$$\text{IRR: } CF_0 + \frac{CF_1}{(1+IRR)^1} + \frac{CF_2}{(1+IRR)^2} + \cdots + \frac{CF_N}{(1+IRR)^N} = 0$$

$$NPV = \sum_{t=0}^{N} \frac{CF_t}{(1+IRR)^t} = 0$$

MIRR: PV of costs = PV of terminal value

$$\sum_{t=0}^{N} \frac{COF_t}{(1+r)^t} = \frac{\sum_{t=0}^{N} CIF_t(1+r)^{N-t}}{(1+MIRR)^N}$$

$$\text{PV of costs} = \frac{\text{Terminal value}}{(1+MIRR)^N}$$

$$PI = \frac{\text{PV of future cash flows}}{\text{Initial cost}} = \frac{\sum_{t=1}^{N} \frac{CF_t}{(1+r)^t}}{CF_0}$$

$$\text{Payback} = \begin{matrix}\text{Number of} \\ \text{years prior to} \\ \text{full recovery}\end{matrix} + \frac{\begin{matrix}\text{Unrecovered cost} \\ \text{at start of year}\end{matrix}}{\begin{matrix}\text{Cash flow during} \\ \text{full recovery year}\end{matrix}}$$

Chapter 11

$$\text{Project cash flow} = \text{FCF} = \begin{matrix}\text{Investment outlay}\\ \text{cash flow}\end{matrix} + \begin{matrix}\text{Operating}\\ \text{cash flow}\end{matrix} + \begin{matrix}\text{NOWC}\\ \text{cash flow}\end{matrix} + \begin{matrix}\text{Salvage}\\ \text{cash flow}\end{matrix}$$

$$\text{Expected NPV} = \sum_{i=1}^{n} P_i(NPV_i)$$

$$\sigma_{NPV} = \sqrt{\sum_{i=1}^{n} P_i(NPV_i - \text{Expected NPV})^2}$$

$$CV_{NPV} = \frac{\sigma_{NPV}}{E(NPV)}$$

Chapter 12

$$\begin{matrix}\text{Additional}\\ \text{funds}\\ \text{needed}\end{matrix} = \begin{matrix}\text{Required}\\ \text{asset}\\ \text{increase}\end{matrix} - \begin{matrix}\text{Spontaneous}\\ \text{liability}\\ \text{increase}\end{matrix} - \begin{matrix}\text{Increase in}\\ \text{retained}\\ \text{earnings}\end{matrix}$$

$$\text{AFN} = (A^*/S_0)\Delta S - (L^*/S_0)\Delta S - MS_1(1 - \text{Payout ratio})$$

$$\begin{matrix}\text{Full}\\ \text{capacity}\\ \text{sales}\end{matrix} = \frac{\text{Actual sales}}{\begin{matrix}\text{Percentage of capacity}\\ \text{at which fixed assets}\\ \text{were operated}\end{matrix}}$$

$$\text{Target fixed assets/Sales} = \frac{\text{Actual fixed assets}}{\text{Full capacity sales}}$$

$$\begin{matrix}\text{Required level}\\ \text{of fixed assets}\end{matrix} = (\text{Target fixed assets/Sales})(\text{Projected sales})$$

Chapter 13

$$V_{op} = \text{Value of operations} = \text{PV of expected future free cash flows}$$

$$= \sum_{t=1}^{\infty} \frac{FCF_1}{(1 + WACC)^t}$$

$$\text{Horizon value: } V_{op(\text{at time N})} = \frac{FCF_{N+1}}{WACC - g} = \frac{FCF_N(1 + g)}{WACC - g}$$

$$\text{Total value} = V_{op} + \text{Value of nonoperating assets}$$

$$\text{Value of equity} = \text{Total value} - \text{Preferred stock} - \text{Debt}$$

$$\text{Operating profitability (OP)} = \text{NOPAT/Sales}$$

$$\text{Capital requirements (CR)} = \text{Operating capital/Sales}$$

$$\begin{aligned}\text{EROIC}_t &= \text{Expected return on invested capital}\\ &= \text{NOPAT}_{t+1}/\text{Capital}_t\\ &= \text{NOPAT}_t(1+g)/\text{Capital}_t\\ &= \text{OP}_{t+1}/\text{CR}_t\end{aligned}$$

For constant growth:

$$\begin{aligned}V_{\text{op(at time N)}} &= \text{Capital}_N + \left[\frac{\text{Sales}_N(1+g)}{\text{WACC}-g}\right]\left[\text{OP} - \text{WACC}\left(\frac{\text{CR}}{1+g}\right)\right]\\ &= \text{Capital}_N + \frac{\text{Capital}_N(\text{EROIC}_N - \text{WACC})}{\text{WACC}-g}\\ &= \text{Capital}_N + \frac{\text{Capital}_N\left(\frac{\text{OP}_{N+1}}{\text{CR}_N} - \text{WACC}\right)}{\text{WACC}-g}\end{aligned}$$

Chapter 14

Residual distribution = Net income − [(Target equity ratio)(Total capital budget)]

$$\text{Number of shares repurchased} = n_{\text{Prior}} - n_{\text{Post}} = \frac{\text{Cash}_{\text{Rep}}}{P_{\text{Prior}}}$$

$$n_{\text{Post}} = n_{\text{Prior}} - \frac{\text{Cash}_{\text{Rep}}}{P_{\text{Prior}}} = n_{\text{Prior}} - \frac{\text{Cash}_{\text{Rep}}}{S_{\text{Prior}}/n_{\text{Prior}}} = n_{\text{Prior}}\left(1 - \frac{\text{Cash}_{\text{Rep}}}{S_{\text{Prior}}}\right)$$

Chapter 15

$$V_{\text{op}} = \sum_{t=1}^{\infty}\frac{\text{FCF}_t}{(1+\text{WACC})^t}$$

$$\text{WACC} = w_d(1-T)r_d + w_s r_s$$

$$\text{ROIC} = \frac{\text{NOPAT}}{\text{Capital}} = \frac{\text{EBIT}(1-T)}{\text{Capital}}$$

$$\text{EBIT} = PQ - VQ - F$$

$$Q_{BE} = \frac{F}{P-V}$$

$$V_L = D + S$$

MM, no taxes: $V_L = V_U$

MM, corporate taxes: $V_L = V_U + TD$

Miller, corporate and personal taxes: $V_L = V_U + \left[1 - \frac{(1-T_c)(1-T_s)}{(1-T_d)}\right]D$

$$b = b_U[1 + (1-T)(D/S)]$$

$$b_U = b/[1 + (1-T)(D/S)]$$

$$r_s = r_{RF} + RP_M(b)$$

$r_s = r_{RF}$ + Premium for business risk + Premium for financial risk

If $g = 0$: $V_{op} = \frac{FCF}{WACC} = \frac{NOPAT}{WACC} = \frac{EBIT(1 - T)}{WACC}$

Total corporate value = V_{op} + Value of short-term investments

S = Total corporate value − Value of all debt

$D = w_d V_{op}$

$S = (1 - w_d)V_{op}$

Cash raised by issuing debt = $D - D_0$

$P_{Prior} = S_{Prior}/n_{Prior}$

$P_{Post} = P_{Prior}$

$$n_{Post} = n_{Prior}\left[\frac{V_{opNew} - D_{New}}{V_{opNew} - D_{Old}}\right]$$

$$n_{Post} = n_{Prior} - (D_{New} - D_{Old})/P_{Prior}$$

$$P_{Post} = \frac{V_{opNew} - D_{Old}}{n_{Prior}}$$

$NI = (EBIT - r_d D)(1 - T)$

$EPS = NI/n$

Chapter 16

$$\text{Inventory conversion period} = \frac{\text{Inventory}}{(\text{Cost of goods sold})/365}$$

$$\text{Receivables collection period} = \text{DSO} = \frac{\text{Receivables}}{\text{Sales}/365}$$

$$\text{Payables deferral period} = \frac{\text{Payables}}{(\text{Cost of goods sold})/365}$$

$$\begin{array}{c}\text{Cash} \\ \text{conversion} \\ \text{cycle}\end{array} = \begin{array}{c}\text{Inventory} \\ \text{conversion} \\ \text{period}\end{array} + \begin{array}{c}\text{Average} \\ \text{collection} \\ \text{period}\end{array} - \begin{array}{c}\text{Payables} \\ \text{deferral} \\ \text{period}\end{array}$$

$$\begin{array}{c}\text{Accounts} \\ \text{receivable}\end{array} = \begin{array}{c}\text{Credit sales} \\ \text{per day}\end{array} \times \begin{array}{c}\text{Length of} \\ \text{collection period}\end{array}$$

$$\text{ADS} = \frac{(\text{Units sold})(\text{Sales price})}{365} = \frac{\text{Annual sales}}{365}$$

Receivables = (ADS)(DSO)

$$\begin{array}{c}\text{Nominal annual cost} \\ \text{of trade credit}\end{array} = \frac{\text{Discount percentage}}{100 - \begin{array}{c}\text{Discount} \\ \text{percentage}\end{array}} \times \frac{365}{\begin{array}{c}\text{Days credit is} \\ \text{outstanding}\end{array} - \begin{array}{c}\text{Discount} \\ \text{period}\end{array}}$$

Chapter 17

$$\text{Single-period interest rate parity}: \frac{\text{Forward exchange rate}}{\text{Spot exchange rate}} = \frac{1 + r_h}{1 + r_f}$$

$$\text{Expected t-year forward exchange rate} = (\text{Spot rate})\left(\frac{1 + r_h}{1 + r_f}\right)^t$$

$$P_h = (P_f)(\text{Spot rate})$$

$$\text{Spot rate} = \frac{P_h}{P_f}$$

Chapter 18

NAL = PV cost of owning – PV cost of leasing

Chapter 19

$$\text{Price paid for bond with warrants} = \text{Straight-debt value of bond} + \text{Value of warrants}$$

$$\text{Conversion price} = P_c = \frac{\text{Par value of bond given up}}{\text{Shares received}} = \frac{\text{Par value of bond given up}}{CR}$$

$$\text{Conversion ratio} = CR = \frac{\text{Par value of bond given up}}{P_c}$$

Chapter 20

Amount left on table = (Closing price – Offer price)(Number of shares)

Chapter 21

$$r_{sL} = r_{sU} + (r_{sU} - r_d)(D/S)$$

$$r_{sU} = w_s r_{sL} + w_d r_d$$

Tax savings = (Interest expense)(Tax rate)

$$\text{Horizon value of unlevered firm} = HV_{U,N} = \frac{FCF_{N+1}}{r_{sU} - g} = \frac{FCF_N(1 + g)}{r_{sU} - g}$$

$$\text{Horizon value of tax shield} = HV_{TS,N} = \frac{TS_{N+1}}{r_{sU} - g} = \frac{TS_N(1 + g)}{r_{sU} - g}$$

$$V_{\text{Unlevered}} = \sum_{t=1}^{N} \frac{FCF_t}{(1 + r_{sU})^t} + \frac{HV_{U,N}}{(1 + r_{sU})^N}$$

$$V_{\text{Tax shield}} = \sum_{t=1}^{N} \frac{TS_t}{(1 + r_{sU})^t} + \frac{HV_{TS,N}}{(1 + r_{sU})^N}$$

$$\text{Value of operations} = V_{op} = V_{\text{Unlevered}} + V_{\text{Tax shield}}$$

$$\text{FCFE} = \begin{matrix}\text{Free} \\ \text{cash flow}\end{matrix} - \begin{matrix}\text{After-tax} \\ \text{interest expense}\end{matrix} - \begin{matrix}\text{Principal} \\ \text{payments}\end{matrix} + \begin{matrix}\text{Newly issued} \\ \text{debt}\end{matrix}$$

$$= \begin{matrix}\text{Free} \\ \text{cash flow}\end{matrix} - \begin{matrix}\text{Interest} \\ \text{expense}\end{matrix} + \begin{matrix}\text{Interest} \\ \text{tax shield}\end{matrix} + \begin{matrix}\text{Net change} \\ \text{in debt}\end{matrix}$$

$$\text{FCFE} = \text{Net income} - \begin{matrix}\text{Net investment in} \\ \text{operating capital}\end{matrix} + \begin{matrix}\text{Net change} \\ \text{in debt}\end{matrix}$$

$$HV_{FCFE,N} = \frac{FCFE_{N+1}}{r_{sL} - g} = \frac{FCFE_N(1 + g)}{r_{sL} - g}$$

$$V_{FCFE} = \sum_{t=1}^{N} \frac{FCFE_t}{(1 + r_{sL})^t} + \frac{HV_{FCFE,N}}{(1 + r_{sL})^N}$$

$$S = V_{FCFE} + \text{Nonoperating assets}$$

$$\frac{\text{Total value of shares to target shareholders}}{\text{Total post-merger value of equity}} = \begin{matrix}\text{Percent required by} \\ \text{target stockholders}\end{matrix} = \frac{n_{New}}{n_{New} + n_{Old}}$$

Chapter 24

$$\hat{r}_p = w_A \hat{r}_A + (1 - w_A)\hat{r}_B$$

$$\text{Portfolio SD} = \sigma_p = \sqrt{w_A^2\sigma_A^2 + (1 - w_A)^2\sigma_B^2 + 2w_A(1 - w_A)\rho_{AB}\sigma_A\sigma_B}$$

$$\text{Minimum-risk portfolio: } w_A = \frac{\sigma_B(\sigma_B - \rho_{AB}\sigma_A)}{\sigma_A^2 + \sigma_B^2 - 2\rho_{AB}\sigma_A\sigma_B}$$

$$\hat{r}_p = \sum_{i=1}^{N} (w_i \hat{r}_i)$$

$$\sigma_p^2 = \sum_{i=1}^{N} \sum_{j=1}^{N} (w_i\, w_j\, \sigma_i\, \sigma_j\, \rho_{ij})$$

$$\sigma_p^2 = \sum_{i=1}^{N} w_i^2\, \sigma_i^2 + \sum_{i=1}^{N} \sum_{\substack{j=1 \\ j \neq i}}^{N} w_i\, \sigma_i\, w_j\, \sigma_j\, \sigma_{ij}$$

$$\sigma_p = \sqrt{(1 - w_{RF})^2\sigma_M^2} = (1 - w_{RF})\sigma_M$$

$$\text{CML: } \hat{r}_p = r_{RF} + \left(\frac{\hat{r}_M - r_{RF}}{\sigma_M}\right)\sigma_p$$

$$r_i = r_{RF} + \frac{(r_M - r_{RF})}{\sigma_M}\left(\frac{Cov(r_i, r_M)}{\sigma_M}\right) = r_{RF} + (r_M - r_{RF})\left(\frac{Cov(r_i, r_M)}{\sigma_M^2}\right)$$

$$b_i = \frac{\text{Covariance between Stock i and the market}}{\text{Variance of market returns}} = \frac{Cov(r_i, r_M)}{\sigma_M^2} = \frac{\rho_{iM}\sigma_i\sigma_M}{\sigma_M^2} = \rho_{iM}\left(\frac{\sigma_i}{\sigma_M}\right)$$

$$SML = r_i = r_{RF} + (r_M - r_{RF})b_i = r_{RF} + (RP_M)b_i$$

$$\sigma_i^2 = b_i^2\sigma_M^2 + \sigma_{e_i}^2$$

APT: $r_i = r_{RF} + (r_1 - r_{RF})b_{i1} + \cdots + (r_j - r_{RF})b_{ij}$

Fama-French: $r_i = r_{RF} + a_i + b_i(r_M - r_{RF}) + c_i(r_{SMB}) + d_i(r_{HML})$

Chapter 25

$$CV = \frac{\sigma(\text{PV of future CF})}{E(\text{PV of future CF})}$$

Variance of project's rate of return: $\sigma^2 = \frac{\ln(CV^2 + 1)}{t}$

Chapter 26

MM, no taxes:

$$V_L = V_U = \frac{EBIT}{WACC} = \frac{EBIT}{r_{sU}}$$

$$r_{sL} = r_{sU} + \text{Risk premium} = r_{sU} + (r_{sU} - r_d)(D/S)$$

MM, corporate taxes:

$$V_L = V_U + TD$$

$$V_U = S = \frac{EBIT(1 - T)}{r_{sU}}$$

$$r_{sL} = r_{sU} + (r_{sU} - r_d)(1 - T)(D/S)$$

Miller, personal taxes:

$$V_U = \frac{EBIT(1 - T_c)}{r_{sU}} = \frac{EBIT(1 - T_c)(1 - T_s)}{r_{sU}(1 - T_s)}$$

$$CF_L = (EBIT - I)(1 - T_c)(1 - T_s) + I(1 - T_d)$$

$$V_L = V_U + \left[1 - \frac{(1 - T_c)(1 - T_s)}{(1 - T_d)}\right]D$$

Ehrhardt & Daves, impact of growth:

$$V_U = \frac{FCF}{r_{sU} - g}$$

General case:

$$V_L = V_U + V_{Tax\ shield}$$

$$V_{Tax\ shield} = \frac{r_d TD}{r_{TS} - g}$$

$$V_L = V_U + \left(\frac{r_d}{r_{TS} - g}\right) TD$$

Case for $r_{TS} = r_{sU}$:

$$V_L = V_U + \left(\frac{r_d TD}{r_{sU} - g}\right)$$

$$r_{sL} = r_{sU} + (r_{sU} - r_d)\frac{D}{S}$$

$$b = b_U + (b_U - b_D)\frac{D}{S}$$