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1 Valuation

$$\text{FCFE} = \text{NI} - (1 - \text{TDR}) \cdot (\text{CAPX} - \text{D} - (\text{CA} - \text{CL}))$$

FCFE: free cash flow to equity

NI: net income

TDR: target debt ratio

CAPX: capital expenditure

D: depreciation

CA: current assets

CL: current liabilities

$$\text{FCFF} = \text{EBIT} \cdot (1 - \text{CTR}) + \text{B} - \text{CAPX} - (\text{CA} - \text{CL})$$

FCFF: free cash flow to firm

EBIT: earnings before interest and taxes

CTR: corporate tax rate

B: debt

$$\beta_\text{L} = \beta_\text{U} \cdot \left(1 + (1 - \text{CTR}) \cdot \frac{\text{MVB}}{\text{MVE}}\right)$$

β_L: levered beta

β_U: unlevered beta

MVB: market value of debt

MVE: market value of equity

$$\text{CE} = RFR + \beta_\text{L} \cdot \text{ERP}$$

CE: cost of equity

RFR: risk-free rate

ERP: equity risk premium

$$\text{ERPT} = (1 + \text{ERPS}) \cdot \left(\frac{1 + \text{IT}}{1 + \text{IS}}\right) - 1$$

ERPT: equity risk premium of target

ERPS: equity risk premium of source

IT: inflation of target

IS: inflation of source

$$\text{WACC} = \frac{\text{MVE}}{\text{MVE} + \text{MVB}} \cdot \text{CE} + \frac{\text{MVB}}{\text{MVE} + \text{MVB}} \cdot \text{CB} \cdot (1 - \text{CTR})$$

WACC: weighted average cost of capital

CB: pre-tax cost of debt

$$\text{FCFEGR} = \text{ROE} \cdot \text{FCFERR}$$
$$= \left(\frac{\text{NI}}{\text{BVE}}\right) \cdot \left(1 - \frac{\text{DP}}{\text{NI}}\right)$$

FCFEGR: FCFE growth rate estimate

ROE: return on equity

FCFERR: FCFE retention ratio

BVE: book value of equity

DP: dividends paid

$$\begin{aligned}
\text{FCFFGR} &= \text{ROIC} \cdot \text{FCFFRR} \\
&= \left(\frac{\text{NOPAT}}{\text{IC}} \right) \cdot \left(\frac{\text{CAPX} - \text{D} + (\text{CA} - \text{CL})}{\text{NOPAT}} \right) \\
&= \left(\frac{\text{EBIT} \cdot (1 - \text{ETR})}{\text{IC}} \right) \cdot \left(\frac{\text{CAPX} - \text{D} + (\text{CA} - \text{CL})}{\text{EBIT} \cdot (1 - \text{ETR})} \right) \\
&= \left(\frac{\text{EBIT} \cdot \left(1 - \frac{\text{ITE}}{\text{EBIT}}\right)}{\text{IC}} \right) \cdot \left(\frac{\text{CAPX} - \text{D} + (\text{CA} - \text{CL})}{\text{EBIT} \cdot \left(1 - \frac{\text{ITE}}{\text{EBIT}}\right)} \right)
\end{aligned}$$

FCFFGR: FCFF growth rate estimate

ROIC: return on invested capital

FCFFRR: FCFF reinvestment rate

NOPAT: net operating profit after taxes

IC: invested capital

ETR: effective tax rate

ITE: income tax expense

$$\text{PVE} = \text{PVFCFE} + \text{PVTVFCFE}$$

$$= \left(\sum_{t=1}^{h} \frac{\text{FCFE}_t}{(1+\text{CE})^t} \right) + \text{PVTVFCFE}$$

$$= \left(\sum_{t=1}^{h} \frac{\text{FCFE}_0 \cdot (1+\text{FCFEGR})^t}{(1+\text{CE})^t} \right) + \text{PVTVFCFE}$$

$$= \text{PVFCFE} + \left(\sum_{t=h+1}^{\infty} \frac{\text{FCFE}_t}{(1+\text{CE})^t} \right)$$

$$= \text{PVFCFE} + \left(\sum_{t=h+1}^{\infty} \frac{\text{FCFE}_h \cdot (1+\text{TGR})^{t-h}}{(1+\text{CE})^t} \right)$$

$$= \text{PVFCFE} + \left(\sum_{t=h+1}^{\infty} \frac{\text{FCFE}_h}{(1+\text{CE})^h} \cdot \left(\frac{1+\text{TGR}}{1+\text{CE}} \right)^{t-h} \right)$$

$$= \text{PVFCFE} + \left(\frac{\text{FCFE}_h}{(1+\text{CE})^h} \sum_{k=1}^{\infty} \left(\frac{1+\text{TGR}}{1+\text{CE}} \right)^k \right)$$

$$\stackrel{\text{GGM}}{=} \text{PVFCFE} + \left(\frac{\text{FCFE}_h}{(1+\text{CE})^h} \cdot \frac{\frac{1+\text{TGR}}{1+\text{CE}}}{1 - \frac{1+\text{TGR}}{1+\text{CE}}} \right)$$

$$= \text{PVFCFE} + \left(\frac{\text{FCFE}_h}{(1+\text{CE})^h} \cdot \frac{1+\text{TGR}}{\text{CE} - \text{TGR}} \right)$$

$$= \text{PVFCFE} + \left(\frac{\text{FCFE}_h \cdot (1+\text{TGR})}{(\text{CE} - \text{TGR})} \cdot \frac{1}{(1+\text{CE})^h} \right)$$

$$= \text{PVFCFE} + \left(\frac{\text{FCFE}_{h+1}}{(\text{CE} - \text{TGR})} \cdot \frac{1}{(1+\text{CE})^h} \right)$$

$$= \text{PVFCFE} + \left(\frac{\text{TVFCFE}}{(1+\text{CE})^h} \right)$$

$$= \left(\sum_{t=1}^{h} \frac{\text{FCFE}_0 \cdot (1+\text{FCFEGR})^t}{(1+\text{CE})^t} \right) + \left(\frac{\text{FCFE}_h \cdot (1+\text{TGR})}{(\text{CE} - \text{TGR}) \cdot (1+\text{CE})^h} \right)$$

PVE: present value of equity

PVFCFE: present value of free cash flow to equity

PVTVFCFE: present value of terminal value of free cash flow to firm

h: growth forecast horizon (before terminal growth rate into perpetuity)

GGM: Gordon growth model (closed-form solution of infinite geometric series)

TGR: terminal growth rate

TVFCFE: terminal value of free cash flow to firm

$$\text{PVF} = \text{PVFCFF} + \text{PVTVFCFF}$$

$$= \left(\sum_{t=1}^{h} \frac{\text{FCFF}_t}{(1 + \text{WACC})^t} \right) + \text{PVTVFCFF}$$

$$= \left(\sum_{t=1}^{h} \frac{\text{FCFF}_0 \cdot (1 + \text{FCFFGR})^t}{(1 + \text{WACC})^t} \right) + \text{PVTVFCFF}$$

$$= \text{PVFCFF} + \left(\sum_{t=h+1}^{\infty} \frac{\text{FCFF}_t}{(1 + \text{WACC})^t} \right)$$

$$= \text{PVFCFF} + \left(\sum_{t=h+1}^{\infty} \frac{\text{FCFF}_h \cdot (1 + \text{TGR})^{t-h}}{(1 + \text{WACC})^t} \right)$$

$$= \text{PVFCFF} + \left(\sum_{t=h+1}^{\infty} \frac{\text{FCFF}_h}{(1 + \text{WACC})^h} \cdot \left(\frac{1 + \text{TGR}}{1 + \text{WACC}} \right)^{t-h} \right)$$

$$= \text{PVFCFF} + \left(\frac{\text{FCFF}_h}{(1 + \text{WACC})^h} \sum_{k=1}^{\infty} \left(\frac{1 + \text{TGR}}{1 + \text{WACC}} \right)^{k} \right)$$

$$\overset{\text{GGM}}{=} \text{PVFCFF} + \left(\frac{\text{FCFF}_h}{(1 + \text{WACC})^h} \cdot \frac{\frac{1+\text{TGR}}{1+\text{WACC}}}{1 - \frac{1+\text{TGR}}{1+\text{WACC}}} \right)$$

$$= \text{PVFCFF} + \left(\frac{\text{FCFF}_h}{(1 + \text{WACC})^h} \cdot \frac{1 + \text{TGR}}{\text{WACC} - \text{TGR}} \right)$$

$$= \text{PVFCFF} + \left(\frac{\text{FCFF}_h \cdot (1 + \text{TGR})}{(\text{WACC} - \text{TGR})} \cdot \frac{1}{(1 + \text{WACC})^h} \right)$$

$$= \text{PVFCFF} + \left(\frac{\text{FCFF}_{h+1}}{(\text{WACC} - \text{TGR})} \cdot \frac{1}{(1 + \text{WACC})^h} \right)$$

$$= \text{PVFCFF} + \left(\frac{\text{TVFCFF}}{(1 + \text{WACC})^h} \right)$$

$$= \left(\sum_{t=1}^{h} \frac{\text{FCFF}_0 \cdot (1 + \text{FCFFGR})^t}{(1 + \text{WACC})^t} \right) + \left(\frac{\text{FCFF}_h \cdot (1 + \text{TGR})}{(\text{WACC} - \text{TGR}) \cdot (1 + \text{WACC})^h} \right)$$

PVF: present value of the firm

PVFCFF: present value of free cash flow to firm

PVTVFCFF: present value of terminal value of free cash flow to firm

TVFCFF: terminal value of free cash flow to firm

$$\text{PVE} \approx \text{PVF} - \text{B} + \text{CNOA}$$

CNOA: cash and non-operating assets

$$\text{IVE} = \text{PVE}$$

IVE: intrinsic value of equity

$$\text{IVE} = \text{PVF} - \text{B} + \text{CNOA}$$

$$\text{IVPS} = \frac{\text{IVE}}{\text{SO}}$$

IVPS: intrinsic value per share

SO: shares outstanding

References

A. Damodaran. *Investment Valuation: Tools and Techniques for Determining the Value of Any Asset.* Wiley Finance Series. John Wiley & Sons, Incorporated, Newark, 4th ed edition, 2025. ISBN 978-1-394-25460-6 978-1-394-25461-3.

A. Nag. *Stochastic Finance with Python: Design Financial Models from Probabilistic Perspective.* Apress, Berkeley, CA, 1st ed. 2024 edition, 2024. ISBN 979-8-8688-1052-7. doi: 10.1007/979-8-8688-1052-7.

G. Smith and M. Smith. *The Power of Modern Value Investing: Beyond Indexing, Algos, and Alpha.* Springer Nature Switzerland, Cham, 2023. ISBN 978-3-031-45899-6 978-3-031-45900-9. doi: 10.1007/978-3-031-45900-9.