

## Introduction

In other papers [‘Business Valuation’ Parts IV and V] the DCF equity value was calculated by deducting from the DCF enterprise value the claims of equity equivalents (e.g. employee options) and debt equivalents (e.g. debt, leases, pension deficits). The resulting equity value per share assumes each share has the same rights and hence intrinsic value.

This paper introduces one methodology (‘Option Pricing Method’ / ‘OPM’) to allocate the equity value to investors with different rights that potentially increase the ‘payoff’, depending on the amount of equity value realized on a ‘Liquidity Event’ (e.g. an Initial Public Offering or Trade Sale). An alternative method, the Probability-Weighted Expected Return Method (‘PWERM’), will not be discussed.

## Preference Share Rights

A preference shareholder may be granted the right to receive, in priority to any ordinary shareholder, a portion of the exit proceeds up to the amount of, or a multiple of, the capital they have invested (‘Liquidation Preference’ / ‘LP’). They may have equal ranking (‘Pari Passu’) and receive their LP pro-rata, or be given seniority rights that require their LP to be paid in full before a junior preference shareholder. Accrued unpaid dividends may also be given preference, and may be senior to or rank alongside the shareholder’s LP.

The preference shareholder may also have the right to convert their preference shares into ordinary shares at a stated ‘Conversion Ratio’ (ordinary shares received on conversion for each preference share), giving them an unrestricted payout as exit value increases, as well as downside protection (via their LP). The effective price paid for each ordinary share (‘Conversion Price’) will be the price paid for each preference share (‘Issue Price’) divided by the Conversion Ratio.

The terms of a ‘Non-Participating’ convertible preference share require the holder to choose the right to receive the LP or convert, whereas a ‘Participating’ convertible allows the holder to keep both rights: they can receive their invested capital and share in the proceeds of what remains of the exit value alongside and equally with the ordinary shareholders (‘Double Dipping’).

For a non-participating share, it will be beneficial for the holder to convert when their share of the exit proceeds is more than their LP. The holder will be indifferent between converting and receiving the LP when the two amounts are the same. For example, a Series A preference shareholder (P<sub>A</sub>), converting at a lower exit value than the Series B and C preference shareholders, would be indifferent where:

Proceeds received as ordinary shareholder after conversion = Proceeds received for Liquidation Preference

$$\text{As-If-Converted } P_A \text{ shareholding \%} \times \left( \frac{\text{Equity Value} - \text{Total LP less LP for } P_A}{\text{Equity Value} - \text{Total LP less LP for } P_A} \right) = * \text{ LP for } P_A$$

$$\text{Equity Value} = \frac{\text{LP for } P_A}{\text{As-If-Converted } P_A \text{ shareholding \%}} + \text{Total LP less LP for } P_A$$

\* LP = Preference Shares x Issue Price x Liquidation Multiple

Preference shares with such rights are usually present in early-stage venture capital financing, depending on the start-up's stage of development, growth and risk (Seed Series, Series A, B, C etc). Ordinary shareholders (e.g. the founders) may want protection against investors receiving excessive payouts, and convertible preference shareholders may be forced to convert at some exit value or event ('Mandatory Conversion'), which may result in conversion occurring below the indifference point. Participating preference shares may have their total payout (LP plus share of residual equity proceeds) restricted to a maximum amount ('Participation Cap'), based on a multiple of their invested capital.

If a preference shareholder does not participate in any subsequent funding round, their shareholding percentage will be diluted by the issue of additional ordinary or convertible preference shares ('Percentage Dilution') and their shareholding value may be reduced if the new shares are issued below a certain amount ('Economic Dilution'). For example, if a start-up has a 'Pre-Money' value of £9m (with 9m ordinary shares outstanding) just before a £1m Series A convertible preference share investment, its 'Post-Money' value will be £10m. If the Series A is priced at £1.00, Series A investors will receive 1m convertible preference shares. Assuming a conversion ratio of x 1.00, on conversion they would have a 10% holding valued at £1m (= 1m new shares / (9m existing shares + 1m new shares) = 10% x £10m). If a subsequent Series B £2m funding round is priced at £1.00 or higher, Percentage Dilution will occur for Series A (1/10 to 1/12) but Economic Dilution will not (Series A £1m value = 1m shares valued at £1.00 or 1/12 x £12m). If Series B were priced at less than Series A ('Down Round'), Economic Dilution would occur as well. It would also happen if capital was reorganised via a stock split but the conversion ratio remained the same.

Anti-dilution protection can be achieved by reducing the Conversion Price (via an increase in the Conversion Ratio), so more ordinary shares are received to offset the economic dilution that would arise from the lower down round pricing without such protection. The Conversion Price can be adjusted downwards to match the price paid in the down round ('Full Ratchet' formula) or downwards to a price between the original issue price and down-round price ('Weighted Average' formula). (See Bartlett (2003) or Woronoff & Rosen (2005)).

## OPM Methodology

An investor who has the right to exchange securities for ordinary shares at a stated conversion price (convertibles) or subscribe for ordinary shares at a stated exercise price (options and warrants) should use those rights to maximise their payoff for any given exit proceeds, subject to any restriction imposed by seniority, mandatory conversion or participating caps.

A 'Breakpoint' ('BP') represents the amount of proceeds at which an investor is indifferent between not exercising their rights (e.g. not converting) and exercising their rights (e.g. converting). Immediately above this point, the marginal allocation of proceeds changes (for example, existing ordinary shareholders having to share proceeds with investors who have just converted). A subsequent BP occurs at the next higher level of proceeds when the marginal allocation changes again.

The OPM involves segmenting a hypothetical exit value into tranches between BPs. Each tranche can be valued using the Black-Scholes Model ('BSM') for pricing Call options (see Black & Scholes (1973), Chriss (1996)). The approach uses the principles of the Merton Model, where equity is valued as a Call option on the value of the company's net assets, with debt as the strike price (see Merton (1973)). In the OPM, the strike price is the lower BP in the tranche.

## Breakpoint Examples

Allocating securities and options to BPs will be illustrated using a simple Capitalisation Table ('Cap Table'), before additional features are introduced in subsequent case scenarios (in the examples that follow, blue font and shaded cells represent inputs to the Excel model):

### CASE 1 : LP MULTIPLIER = x1.0 + CONVERTIBLES (NO MANDATORY)

TABLE 1			SHARES		LIQUIDATION PREFERENCES						CONVERTIBLES			
			Ordinary No.	Preferred No.	Ordinary Diluted No.	Issue Price £	Invested Capital £	Multiplier	Seniority	LP £	LP/share £	Conversion Price	Conversion Ratio	Shares No.
Founders	Ordinary		5,000,000		5,000,000									
Seed	Preferred	Convertible		1,000,000	1,000,000	1.00	1,000,000	x 1.00	1	1,000,000	1.00	1.0000	x 1.00	1,000,000
A	Preferred	Convertible		2,000,000	2,000,000	2.00	4,000,000	x 1.00	1	4,000,000	2.00	2.0000	x 1.00	2,000,000
B	Preferred	Convertible		3,000,000	3,000,000	3.00	9,000,000	x 1.00	1	9,000,000	3.00	3.0000	x 1.00	3,000,000
C	Preferred	Convertible		4,000,000	4,000,000	4.00	16,000,000	x 1.00	1	16,000,000	4.00	4.0000	x 1.00	4,000,000
			5,000,000	10,000,000	15,000,000		30,000,000			30,000,000				10,000,000

- BP 1- Founders:

The first BP will be the level of exit proceeds that pay senior ranking preference shareholders their LP, with the second BP being junior ranking LPs. If preference shareholders are ranked equally, the first BP will be when total LP is paid off from exit proceeds (£30m in this example- this equals the invested capital as the LP multiple is 1 for each investor), above which ordinary shareholders receive their share of the proceeds. If the exit value was less than this, investors would receive their pro-rata share (for example, Series B would receive 9/30 x the exit value).

- BP 2- 5:
  - Determining each investor's BP amount independently:

As exit proceeds increase above the level of the LP, each investor should consider when conversion would be optimal. Taking the Seed investors, their optimal conversion point or Breakpoint Value ('BPV'), can be derived from the following (ignoring all other conversions):

$$\begin{array}{rcl} \text{Conversion Payoff} & = & \text{Liquidation Payoff} \\ \frac{\text{Shares on conversion (1m)}}{\text{Shares at BP (5m) + shares on conversion (1m)}} \times (\text{BPVs} - [\text{Total LP} - * \text{LPs}]) & = & \text{LPs} \\ & & \text{£30m} - \text{£1m} \quad \text{£1m} \end{array}$$

$$\begin{aligned} \therefore \text{BPVs} &= \text{£1m} \times (6\text{m} / 1\text{m}) + (\text{£30m} - \text{£1m}) \\ &= \text{£35m} \end{aligned}$$

\* As the Seed investors have elected to convert their non-participating convertible preference shares, they relinquish any right to receive their LP

The equity value at this BP is £6m (£35m BP<sub>s</sub> - £29m remaining LP) giving a share price of £1.00 (= £6m / 6m ordinary shares).

The Breakpoint Values for the remaining investors are calculated, assuming no other conversions:

$$\begin{aligned} \text{BPV}_A &= \text{£4m} \times (5\text{m} + 2\text{m}) / 2\text{m} + (\text{£30m} - \text{£4m}) = \text{£40m} \\ &= (\text{£40m} - \text{£26m remaining LP}) / 7\text{m} \\ &= \text{£2.00 share price} \end{aligned}$$

$$\begin{aligned} \text{BPV}_B &= \text{£9m} \times (5\text{m} + 3\text{m}) / 3\text{m} + (\text{£30m} - \text{£9m}) = \text{£45m} \\ &= (\text{£45m} - \text{£21m remaining LP}) / 8\text{m} \\ &= \text{£3.00 share price} \end{aligned}$$

$$\begin{aligned} \text{BPV}_C &= \text{£16m} \times (5\text{m} + 4\text{m}) / 4\text{m} + (\text{£30m} - \text{£16m}) = \text{£50m} \\ &= (\text{£50m} - \text{£14m remaining LP}) / 9\text{m} \\ &= \text{£4.00 share price} \end{aligned}$$

In all cases, the share price equals the LP per preference share, as this is the indifference point for each investor. The conversion points are summarised in Table 2:

	LIQUIDATION PREFERENCE			BREAKPOINTS		
	Non-Participating LP £	Remove Converting £	Uncapped Remaining Total LP £	This Breakpoint £	Equity Value £	Current Price £
Founders	-	-	30,000,000	30,000,000	-	-
Seed	30,000,000	(1,000,000)	29,000,000	35,000,000	6,000,000	1.0000
A	30,000,000	(4,000,000)	26,000,000	40,000,000	14,000,000	2.0000
B	30,000,000	(9,000,000)	21,000,000	45,000,000	24,000,000	3.0000
C	30,000,000	(16,000,000)	14,000,000	50,000,000	36,000,000	4.0000

- o Determining the sequence of conversion:

Investors will convert in ascending BPV, so the BPVs need to be revised to take into account investors who have already converted (this affects the shareholding percentages and hence the above calculations). Seed investors will convert first (BP 2), followed by A, B and C (BPs 3,4 and 5 respectively):

$$\begin{aligned}
 BPV_A &= \text{£}4\text{m} \times (6\text{m}^* + 2\text{m}) / 2\text{m} + (\text{£}29\text{m}^* - \text{£}4\text{m}) = \text{£}41\text{m} \\
 &= (\text{£}41\text{m} - \text{£}25\text{m remaining LP}) / 8\text{m} \\
 &= \text{£}2.00 \text{ share price}
 \end{aligned}$$

$$\begin{aligned}
 BPV_B &= \text{£}9\text{m} \times (8\text{m}^* + 3\text{m}) / 3\text{m} + (\text{£}25\text{m}^* - \text{£}9\text{m}) = \text{£}49\text{m} \\
 &= (\text{£}49\text{m} - \text{£}16\text{m remaining LP}) / 11\text{m} \\
 &= \text{£}3.00 \text{ share price}
 \end{aligned}$$

$$\begin{aligned}
 BPV_C &= \text{£}16\text{m} \times (11\text{m}^* + 4\text{m}) / 4\text{m} + (\text{£}16\text{m}^* - \text{£}16\text{m}) = \text{£}60\text{m} \\
 &= (\text{£}60\text{m} - \text{£}0\text{m remaining LP}) / 15\text{m} \\
 &= \text{£}4.00 \text{ share price}
 \end{aligned}$$

\*The base number of shares include, and the remaining LP exclude, investors who have converted before the relevant BP.

Table 3 shows the final BPs:

	LIQUIDATION PREFERENCE				SHAREHOLDINGS						BREAKPOINTS			
	Non-Participating LP £	Remove Converted £	Remove Self Converted £	Remove Other Converted £	Uncapped Remaining Total LP £	Converted Now No.	Converted Before No.	Diluted Shares No.	Founders Holding %	Investor Holding %	Other Investors Holdings %	This Breakpoint £	Equity Value £	Current Price £
Founders					30,000,000			5,000,000	100.0 %	-	-	30,000,000	-	-
Seed	30,000,000	(1,000,000)			29,000,000	1,000,000		6,000,000	83.3 %	16.7 %		35,000,000	6,000,000	1.0000
A	30,000,000	(4,000,000)	(1,000,000)		25,000,000	2,000,000	1,000,000	8,000,000	62.5 %	25.0 %	12.5 %	41,000,000	16,000,000	2.0000
B	30,000,000	(9,000,000)	(5,000,000)		16,000,000	3,000,000	3,000,000	11,000,000	45.5 %	27.3 %	27.3 %	49,000,000	33,000,000	3.0000
C	30,000,000	(16,000,000)	(14,000,000)			4,000,000	6,000,000	15,000,000	33.3 %	26.7 %	40.0 %	60,000,000	60,000,000	4.0000

The BP share prices reflect the optimal conversion point for each investor. Taking the Seed investors, the effective price paid to receive each ordinary share on conversion (Conversion Price) is £1.00, equal to amount invested (£1m = 1m preference shares issued at £1) divided by number of ordinary shares received (1m = 1m preference shares x 1 Conversion Ratio). The Conversion Price therefore equals the issue price divided by the Conversion Ratio.

The optimal conversion point per share is where the conversion payoff ('Conversion Value') per share equals the liquidation payoff per share (using the Seed Series example to illustrate):

$$\text{Share Price} \times \text{Conversion Ratio ('CR')} = \frac{\text{Liquidation Preference}}{\text{Preference Shares held}}$$

$$\therefore \text{Share Price} = \frac{\text{Liquidation Preference}}{\text{Ordinary Shares received on conversion}} \quad \frac{\pounds 1\text{m}}{1\text{m}} = \pounds 1.00$$

$$\text{or Share Price} = \frac{\text{LP per preference share}}{\text{CR}} \quad \frac{\pounds 1}{\text{x1}} = \pounds 1.00$$

$$= \frac{\text{Pref. issue price} \times \text{LP Multiplier}}{\text{Pref.issue price / Conversion Price ('CP')}} \quad \frac{\pounds 1}{\text{x1}} = \pounds 1.00$$

$$= \text{Conversion Price} \times \text{LP Multiplier} \quad \pounds 1 \times 1 = \pounds 1.00$$

## CASE 2 : CASE 1 + LP MULTIPLIER MORETHAN X1.0

Case 1 is extended in Case 2 to show the effect of having LP Multipliers, so that the LP will be greater than the amount invested. Table 4 reproduces Table 1 but now with LP Multipliers greater than 1.00:

	SHARES			LIQUIDATION PREFERENCES					CONVERTIBLES			
	Ordinary No.	Preferred No.	Ordinary Diluted No.	Issue Price £	Invested Capital £	Multiplier	Seniority	LP £	LP/share £	Conversion Price	Conversion Ratio	Shares No.
Founders	5,000,000		5,000,000									
Seed		1,000,000	1,000,000	1.00	1,000,000	x 1.00	1	1,000,000	1.00	1.0000	x 1.00	1,000,000
A		2,000,000	2,000,000	2.00	4,000,000	x 1.50	1	6,000,000	3.00	2.0000	x 1.00	2,000,000
B		3,000,000	3,000,000	3.00	9,000,000	x 2.00	1	18,000,000	6.00	3.0000	x 1.00	3,000,000
C		4,000,000	4,000,000	4.00	16,000,000	x 2.50	1	40,000,000	10.00	4.0000	x 1.00	4,000,000
	5,000,000	10,000,000	15,000,000		30,000,000			65,000,000				10,000,000

The calculations will be as before, but with higher LPs. The liquidation multiple means the optimal conversion point per share will equal the Conversion Price multiplied by the LP Multiple or the LP per preference share divided by the Conversion Ratio as shown in Table 5:

	LIQUIDATION PREFERENCE			BREAKPOINTS			
	Non-Participating LP £	Remove Converting £	Uncapped Remaining Total LP £	This Breakpoint £	Equity Value £	Diluted Shares No.	Current Price £
Founders	-	-	65,000,000	65,000,000	-	5,000,000	-
Seed	65,000,000	(1,000,000)	64,000,000	70,000,000	6,000,000	6,000,000	1.0000
A	65,000,000	(6,000,000)	59,000,000	80,000,000	21,000,000	7,000,000	3.0000
B	65,000,000	(18,000,000)	47,000,000	95,000,000	48,000,000	8,000,000	6.0000
C	65,000,000	(40,000,000)	25,000,000	115,000,000	90,000,000	9,000,000	10.0000

The final BPs are as follows:

TABLE 6	LIQUIDATION PREFERENCE				SHAREHOLDINGS						BREAKPOINTS			
	Non-Participating LP £	Remove Converted £	Remove Self Converted £	Remove Other Converted £	Uncapped Remaining Total LP £	Converted Now No.	Converted Before No.	Diluted Shares No.	Founders Holding %	Investor Holding %	Other Investors Holdings %	This Breakpoint £	Equity Value £	Current Price £
Founders	-				65,000,000			5,000,000	100.0 %	-	-	65,000,000	-	-
Seed	65,000,000	(1,000,000)			64,000,000	1,000,000		6,000,000	83.3 %	16.7 %	-	70,000,000	6,000,000	1.0000
A	65,000,000	(6,000,000)		(1,000,000)	58,000,000	2,000,000	1,000,000	8,000,000	62.5 %	25.0 %	12.5 %	82,000,000	24,000,000	3.0000
B	65,000,000	(18,000,000)		(7,000,000)	40,000,000	3,000,000	3,000,000	11,000,000	45.5 %	27.3 %	27.3 %	106,000,000	66,000,000	6.0000
C	65,000,000	(40,000,000)		(25,000,000)	-	4,000,000	6,000,000	15,000,000	33.3 %	26.7 %	40.0 %	150,000,000	150,000,000	10.0000

Taking Series B as an example, the BPV is calculated in two ways:

$$\begin{aligned}
 BPV_B &= \text{£}18\text{m} \times (8\text{m} + 3\text{m}) / 3\text{m} + (\text{£}58\text{m} - \text{£}18\text{m}) = \text{£}106\text{m} \\
 &= (\text{£}106\text{m} - \text{£}40\text{m remaining LP}) / 11\text{m} \\
 &= \text{£}6.00 \text{ share price}
 \end{aligned}$$

$$\begin{aligned}
 BPV_B &= \text{Conversion Price } \text{£}3.00 \times \text{LP Multiplier } 2.00 \\
 &= \text{£}6.00 \text{ share price} \times 11\text{m shares} + \text{£}40\text{m remaining LP} \\
 &= \text{£}106\text{m}
 \end{aligned}$$

### CASE 3 : CASE 2 + OPTIONS

Case 2 now includes options. Five tranches of 200,000 options are issued, giving option holders the right without any obligation to subscribe for 1 share for each option held at various exercise (or 'strike') prices (it is assumed exercise proceeds are paid to the start-up). The Cap table is shown in Table 7:

TABLE 7	SHARES		LIQUIDATION PREFERENCES			CONVERTIBLES			OPTIONS					
	Ordinary No.	Preferred No.	Ordinary Diluted No.	Issue Price £	Multiplier	LP £	Conversion Price	Conversion Ratio	Shares No.	Number No.	Price £	Ratio	Shares No.	Exercise Amount £
Founders	5,000,000		5,000,000											
Seed		1,000,000	1,000,000	1.00	x 1.00	1,000,000	1.0000	x 1.00	1,000,000					
A		2,000,000	2,000,000	2.00	x 1.50	6,000,000	2.0000	x 1.00	2,000,000					
B		3,000,000	3,000,000	3.00	x 2.00	18,000,000	3.0000	x 1.00	3,000,000					
C		4,000,000	4,000,000	4.00	x 2.50	40,000,000	4.0000	x 1.00	4,000,000					
O (£5.00)			200,000							200,000	5.00000	x 1.00	200,000	1,000,000
O (£7.00)			200,000							200,000	7.00000	x 1.00	200,000	1,400,000
O (£9.00)			200,000							200,000	9.00000	x 1.00	200,000	1,800,000
O (£15.00)			200,000							200,000	15.00000	x 1.00	200,000	3,000,000
O (£20.00)			200,000							200,000	20.00000	x 1.00	200,000	4,000,000
	5,000,000	10,000,000	16,000,000			65,000,000			10,000,000	1,000,000				11,200,000

Each option holder should convert where its share of the exit proceeds is at least equal to the exercise cost (any option premium paid when the options were granted is ignored for this illustration, which applies for employee options):

$$\frac{\text{Option Shares (Os)}}{\text{Existing Shares (Es) + Option Shares (Os)}} \times (\text{Equity Value} + \text{Exercise Proceeds}) = \text{Exercise Cost}$$

$$\therefore \text{Equity Value} = \text{Exercise Cost} \times (\text{Es} + \text{Os}) / \text{Os} - \text{Exercise Proceeds (= Cost)}$$

$$= (\text{Exercise Price} \times \text{Os}) \times (\text{Es} + \text{Os}) / \text{Os} - \text{Exercise Proceeds}$$

$$= \text{Exercise Price} \times (\text{Es} + \text{Os}) - \text{Exercise Proceeds}$$

$$= \text{Exercise Price} \times \text{Es}$$

Table 8 shows the equity value for options equal to the BPV less remaining LP plus proceeds from the exercise of the options

	CONVERSIONS			SHAREHOLDINGS			BREAKPOINTS				
	Remaining Total LP C1	Investor LP C2	Investor Holding C3	Converted Now C4	Converted Before C5	Diluted Shares C6	Breakpoint No. C7	Breakpoint Value C7	Options Proceeds C8	Equity Value C9	Current Price C10
	£	£	%	No.	No.	No.		£	£	£	£
								= C1 + C2 / C3	= C7 - C1 + C8		= C9 / C6
Founders	65,000,000					5,000,000	1	65,000,000	-	-	-
Seed	64,000,000	1,000,000	16.7 %	1,000,000	-	6,000,000		70,000,000	-	6,000,000	1.0000
A	59,000,000	6,000,000	28.6 %	2,000,000	-	7,000,000		80,000,000	-	21,000,000	3.0000
B	47,000,000	18,000,000	37.5 %	3,000,000	-	8,000,000		95,000,000	-	48,000,000	6.0000
C	25,000,000	40,000,000	44.4 %	4,000,000	-	9,000,000		115,000,000	-	90,000,000	10.0000

	OPTIONS					SHAREHOLDINGS				BREAKPOINTS					
	Shares Post-Exercise O1	Exercise Price O2	In-the-Money Equity Value O3	Exercise Cost Now O4	Exercise Cost Before O5	Remaining Total LP O6	Exercised / Now O7	Exercised / Before O8	Diluted Shares O9	Sequence	This Breakpoint O10	Exercise Proceeds O11	Equity Value O12	Current Price O13	
	No.	£	£	£	£	£	No.	No.	No.		£	£	£	£	
	= O1 x O2			= O3 + O4 + O5 + O6											= O10 + O11 - O6
O (£5.00)	5,200,000	5.0000	26,000,000	(1,000,000)	-	65,000,000	200,000	-	5,200,000		90,000,000	1,000,000	26,000,000	5.0000	
O (£7.00)	5,200,000	7.0000	36,400,000	(1,400,000)	-	65,000,000	200,000	-	5,200,000		100,000,000	1,400,000	36,400,000	7.0000	
O (£9.00)	5,200,000	9.0000	46,800,000	(1,800,000)	-	65,000,000	200,000	-	5,200,000		110,000,000	1,800,000	46,800,000	9.0000	
O (£15.00)	5,200,000	15.0000	78,000,000	(3,000,000)	-	65,000,000	200,000	-	5,200,000		140,000,000	3,000,000	78,000,000	15.0000	
O (£20.00)	5,200,000	20.0000	104,000,000	(4,000,000)	-	65,000,000	200,000	-	5,200,000		165,000,000	4,000,000	104,000,000	20.0000	

Table 9 shows the actual conversion and exercising BPs:

Breakpoint	INVESTOR	LP	CONVERTIBLES					OPTIONS							
			Remaining Total LP	Convertible Breakeven	Investor Holding	Option Proceeds	Conversion Breakpoint	Conversion Breakpoint	Conversion Breakpoint	Shares Post-Exercise	Exercise Price	In-the-Money Equity Value	Exercise Cost Now	Exercise Cost Before	Options Breakpoint
			£	£	%	£	£	£	£	No.	£	£	£	£	£
1	Founders	65,000,000	-	-	-	-	-	-	-	-	-	-	-	-	-
2	Seed	64,000,000	1,000,000	16.667 %	-	70,000,000	70,000,000	70,000,000	-	-	-	-	-	-	-
3	A	58,000,000	6,000,000	25.000 %	-	82,000,000	82,000,000	82,000,000	-	-	-	-	-	-	-
4	O (£5.00)	58,000,000	-	-	-	-	-	-	8,200,000	5.00	41,000,000	(1,000,000)	-	-	98,000,000
5	B	40,000,000	18,000,000	26.786 %	(1,000,000)	106,200,000	106,200,000	106,200,000	-	-	-	-	(1,000,000)	-	
6	O (£7.00)	40,000,000	-	-	-	-	-	-	11,400,000	7.00	79,800,000	(1,400,000)	(1,000,000)	(1,000,000)	117,400,000
7	O (£9.00)	40,000,000	-	-	-	-	-	-	11,600,000	9.00	104,400,000	(1,800,000)	(2,400,000)	(2,400,000)	140,200,000
8	C	-	40,000,000	25.641 %	(4,200,000)	151,800,000	151,800,000	151,800,000	-	-	-	-	(4,200,000)	-	
9	O (£15.00)	-	-	-	-	-	-	-	15,800,000	15.00	237,000,000	(3,000,000)	(4,200,000)	(4,200,000)	229,800,000
10	O (£20.00)	-	-	-	-	-	-	-	16,000,000	20.00	320,000,000	(4,000,000)	(7,200,000)	(7,200,000)	308,800,000

Breakpoint	INVESTOR	BREAKPOINTS & EQUITY VALUE								
		BREAKPOINT	Remaining LP	Options Proceeds	Equity Value	Base Shares	Conv / Ex Now	Conv / Ex Before	Final Shares	Current Price
		£	£	£	£	No.	No.	No.	No.	£
		1	2	3	4	5	6	7	8	9
1	Founders	65,000,000	65,000,000	-	-	5,000,000	-	-	5,000,000	0.00
2	Seed	70,000,000	64,000,000	-	6,000,000	5,000,000	1,000,000	-	6,000,000	1.00
3	A	82,000,000	58,000,000	-	24,000,000	5,000,000	2,000,000	1,000,000	8,000,000	3.00
4	O (£5.00)	98,000,000	58,000,000	1,000,000	41,000,000	5,000,000	200,000	3,000,000	8,200,000	5.00
5	B	106,200,000	40,000,000	1,000,000	67,200,000	5,000,000	3,000,000	3,200,000	11,200,000	6.00
6	O (£7.00)	117,400,000	40,000,000	2,400,000	79,800,000	5,000,000	200,000	6,200,000	11,400,000	7.00
7	O (£9.00)	140,200,000	40,000,000	4,200,000	104,400,000	5,000,000	200,000	6,400,000	11,600,000	9.00
8	C	151,800,000	-	4,200,000	156,000,000	5,000,000	4,000,000	6,600,000	15,600,000	10.00
9	O (£15.00)	229,800,000	-	7,200,000	237,000,000	5,000,000	200,000	10,600,000	15,800,000	15.00
10	O (£20.00)	308,800,000	-	11,200,000	320,000,000	5,000,000	200,000	10,800,000	16,000,000	20.00

- BP 1, 2, 3 - Founders, Seed converts, Series A converts: See Case 2 (Table 6)
- BP 4, 6, 7, 9, 10 - options exercised:

BP No.	Investor	LP at Breakpoint	LP removed	Remaining LP	Exercise Price	Shares at Exercise	Option Proceeds before	Breakpoint Value	Option Proceeds now	Equity Value	Shares	Share Price
		O1	O2	O3	O4	O5	O6	O7	O8	O9	O10	O11
				= O1 + O2				= O3 + O4 x O5 + O6		= O7 - O3 - O6 - O8		
4	O (£5.00)	58,000,000	-	58,000,000	5.00	8,000,000	-	98,000,000	(1,000,000)	41,000,000	8,200,000	5.00
6	O (£7.00)	40,000,000	-	40,000,000	7.00	11,200,000	(1,000,000)	117,400,000	(1,400,000)	79,800,000	11,400,000	7.00
7	O (£9.00)	40,000,000	-	40,000,000	9.00	11,400,000	(2,400,000)	140,200,000	(1,800,000)	104,400,000	11,600,000	9.00
9	O (£15.00)	-	-	-	15.00	15,600,000	(4,200,000)	229,800,000	(3,000,000)	237,000,000	15,800,000	15.00
10	O (£20.00)	-	-	-	20.00	15,800,000	(7,200,000)	308,800,000	(4,000,000)	320,000,000	16,000,000	20.00

- BP 5, 8 - Series B and C convert:

Breakpoint No.	LP at Breakpoint	LP removed	Remaining LP	Investor Shares	Total Shares	Option Proceeds before	Breakpoint Value	Option Proceeds now	Equity Value	Shares	Share Price	
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	
			= C1 + C2				= C3 + C2/(C4/C5) + C6		= C7 - C3 - C6 - C8			
5	B	58,000,000	(18,000,000)	40,000,000	3,000,000	11,200,000	(1,000,000)	106,200,000	-	67,200,000	11,200,000	6.00
8	C	40,000,000	(40,000,000)	-	4,000,000	15,600,000	(4,200,000)	151,800,000	-	156,000,000	15,600,000	10.00

The cap table can be re-arranged into a format ('Waterfall') that will eventually be used for the valuation. Table 10 shows shareholdings for BP sections:

TABLE 10		0	1	2	3	4	5	6	7	8	9	10
	From	-	65,000,000	70,000,000	82,000,000	98,000,000	106,200,000	117,400,000	140,200,000	151,800,000	229,800,000	-
	To	65,000,000	70,000,000	82,000,000	98,000,000	106,200,000	117,400,000	140,200,000	151,800,000	229,800,000	308,800,000	-
	Change	65,000,000	5,000,000	12,000,000	16,000,000	8,200,000	11,200,000	22,800,000	11,600,000	78,000,000	79,000,000	-
<b>SHARES</b>	No.	£	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Founders - Ordinary	5,000,000		5,000,000	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000
Seed - Preferred Convertible	1,000,000	1,000,000	-	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
A - Preferred Convertible	2,000,000	6,000,000	-	-	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
O (£5.00) - Options	200,000	-	-	-	-	200,000	200,000	200,000	200,000	200,000	200,000	200,000
B - Preferred Convertible	3,000,000	18,000,000	-	-	-	-	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000
O (£7.00) - Options	200,000	-	-	-	-	-	200,000	200,000	200,000	200,000	200,000	200,000
O (£9.00) - Options	200,000	-	-	-	-	-	-	200,000	200,000	200,000	200,000	200,000
C - Preferred Convertible	4,000,000	40,000,000	-	-	-	-	-	-	4,000,000	4,000,000	4,000,000	4,000,000
O (£15.00) - Options	200,000	-	-	-	-	-	-	-	-	200,000	200,000	200,000
O (£20.00) - Options	200,000	-	-	-	-	-	-	-	-	-	200,000	200,000
No	16,000,000	£65,000,000	5,000,000	6,000,000	8,000,000	8,200,000	11,200,000	11,400,000	11,600,000	15,600,000	15,800,000	16,000,000
Cum. Option Proceeds	£		-	-	-	1,000,000	1,000,000	2,400,000	4,200,000	4,200,000	7,200,000	11,200,000

### CASE 4 : CASE 3 + PARTICIPATION (WITHOUT ANY CAP)

Case 3 is extended in Case 4 so that Series B is participating (no cap). Series B receive 3m shares once proceeds exceed £65m LP, giving holders a share of the equity proceeds in excess of this plus their £18m LP. They would never convert without a cap (otherwise they would lose their LP) and hence their BP is the same as the ordinary shareholders (no.1), as shown in Tables 11 and 12:

TABLE 11	INVESTOR	LP	CONVERTIBLES				OPTIONS						
Breakpoint		Remaining Total LP	Convertible Breakeven	Investor Holding	Option Proceeds	Conversion Breakpoint	Shares Post-Exercise	Exercise Price	In-the-Money Equity Value	Exercise Cost Now	Exercise Cost Before	Remaining LP	Options Breakpoint
		£	£	%	£	£	No.	£	£	£	£	£	£
		1	2	3	4	5	6	7	8	9	10	11	11
						= 1 + 2/3 + 4							= 1 + 8 + 10
1	Founders	65,000,000	-	-	-	-	-	-	-	-	-	-	-
1	B	65,000,000	18,000,000	-	-	-	-	-	-	-	-	-	-
2	Seed	64,000,000	1,000,000	11.1 %	-	73,000,000	-	-	-	-	-	-	-
3	A	58,000,000	6,000,000	18.2 %	-	91,000,000	-	-	-	-	-	-	-
4	O (£5.00)	58,000,000	-	-	-	-	11,200,000	5.00	56,000,000	(1,000,000)	-	-	113,000,000
5	O (£7.00)	58,000,000	-	-	-	-	11,400,000	7.00	79,800,000	(1,400,000)	(1,000,000)	-	135,400,000
6	O (£9.00)	58,000,000	-	-	-	-	11,600,000	9.00	104,400,000	(1,800,000)	(2,400,000)	-	158,200,000
7	C	18,000,000	40,000,000	25.6 %	(4,200,000)	169,800,000	-	-	-	-	(4,200,000)	-	-
8	O (£15.00)	18,000,000	-	-	-	-	15,800,000	15.00	237,000,000	(3,000,000)	(4,200,000)	-	247,800,000
9	O (£20.00)	18,000,000	-	-	-	-	16,000,000	20.00	320,000,000	(4,000,000)	(7,200,000)	-	326,800,000

INVESTOR		BREAKPOINTS & EQUITY VALUES								
Breakpoint		BREAKPOINT	Remaining LP	Options Proceeds	Equity Value	Base Shares	Converted Now	Converted Before + B	Diluted Shares	Current Price
		£	£	£	£	No.	No.	No.	No.	£
		1	2	3	4	5	6	7	8	9
					=1 - 2 + 3				= 5 + ... + 7	= 4/8
1	Founders	65,000,000	65,000,000	-	-	5,000,000	-	-	5,000,000	0.00
1	B	65,000,000	65,000,000	-	-	5,000,000	-	-	5,000,000	0.00
2	Seed	73,000,000	64,000,000	-	9,000,000	5,000,000	1,000,000	3,000,000	9,000,000	1.00
3	A	91,000,000	58,000,000	-	33,000,000	5,000,000	2,000,000	4,000,000	11,000,000	3.00
4	O (£5.00)	113,000,000	58,000,000	1,000,000	56,000,000	5,000,000	200,000	6,000,000	11,200,000	5.00
5	O (£7.00)	135,400,000	58,000,000	2,400,000	79,800,000	5,000,000	200,000	6,200,000	11,400,000	7.00
6	O (£9.00)	158,200,000	58,000,000	4,200,000	104,400,000	5,000,000	200,000	6,400,000	11,600,000	9.00
7	C	169,800,000	18,000,000	4,200,000	156,000,000	5,000,000	4,000,000	6,600,000	15,600,000	10.00
8	O (£15.00)	247,800,000	18,000,000	7,200,000	237,000,000	5,000,000	200,000	10,600,000	15,800,000	15.00
9	O (£20.00)	326,800,000	18,000,000	11,200,000	320,000,000	5,000,000	200,000	10,800,000	16,000,000	20.00

TABLE 12		0	1	2	3	4	5	6	7	8	9
	From	-	65,000,000	73,000,000	91,000,000	113,000,000	135,400,000	158,200,000	169,800,000	247,800,000	326,800,000
	To	65,000,000	73,000,000	91,000,000	113,000,000	135,400,000	158,200,000	169,800,000	247,800,000	326,800,000	-
	Change	65,000,000	8,000,000	18,000,000	22,000,000	22,400,000	22,800,000	11,600,000	78,000,000	79,000,000	-
SHARES	No.	£	No.	No.	No.	No.	No.	No.	No.	No.	No.
Founders - Ordinary	5,000,000		5,000,000	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000
B - Preferred Convertible	3,000,000	18,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000
Seed - Preferred Convertible	1,000,000	1,000,000	-	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
A - Preferred Convertible	2,000,000	6,000,000	-	-	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
O (£5.00) - Options	200,000	-	-	-	-	200,000	200,000	200,000	200,000	200,000	200,000
O (£7.00) - Options	200,000	-	-	-	-	-	200,000	200,000	200,000	200,000	200,000
O (£9.00) - Options	200,000	-	-	-	-	-	-	200,000	200,000	200,000	200,000
C - Preferred Convertible	4,000,000	40,000,000	-	-	-	-	-	-	4,000,000	4,000,000	4,000,000
O (£15.00) - Options	200,000	-	-	-	-	-	-	-	-	200,000	200,000
O (£20.00) - Options	200,000	-	-	-	-	-	-	-	-	-	200,000
	16,000,000	£ 65,000,000	8,000,000	9,000,000	11,000,000	11,200,000	11,400,000	11,600,000	15,600,000	15,800,000	16,000,000
Check			8,000,000	9,000,000	11,000,000	11,200,000	11,400,000	11,600,000	15,600,000	15,800,000	16,000,000
Cum. Option Proceeds			-	-	-	1,000,000	2,400,000	4,200,000	4,200,000	7,200,000	11,200,000

- BP 1 - Founders, Series B participates:

As the investors' LP are ranked pari-passu, BP 1 occurs once the £65m LP are paid off, after which the founders and Series B participants share in the proceeds above this amount. Series B would not convert, as no participation cap exists and it continues to receive its LP as well as equity proceeds.

- BP 2 – Seed convert:

Seed investors will convert at a BP value that gives them a share in the equity residual proceeds equal to their LP amount (LPs). They will share proceeds with the founders (5m) and Series B participating shares (3m):

$$\begin{aligned} \text{Post Conversion \% Holding} \times (\text{BPVs} - \text{Remaining LP}) &= \text{LPs} \\ 1\text{m} / (8\text{m} + 1\text{m}) \times ? &= £65\text{m} - £1\text{m} = £1\text{m} \end{aligned}$$

$$\therefore V_2 = £73\text{m} - \text{option proceeds at BP}_2 \text{ £nil}$$

$$\begin{aligned} \text{Equity Value} &= £73\text{m} - £64\text{m} + \text{option proceeds at BP}_2 \text{ £nil} \\ &= £9\text{m} \end{aligned}$$

$$\text{Shares} = 9\text{m}$$

$$\text{Price} = £1.00$$

- BP 3, 7 - Series A and C convert:

Breakpoint No.		LP at Breakpoint C1	LP Removed C2	LP Remaining C3 = C1 + C2	Shares Held C4	Shares C5	Option Proceeds before C6	Breakpoint Value C7 = C3 + C2/(C4/C5) + C6	Option Proceeds now C8	Equity Value C9 = C7 - C3 - C6 - C8	Shares C10	Share Price C11
3	A	64,000,000	(6,000,000)	58,000,000	2,000,000	11,000,000	-	91,000,000	-	33,000,000	11,000,000	3.00
7	C	58,000,000	(40,000,000)	18,000,000	4,000,000	15,600,000	(4,200,000)	169,800,000	-	156,000,000	15,600,000	10.00

- BP 4, 5, 6, 8, 9 – options exercised:

BP No.	Investor	LP at Breakpoint O1	LP Removed O2	Remaining LP O3 = O1 + O2	Exercise Price O4	Shares at Exercise O5	Option Proceeds before O6	Breakpoint Value O7	Option Proceeds now O8	Equity Value O9 = O7 - O3 - O6 - O8	Shares O10	Share Price O11
4	O (£5.00)	58,000,000	-	58,000,000	5.00	11,000,000	-	113,000,000	(1,000,000)	56,000,000	11,200,000	5.00
5	O (£7.00)	58,000,000	-	58,000,000	7.00	11,200,000	(1,000,000)	135,400,000	(1,400,000)	79,800,000	11,400,000	7.00
6	O (£9.00)	58,000,000	-	58,000,000	9.00	11,400,000	(2,400,000)	158,200,000	(1,800,000)	104,400,000	11,600,000	9.00
8	O (£15.00)	18,000,000	-	18,000,000	15.00	15,600,000	(4,200,000)	247,800,000	(3,000,000)	237,000,000	15,800,000	15.00
9	O (£20.00)	18,000,000	-	18,000,000	20.00	15,800,000	(7,200,000)	326,800,000	(4,000,000)	320,000,000	16,000,000	20.00

## CASE 5 : CASE 4 + PARTICIPATION (WITH CAP)

Participating convertible preference shares allow the holder to receive their LP and a share of residual equity proceeds alongside other ordinary shareholders (after all LP have been paid). As mentioned, there would be no need to convert, as the investor would lose entitlement to its LP. If a participation cap is included, the payoff (LP plus share of equity residual proceeds) will be restricted to a fixed amount, usually a multiple of the invested capital. After the cap is reached, the payoff reaches a plateau until the investor decides to convert and relinquish the LP.

Assume Series B are participating with a payoff cap at three times their investment (3 x £9m = £27m), so that their share of equity proceeds is restricted to £9m (£27m cap- £18m LP). Their payoff will be capped at a  $BPV_{BCap}$ , calculated as follows:

$$B's \text{ Shareholding } \% \text{ at } BP_i \times (BPV_{BCap} - \text{Remaining LP}) + LP_c = \text{Cap}$$

Once capped, Series B will convert (losing entitlement to  $LP_c$ ) at a subsequent BP when the conversion value of its ordinary shares exceed the fixed cap:

$$B's \text{ Shareholding } \% \text{ at } BP_{i+j} \times (BPV_{BCon} - \text{Remaining LP}) \geq \text{Cap}$$

If another convertible preference shareholder converts between BPs  $i$  and  $i+j$ , B's shareholding will be diluted, although the remaining LP will decrease.

The sequence of conversions and option exercises will depend on whether or not the Series C cap is triggered or not at each investor's breakeven point, partly due to the treatment of the LP. Separate

computations are required for each investor, assuming an uncapped and capped scenario, which will need to be updated as and when the sequence of converting and exercising is determined.

- BP 1- Founders, Series B participate: see Case 4
- BP 2 - Seed convert:

Assuming an uncapped scenario, Seed investors would convert at £73m:

$$\begin{array}{rcll} \text{Post Conversion \% Holding} & \times & (\text{BPV}_{2u} & - & \text{Remaining LP}) & = & \text{LP}_s \\ 1\text{m} / (5\text{m} + 3\text{m} + 1\text{m}) & & ? & & \text{£65m} - \text{£1m} & & \text{£1m} \end{array}$$

$$\therefore V_{2u} = \text{£73m}$$

The participating Series B will hold 3m shares, so their payoff would be:

$$\begin{array}{rcll} \text{Payoff}_{Bu} & = & \text{Post Conversion \% Holding} & \times & (\text{BPV}_{2u} & - & \text{Remaining LP}) & + & \text{LP}_B \\ & = & 3\text{m} / (5\text{m} + 3\text{m} + 1\text{m}) & & \text{£73m} & - & \text{£64m} & & \text{£18m} \\ & = & \text{£21m} & & & & & & \end{array}$$

which is less than their £27m cap

If Series B was capped, the BP for the Seed investors would be £79m ( $V_{2c}$ ), based on the following:

$$\begin{array}{rcll} \text{Post Conversion \% Holding}^* & \times & (\text{BPV}_{2c} & - & \text{Remaining LP}^* & - & \text{Cap}) & = & \text{LP}_s \\ 1\text{m} / (5\text{m} + 1\text{m}) & & ? & & \text{£46m} & - & \text{£27m} & & \text{£1m} \end{array}$$

$$\therefore V_{2c} = \text{£79m}$$

\* The Seed investors' holding and remaining LP exclude Series B's 3m shares and £18m LP, as it is assumed to be capped (the cap replaces their LP) and they no longer participate.

Series B's payoff at this value would be:

$$\begin{array}{rcll} \text{Payoff}_{Bc} & = & \text{Post Conversion \% Holding} & \times & (\text{BPV}_{2c} & - & \text{Remaining LP}) & + & \text{LP}_B \\ & = & 3\text{m} / (5\text{m} + 3\text{m} + 1\text{m}) & & \text{£79m} & - & \text{£64m} & & \text{£18m} \\ & = & \text{£23m} & & & & & & \end{array}$$

which is still below their £27m cap.

It will be shown later that the Seed investors are the first to convert at the uncapped £73m BP.

- BP 3 - Series A converts, Series B capped:

Assuming Series B was uncapped or capped, Series A would convert at £91m:

$$\text{Post Conversion \% Holding} \times (\text{BPV}_{3u} - \text{Remaining LP}) = \text{LP}_A$$

$$2m / (5m + 3m + 1m + 2m) \times ( ? - (\text{£46m} - \text{£6m} + \text{£18m}) ) = \text{£6m}$$

$$\text{Post Conversion \% Holding} \times (\text{BPV}_{3c} - \text{Remaining LP} - \text{Cap}) = \text{LP}_A$$

$$2m / (5m + 1m + 2m) \times ( ? - (\text{£46m} - \text{£6m}) - \text{£27m} ) = \text{£6m}$$

$$\therefore V_{3u} = V_{3c} = \text{£91m}$$

The BPs are the same in this case as Series B's excess cap (£9m = £27m - £18m) equals the difference in Series A's required equity residual proceeds (£6m x (11m - 8m) / 2m).

At £91m, however, Series B's cap is triggered:

$$\text{Payoff}_{Ac} = \text{B's Shareholding \%} \times (\text{BPV}_{3u} - \text{Remaining LP}) + \text{LP}_A$$

$$= 3m / (5m + 3m + 1m) \times (\text{£91m} - \text{£64m}) + \text{£18m}$$

$$= \text{£27m}$$

So at BP 3 Series A converts and Series B is capped.

- BP 4, 5, 6 - £5, £7, £9 options exercised:

CAPPED										
BP No.	Investor	Capped Remaining LP	Exercise Price	Shares at Exercise	Option Proceeds before	Breakpoint Value	Option Proceeds now	Equity Value	Shares	Share Price
		1	2	3	4	5	6	7	8	9
						=1 + 2 x 3 + 4		=5 - 1 - 4 - 6		= 7 / 8
4	O (£5.00)	58,000,000	5.00	8,000,000	-	98,000,000	(1,000,000)	41,000,000	8,200,000	5.00
5	O (£7.00)	58,000,000	7.00	8,200,000	(1,000,000)	114,400,000	(1,400,000)	58,800,000	8,400,000	7.00
6	O (£9.00)	58,000,000	9.00	8,400,000	(2,400,000)	131,200,000	(1,800,000)	77,400,000	8,600,000	9.00

- BP 7 – Series B converts:

Series B's proceeds are capped at £27m when the enterprise value is £91m. Once it exceeds £144.4m, Series B will receive more from converting than receiving the cap. At BP 7, Series B will therefore convert and regain its 3m share entitlement:

$$\text{B's Shareholding \% at BP 5 (as-if-converted)} \times (\text{BPV}_{BCon} - \text{Remaining LP}) \geq \text{Cap}$$

$$3m^* / (8.6m + 3m) \times ( ? - [\text{£67m} - \text{£27m}^*] ) = \text{£27m}$$

$$\therefore V_{\text{BCon}} = \text{£}144.4\text{m}$$

\* Shares include B's conversion entitlement, the cap is removed

- BP 8 - Series C converts:

Series C will convert at BP 8 when the proceeds reach £151.8m:

$$\begin{aligned} \text{Post Conversion \% Holding} & \times (\text{BPV}_C - \text{Remaining LP}) & = \text{LP}_A \\ 4\text{m} / (11.6\text{m} + 4\text{m}) & \quad ? \quad 0 & = \text{£}40\text{m} \end{aligned}$$

$$\begin{aligned} V_C & = \text{£}156\text{m} \text{ less cumulative option proceeds } \text{£}4.2\text{m} \\ & = \text{£}151.8\text{m} \end{aligned}$$

The share price is £10.00 (= £156.0 / 15.6m), which equals Series C LP amount per preference share divided by the conversion ratio.

- BP 9, 10 - £15, £20 options exercised:

The £15.00 and £20.00 strike price options will be exercised at BPs 9 (£229.8m) and 10 (£308.8m):

The shareholdings and values at each BP are shown below in Table 13:

TABLE 13			BREAKPOINTS & EQUITY VALUES					SHARES						
Breakpoint			Cap Triggered?	Cap Converted	BREAKPOINT	Remaining LP	Options Proceeds	Equity Value	Base Shares	Participating +			Current Price	
										Converted	Now	Before		Participating Shares
1	Founders	Ordinary	--	--	£65,000,000	£65,000,000	-	-	5,000,000	-	-	3,000,000	8,000,000	0.00
1	B	Preferred	--	--	£65,000,000	£65,000,000	-	-	5,000,000	-	-	3,000,000	8,000,000	0.00
2	Seed	Preferred	--	--	£73,000,000	£64,000,000	-	£9,000,000	5,000,000	1,000,000	-	3,000,000	9,000,000	1.00
3	A	Preferred	Yes	--	£91,000,000	£67,000,000	-	£24,000,000	5,000,000	2,000,000	1,000,000	-	8,000,000	3.00
3	B	Preferred - Capped	Yes	--	£91,000,000	£46,000,000	-	£45,000,000	5,000,000	2,000,000	1,000,000	-	8,000,000	5.63
4	O (£5.00)	Options	Yes	--	£107,000,000	£67,000,000	£1,000,000	£41,000,000	5,000,000	200,000	3,000,000	-	8,200,000	5.00
5	O (£7.00)	Options	Yes	--	£123,400,000	£67,000,000	£2,400,000	£58,800,000	5,000,000	200,000	3,200,000	-	8,400,000	7.00
6	O (£9.00)	Options	Yes	--	£140,200,000	£67,000,000	£4,200,000	£77,400,000	5,000,000	200,000	3,400,000	-	8,600,000	9.00
7	B	Preferred - Converted	Yes	Yes	£144,400,000	£13,000,000	£4,200,000	£135,600,000	5,000,000	3,000,000	3,600,000	-	11,600,000	11.69
8	C	Preferred	Yes	Yes	£151,800,000	-	£4,200,000	£156,000,000	5,000,000	4,000,000	6,600,000	-	15,600,000	10.00
9	O (£15.00)	Options	Yes	Yes	£229,800,000	-	£7,200,000	£237,000,000	5,000,000	200,000	10,600,000	-	15,800,000	15.00
10	O (£20.00)	Options	Yes	Yes	£308,800,000	-	£11,200,000	£320,000,000	5,000,000	200,000	10,800,000	-	16,000,000	20.00

SHAREHOLDINGS AT EACH BREAKPOINT										
Breakpoint	Ordinary Founders	Preferred Seed	Preferred A	Preferred B	Preferred C	Options O (£5.00)	Options O (£7.00)	Options O (£9.00)	Options O (£15.00)	Options O (£20.00)
1	5,000,000	-	-	3,000,000	-	-	-	-	-	-
2	5,000,000	1,000,000	-	3,000,000	-	-	-	-	-	-
3	5,000,000	1,000,000	2,000,000	-	-	-	-	-	-	-
4	5,000,000	1,000,000	2,000,000	-	-	200,000	-	-	-	-
5	5,000,000	1,000,000	2,000,000	-	-	200,000	200,000	-	-	-
6	5,000,000	1,000,000	2,000,000	-	-	200,000	200,000	200,000	-	-
7	5,000,000	1,000,000	2,000,000	3,000,000	-	200,000	200,000	200,000	-	-
8	5,000,000	1,000,000	2,000,000	3,000,000	4,000,000	200,000	200,000	200,000	-	-
9	5,000,000	1,000,000	2,000,000	3,000,000	4,000,000	200,000	200,000	200,000	200,000	-
10	5,000,000	1,000,000	2,000,000	3,000,000	4,000,000	200,000	200,000	200,000	200,000	200,000

## Option Valuation

In the OPM, the Black-Scholes Model ('BSM') can be used to value each tranche as the incremental Call option value, where the exercise price is the lower BP. Taking the example in Case 5, assuming an equity value of £500m, a 5 year exit horizon, equity returns volatility of 30% and a risk free rate of return 4.0%, the valuation for each security can be calculated as follows:

*Step 1: Allocate exit value / proceeds to tranches and determine shareholdings:*

TABLE 14		0	1	2	3	4	5	6	7	8	9	10
	From	-	65,000,000	73,000,000	91,000,000	107,000,000	123,400,000	140,200,000	144,400,000	151,800,000	229,800,000	308,800,000
	To	65,000,000	73,000,000	91,000,000	107,000,000	123,400,000	140,200,000	144,400,000	151,800,000	229,800,000	308,800,000	500,000,000
	Change	65,000,000	8,000,000	18,000,000	16,000,000	16,400,000	16,800,000	4,200,000	7,400,000	78,000,000	79,000,000	191,200,000
<b>SHARES</b>		No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Founders - Ordinary	5,000,000		5,000,000	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000	5,000,000
B - Preferred Convertible - with cap	3,000,000	18,000,000	3,000,000	3,000,000	-	-	-	-	3,000,000	3,000,000	3,000,000	3,000,000
Seed - Preferred Convertible	1,000,000	1,000,000	-	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000	1,000,000
A - Preferred Convertible	2,000,000	6,000,000	-	-	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000	2,000,000
O (£5.00) - Options	200,000	-	-	-	-	200,000	200,000	200,000	200,000	200,000	200,000	200,000
O (£7.00) - Options	200,000	-	-	-	-	-	200,000	200,000	200,000	200,000	200,000	200,000
O (£9.00) - Options	200,000	-	-	-	-	-	-	200,000	200,000	200,000	200,000	200,000
C - Preferred Convertible	4,000,000	40,000,000	-	-	-	-	-	-	-	4,000,000	4,000,000	4,000,000
O (£15.00) - Options	200,000	-	-	-	-	-	-	-	-	-	200,000	200,000
O (£20.00) - Options	200,000	-	-	-	-	-	-	-	-	-	-	200,000
	16,000,000	£ 65,000,000	8,000,000	9,000,000	8,000,000	8,200,000	8,400,000	8,600,000	11,600,000	15,600,000	15,800,000	16,000,000
Check			8,000,000	9,000,000	8,000,000	8,200,000	8,400,000	8,600,000	11,600,000	15,600,000	15,800,000	16,000,000
Cum. Option Proceeds			-	-	-	1,000,000	2,400,000	4,200,000	4,200,000	4,200,000	7,200,000	11,200,000
<b>SHAREHOLDINGS</b>		%	%	%	%	%	%	%	%	%	%	%
Founders - Ordinary		-	62.5 %	55.6 %	62.5 %	61.0 %	59.5 %	58.1 %	43.1 %	32.1 %	31.6 %	31.3 %
B - Preferred Convertible - with cap		27.7 %	37.5 %	33.3 %	-	-	-	-	25.9 %	19.2 %	19.0 %	18.8 %
Seed - Preferred Convertible		1.5 %	-	11.1 %	12.5 %	12.2 %	11.9 %	11.6 %	8.6 %	6.4 %	6.3 %	6.3 %
A - Preferred Convertible		9.2 %	-	-	25.0 %	24.4 %	23.8 %	23.3 %	17.2 %	12.8 %	12.7 %	12.5 %
O (£5.00) - Options		-	-	-	-	2.4 %	2.4 %	2.3 %	1.7 %	1.3 %	1.3 %	1.3 %
O (£7.00) - Options		-	-	-	-	-	2.4 %	2.3 %	1.7 %	1.3 %	1.3 %	1.3 %
O (£9.00) - Options		-	-	-	-	-	-	2.3 %	1.7 %	1.3 %	1.3 %	1.3 %
C - Preferred Convertible		61.5 %	-	-	-	-	-	-	-	25.6 %	25.3 %	25.0 %
O (£15.00) - Options		-	-	-	-	-	-	-	-	-	1.3 %	1.3 %
O (£20.00) - Options		-	-	-	-	-	-	-	-	-	-	1.3 %
		100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %	100.0 %

*Step 2: Calculate option values:*

BLACK SCHOLES MODEL		0	1	2	3	4	5	6	7	8	9	10
Breakpoint threshold												
Equity Value		500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000	500,000,000
Exercise Price (X)		0	65,000,000	73,000,000	91,000,000	107,000,000	123,400,000	140,200,000	144,400,000	151,800,000	229,800,000	308,800,000
Risk Free (continuous)(r)		4.00 %	4.00 %	4.00 %	4.00 %	4.00 %	4.00 %	4.00 %	4.00 %	4.00 %	4.00 %	4.00 %
Volatility (s)		30.0 %	30.0 %	30.0 %	30.0 %	30.0 %	30.0 %	30.0 %	30.0 %	30.0 %	30.0 %	30.0 %
Time to Expiry (years)(T)		5.00 yrs	5.00 yrs	5.00 yrs	5.00 yrs	5.00 yrs	5.00 yrs	5.00 yrs	5.00 yrs	5.00 yrs	5.00 yrs	5.00 yrs
Dividends - yield (%) (q)		0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
$d1 = (\ln(500m/65m) + (4\% + 0.5 \times 30\%^2) \times 5.00) / (0.5 \times 30\% \times \text{SQRT}(5))$		61.3851	3.6749	3.5019	3.1734	2.9319	2.7193	2.5290	2.4850	2.4105	1.7924	1.3519
$d2 = 3.6749 - 30\% \times \text{SQRT}(5)$		60.7143	3.0041	2.8311	2.5025	2.2611	2.0485	1.8582	1.8142	1.7397	1.1216	0.6811
$N(d1) = \text{NORMSDIST}(3.6749)$		1.0000	0.9999	0.9998	0.9992	0.9983	0.9967	0.9943	0.9935	0.9920	0.9635	0.9118
$N(d2) = \text{NORMSDIST}(3.0041)$		1.0000	0.9987	0.9977	0.9938	0.9881	0.9797	0.9684	0.9652	0.9590	0.8690	0.7521
Share price (500,000,000) x N(d1)		500,000,000	499,940,522	499,884,514	499,623,274	499,157,766	498,364,605	497,140,704	496,761,651	496,017,848	481,733,980	455,902,011
PV of exp price (65,000,000 x EXP(-4.00 x 5)) x N(d2)		0	53,146,625	59,628,713	74,045,145	86,563,705	98,984,943	111,162,459	114,107,977	119,193,491	163,494,751	190,150,141
Call Price		500,000,000	446,793,897	440,255,801	425,578,130	412,594,061	399,379,662	385,978,245	382,653,674	376,824,356	318,239,229	265,751,870
Incremental Call Value		53,206,103	6,538,097	14,677,671	12,984,069	13,214,398	13,401,417	3,324,571	5,829,318	58,585,127	52,487,359	265,751,870

Step 3: Allocate incremental option values according to shareholding %:

OPTION VALUATIONS	£	£	£	£	£	£	£	£	£	£	£	£
Founders - Ordinary	159,270,404	-	4,086,310	8,154,262	8,115,043	8,057,560	7,977,034	1,932,890	2,512,637	18,777,284	16,609,924	83,047,459
B - Preferred Convertible - with cap	94,646,724	14,733,998	2,451,786	4,892,557	-	-	-	-	1,507,582	11,266,371	9,965,954	49,828,476
Seed - Preferred Convertible	31,855,374	818,555	-	1,630,852	1,623,009	1,611,512	1,595,407	386,578	502,527	3,755,457	3,321,985	16,609,492
A - Preferred Convertible	63,723,265	4,911,333	-	-	3,246,017	3,223,024	3,190,814	773,156	1,005,055	7,510,914	6,643,970	33,218,984
O (£5.00) - Options	5,556,592	-	-	-	-	322,302	319,081	77,316	100,505	751,091	664,397	3,321,898
O (£7.00) - Options	5,234,289	-	-	-	-	-	319,081	77,316	100,505	751,091	664,397	3,321,898
O (£9.00) - Options	4,915,208	-	-	-	-	-	-	77,316	100,505	751,091	664,397	3,321,898
C - Preferred Convertible	127,489,951	32,742,217	-	-	-	-	-	-	-	15,021,827	13,287,939	66,437,968
O (£15.00) - Options	3,986,295	-	-	-	-	-	-	-	-	-	664,397	3,321,898
O (£20.00) - Options	3,321,898	-	-	-	-	-	-	-	-	-	-	3,321,898
	500,000,000	53,206,103	6,538,097	14,677,671	12,984,069	13,214,398	13,401,417	3,324,571	5,829,318	58,585,127	52,487,359	265,751,870

Step 4: Calculate fair value prices:

OPTION VALUATIONS	No.	£/ share	£
Founders - Ordinary	5,000,000	31.85	159,270,404
B - Preferred Convertible - with cap	3,000,000	31.55	94,646,724
Seed - Preferred Convertible	1,000,000	31.86	31,855,374
A - Preferred Convertible	2,000,000	31.86	63,723,265
O (£5.00) - Options	200,000	27.78	5,556,592
O (£7.00) - Options	200,000	26.17	5,234,289
O (£9.00) - Options	200,000	24.58	4,915,208
C - Preferred Convertible	4,000,000	31.87	127,489,951
O (£15.00) - Options	200,000	19.93	3,986,295
O (£20.00) - Options	200,000	16.61	3,321,898
	16,000,000		500,000,000

If one of these securities was recently issued at a fair price, then the fair price of others can be implied ('Backsolve'). For example, if the series C were recently issued at £30.00 for each preference share, at a conversion ratio of 1.0, we can determine the other fair values. In practice, using goal seek in Excel, the £500m assumed enterprise value can be adjusted to result in Series C's value being £30 per share. The result is an enterprise value of £469.8m

OPTION VALUATIONS	No.	£/ share	£
Founders - Ordinary	5,000,000	29.95	149,758,858
B - Preferred Convertible - with cap	3,000,000	29.67	89,009,431
Seed - Preferred Convertible	1,000,000	29.95	29,953,498
A - Preferred Convertible	2,000,000	29.96	59,923,336
O (£5.00) - Options	200,000	25.89	5,177,447
O (£7.00) - Options	200,000	24.28	4,856,476
O (£9.00) - Options	200,000	22.70	4,539,379
C - Preferred Convertible	4,000,000	30.00	120,000,005
O (£15.00) - Options	200,000	18.12	3,624,067
O (£20.00) - Options	200,000	14.90	2,980,846
	16,000,000		469,823,344

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### Suggested reading

#### *Books:*

- AICPA (2013) *Valuation of Privately Held-Company Equity Securities Issued as Compensation*, American Institute of Certified Public Accountants, Inc.
- Beaton, N.J. (2010) *Valuing Early Stage and Venture Backed Companies*, Wiley
- Chriss, N.A. (1997) *Black-Scholes and Beyond: Option Pricing Models*. McGraw-Hill.
- Puca, A. (2020) *Early Stage Valuation: a Fair Value Perspective*, Wiley

#### *Papers:*

- Beaton, N.J., Dal Santo, A. & Puca, A. (2019) "Calibration With OPM in Early-Stage Enterprises: A Fair Value Update," *Business Valuation Update* Vol.25, No.3, March 2019, <https://www.alvarezandmarsal.com/sites/default/files/BPVu0319-calibration.pdf>
- Black, F., and M. Scholes (1973), "The Pricing of Options and Corporate Liabilities," *Journal of Political Economy*, 81(3), 1973, 637-659.
- Harms, T.W. / Mercer Capital (2016) "A Layperson's Guide to the Option Pricing Model," [https://mercercapital.com/content/uploads/Article\\_Mercer-Capital-Guide-Option-Pricing-Model.pdf](https://mercercapital.com/content/uploads/Article_Mercer-Capital-Guide-Option-Pricing-Model.pdf)
- Kiepora, F. (2020) "Valuing Securities Using the Option Pricing Method," *The CPA Journal*, Jul-Aug 2020 <https://www.cpajournal.com/2020/09/09/valuing-securities-using-the-option-pricing-method/>
- Merton, R.C. (1973), "The Theory of Rational Option Pricing", *Bell Journal of Economics and Management Science*, 4(1), 1973, 141-183.

#### Anti-Dilution protection:

- Bartlett, R. P. (2003) "Understanding Price-Based Antidilution Protection: Five Principles to Apply When Negotiating a Down-Round Financing" [https://digitalcommons.law.uga.edu/fac\\_artchop/438/](https://digitalcommons.law.uga.edu/fac_artchop/438/)
- Woronoff, M.A. & Rosen J.A. (2005) "Understanding Anti-Dilution Provisions In Convertible Securities" Vol.74, Issue 1 *Fordham Law Review* <https://ir.lawnet.fordham.edu/cgi/viewcontent.cgi?article=4095&context=flr>

#### *Videos:*

- Prof. Jiro Kondo (McGill Desautels):  
<https://www.youtube.com/watch?v=6pUFZBLQwCM>  
<https://www.youtube.com/watch?v=b0KaBln94XI>

These videos are very well presented with clear explanations and are highly recommended