

## Overview

This is the final part in a three part series on Business Valuation. Parts 1 and 2 discussed calculation of the 'Enterprise Value' by discounting forecast 'Free Cash Flows to the Firm' ('FCFF') at the appropriate discount rate, the 'Weighted Average Cost of Capital' (WACC). This article discusses alternative approaches to discounting, using different measures of income or cash flow:

	Cash flows	Pre / post tax	Discount rate	Value	Page
<b>1</b>	Free Cash Flows to the Firm (FCFF)	Post-tax	Post-tax WACC	Enterprise	3.2
<b>2</b>	Economic Profits + Existing Invested Capital	Post-tax  n / a	Post-tax WACC  n / a	Enterprise	3.4
<b>3</b>	Free Cash Flows to the Firm + Tax cash flows on debt interest	Post-tax  Tax	Pre-tax WACC  Pre-tax WACC	Enterprise  'Capital Cash Flows'	3.6
<b>4</b>	Free Cash Flows to the Firm + Tax cash flows on debt interest	Post-tax  Tax	Ungearred Cost of Equity  Pre-tax Cost of Debt	Enterprise  'Adjusted PV'	3.7
<b>5</b>	Free Cash Flows to Equity	Post-tax	Gearred Cost of Equity	Equity	3.8
<b>6</b>	Residual Income + Existing Book Value of Equity	Post-tax  n / a	Gearred Cost of Equity  n / a	Equity	3.9
<b>7</b>	Dividends	Post-tax	Gearred Cost of Equity	Equity	3.11

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## Notes

1. This is a new version of a paper originally published in September 2025 (now part of a series of three papers). No A.I. was used.

## Alternative DCF Methods

### Method 1: FCFF discounted at the post-tax WACC

Method 1 was discussed in Part 1 of this Valuation Series (see Appendix 3 of that Part for an example). Details of how the WACC is calculated were provided in Part 2. As the debt levels were set as a proportion of the Enterprise Value ('EntV'), the tax shields should be discounted at the ungeared cost of equity and hence re-levering of the beta ignores the tax adjustment  $(1 - t)$  (see Part 2 Appendix 1).

	Forecast Year					
	1	2	3	4	5	
<b>FINANCIALS</b>						
EBITDA	212.18	180.94	173.35	178.55	183.91	
Depreciation	(69.64)	(73.89)	(77.62)	(79.95)	(82.35)	
EBIT	142.54	107.05	95.73	98.60	101.56	
Interest	(10.50)	(10.56)	(10.88)	(11.21)	(11.55)	
Pre-tax profits	132.04	96.49	84.84	87.39	90.01	
Tax	(33.01)	(24.12)	(21.21)	(21.85)	(22.50)	
Post-tax profits	99.03	72.37	63.63	65.54	67.51	
Dividends	(63.62)	(49.08)	(50.92)	(52.45)	(54.02)	
Retained profits	35.41	23.29	12.71	13.09	13.48	
EBITDA	212.18	180.94	173.35	178.55	183.91	
less: capital expenditures	(94.00)	(95.36)	(91.00)	(93.73)	(96.54)	
less: increase in working capital	(11.93)	(6.42)	(4.00)	(4.12)	(4.24)	
less: taxes paid (excluding financing)	(35.63)	(26.76)	(23.93)	(24.65)	(25.39)	
<b>Free Cash Flows to the Firm</b>	<b>70.62</b>	<b>52.39</b>	<b>54.42</b>	<b>56.05</b>	<b>57.73</b>	
Debt cash flows (after tax relief on interest)	(7.00)	(3.31)	(3.50)	(3.60)	(3.71)	
Dividends paid to ordinary shareholders	(63.62)	(49.08)	(50.92)	(52.45)	(54.02)	
Net cash flows	-	-	-	-	-	
EBITDA	212.18	180.94	173.35	178.55	183.91	
Depreciation	(69.64)	(73.89)	(77.62)	(79.95)	(82.35)	
EBIT	142.54	107.05	95.73	98.60	101.56	
less: taxes paid (excluding financing)	(35.63)	(26.76)	(23.93)	(24.65)	(25.39)	
<b>Net Operating Profits After Taxes</b>	<b>106.90</b>	<b>80.29</b>	<b>71.80</b>	<b>73.95</b>	<b>76.17</b>	
Capital expenditures ('capex')	94.00	95.36	91.00	93.73	96.54	
less: replacement capex (depreciation)	(69.64)	(73.89)	(77.62)	(79.95)	(82.35)	
Growth capex	24.36	21.47	13.37	13.78	14.19	
Increase in working capital	11.93	6.42	4.00	4.12	4.24	
New Invested Capital	36.29	27.90	17.38	17.90	18.43	
<b>Free Cash Flows</b>	<b>70.62</b>	<b>52.39</b>	<b>54.42</b>	<b>56.05</b>	<b>57.73</b>	
	Opening					
Fixed assets	400.00	424.36	445.83	459.21	472.98	487.17
Working capital (including operating cash)	115.00	126.93	133.35	137.35	141.47	145.71
<b>Invested Capital</b>	<b>515.00</b>	<b>551.29</b>	<b>579.18</b>	<b>596.56</b>	<b>614.45</b>	<b>632.89</b>
Opening Invested Capital	515.00	515.00	551.29	579.18	596.56	614.45
New Invested Capital	-	36.29	27.90	17.38	17.90	18.43
Closing Invested Capital	515.00	551.29	579.18	596.56	614.45	632.89
Gross debt	150.00	150.88	155.49	160.15	164.95	169.90
Equity	365.00	400.41	423.69	436.41	449.50	462.98
<b>Financial Capital</b>	<b>515.00</b>	<b>551.29</b>	<b>579.18</b>	<b>596.56</b>	<b>614.45</b>	<b>632.89</b>

## DCF VALUATION

	Forecast Year				
	1	2	3	4	5
Free Cash Flows to the Firm	70.62	52.39	54.42	56.05	57.73
Terminal Value	-	-	-	-	849.52
Post-Tax WACC at start of year	10.00%	10.00%	10.00%	10.00%	10.00%
Discount factor	0.9091	0.8264	0.7513	0.6830	0.6209
PV of cash flows today	750.00	64.20	43.30	40.89	38.28
less: market value of debt at valuation date	(150.00)				
Equity Value	600.00				
Enterprise value at year end	750.00	754.38	777.43	800.75	824.77
Debt	(150.00)	(150.88)	(155.49)	(160.15)	(164.95)
Equity	600.00	603.51	621.94	640.60	659.82
Debt / Enterprise Value	20.00%	20.00%	20.00%	20.00%	20.00%

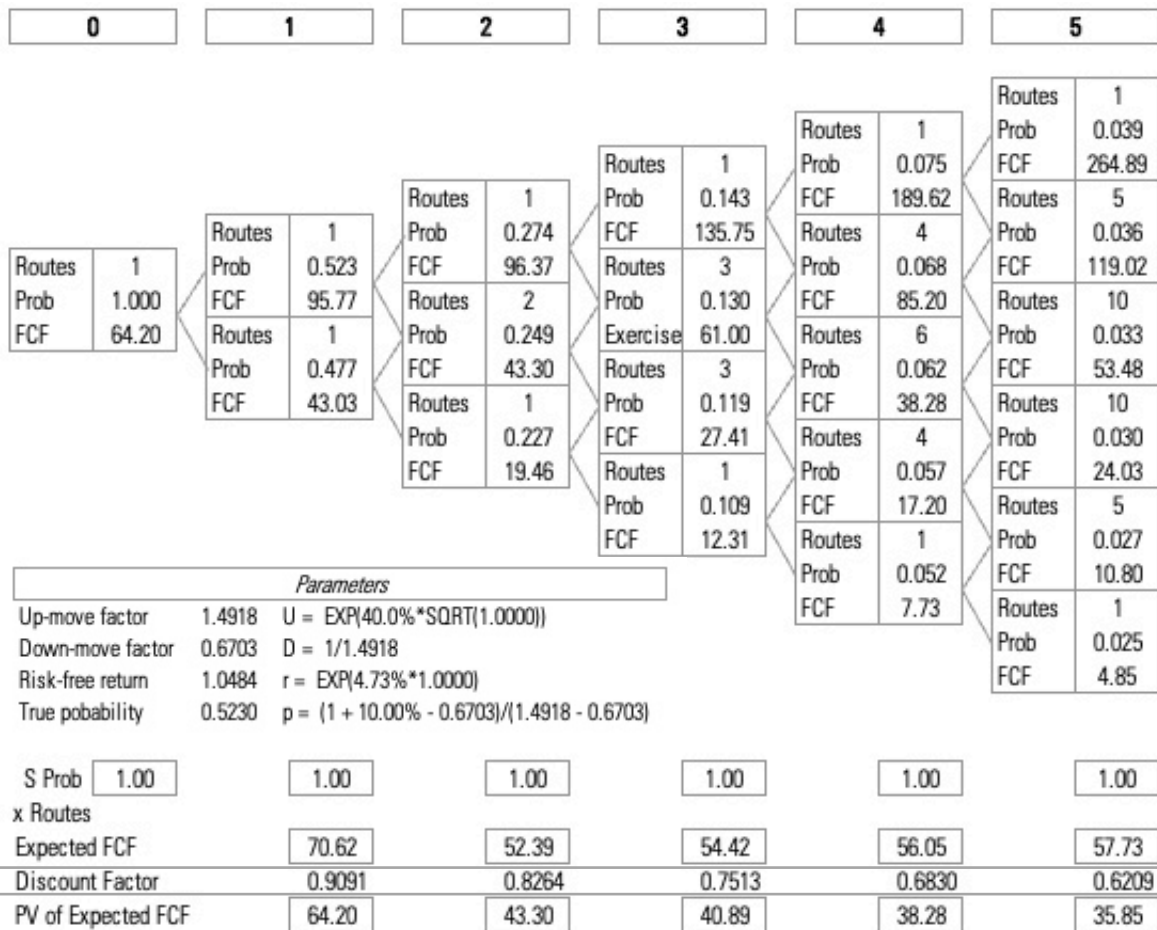
### FCFF Perpetuity TV

Final year FCFF	57.73
Growth rate	3.00%
Discount rate	10.00%
TV = $57.73 \times (1 + 3.00\%) / (10.00\% - 3.00\%)$	849.52

Final year NOPAT	76.17
Reinvestment Rate	24.20% g
FCFF	57.73 RONIC
First terminal period EBITDA	189.43
Implied Forward EBITDA x	x 4.5

		Forecast Year				
		1	2	3	4	5
<b>Cost of debt</b>						
Risk free rate	$R_f$	5.00%	5.00%	5.00%	5.00%	5.00%
Debt Risk Premium	DRP	2.00%	2.00%	2.00%	2.00%	2.00%
Pre-tax cost of debt	$= 5.00\% + 2.00\%$	7.00%	7.00%	7.00%	7.00%	7.00%
Tax rate	t	25.00%	25.00%	25.00%	25.00%	25.00%
Post-tax cost of debt	$= 7.00\% \times (1 - 25.00\%)$	5.25%	5.25%	5.25%	5.25%	5.25%
Debt ratio - target assumed		20.00%	20.00%	20.00%	20.00%	20.00%
Debt ratio - actual		20.00%	20.00%	20.00%	20.00%	20.00%
Debt ratio	L	20.00%	20.00%	20.00%	20.00%	20.00%
<b>Cost of equity</b>						
Risk free rate	$R_f$	5.00%	5.00%	5.00%	5.00%	5.00%
Equity risk premium	ERP	4.50%	4.50%	4.50%	4.50%	4.50%
Ungeared, assets beta	$\beta_a$	1.1889	1.1889	1.1889	1.1889	1.1889
Implied debt beta	$\beta_d$	0.4444	0.4444	0.4444	0.4444	0.4444
Ungeared cost equity	$K_u = R_f + \beta_a E = 5.00\% + 1.19 \times 4.50\%$	10.35%	10.35%	10.35%	10.35%	10.35%
Tax adjustment	1 - t	0.00%	0.00%	0.00%	0.00%	0.00%
G geared equity beta	$\beta_e = \beta_a + (\beta_a - 1) \times (D/E) = 1.19 + (1.19 - 1) \times (20\% / 80\%)$	1.3750	1.3750	1.3750	1.3750	1.3750
G geared Cost of Equity	$K_g = R_f + \beta_e E = 5.00\% + 1.37 \times 4.50\%$	11.19%	11.19%	11.19%	11.19%	11.19%
Equity ratio	1 - L	80.00%	80.00%	80.00%	80.00%	80.00%
Weighted rate		8.950%	8.950%	8.950%	8.950%	8.950%
<i>Debt = Leverage % x Enterprise Value</i>						
WACC (post-tax)		10.00%	10.00%	10.00%	10.00%	10.00%
WACC (pre-tax) (i.e. assume t = 0)		10.35%	10.35%	10.35%	10.35%	10.35%

The FCFF can be thought of as the probability weighted expected cash flows, based on possible future up or down 'routes' or 'paths' in a 'Binomial Tree' (used for option pricing). Assuming 40% volatility, the FCFF could be shown as follows (expected FCFF = sum of routes x probability x FCFF at each node):



**Method 2: Economic Operating Profits discounted at the post-tax WACC**

Net Operating Profit After Tax ('NOPAT') and Invested Capital ('IC') were introduced in Part 1 and discussed in the context of the perpetuity Terminal Value ('TV') in Appendix 2, particularly the idea that the EnV TV could be calculated based on IC plus the value of excess residual operating income or Economic Profits ('EP'):

$$TV_n = IC_n + IC_n \left( \frac{ROIC_{av\ n+1} - r}{r - g} \right) \quad \text{see App 2 in Part 1}$$

From Part 2, we can now replace r with WACC.

Economic return models (such as Economic Value Added (EVA®), created by Stern Value Management), value a business as the value of existing net operating assets (IC) plus the present value of future EP, representing residual net operating profits (NOPAT) after a charge for capital has been made:

$$\text{Economic profit (EP}_{n+1}) = \text{NOPAT}_{n+1} - (IC_n \times \text{WACC}) = IC_n \times (ROIC_{av\ n+1} - \text{WACC})$$

$$\text{Where } ROIC_{av\ n+1} = \frac{\text{NOPAT}_{n+1}}{IC_n}$$

In the TV equation above, the PV of the future EP is calculated as the first terminal year  $EP_{n+1}$  ( $= IC_n \times (ROIC_{av\ n+1} - WACC)$ ) discounted at the growing perpetuity formula ( $WACC - g$ ). If the final forecast year is in a steady state, where the rate of growth of NOPAT and IC ( $g_{NOPAT}$  and  $g_{IC}$ ) equals the perpetuity growth rate, then the final forecast year EP can be increased by the growth rate and used for the first terminal period ( $EP_{n+1} = EP_n \times (1 + g)$ ). This is because the 'spread' ( $ROIC - WACC$ ) will be the same in both years, so EP will grow because of the NOPAT growth rate. Using the example from Part 1:

		Forecast Year				
		1	2	3	4	5
Opening invested Capital ( $IC_{t-1}$ )		515.00	551.29	579.18	596.56	614.45
NOPAT <sub>t</sub>		106.90	80.29	71.80	73.95	76.17
ROIC <sub>t</sub>		20.8 %	14.6 %	12.4 %	12.4 %	12.4 %
WACC		10.0 %	10.0 %	10.0 %	10.0 %	10.0 %
Economic Profit		55.40	25.16	13.88	14.29	14.72
Economic profits growing in perpetuity		-	-	-	-	216.63
Discount factor (post-tax WACC)		0.9091	0.8264	0.7513	0.6830	0.6209
PV	<b>235.00</b>	50.37	20.79	10.43	9.76	143.65
add: IC at valuation date	515.00					
Enterprise Value	<b>750.00</b>					
less: debt	(150.00)					
Equity Value	<b>600.00</b>					
Economic profits value at each year end		235.00	203.10	198.25	204.19	210.32
Invested Capital		515.00	551.29	579.18	596.56	614.45
Enterprise Value at each year end		750.00	754.38	777.43	800.75	824.77

The terminal value is the PV of first year economic profits growing at 3.0% in perpetuity:

NOPAT final year $\times (1 + g)$	78.45
Invested Capital at start of terminal period $\times$ WACC	(63.29)
First terminal year economic profits	15.16
Growth rate	3.00%
Discount rate	10.00%
TV = $15.16 \times (1 + 3.00\%) / (10.00\% - 3.00\%)$	216.63

From the Appendix 2 of Part 1, this can also be shown as (equation A2.4) (replacing  $r$  with WACC):

$$TV = \frac{IC_n (ROIC_{n+1} - WACC)}{WACC} + \left\{ \frac{NOPAT_{n+1} \left( \frac{g^*}{RONIC_{n+1}} \right) (RONIC_{n+1} - WACC)}{WACC - g} \right\}$$

where RONIC is the Return On New Invested Capital (increase in NOPAT this year / New Invested Capital last year). The above shows the PV of first terminal year economic profits received in perpetuity without growth and the PV of economic profits from New Invested Capital made each year in perpetuity

$$\begin{aligned}
&= 632.89 \left( \frac{12.40\% - 10.00\%}{10.00\%} \right) + \left[ 78.45 \left( \frac{3.00\%}{12.40\%} \right) \left( \frac{12.40\% - 10.00\%}{10.00\%} \right) \right] \\
&= \frac{15.16}{10.00\%} + \frac{4.55}{10.00\% - 3.00\%} + \frac{78.45 \left( \frac{3.00\%}{12.40\%} \right) \left( \frac{12.40\% - 10.00\%}{10.00\%} \right)}{10.00\% - 3.00\%} \\
&= 151.64 + 64.99 \\
&= 216.63
\end{aligned}$$

We can split the TV into a two stage model by assuming Ronic reduces over a given number of years, due to competitive advantages being eroded, so that it 'fades' down to WACC, after which zero value will be added. This is best modelled explicitly in Excel but a single formula can be used.

### Method 3: Capital Cash Flows discounted at the pre-tax WACC

Part 2 of this Series discusses the tax benefits of leverage ('tax shield') arising from the tax relief on debt interest and the additional value for a geared company compared to an ungeared one. FCFF was shown as follows:  $FCFF + TS = CFE + CFD$ , where: TS Tax Shield cash flows = pre-tax interest x tax rate; CFE 'Cash Flows to Equity' = dividends + stock repurchases; CFD 'Cash Flows to Debt' = debt principal net payments + pre-tax interest. CFE and CFD are termed 'Capital Cash Flows' ('CCF') (Kaplan & Ruback (1994)). As the effect of tax relief has been captured in a cash flow (TS), tax in the WACC can be ignored. Discounting at the pre-tax WACC gives the same EntV as under method 1:

#### CAPITAL CASH FLOWS MODEL

	Forecast Year				
	1	2	3	4	5
Free Cash Flows to the Firm	70.62	52.39	54.42	56.05	57.73
Debt funding / (principal repayments)	0.88	4.61	4.66	4.80	4.95
Interest at 7.00% x opening balance	(10.50)	(10.56)	(10.88)	(11.21)	(11.55)
Pre-tax capital cash flows to debt holders	(9.62)	(5.95)	(6.22)	(6.41)	(6.60)
Tax relief on interest	2.63	2.64	2.72	2.80	2.89
Debt servicing (post-tax)	(7.00)	(3.31)	(3.50)	(3.60)	(3.71)
Opening cash	-	-	-	-	-
FCFE (paid out as dividends) - full payout	63.62	49.08	50.92	52.45	54.02
Equity Cash Flows	63.62	49.08	50.92	52.45	54.02
Add back: Pre-tax debt servicing	9.62	5.95	6.22	6.41	6.60
<b>Capital cash flows</b>	<b>73.24</b>	<b>55.04</b>	<b>57.14</b>	<b>58.86</b>	<b>60.62</b>
FCFF	70.62	52.39	54.42	56.05	57.73
Tax Shield (tax on interest)	2.63	2.64	2.72	2.80	2.89
<b>Capital cash flows</b>	<b>73.24</b>	<b>55.04</b>	<b>57.14</b>	<b>58.86</b>	<b>60.62</b>
Terminal Value	-	-	-	-	849.52
Pre-tax WACC at start of year	10.35%	10.35%	10.35%	10.35%	10.35%
Discount factor	0.9062	0.8212	0.7442	0.6744	0.6111
Forecast period	Yes	Yes	Yes	Yes	Yes
PV of pre-tax capital cash flows	750.00	66.37	45.20	42.52	39.69
less: debt	(150.00)				
Equity Value	600.00				

Final year	60.62
Growth rate	3.00%
Discount rate	10.35%
TV	849.52

TV = 60.62 x (1 + 3.00%) / (10.35% - 3.00%)

In the original papers on CCF (Kaplan & Ruback (1994), Ruback (2000)), a debt beta was assumed when calculating the cost of debt and equity beta (see note 1 on page 10 and note 6 on page 12, Ruback (2000)) (debt beta = debt risk premium / equity risk premium). Using a debt beta defined in this way, the pre-tax WACC will equal the ungeared cost of equity (see note 1 at the end).

**Method 4: FCF discounted at the ungeared cost of equity and tax shield cash flows discounted at pre-tax cost of debt or ungeared cost of equity ('APV')**

The Adjusted Present Value (Myers (1974)) is similar to method 3 in that the Ent.V comprises the value of an all equity financed firm plus the value of the tax shield, however the discount rates are different. In the APV, FCF are discounted at the ungeared cost of equity and tax shields at the pre-tax cost of debt (if debt levels depended on FCF or the ungeared enterprise value, the discount rate would be the ungeared cost of equity, to reflect business risk, as in this case):

	Forecast Year					
	1	2	3	4	5	
<b>APV</b>						
Free Cash Flows to the Firm FCFF	70.62	52.39	54.42	56.05	57.73	
Terminal Value	-	-	-	-	809.06	
Ungeared Cost of Equity	10.35%	10.35%	10.35%	10.35%	10.35%	
Discount factor	0.9062	0.8212	0.7442	0.6744	0.6111	
Forecast period	Yes	Yes	Yes	Yes	Yes	
PV of FCFF	<b>715.05</b>	63.99	43.03	40.50	37.80	529.73
Final year					57.73	
Growth rate					3.00%	
Discount rate					10.35%	
TV					809.06	
Tax Shields	2.63	2.64	2.72	2.80	2.89	
Terminal Value	-	-	-	-	40.45	
Ungeared Cost of Equity (since leverage is set using Ent.V)	10.35%	10.35%	10.35%	10.35%	10.35%	
Discount factor	0.9062	0.8212	0.7442	0.6744	0.6111	
Forecast period	Yes	Yes	Yes	Yes	Yes	
PV of FCFF	<b>34.95</b>	2.38	2.17	2.02	1.89	26.49
Final year					2.89	
Growth rate					3.00%	
Discount rate					10.35%	
TV					40.45	
Value of FCFF	715.05	718.44	740.41	762.62	785.50	809.06
Value of tax shields	34.95	35.94	37.02	38.13	39.27	40.45
Enterprise Value at each year end	<b>750.00</b>	754.38	777.43	800.75	824.77	849.52
Debt ratio	20.00%	20.00%	20.00%	20.00%	20.00%	20.00%

### Method 5: FCFE discounted at the geared cost of equity

The amount of FCFF remaining after payments (net of tax relief) to financial capital providers with superior claims to equity providers ('Equity Cash Flows' or 'Free Cash Flows to Equity' / 'FCFE') can be distributed as equity cash flows in the form of dividends and / or share repurchases. The present value of FCFE when discounted at the return required by the providers of equity capital (cost of equity) will represent the Equity Value. We can reconcile Enterprise Value to Equity Value (the 'Bridge') as follows:

Operating Enterprise Value (FCFF discounted at the cost of capital)	x
Fair value of non-operating net assets	<u>x</u>
Total Enterprise Value	x
Less: net debt (gross debt less surplus cash)	(x)
Less: other non-equity claims and debt-equivalents (e.g. pension deficit)	<u>(x)</u>
Equity Value (FCFE discounted at the geared cost of equity)	x
Less: equity claims (e.g. employee stock options value)	<u>(x)</u>
Equity Value for current shareholders	x

This method requires forecasting financing cash flows and related tax in order to calculate residual post-tax cash flows available for distribution to equity holders (via ordinary dividends, special dividends or share buybacks), assuming all excess cash is distributed. The steps are as follows:

- Determine funding requirements, allocate to debt facilities, calculate net interest, pre-tax profit, tax
- Calculate FCFE (see method 3) <sup>1</sup> & reconcile to net profit <sup>2</sup>
- Calculate the Equity Value Terminal Value (Eq.TV) at the end of the forecast period
- Calculate the PV of FCFE and Eq.TV at the valuation date
- Add net debt and equivalents to the Equity Value to determine the Enterprise Value

<sup>1</sup> The interest cash flows need to be consistent with what is used in the WACC calculation, so that if leverage is based on net debt and debt equivalents, the equity cash flows should be after interest is calculated based on net debt and debt equivalents, meaning a notional interest may have to be applied to match the two.

<sup>2</sup> Equity cash flows are paid out in full as dividends and reconciled as follows:

	Forecast Year				
	1	2	3	4	5
Profits after tax	99.03	72.37	63.63	65.54	67.51
add: Debt funding	0.88	4.61	4.66	4.80	4.95
less: New Invested Capital	(36.29)	(27.90)	(17.38)	(17.90)	(18.43)
Equity Cash Flows (= dividends)	63.62	49.08	50.92	52.45	54.02
FCFF	70.62	52.39	54.42	56.05	57.73
add: Debt funding	0.88	4.61	4.66	4.80	4.95
less: debt interest	(10.50)	(10.56)	(10.88)	(11.21)	(11.55)
add back: tax relief on interest	2.63	2.64	2.72	2.80	2.89
Equity Cash Flows (= dividends)	63.62	49.08	50.92	52.45	54.02

From method 3 above, we can start with the equity cash flows for our example:

## EQUITY CASH FLOW MODEL

	Forecast Year				
	1	2	3	4	5
Equity Cash Flows	63.62	49.08	50.92	52.45	54.02
Terminal Value (equity)	-	-	-	-	679.61
Geared cost of equity at start of year	11.19%	11.19%	11.19%	11.19%	11.19%
Discount factor	0.8994	0.8089	0.7275	0.6543	0.5885
Forecast period	Yes	Yes	Yes	Yes	Yes
PV of Equity Cash Flows	<b>600.00</b>	57.22	39.70	37.05	34.32
Equity value at each year end	600.00	603.51	621.94	640.60	659.82
Debt	150.00	150.88	155.49	160.15	164.95
Enterprise Value at each year end	750.00	754.38	777.43	800.75	824.77

### TV using perpetuity

Final year	54.02
Growth rate	3.00%
Discount rate	11.19%
TV = 54.02 x (1 + 3.00%) / (11.19% - 3.00%)	679.61

### Method 6: Residual Income discounted at the geared cost of equity

The Residual Income (RI) model is similar to the residual operating income method 2, but uses profits after tax and the book value of equity (BVE) rather than NOPAT and Invested Capital (Ohlson (1995)). The equity value is calculated as BVE at the valuation date plus the present value of future residual income. The perpetuity value is:

$$\text{Equity TV}_n = \text{BVE}_n + \text{BVE}_n \left( \frac{\text{ROE}_{n+1} - K_g}{K_g - g} \right)$$

where:

- BVE<sub>n</sub> book value of equity at the end of the forecast period
- ROE<sub>n+1</sub> the return on equity (= profits after tax<sub>n+1</sub> / BVE<sub>n</sub>)
- K<sub>g</sub> geared cost of equity
- g stable growth in profits after tax

If the change in BVE reflects profits after tax net of dividends paid ('Clean Surplus' accounting), this method should give the same equity value as the equity cash flow method (5). This value can also be shown as the value of profits after tax in the first year of the terminal period (PAT<sub>n+1</sub>) if received in perpetuity without growth and capitalised at the geared cost of equity (= PAT<sub>n+1</sub> / K<sub>g</sub>) plus the present value of growth from the second year in perpetuity (measured as the growth in PAT less a charge for equity capital based on the prior year change in BVE, equal to PAT less dividends paid). The second period RI growth will be (and similarly for the remaining years in perpetuity):

$$\text{RI growth} = (g_{n+2} \times \text{PAT}_{n+1}) - (K_g \times \text{change in BVE}_{n+1})$$

This is then discounted back to the end of the first year and capitalised in perpetuity (no growth). This can be shown as follows (the equivalent for NOPAT is discussed in Appendix 2 of part 2):

$$TV_n = PAT_{n+1} \left( \frac{1}{K_g} + \frac{ROE - K_g}{K_g \cdot ROE} \times \frac{g}{K_g - g} \right)$$

Using our example:

### RESIDUAL INCOME MODEL

				Forecast Year				
				1	2	3	4	5
Retained Profits				35.41	23.29	12.71	13.09	13.48
Book Value of Equity	BVE	365.00		400.41	423.69	436.41	449.50	462.98
BVE growth					5.8%	3.0%	3.0%	3.0%
Profits After Tax	PAT			99.03	72.37	63.63	65.54	67.51
Return on Equity = PAT / opening BVE	ROE			27.1%	18.1%	15.0%	15.0%	15.0%
Cost of Equity (geared)	K <sub>g</sub>			11.19%	11.19%	11.19%	11.19%	11.19%
Residual Income = PAT - opening BVE x K <sub>g</sub>				58.19	27.57	16.23	16.72	17.22
TV perpetuity				-	-	-	-	216.63
BE				-	-	-	-	-
TV				-	-	-	-	216.63
Discount factor (geared cost of equity)				0.8994	0.8089	0.7275	0.6543	0.5885
Forecast period				Yes	Yes	Yes	Yes	Yes
PV of Residual Income + TV		235.00		52.34	22.30	11.81	10.94	137.61
add: BVE at valuation date		365.00						
Equity Value		600.00						
Net cash		-						
Equity Value		600.00						
Value of residual income each period		235.00	203.10	198.25	204.19	210.32	216.63	
BVE		365.00	400.41	423.69	436.41	449.50	462.98	
Equity value at each year end		600.00	603.51	621.94	640.60	659.82	679.61	
Debt		150.00	150.88	155.49	160.15	164.95	169.90	
Enterprise Value at each year end		750.00	754.38	777.43	800.75	824.77	849.52	

#### TV using perpetuity

Final year PAT	67.51
First terminal year PAT	69.53
BVE	462.98
RI	17.74
Growth rate	3.00%
Discount rate	11.19%
TV = 17.74 x (1 + 3.00%) / (11.19% - 3.00%)	216.63

The TV is shown as the value of profit after tax arising in the first terminal year remaining constant in perpetuity plus the value from growth, less the book value of equity at the terminal

Growth rate	3.00%
First terminal year PAT	69.53
Geared cost of equity (K)	11.19%
First year RI	17.74
ROE	15.02%
Implied retention ratio	0.45%
ROE - Cost of Equity (K)	3.83%
K. ROE	1.68%
g / (k - g)	36.64%
Growth factor	x 0.84 = (3.83% / 1.68%) x 36.64%
No growth value	621.52 = 69.53 / 11.19%
Growth value	58.09 = 69.53 x 0.84
TV plus BVE	679.61
less: BVE	(462.98)
TV	216.63

If the cost of debt ( $K_d$ ) is calculated as interest paid / opening debt, ROE can be obtained from the ROIC as follows (see Appendix):

$$ROE_t = ROIC_t \left( 1 + \frac{D_{t-1}}{E_{t-1}} (ROIC_t - K_d(1-t)) \right)$$

		Forecast Year				
		1	2	3	4	5
Profit After Tax	PAT	99.03	72.37	63.63	65.54	67.51
Add back: interest	i	10.50	10.56	10.88	11.21	11.55
Less: tax relief on interest	t. i	(2.63)	(2.64)	(2.72)	(2.80)	(2.89)
NOPAT		106.90	80.29	71.80	73.95	76.17
Equity (book value)	E	365.00	400.41	423.69	449.50	462.98
Debt (book value)	D	150.00	150.88	155.49	164.95	169.90
Invested Capital		515.00	551.29	579.18	596.56	614.45
Post-tax interest	i.(1 - t)	7.88	7.92	8.16	8.41	8.66
Debt at start of period	D	150.00	150.88	155.49	160.15	164.95
Effective rate		5.25 %	5.25 %	5.25 %	5.25 %	5.25 %
D/E prior period		41.10 %	37.68 %	36.70 %	36.70 %	36.70 %
ROIC - $K_{dt}$		15.51 %	9.31 %	7.15 %	7.15 %	7.15 %
D/E x (ROIC - $K_{dt}$ )		6.37 %	3.51 %	2.62 %	2.62 %	2.62 %
ROIC		20.76 %	14.56 %	12.40 %	12.40 %	12.40 %
ROE		27.13 %	18.07 %	15.02 %	15.02 %	15.02 %

### Method 7 Dividends discounted at the geared cost of equity ("Dividend Discount Model")

This well known valuation model values dividends rather than equity cash flows, although in the example provided here all equity cash flows are paid out as dividends, so method 5 would be sufficient. It is shown here based on the example in Part 1:

DIVIDEND DISCOUNT MODEL		Forecast Year				
		1	2	3	4	5
Geared Cost of Equity ( $K_{eg}$ )		11.19%	11.19%	11.19%	11.19%	11.19%
Discount rate		0.8994	0.8089	0.7275	0.6543	0.5885
Dividends		63.62	49.08	50.92	52.45	54.02
PV of dividends	200.07	57.22	39.70	37.05	34.32	31.79
Dividend growth rate (g)						3.00 %
Year 6 dividend (= $D_1$ )						55.64
Perpetuity value = $D_1 / (K_{eg} - g)$						679.61
PV of perpetuity (x yr 5 disc. factor)	399.93					
Equity Value	600.00					
ROE		27.13%	18.07%	15.02%	15.02%	15.02%
Sustainable growth (BVE growth)		9.70%	5.82%	3.00%	3.00%	3.00%
ROE - g		17.43%	12.26%	12.02%	12.02%	12.02%
x opening book value of equity =		63.62	49.08	50.92	52.45	54.02
PV at cost of equity	200.07	57.22	39.70	37.05	34.32	31.79
Year 6 : ROE - g						12.02%
Year 6 : Ke - g						8.19%
Price : Book Multiple = $(ROE - g) / (Ke - g)$						x 1.5
x year 5 book value of equity						679.61
PV of terminal value	399.93					
Equity Value	600.00					

## Multiples

### *Introduction*

An enterprise or equity multiple can be determined from acquisition prices ('Transaction' multiple) or quoted prices ('Trading' multiple) and used to value a business by applying the multiple to the equivalent earnings or assets measure. Providing the multiple relates to businesses that are a good proxy for the business being valued (comparable companies – same sector, size, growth and risk) and has been adjusted to remove the effects of any abnormality ('normalised'), they could be treated as a 'benchmark' multiple to compare to the business ('relative' valuation), and are a useful measure to support a DCF valuation, particularly when analysing the perpetuity cash flow derived terminal value.

As value and price are forward-looking, the underlying financial measure in an earnings multiple (revenue, EBIT, EBITDA, FCFF or net income) should ideally be the amount expected over the next 12 months ('forward multiple') rather than the last 12 months ('trailing multiple'). Expected future growth in the underlying measure will be incorporated in the price, which should change as expectations change (the growth and the risk associated with the growth).

### *Types of Multiple*

The Enterprise Value (EnV), being the market value of all financial capital (equity, net debt, preferred etc), relating to a company, quoted or acquired, is used together with operating, pre-financing earnings (revenue, EBITDA, EBITA, EBIT, NOPAT or FCFF) to calculate the EnV multiple. When applied to the same earnings for the business being valued, the EnV is estimated and the Equity Value (EqV) calculated after deducting the value of all non-equity financial capital). The EqV can be estimated directly by applying an equity multiple (the P / E, using price and earnings per share EPS, being widely used) to a financial measure that is after all financing and tax costs have been deducted (FCFE or profit after tax). EqV can also be based on asset multiples applied to the Equity Book Value (the Price-to-Book multiple).

### *Adjustments*

Issues relating to debt financing, different effective tax rates and capital expenditures, can be ignored when using EBITDA. Growth in EBITDA requires investment, however, and deducting depreciation allows for some of the capital expenditure to be considered (depending on the capex / depreciation ratio), meaning EBIT might be more suitable if the business is more capital intensive (with depreciation being used as proxy for 'maintenance' capex).

Debt financing effects and tax can be factored in when calculating the P / E multiple. An increase in leverage due to capital investment requirements will increase financial risk, but this would be decreased by the economic benefits from those investments (if RONIC exceeds WACC). As the P / E is based on EPS as determined under accounting rules (using weighted average shares), the equivalent measure based on all the whole firm might be preferred to a per share calculation.



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## Suggested reading

### Books:

- Arzac, E.R. (2008) *Valuation for Mergers, Buyouts and Restructurings* (2<sup>nd</sup> ed.) Wiley.
- Damadoran, A. (2015) *Applied Corporate Finance*. (4<sup>th</sup> ed.) Wiley
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## Growth and Returns

We can break down the P/E (price / earnings per share) to extract key value drivers for growth, returns and risk, starting with the simplest of valuation models: the Dividend Discount Model (DDM). If we assume a dividend of  $D_1$  is received in 1 year and thereafter in perpetuity from a company which is all equity financed, assuming a dividend growth rate of  $g$ , the present value of those dividends (using the growing perpetuity formula introduced in Part 1 of this series) should be a fair value for the share price, assuming for now that all distributable net income is paid out. As the company is debt free, the discount rate is the ungeared cost of equity used in the Gordon Growth formula:

$$\text{Price} = \frac{D_1}{K_u - g}$$

The dividend paid per share will depend on the proportion of net income (EPS on a per share basis) that the company decides to retain and reinvest ('Retention Ratio' / 'RR') rather than payout ('Payout Ratio' / 'PR', where  $RR + PR = 100\%$ ). In a growing perpetuity model, we can replace the dividend at time 1 with  $\text{EPS} \times \text{PR}$  or  $\text{EPS} \times (1 - \text{RR})$ :

$$\text{Price} = \frac{\text{EPS}_1 (1 - \text{RR})}{K_u - g}$$

$$\therefore \text{P / E} = \frac{1 - \text{RR}}{K_u - g}$$

PR is similar to the NOPAT reinvestment rate (RR):

$$\text{Growth}_{\text{NOPAT } t} = \text{RONIC}_t \times \text{RR}_{t-1}$$

$$\therefore \frac{\text{Growth}_{\text{NOPAT } t}}{\text{RONIC}_t} = \text{RR}_{t-1}$$

So it is for the P/E RR:

$$\frac{\text{EPS growth}}{\text{ROE}} = \text{RR}$$

Return on Equity is Net Income per Share / Book Value of Equity per Share, so

$$\therefore \text{P / E} = \frac{\left( 1 - \frac{g}{\text{ROE}} \right)}{K_u - g}$$

$$= \frac{ROE - g}{ROE (K_u - g)}$$

This can be decomposed into the following after  $1/K_u$  is added and subtracted:

$$P / E = \frac{1}{K_u} + \underbrace{\left( \frac{ROE - K_u}{ROE \times K_u} \right)}_{\text{Franchise Factor}} \underbrace{\left( \frac{g}{K - g} \right)}_{\text{Growth Factor}}$$

(see Arzac 2008 p.77, Leibowitz 2004)

In terms of  $K_u$ , this can be re-arranged into:

$$K_u = \frac{1}{P / E} \left( 1 - \frac{g}{ROE} \right) + g$$

(see Koller et al. (McKinsey) 2025 p.307)

The Residual Income model growing perpetuity formula (discussed above under method 6) is:

$$P = BVE \left( \frac{ROE - g}{K_u - g} \right)$$

where BVE = book value of equity per share  
 EPS = ROE x BVE (replacing BVE with EPS / ROE)

This can be derived from the above P / E multiple formula

$$\frac{P}{EPS} = \frac{1}{ROE} \left( \frac{ROE - g}{(K_u - g)} \right) \quad \text{Since } ROE = \frac{EPS}{BVE}$$

In a finite period we use the PV formula mentioned in Part 1 of this series:

$$PV = C \times \frac{1}{r - g} \times \left( 1 - \frac{(1 + g)^n}{(1 + r)^n} \right)$$

where

$$C = BVE \times (ROE - g) = (EPS / ROE) \times (ROE - g)$$

In a 'steady state' scenario (see Part 2 of this series), BVE grows at a constant rate  $g$  in perpetuity, if ROE and the reinvestment rate  $RR$  grow at this same  $g$ . Over one period this is:

$$g = \left\{ \frac{BVE_1 - BVE_0}{BVE_0} \right\} - 1$$

$$= \left\{ \frac{(BVE_0 + EPS \times RR) - BVE_0}{BVE_0} \right\} - 1$$

$$= \text{ROE} \times \text{RR} \quad (\text{as } \text{EPS} = \text{ROE} \times \text{BVE}_0)$$

This assumes BVE changes only due to net income less dividends paid out ('clean surplus'), where EPS x RR equals EPS less dividend per share (EPS x (1 - RR)). The Price / Book ratio (price / BVE) can be calculated as ROE x P/E ratio

## Returns and Risk

ROE increases because of the effects of leverage, but with this higher return there is greater risk, as measured in the geared cost of equity ( $K_g$ ) as D/E increases (see Part 2):

$$K_g = R_f + \beta_a \left( 1 + \frac{D}{E} (1 - t) \right) \text{ERP} \quad (\text{ignore } 1 - t \text{ if leverage is constant})$$

ROE can be analysed further in terms of ROIC and leverage. Assuming there are no non-operating items or another adjustments, we can reconcile NOPAT to profit after tax as:

NOPAT	x
Less: net interest expense x (1 - tax rate)	<u>x</u>
Profit after tax	<u>x</u>

$$\begin{aligned} \text{ROIC}_t &= \frac{\text{PAT}_t + i(1-t)}{\text{BVE}_{t-1} + \text{Debt}_{t-1}} \\ &= \frac{\text{ROE}_t + \left( \frac{i(1-t)}{\text{BVE}_{t-1}} \right)}{1 + \frac{\text{Debt}_{t-1}}{\text{BVE}_{t-1}}} \end{aligned} \quad \begin{array}{l} \text{After dividing top} \\ \text{and bottom by} \\ \text{BVE}_{t-1} \end{array}$$

$$\therefore \text{ROE}_t = \text{ROIC}_t + \text{ROIC}_t \left( \frac{D_{t-1}}{E_{t-1}} \right) - i(1-t)$$

$$\text{ROE}_t = \text{ROIC}_t \left( 1 + \frac{D_{t-1}}{E_{t-1}} (\text{ROIC}_t - K_d (1-t)) \right) \quad \begin{array}{l} \text{After dividing top} \\ \text{and bottom by } D_{t-1} \end{array}$$

Where  $K_d$  = Pre-tax cost of borrowing %

And  $\text{ROIC}_t$  = 
$$\frac{\text{NOPAT margin}}{\frac{\text{Net PP\&E}_{t-1}}{\text{Revenues}_t} + \frac{\text{Working Capital}_{t-1}}{\text{Revenues}_t}}$$

see Part 1

see Part 2 but with  $t = n + 1$  = 
$$\text{Prior year } \text{ROIC}_{t-1} \left( \frac{1 + g_{\text{NOPAT } t}}{1 + g_{\text{IC}t-1}} \right)$$

## Multiples based on return measures

If we replace  $IC_n$  with an expression for EBITDA, we can derive the forward TV EBITDA multiple version:

$$\begin{aligned}
 IC_n &= \frac{NOPAT_{n+1}}{ROIC_{n+1}} \\
 &= \frac{EBITDA_{n+1} \times (1 - \text{tax rate } t) \times (1 - \text{Depreciation} / \text{EBITDA})}{ROIC_{n+1}} \\
 \frac{TV_n}{EBITDA_{n+1}} &= \left( \frac{1}{ROIC_{n+1}} \right) \left( (1 - t) \times (1 - \text{Depreciation} / \text{EBITDA}) \right) \times \left( \frac{ROIC_{n+1} - g^*}{r - g^*} \right)
 \end{aligned}$$

Taking the example from Part 1 of this series and referred to in this paper, for the terminal value:

Terminal value multiple:

$$\begin{aligned}
 &= \frac{1}{ROIC_{n+1}} (1 - \text{tax rate}) \times (1 - \frac{\text{Depreciation}}{\text{EBITDA}}) \times \left( \frac{ROIC_{n+1} - g}{WACC - g} \right) \\
 &= \frac{1}{12.40\%} (1 - 25.00\%) \times (1 - 44.78\%) \times \left( \frac{12.40\% - 3.00\%}{10.00\% - 3.00\%} \right) \\
 &= 8.067108 \times 75.00\% \times 55.22\% \times 1.34 \\
 &= 4.48
 \end{aligned}$$

849.52	TV
189.43	First year EBITDA
x 4.48	Forward EBITDA x

This is the enterprise value equivalent version of the price-book multiple, which can be written as follows:

$$\text{Price} = \text{Book Value}_{\text{equity}} \times \left( \frac{\text{Return on Equity ROE} - g}{\text{Cost of Equity } K - g} \right)$$