



# Contents

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# 1 Valuation

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

FCFE: free cash flow to equity

NI: net income

TDR: target debt ratio

CAPX: capital expenditure

D: depreciation

CA: current assets

CL: current liabilities

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

FCFF: free cash flow to firm

EBIT: earnings before interest and taxes

CTR: corporate tax rate

B: debt

$$\beta_L = \beta_U \cdot \left( 1 + (1 - CTR) \cdot \frac{MVB}{MVE} \right)$$

$\beta_L$ : levered beta

$\beta_U$ : unlevered beta

MVB: market value of debt

MVE: market value of equity

$$CE = RFR + \beta_L \cdot ERP$$

CE: cost of equity

RFR: risk-free rate

ERP: equity risk premium

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

ERPT: equity risk premium of target

ERPS: equity risk premium of source

IT: inflation of target

IS: inflation of source

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

WACC: weighted average cost of capital

CB: pre-tax cost of debt

$$\begin{aligned} FCFEGR &= ROE \cdot FCFERR \\ &= \left( \frac{NI}{BVE} \right) \cdot \left( 1 - \frac{DP}{NI} \right) \end{aligned}$$

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

$$\begin{aligned}
\text{PVE} &= \text{PVFCFE} + \text{PVTVFCFE} \\
&= \left( \sum_{t=1}^h \frac{\text{FCFE}_t}{(1 + \text{CE})^t} \right) + \text{PVTVFCFE} \\
&= \left( \sum_{t=1}^h \frac{\text{FCFE}_0 \cdot (1 + \text{FCFEGR})^t}{(1 + \text{CE})^t} \right) + \text{PVTVFCFE} \\
&= \text{PVFCFE} + \left( \sum_{t=h+1}^{\infty} \frac{\text{FCFE}_t}{(1 + \text{CE})^t} \right) \\
&= \text{PVFCFE} + \left( \sum_{t=h+1}^{\infty} \frac{\text{FCFE}_h \cdot (1 + \text{TGR})^{t-h}}{(1 + \text{CE})^t} \right) \\
&= \text{PVFCFE} + \left( \sum_{t=h+1}^{\infty} \frac{\text{FCFE}_h}{(1 + \text{CE})^h} \cdot \left( \frac{1 + \text{TGR}}{1 + \text{CE}} \right)^{t-h} \right) \\
&= \text{PVFCFE} + \left( \frac{\text{FCFE}_h}{(1 + \text{CE})^h} \sum_{k=1}^{\infty} \left( \frac{1 + \text{TGR}}{1 + \text{CE}} \right)^k \right) \\
&\stackrel{\text{GGM}}{=} \text{PVFCFE} + \left( \frac{\text{FCFE}_h}{(1 + \text{CE})^h} \cdot \frac{\frac{1 + \text{TGR}}{1 + \text{CE}}}{1 - \frac{1 + \text{TGR}}{1 + \text{CE}}} \right) \\
&= \text{PVFCFE} + \left( \frac{\text{FCFE}_h}{(1 + \text{CE})^h} \cdot \frac{1 + \text{TGR}}{\text{CE} - \text{TGR}} \right) \\
&= \text{PVFCFE} + \left( \frac{\text{FCFE}_h \cdot (1 + \text{TGR})}{(\text{CE} - \text{TGR})} \cdot \frac{1}{(1 + \text{CE})^h} \right) \\
&= \text{PVFCFE} + \left( \frac{\text{FCFE}_{h+1}}{(\text{CE} - \text{TGR})} \cdot \frac{1}{(1 + \text{CE})^h} \right) \\
&= \text{PVFCFE} + \left( \frac{\text{TVFCFE}}{(1 + \text{CE})^h} \right) \\
&= \left( \sum_{t=1}^h \frac{\text{FCFE}_0 \cdot (1 + \text{FCFEGR})^t}{(1 + \text{CE})^t} \right) + \left( \frac{\text{FCFE}_h \cdot (1 + \text{TGR})}{(\text{CE} - \text{TGR}) \cdot (1 + \text{CE})^h} \right)
\end{aligned}$$

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

$$\begin{aligned}
\text{PVF} &= \text{PVFCFF} + \text{PVTVFCFF} \\
&= \left( \sum_{t=1}^h \frac{\text{FCFF}_t}{(1 + \text{WACC})^t} \right) + \text{PVTVFCFF} \\
&= \left( \sum_{t=1}^h \frac{\text{FCFF}_0 \cdot (1 + \text{FCFFGR})^t}{(1 + \text{WACC})^t} \right) + \text{PVTVFCFF} \\
&= \text{PVFCFF} + \left( \sum_{t=h+1}^{\infty} \frac{\text{FCFF}_t}{(1 + \text{WACC})^t} \right) \\
&= \text{PVFCFF} + \left( \sum_{t=h+1}^{\infty} \frac{\text{FCFF}_h \cdot (1 + \text{TGR})^{t-h}}{(1 + \text{WACC})^t} \right) \\
&= \text{PVFCFF} + \left( \sum_{t=h+1}^{\infty} \frac{\text{FCFF}_h}{(1 + \text{WACC})^h} \cdot \left( \frac{1 + \text{TGR}}{1 + \text{WACC}} \right)^{t-h} \right) \\
&= \text{PVFCFF} + \left( \frac{\text{FCFF}_h}{(1 + \text{WACC})^h} \sum_{k=1}^{\infty} \left( \frac{1 + \text{TGR}}{1 + \text{WACC}} \right)^k \right) \\
&\stackrel{\text{GGM}}{=} \text{PVFCFF} + \left( \frac{\text{FCFF}_h}{(1 + \text{WACC})^h} \cdot \frac{\frac{1 + \text{TGR}}{1 + \text{WACC}}}{1 - \frac{1 + \text{TGR}}{1 + \text{WACC}}} \right) \\
&= \text{PVFCFF} + \left( \frac{\text{FCFF}_h}{(1 + \text{WACC})^h} \cdot \frac{1 + \text{TGR}}{\text{WACC} - \text{TGR}} \right) \\
&= \text{PVFCFF} + \left( \frac{\text{FCFF}_h \cdot (1 + \text{TGR})}{(\text{WACC} - \text{TGR})} \cdot \frac{1}{(1 + \text{WACC})^h} \right) \\
&= \text{PVFCFF} + \left( \frac{\text{FCFF}_{h+1}}{(\text{WACC} - \text{TGR})} \cdot \frac{1}{(1 + \text{WACC})^h} \right) \\
&= \text{PVFCFF} + \left( \frac{\text{TVFCFF}}{(1 + \text{WACC})^h} \right) \\
&= \left( \sum_{t=1}^h \frac{\text{FCFF}_0 \cdot (1 + \text{FCFFGR})^t}{(1 + \text{WACC})^t} \right) + \left( \frac{\text{FCFF}_h \cdot (1 + \text{TGR})}{(\text{WACC} - \text{TGR}) \cdot (1 + \text{WACC})^h} \right)
\end{aligned}$$

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

	FCFE > Price	FCFE ≈ Price	FCFE < Price
FCFF > Price	<b>strong buy:</b> The firm's assets and operations generate more value than what is priced in by the market, and equity holders retain it — low leverage or efficient debt structure.	<b>buy:</b> The firm's assets and operations are underpriced, but excess value is absorbed by debt or reinvestment, leaving equity fairly valued.	<b>caution:</b> The firm's assets and operations are underpriced, but debt or reinvestment absorbs most cash flows — equity claims more than it economically receives.
FCFF ≈ Price	<b>buy:</b> The firm's assets and operations are fairly priced, but equity captures a disproportionately large share — market underprices the equity upside.	<b>hold:</b> The present value of free cash flows — to the firm (before payments to debt holders) and to equity (after them) — is consistent with market prices; no mispricing is evident.	<b>speculative:</b> The business generates enough pre-financing cash flow to justify its market price, but equity holders retain too little after payments to debt holders.
FCFF < Price	<b>caution:</b> The business is overvalued, but equity appears cheap due to temporarily favorable debt terms — value may be unstable under a leveraged structure.	<b>speculative:</b> Equity is fairly priced, but depends on cash flows from a business generating less than what its market price would suggest — any decline in operations could undermine equity value.	<b>avoid:</b> There isn't sufficient cash flow to the business or the equity for the fundamentals to justify the high market price.

## References

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