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Valuing Investments in Start-Ups

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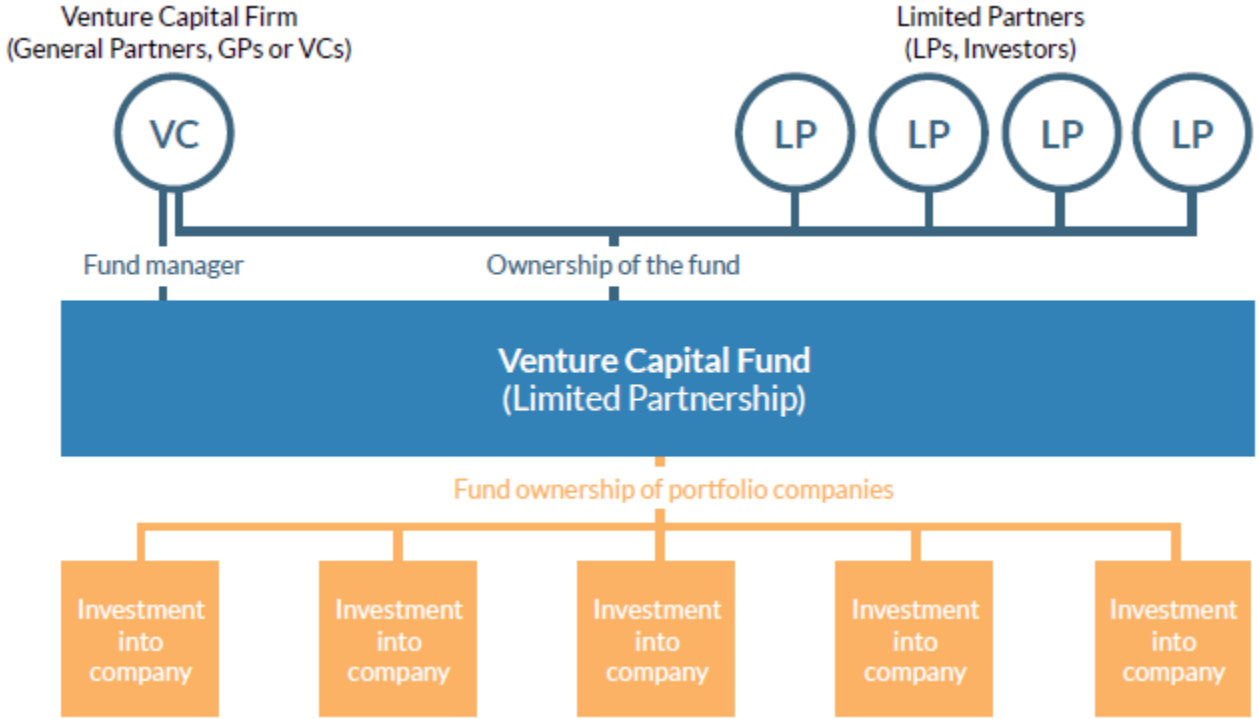
Topics to Cover

- VC Market Overview
- Valuing the Enterprise
  - Calibration
  - Measuring Current Value
- Valuing the Interest in the Enterprise
  - PWERM
  - OPM

VC Market Overview

SECTION 1

Basic VC Architecture



Source: NVCA 2017 Yearbook

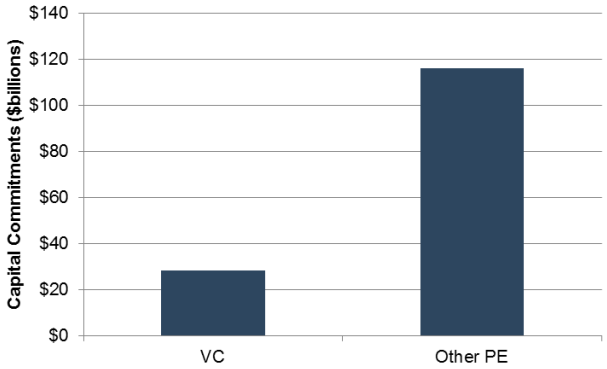
Investors commit capital to fund => GP identifies early-stage companies to invest in => investment returns are shared by GP (fees & carry) and LPs

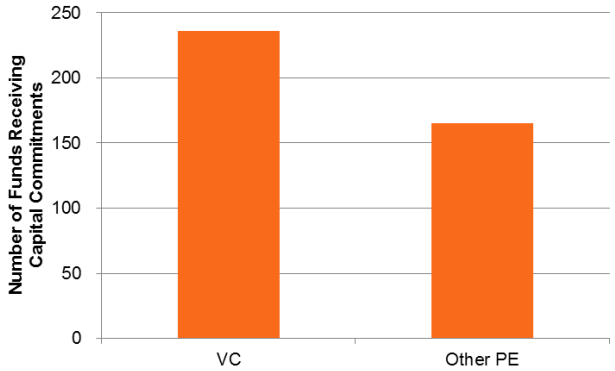
Relation to Private Equity

	Venture Capital	Other Private Equity
Life Cycle Stage	Early / Development	Mature
Transaction Type	Primary	Secondary
Financial Leverage	Not used	Significant source of returns
Managerial Assistance	More likely	Less likely
Holding Periods	Depends on strategy – on balance, potentially longer than PE	Depends on strategy – on balance, potentially shorter than PE

Strictly speaking, VC is a subset of private equity. There are, however, some primary characteristics that separate VC from the rest of the PE universe

Comparison to Traditional PE





During 2015, capital commitments to VC funds accounted for approximately 20% of total private equity commitments

The number of VC funds receiving commitments actually exceeded traditional LBO and mezzanine funds

Because VC funds typically make smaller investments, the fund sizes tend to be much smaller. VC funds received average capital commitments of $120 million during 2015, compared to $705 million for non-venture private equity funds

Source: NVCA 2016 Yearbook

Development Company Life Cycle

	Stage 1	Stage 2	Stage 3	Stage 4	Stage 5	Stage 6
Product Revenue	None	None	None	Some	Growing	Established History
Expense History	Limited	Substantive	Substantive	Substantive	Established History	Established History
Profitability	Losses	Losses	Losses	Losses	Breakeven / Profitable	Established History
Management Team	Incomplete	Expanding	Complete	Complete	Complete	Complete
Product Development	Limited	Underway	Beta Testing	Shipping Orders	Shipping Orders	Ongoing
Financing Sources	Angels / Early VC	Venture Capital	VC / Strategics	Mezz / Strategics	Strategic / IPO	Self-Funding

AICPA Practice Aid Life Cycle Stage Framework

Paragraph 2.02: An enterprise typically builds value throughout the various stages of development but generally not in a linear fashion. In valuing the securities within an enterprise, it is important to recognize the enterprise's stage of development and its achievement of developmental milestones. The stage of development will influence the perceived risk of investing in the enterprise, which, in turn, will influence the valuation.

Source: AICPA Practice Aid – Valuation of Privately-Held-Company Equity Securities Issued as Compensation

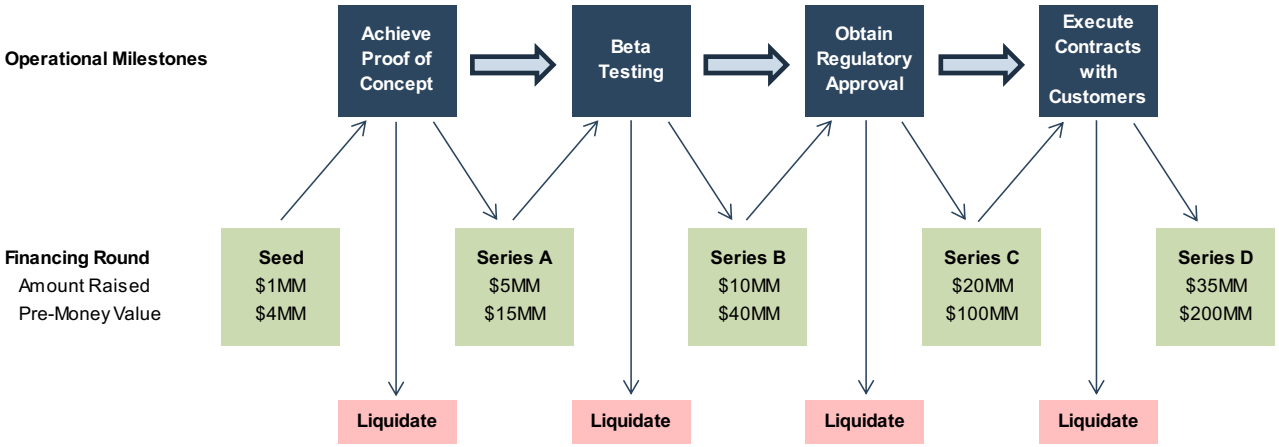
Development Milestones

- Finalize original business plan
- Obtain initial outside financing
- Achieve proof of concept
- Beta test product or service
- Successfully assemble management team
- Establish relationship with strategic partners
- Obtain key customer(s)
- Obtain regulatory approval
- Develop manufacturing plan
- Secure key raw materials, equipment, or work force
- Execute customer contracts
- Deliver product or service
- Achieve positive cash flows / breakeven
- Achieve profitability

Examples from AICPA Practice Aid

Source: AICPA Practice Aid – Valuation of Privately-Held-Company Equity Securities Issued as Compensation

Staged Investment Model



Paragraph 3.02: Many early-stage enterprises have a well-developed business plan that sets forth the business strategy, the product, the market, the competition, and a projected financing and operating schedule. Few investors are willing to commit funds in advance sufficient to carry the firm from concept to public offering. Rather, they want to see that the enterprise's management has a sound plan, is executing its plan, and is meeting its commitments. As a result, several financing rounds usually are necessary, with each round contingent on the enterprise having met its prior commitments. Those commitments often are set forth in the original business plan as a series of milestones.

VC investing illustrates "real options" framework

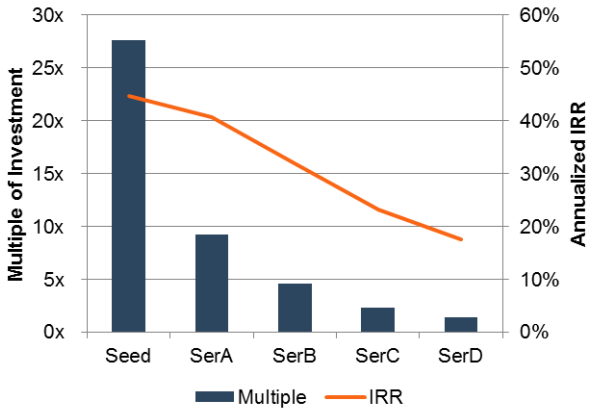
Evolving Capital Structures

	Jun-16		Dec-18		Dec-19		Jun-21		Jun-23	
Common & Options	1,000	80%	1,000	60%	1,000	48%	1,000	40%	1,000	34%
Seed Preferred	250	20%	250	15%	250	12%	250	10%	250	9%
Series A Preferred		0%	417	25%	417	20%	417	17%	417	14%
Series B Preferred		0%		0%	417	20%	417	17%	417	14%
Series C Preferred		0%		0%		0%	417	17%	417	14%
Series D Preferred		0%		0%		0%		0%	438	15%
Total	**1,250**	**100%**	**1,667**	**100%**	**2,083**	**100%**	**2,500**	**100%**	**2,938**	**100%**
Proceeds from Round ($000s)	$1,000		$5,000		$10,000		$20,000		$35,000	
Per Fully-Diluted Share	*$4.00*		*$12.00*		*$24.00*		*$48.00*		*$80.00*	
Pre-Money Value	$4,000		$15,000		$40,000		$100,000		$200,000	
Post-Money Value	$5,000		$20,000		$50,000		$120,000		$235,000	
Cumulative Financing	$1,000		$6,000		$16,000		$36,000		$71,000	

As the Company raises additional rounds of financing, the capital structure evolves; enterprise value increases as developmental milestones are achieved

Risk and Return

	Exit // Jun-25			
	Shares	*Holding Period*	*Multiple*	*IRR*
Common & Options	1,000			
Seed Preferred	250	9.0	27.7x	45%
Series A Preferred	417	6.5	9.2x	41%
Series B Preferred	417	5.5	4.6x	32%
Series C Preferred	417	4.0	2.3x	23%
Series D Preferred	438	2.0	1.4x	18%
Total	**2,938**			
Transaction Proceeds ($000s)	$325,000			
Per Fully-Diluted Share	*$110.64*			



Potential returns decrease in later rounds as risk is mitigated

Paragraph 3.04: In general, as each milestone is met, the value of the enterprise and the securities within the enterprise are enhanced. As the number of remaining milestones and the related time frame for achieving the business plan are reduced, uncertainty about achieving the original business plan declines. As uncertainty is reduced, investors perceive that there is less risk, which, in turn, reduces their *required rate of return*, which increases the value of the enterprise and its securities.

Other Enterprise Value Considerations

- State of industry and economy
- Management & BoD
- Marketplace and major competitors
- Barriers to entry
- Competitive forces
- Existence of proprietary technology, product, or service
- Workforce / human capital
- Customer and vendor characteristics
- Strategic relationships with major suppliers or customers
- Major investors
- Cost structure and financial condition
- Attractiveness of industry segment

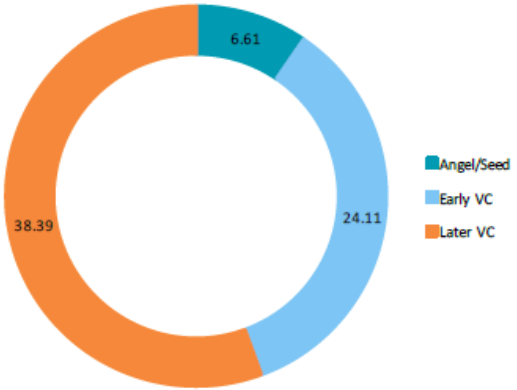
Factors from AICPA Practice Aid

Source: AICPA Practice Aid – Valuation of Privately-Held-Company Equity Securities Issued as Compensation

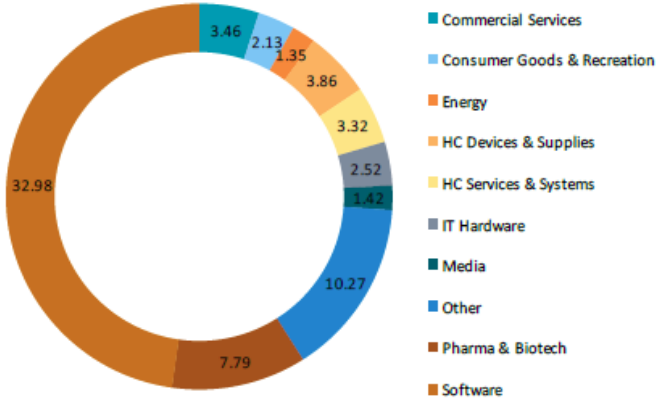
Financing Diversity

2016 VC investing activity by stage and industry sector

2016 U.S. VC Deals by Stage ($B)

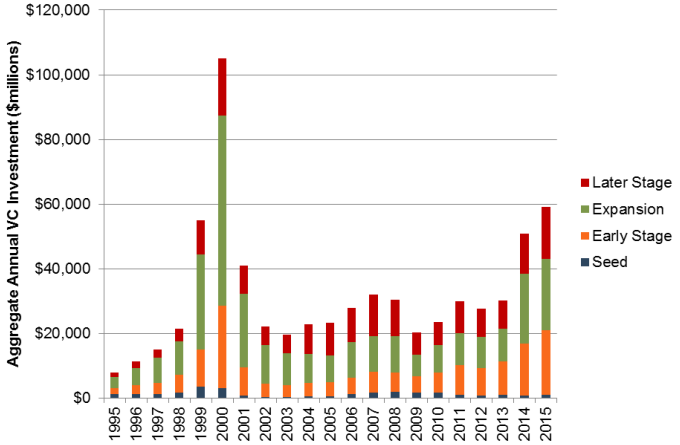


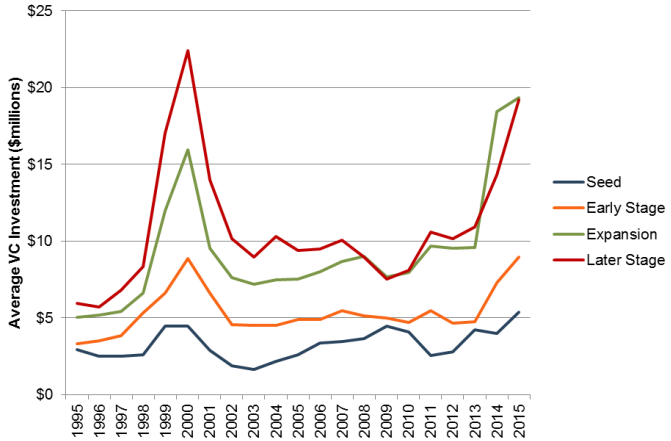
16 US VC Deals by Sector ($B)



Source: NVCA 2017 Yearbook

Financing Trends Over Time





Source: NVCA 2016 Yearbook

VC investing is cyclical and generally sensitive to overall economic conditions

Economic Rights – Preferred Shares

Table 6-1

Economic Rights

Nature of right	*Is the right meaningful and substantive?*	*Purpose of right*	*When, if ever, is the right generally meaningful and substantive before initial public offering (IPO)?*	*Is the value of the right readily and objectively measurable?*	*Do valuation methods typically consider the right?*
Preferred dividends (noncumulative)	No	Preference to receive dividends if declared	N/A[1]	N/A	N/A
Preferred dividends (cumulative)	Yes	Aims to provide a minimum fixed return in all situations except IPO	Entire life of instrument	Yes	Yes
Liquidation preference (nonparticipating)	Yes	Ensures higher return up until break-even point[2]	Up until break-even point[3]	Yes	Yes
Liquidation preference (participating)	Yes	Ensures disproportionately higher return in all situations except IPO	Entire life of instrument	Yes	Yes
Mandatory redemption	Yes[4]	Right to return of capital; aims to provide liquidity	Entire life of instrument	No	No
Conversion (fixed or variable ratio)	Yes	Produces better economic results in certain circumstances	Entire life of instrument	Yes	Yes
Participation (fixed or variable ratio)	Yes	Ensures disproportionately higher return in all situations except IPO	Entire life of instrument	Yes	Yes
Antidilution	Yes	Aims to protect value of investment	Entire life of instrument	Maybe[5]	No
Registration	No[6]	Aims to provide liquidity	N/A	N/A	N/A

Source: AICPA Practice Aid – Valuation of Privately-Held-Company Equity Securities Issued as Compensation

VCs invest in preferred shares, which generally provide enhanced economic rights relative to common shares

Control Rights – Preferred Shares

Table 6-2

Control Rights

Nature of right	*Is the right meaningful and substantive?*	*Purpose of right*	*When, if ever, is the right generally meaningful and substantive before initial public offering (IPO)?*	*Is the value of the right readily and objectively measurable?*	*Do valuation methods typically consider the right?*
Voting	Yes	Ability to control or influence	Entire life of instrument	No	No
Protective provisions and veto rights	Yes	Ability to control disproportionate to ownership	Entire life of instrument	No	No
Board composition	Yes	Ability to control disproportionate to ownership	Entire life of instrument	No	No
Drag along	Yes	Ability to control disproportionate to ownership	Entire life of instrument	No	No
Right to participate in future rounds	Yes	Ability to maintain ownership percentage	Entire life of instrument	No	No
First refusal	Yes	Restricted ability to sell common stock	Entire life of instrument	No	No
Tag along	Yes	Restricted ability to sell common stock	Entire life of instrument	No	No
Management	Yes	Access to inside information not available to common stockholders	Entire life of instrument	No	No
Information	Yes	Access to inside information not available to common stockholders	Entire life of instrument	No	No

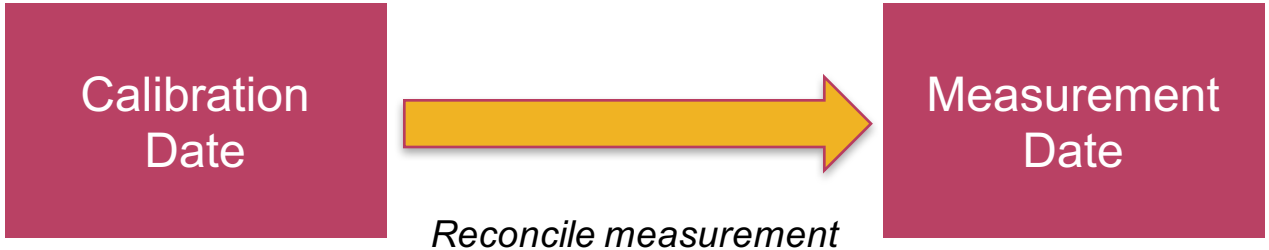
Source: AICPA Practice Aid – Valuation of Privately-Held-Company Equity Securities Issued as Compensation

VCs invest in preferred shares, which generally provide enhanced control rights relative to common shares

Valuing the Enterprise

SECTION 2

Role of Calibration



Reconcile measurement date conclusion to milestones achieved, changes in market conditions, etc.

Calibration :: What Was the Last Valuation?

Last External Round

Issue	Date	Price	Shares	Proceeds
Series E Preferred	4/15/2015	$7.1405	4,971,641	$35,500,003

As-If Converted Basis

Fully-Diluted Share Count	77,494,506
times: Series E Issue Price	$7.1405
Implied Equity Value (Post-Money)	**$553,349,520**
Weight Assigned to Indication	50.0%

Option Pricing Model Backsolve

	Shares	Per Share	Total
Series A Preferred	3,666,666	$1.9749	$7,241,480
Series B Preferred	9,400,764	$2.0362	$19,142,277
Series C Preferred / Warrants	8,409,088	$2.1958	$18,464,963
Series C-1 Preferred	1,198,019	$3.6190	$4,335,618
Series D Preferred	12,256,960	$3.4919	$42,799,698
Series E Preferred	4,971,641	$7.1405	$35,500,052
Options: 2007 Stock Plan / Warrants	14,680,052	$1.7894	$26,268,052
Common Stock	22,911,316	$1.9236	$44,072,577
Total	**77,494,506**		**$197,824,718**
Weight Assigned to Indication			50.0%

Indicated Equity Value - Last External Round	**$376,000,000**
less: Cash	($61,416,003)
plus: Interest-Bearing Debt	$20,823,000
Indicated Enterprise Value - Last External Round	**$335,406,997**

Overstates value because it treats every share as if it were the most senior class

Understates value because it tends to ascribe too much value to seniority preferences

Developing a Calibration Date Enterprise Value

Enterprise Valuation Methods

- Asset-based approaches
- Discounted cash flow analysis
- Market multiples
- PWERM => Probability-Weighted Expected Return Method

Enterprise Valuation Methods

- Asset-based approaches
- Discounted cash flow analysis
- Market multiples
- **PWERM => Probability-Weighted Expected Return Method**

PWERM & VC Perspectives

The PWERM

6.23 Under a PWERM, the value of the various equity securities are estimated based upon an analysis of future values for the enterprise, assuming various future outcomes. Share value is based upon the probability-weighted present value of expected future investment returns, considering each of the possible future outcomes available to the enterprise, as well as the rights of each share class. Although the future outcomes considered in any given valuation model will vary based upon the enterprise's facts and circumstances, common future outcomes modeled might include an IPO, a merger or sale, a dissolution, or continued operation as a private enterprise until a later exit date.[5]

6.24 This method involves a forward-looking analysis of the potential future outcomes available to the enterprise, the estimation of ranges of future and present value under each outcome, and the application of a probability factor to each outcome as of the valuation date. The following list is a simple

Source: AICPA Practice Aid – Valuation of Privately-Held-Company Equity Securities Issued as Compensation

PWERM Calculation Steps:

1 – Determine the possible future outcomes available to the enterprise

2 – Estimate the future equity value under each outcome, either as a point estimate or range

3 – Allocate the estimated future equity value to each share class under each possible outcome

4 – Weight each possible outcome by its respective probability to estimate the expected future probability-weighted cash flows to each share class

5 – Discount the expected equity value allocated to each share class to present value using a risk-adjusted discount rate

6 – Divide the present value allocated to each share class by the respective number of shares outstanding to calculate the value per share for each class.

7 – Consider additional adjustments (i.e., DLOM)

The PWERM mirrors the perspective and assumptions of VCs

PWERM Scenarios

Scenario Definitions

Scenario #1: IPO	
Expected Time Until Event (Years)	4.0

	Revenue	EBITDA
Forward Performance Measures	€ 840.1	€ 42.0
times: Selected Multiples	0.9x	15.0x
Estimated IPO Values	€ 756.1	€ 630.1
Weights Applied	50.0%	50.0%
Estimated IPO Exit	**€ 693.1**	

Scenario #2: Strategic Sale	
Expected Time Until Event (Years)	4.0

	Revenue	EBITDA
Forward Performance Measures	€ 840.1	€ 42.0
times: Selected Multiples	1.25x	20.0x
Estimated Strategic Sale Value	€ 1,050.1	€ 840.1
Weights Applied	50.0%	50.0%
Estimated Strategic Sale Exit	**€ 945.1**	

Scenario #3: Downside Case	
Expected Time Until Event (Years)	4.0
Estimated Strategic Sale Value	€ 945.1
times: Selected Multiple	50.0%
Estimated Value - Downside Case	€ 472.5
Weights Applied	100.0%
Estimated Downside Case Value	**€ 472.5**

Scenario #4: Liquidation / Dissolution	
Expected Time Until Event (Years)	2.0
Cumulative Invested Capital	€ 72.6
times: Estimated Recovery Multiple	50.0%
Estimated Liquidation / Dissolution Value	**€ 36.3**

PWERM assumptions made with reference to life cycle stage, business plan, financial projections, and market data

PWERM Scenarios

	Scen #1	Scen #2	Scen #3	Scen #4
Scenario Description	IPO	Strategic Sale	Downside Case	Liquidation / Dissolution
Exit Enterprise Value	€ 693.1	€ 945.1	€ 472.5	€ 36.3
Assumed Exit Date	12/31/2019	12/31/2019	12/31/2019	12/31/2017
Scenario Weights	25.0%	25.0%	25.0%	25.0%
Implied Enterprise Value Analysis				
Expected Dilution	0.0%	0.0%	0.0%	0.0%
Enterprise Value Attributable to Existing Capital Providers	€ 693.1	€ 945.1	€ 472.5	€ 36.3
Discount Periods	4.0	4.0	4.0	2.0
Weighted Average Cost of Capital	17.4%	17.4%	17.4%	17.4%
Present Value Factor	0.5262	0.5262	0.5262	0.7254
Present Value of Exit Enterprise Value	€ 364.7	€ 497.3	€ 248.7	€ 26.3
Indicated Enterprise Value	**€ 284.3**			
Projected Enterprise Value	€ 693.1	€ 945.1	€ 472.5	€ 36.3

Scenario weights and expected dilution estimated with reference to life cycle stage and business plan

PWERM Inputs

- Discount rate
- Time to liquidity event
- Exit multiples
    - Consider IPO data
    - Consider public company data
- Downside case exit value
- Liquidation recovery multiple
- Scenario weights
- Expected dilution

Discount Rate

Cost of Equity			References and Comments
Risk-Free Rate		2.66%	*Note (1)*
Equity Risk Premium	5.50%		*Note (2)*
Guideline Beta	2.00		*Note (3)*
Beta Adjusted Common Stock Premium		11.00%	
Size Premium		3.74%	*Note (4)*
Specific Company Risk Premium		0.50%	*Note (5)*
Equity Discount Rate (Required Rate of Return)		17.90%	*Rounded to: 0.01%*

Cost of Debt			
Base Cost of Debt		4.86%	*Note (6)*
Applicable Spread Over Base Cost		0.00%	*Note (7)*
Total Pre-tax Cost of Debt		4.86%	
Estimated Tax Rate	38.0%	-1.85%	
After-Tax Cost of Debt Capital		3.01%	*Rounded to: 0.01%*

Weighted Average Cost of Capital (WACC)

Capital Component	Cost	Weight[8]	Product
Equity	17.90%	100.0%	17.90%
Debt	3.01%	0.0%	0.00%
Weighted Average Cost of Capital (WACC)			**17.90%**

At the calibration date, the objective of the WACC analysis is to establish a baseline framework for the enterprise WACC. The enterprise WACC is distinguished from the conditional returns achieved on successful VC investments, and is instead representative of an investor's expected return on a portfolio of VC investments (likely 15-20%)

At the calibration date, the specific company risk premium is implied such that the resulting WACC corresponds to the IRR on the enterprise value

At subsequent fair value measurement dates, the specific company risk premium is reassessed relative to fundamental changes in the business.

Weighted Average Cost of Capital

VC Returns

Type of Fund	5-Year Return 2002	5-Year Return 2008	10-Year Return 2002	10-Year Return 2008	20-Year Return 2002	20-Year Return 2008
Seed/Early Stage[1]	51.4%	3.0%	34.9%	25.5%	20.4%	22.1%
Balanced[2]	20.9%	7.5%	20.9%	12.0%	14.3%	14.6%
Later Stage[3]	10.6%	8.1%	21.6%	7.3%	15.3%	14.7%
All Ventures	28.3%	5.7%	26.3%	13.4%	16.6%	17.2%

1 Venture Economics uses the term *seed stage* to refer to enterprises that have not yet fully established commercial operations and may involve continued research and development. Venture Economics uses the term *early stage* to refer to enterprises involved in product development and initial marketing, manufacturing, and sales activities.

2 Venture Economics uses the term *balanced* to refer to enterprises at a variety of stages of development (seed stage, early stage, later stage).

3 Venture Economics uses the term *later stage* to refer to enterprises that are producing, shipping, and increasing sales volume.

Fund returns, net of fees // Source: AICPA Practice Aid

VC Returns

Rates of Return

Stage of Development	*Plummer*[1]	*Scherlis and Sahlman*[2]	*Sahlman and Others*[3]
Start-up[4]	50%–70%	50%–70%	50%–100%
First stage or early development[5]	40%–60%	40%–60%	40%–60%
Second stage or expansion[6]	35%–50%	30%–50%	30%–40%
Bridge/initial public offering (IPO)[7]	25%–35%	20%–35%	20%–30%

1 James L. Plummer, *QED Report on Venture Capital Financial Analysis* (Palo Alto: QED Research, Inc., 1987).

2 Daniel R. Scherlis and William A. Sahlman, "A Method for Valuing High-Risk, Long Term, Investments: The 'Venture Capital Method,'" Harvard Business School Teaching Note 9-288-006 (Boston: Harvard Business School Publishing, 1989).

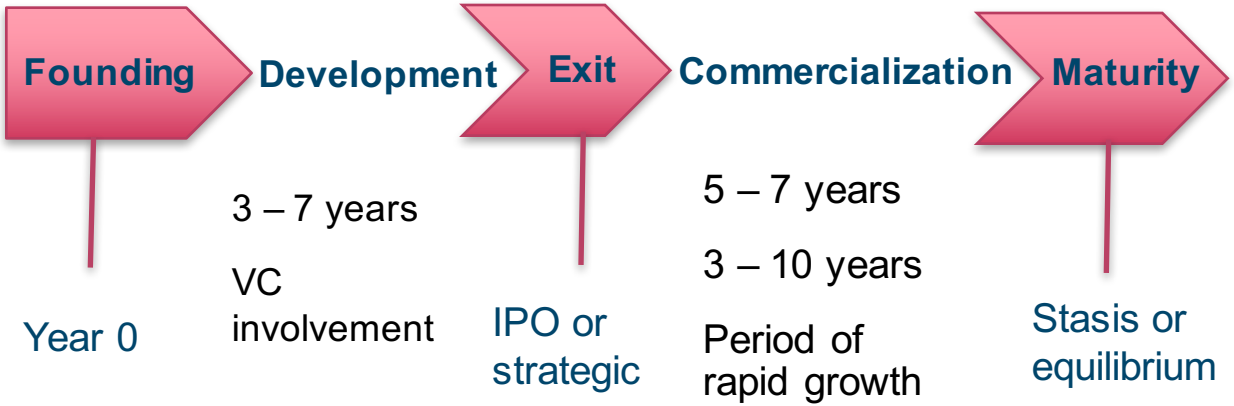
Expected enterprise-level returns Source: AICPA Practice Aid

Discount Rate Perspective

- Extension of CAPM to incorporate four factors:
  - Excess market returns
  - Size
  - Value
  - Liquidity
- Market, value, and liquidity factors appear significant in looking at data from c. 1981 to c. 2008
- Concluded estimate of VC cost of capital: 15%

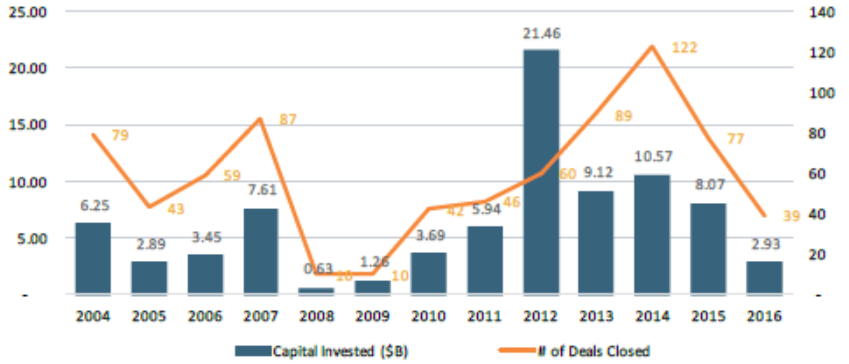
Source: Venture Capital & the Finance of Innovation, Metrick et al

Lifecycle


Founding
Development
Exit
Commercialization
Maturity
Year 0
3 – 7 years
VC involvement
IPO or strategic
5 – 7 years
3 – 10 years
Period of rapid growth
Stasis or equilibrium

Exit Perspectives :: IPO

U.S. VC-backed IPOs by Year



Source: NVCA 2017 Yearbook, Data Provided by PitchBook

U.S. IPOs by Year

	# of All IPOs	# of VC Backed IPOs
2004	281	79
2005	258	43
2006	260	59
2007	294	87
2008	137	10
2009	87	10
2010	173	42
2011	177	46
2012	198	60
2013	320	89
2014	373	122
2015	226	77
2016	138	39

Source: NVCA 2017 Yearbook, Data Provided by PitchBook

Exit Perspectives :: IPO

U.S. VC Backed IPO Value and Age Characteristics

	# of IPOs	Deal Value ($M)	Median Deal Value ($M)	Average Deal Value ($M)	Post Value ($M)	Median Post Value ($M)	Average Post Value ($M)	Median Time from 1st VC to Exit	Average Time from 1st VC to Exit
2004	79	6,250.6	49.8	84.5	41,826.0	220.8	580.9	5.16	5.20
2005	43	2,892.0	53.8	72.3	8,628.8	199.3	227.1	4.77	4.52
2006	59	3,452.9	55.5	63.9	13,908.9	219.8	252.9	4.79	5.09
2007	87	7,611.2	75.0	96.3	33,492.2	333.8	418.7	5.17	5.54
2008	10	626.2	61.8	69.6	2,773.4	237.0	396.2	2.82	4.61
2009	10	1,255.0	86.6	125.5	4,824.2	342.1	536.0	7.32	7.50
2010	42	3,691.9	69.8	87.9	15,903.4	278.7	378.7	6.90	7.38
2011	46	5,938.9	87.7	138.1	45,877.3	423.6	1,092.3	5.88	6.87
2012	60	1,457.5	81.0	390.1	114,752.5	360.3	,206.8	7.14	7.64
2013	89	9,116.7	75.0	107.3	52,808.8	319.5	628.7	6.77	7.30
2014	122	10,565.5	65.6	88.0	52,081.5	249.4	437.7	6.85	7.04
2015	77	8,072.7	74.8	104.8	40,814.5	289.5	551.5	6.94	6.75
2016	39	2,928.5	70.5	75.1	16,079.3	250.6	412.3	8.27	7.61

Source: NVCA 2017 Yearbook, Data Provided by PitchBook

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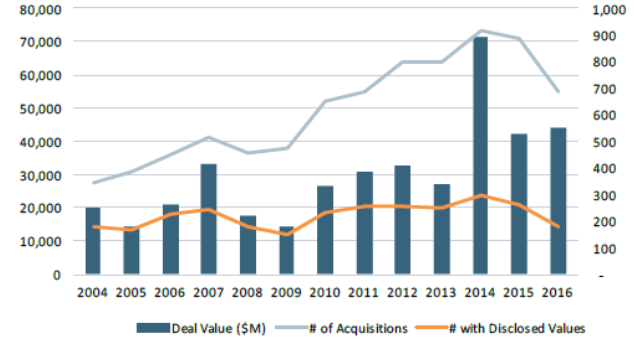
Exit Perspectives :: M&A

U.S. Venture-backed M&A Activity



Source: NVCA 2017 Yearbook, Data Provided by PitchBook

U.S. VC Backed M&A Value and Age Characteristics

	# of Acquisitions	# with Disclosed Values	Deal Value ($M)	Average Deal Value ($M)	Median Deal Value ($M)	Median Time from 1st VC to Exit	Average Time from 1st VC to Exit
2004	341	179	19,745.0	110.3	43.7	3.90	4.07
2005	386	166	14,086.9	84.9	38.1	4.74	4.59
2006	451	227	20,666.5	91.0	44.7	4.70	4.72
2007	515	245	33,180.1	135.4	50.0	4.57	4.82
2008	455	177	17,523.4	99.0	36.0	4.75	4.89
2009	472	146	14,437.0	98.9	25.0	4.34	4.86
2010	651	232	26,583.8	114.6	36.5	4.36	5.00
2011	687	257	30,956.5	120.5	50.0	4.21	4.89
2012	799	252	32,478.5	128.9	48.5	4.51	4.99
2013	796	247	27,124.0	109.8	37.3	4.08	5.05
2014	918	297	71,176.4	239.7	52.0	4.44	5.29
2015	884	258	42,299.5	164.0	50.0	4.31	5.42
2016	687	177	43,894.6	248.0	90.0	4.67	5.83

Source: NVCA 2017 Yearbook, Data Provided by PitchBook

Exit Perspectives

	First Investments	IPO	M&A
2004	869	79	341
2005	1,045	43	386
2006	1,279	59	451
2007	1,678	87	515
2008	1,762	10	455
2009	1,674	10	472
2010	2,089	42	651
2011	2,830	46	687
2012	3,340	60	799
2013	3,586	89	796
2014	3,739	122	918
2015	3,333	77	884
2016	2,340	39	687
2004 - 2011	13,226		
2009 - 2016		485	5,894
% of 1st Investments		*4%*	*45%*

Source: NVCA 2017 Yearbook, Data Provided by Pitchbook

Dilution

- Study of IPOs – implied retention
- First round investments 50%
- Second round investments 60%
- Third round investments 67%
- Fourth and later rounds 70%

Source: Venture Capital & the Finance of Innovation, Metrick et al

PWERM Inputs

- Expected dilution – flip retention data based on additional rounds of investment necessary. These are baseline figures only and need to be adjusted for specific facts & circumstances
    - One round 5% to 10%
    - One to two rounds 10% to 20%
    - Two or more rounds 20% to 30%
    - Ser A (or Seed) 50% (or less)

Source: Venture Capital & the Finance of Innovation, Metrick et al

Pulling It All Together

	Scen #1	Scen #2	Scen #3	Scen #4
Scenario Description	IPO	Strategic Sale	Downside Case	Liquidation / Dissolution
Exit Enterprise Value	€ 693.1	€ 945.1	€ 472.5	€ 36.3
Assumed Exit Date	12/31/2019	12/31/2019	12/31/2019	12/31/2017
Scenario Weights	25.0%	25.0%	25.0%	25.0%
Implied Enterprise Value Analysis				
Expected Dilution	0.0%	0.0%	0.0%	0.0%
Enterprise Value Attributable to Existing Capital Providers	€ 693.1	€ 945.1	€ 472.5	€ 36.3
Discount Periods	4.0	4.0	4.0	2.0
Weighted Average Cost of Capital	17.4%	17.4%	17.4%	17.4%
Present Value Factor	0.5262	0.5262	0.5262	0.7254
Present Value of Exit Enterprise Value	€ 364.7	€ 497.3	€ 248.7	€ 26.3
Indicated Enterprise Value	**€ 284.3**			
Projected Enterprise Value	€ 693.1	€ 945.1	€ 472.5	€ 36.3

Scenario weights and expected dilution estimated with reference to life cycle stage and business plan

PWERM Inputs

- Calibration and FV measurement
    - Total equity value approximates calibrated value and PWERM indicated exit value
- Calibration
    - Reconcile to share price from latest funding round

Indicated Values

	Expected Value	Units Outstanding	Value / Share	
Series A Preferred	$17.3	3,666,666	$4.72	
Series B Preferred	$44.9	9,400,764	$4.78	
Series C Preferred / Warrants	$40.8	8,409,088	$4.85	
Series C-1 Preferred	$6.1	1,198,019	$5.10	
Series D Preferred	$62.4	12,256,960	$5.09	
Series E Preferred	**$33.8**	**4,971,641**	**$6.81**	***Offering Price = $7.1405 per shar***
Options: 2007 Stock Plan / Warrants	$66.1	14,680,052	$4.50	
Common Stock	$106.0	22,911,316	$4.63	
Total Present Value	$377.4			

Reconciliation and Sanity Check

Option Pricing Model

SimpleCo Example

Exhibit 1

Payoff Table - SimpleCo

Enterprise Value	Preferred Shareholders	Common Shareholders
$0	$0	$0
$100	$100	$0
$200	$200	$0
$300	$300	$0
$400	$400	$0
$500	$500	$0
$600	$500	$100
$700	$500	$200
$800	$500	$300
$900	$500	$400
$1,000	$500	$500

Two observations can be made from a brief study of Table 1.

1. **Financial engineering does not create value.** In every possible state of the world, the sum of the payoffs to the preferred and common shareholders is equal to the equity value. Creative pie-slicing does not make the pie any bigger.
2. **The payoffs to the common shareholders have the same basic shape as a call option.** The holder of a call option receives no payoff when the stock price is less than or equal to the strike price. However, the call option holder participates dollar-for-dollar in appreciation above the strike price.

The Basic Insight of the OPM

SimpleCo Example

In light of these observations, we can express the value of the preferred and common share as shown in Exhibit 2.

Exhibit 2

Component Securities - SimpleCo

Enterprise Value	=	Preferred Value	+	Common Value
EV	=	*(EV - $500 Call)*	+	*$500 Call*

By recasting the preferred and common equity classes into the component securities, the subjective judgment associated with selecting the appropriate yield on the preferred shares has been eliminated, as the value of the preferred shares is simply the excess of equity value over the value of a call option with a strike price of $500.

The Basic Insight of the OPM

What is a “Breakpoint”?

Exhibit 3

Capital Structure - ComplexCo

	Liquidation Preference	Liquidation Priority	Conversion/ Exercise Price	Fully-Diluted Shares	% of Total
Class A Preferred	$1,000	*Pari Passu*	$2.00	500	19.6%
Class B Preferred	1,500	*Pari Passu*	$5.00	300	11.8%
Common Shares	0	Residual	na	1,500	58.8%
Warrants	0	Residual	$10.00	250	9.8%
Total	**$2,500**			**2,550**	**100.0%**

One could construct a payoff table similar to that in Exhibit 1. While certainly possible, doing so can become a bit cumbersome as the complexity of the capital structure increases. As a shortcut, valuation specialists identify the relevant “breakpoints” in the capital structure. In the OPM, a breakpoint is an equity value beyond which the marginal allocation of incremental value to the various equity classes changes. SimpleCo had a single breakpoint, while ComplexCo will prove to have four. We often see cases in which a dozen or more can be identified.

Breakpoints are identified starting with an equity value of $0. For ComplexCo, the Class A and Class B preferred shares participate on a *pari passu* basis, so the first breakpoint is the aggregate liquidation preference, or $2,500 (the total “Net Proceeds” in Exhibit 4). Additional elements of Exhibit 4 will be explained as we proceed through the example.

Liquidation Preferences

Exhibit 4

Breakpoint #1 - Class A & Class B Liquidation Preference

	Shares	Gross Proceeds	Exercise Price	Net Proceeds	% of Total	Marginal Proceeds	% of Total
Preference Claims							
Class A Preferred		$1,000	na	$1,000	40.0%	$1,000	40.0%
Class B Preferred		1,500	na	1,500	60.0%	1,500	60.0%
As-If Converted Shares	$0.00						
Class A Preferred	0	0	na	0	0.0%	0	0.0%
Class B Preferred	0	0	na	0	0.0%	0	0.0%
Common Shares	1,500	0	na	0	0.0%	0	0.0%
Warrants	0	0	0	0	0.0%	0	0.0%
Total	1,500	$2,500	$0	$2,500	100.0%	$2,500	100.0%

The definition of the first breakpoint will depend on whether the preferred classes share in liquidation proceeds on a pro rata basis or in order of seniority

Conversion #1

Exhibit 5

Breakpoint #2 - Class A Converts to Common

	Shares	Gross Proceeds	Exercise Price	Net Proceeds	% of Total	Marginal Proceeds	% of Total
Preference Claims							
Class A Preferred		$0	na	$0	0.0%	($1,000)	-33.3%
Class B Preferred		1,500	na	1,500	27.3%	0	0.0%
As-If Converted Shares	$2.00						
Class A Preferred	500	1,000	na	1,000	18.2%	1,000	33.3%
Class B Preferred	0	0	na	0	0.0%	0	0.0%
Common Shares	1,500	3,000	na	3,000	54.5%	3,000	100.0%
Warrants	0	0	0	0	0.0%	0	0.0%
Total	2,000	$5,500	$0	$5,500	100.0%	$3,000	100.0%

Exhibit 3

Capital Structure - ComplexCo

	Liquidation Preference	Liquidation Priority	Conversion/ Exercise Price	Fully-Diluted Shares	% of Total
Class A Preferred	$1,000	*Pari Passu*	$2.00	500	19.6%
Class B Preferred	1,500	*Pari Passu*	$5.00	300	11.8%
Common Shares	0	Residual	na	1,500	58.8%
Warrants	0	Residual	$10.00	250	9.8%
Total	**$2,500**			**2,550**	**100.0%**

Once all liquidation preferences have been covered, the next step is to identify conversion / exercise by order of conversion price (not seniority), from lowest to highest

Conversion #2

Exhibit 6

Breakpoint #3 - Class B Converts to Common

	Shares	Gross Proceeds	Exercise Price	Net Proceeds	% of Total	Marginal Proceeds	% of Total
Preference Claims							
Class A Preferred		$0	na	$0	0.0%	$0	0.0%
Class B Preferred		0	na	0	0.0%	(1,500)	-25.0%
As-If Converted Shares	$5.00						
Class A Preferred	500	2,500	na	2,500	21.7%	1,500	25.0%
Class B Preferred	300	1,500	na	1,500	13.0%	1,500	25.0%
Common Shares	1,500	7,500	na	7,500	65.2%	4,500	75.0%
Warrants	0	0	0	0	0.0%	0	0.0%
Total	2,300	$11,500	$0	$11,500	100.0%	$6,000	100.0%

Once all liquidation preferences have been covered, the next step is to identify conversion / exercise by order of conversion price (not seniority), from lowest to highest

Warrant Exercise

Exhibit 7

Breakpoint #4 - Warrants Exercise

	Shares	Gross Proceeds	Exercise Price	Net Proceeds	% of Total	Marginal Proceeds	% of Total
Preference Claims							
Class A Preferred		$0	na	$0	0.0%	$0	0.0%
Class B Preferred		0	na	0	0.0%	0	0.0%
As-If Converted Shares	$10.00						
Class A Preferred	500	5,000	na	5,000	21.7%	2,500	21.7%
Class B Preferred	300	3,000	na	3,000	13.0%	1,500	13.0%
Common Shares	1,500	15,000	na	15,000	65.2%	7,500	65.2%
Warrants	250	2,500	(2,500)	0	0.0%	0	0.0%
Total	2,550	$25,500	($2,500)	$23,000	100.0%	$11,500	100.0%

Warrants and options are ranked along with convertible preferred to determine breakpoint order; however, unlike conversions, the breakpoint associated with warrant / option exercise needs to incorporate proceeds to corporation

Illustrative Upside

Exhibit 8

Illustrative Upside

	Shares	Gross Proceeds	Exercise Price	Net Proceeds	% of Total	Marginal Proceeds	% of Total
Preference Claims							
Class A Preferred		$0	na	$0	0.0%	$0	0.0%
Class B Preferred		0	na	0	0.0%	0	0.0%
As-If Converted Shares	**$15.00**						
Class A Preferred	500	7,500	na	7,500	21.0%	2,500	19.6%
Class B Preferred	300	4,500	na	4,500	12.6%	1,500	11.8%
Common Shares	1,500	22,500	na	22,500	62.9%	7,500	58.8%
Warrants	250	3,750	(2,500)	1,250	3.5%	1,250	9.8%
Total	2,550	$38,250	($2,500)	$35,750	100.0%	$12,750	100.0%

The only purpose of the “illustrative upside” panel is to define the final set of marginal allocation percentages; the selected share price does not matter, so long as it is greater than that of the penultimate breakpoint

Illustrative Upside

Exhibit 8

Illustrative Upside

	Shares	Gross Proceeds	Exercise Price	Net Proceeds	% of Total	Marginal Proceeds	% of Total
Preference Claims							
Class A Preferred		$0	na	$0	0.0%	$0	0.0%
Class B Preferred		0	na	0	0.0%	0	0.0%
As-If Converted Shares	$15.00						
Class A Preferred	500	7,500	na	7,500	21.0%	2,500	19.6%
Class B Preferred	300	4,500	na	4,500	12.6%	1,500	11.8%
Common Shares	1,500	22,500	na	22,500	62.9%	7,500	58.8%
Warrants	250	3,750	(2,500)	1,250	3.5%	1,250	9.8%
Total	2,550	$38,250	($2,500)	$35,750	100.0%	$12,750	100.0%

Exhibit 3

Capital Structure - ComplexCo

	Liquidation Preference	Liquidation Priority	Conversion/ Exercise Price	Fully-Diluted Shares	% of Total
Class A Preferred	$1,000	*Pari Passu*	$2.00	500	19.6%
Class B Preferred	1,500	*Pari Passu*	$5.00	300	11.8%
Common Shares	0	Residual	na	1,500	58.8%
Warrants	0	Residual	$10.00	250	9.8%
Total	**$2,500**			**2,550**	**100.0%**

The only purpose of the “illustrative upside” panel is to define the final set of marginal allocation percentages; the selected share price does not matter, so long as it is greater than that of the penultimate breakpoint

What is a “Tranche”?

Exhibit 9

Marginal Tranche Allocation Matrix

	Tranche A	Tranche B	Tranche C	Tranche D	Tranche E
Upper Breakpoint	$2,500	$5,500	$11,500	$23,000	$35,750
Lower Breakpoint	$0	$2,500	$5,500	$11,500	$23,000
Tranche Width	$2,500	$3,000	$6,000	$11,500	$12,750
Marginal Allocations					
Class A Preferred	40.0%	0.0%	25.0%	21.7%	19.6%
Class B Preferred	60.0%	0.0%	0.0%	13.0%	11.8%
Common Shares	0.0%	100.0%	75.0%	65.2%	58.8%
Warrants	0.0%	0.0%	0.0%	0.0%	9.8%

% of Marginal Proceeds from Breakpoint payoff tables

The next step in applying the OPM is to build a matrix that identifies the marginal allocation percentages between the various breakpoints. For purposes of the OPM, a “tranche” is the difference between two adjacent breakpoints. The marginal proceeds within a given tranche are allocated to the various equity classes in fixed proportions.

Deriving Tranche Values

Exhibit 10

Derivation of Tranche Values

	Tranche A	Tranche B	Tranche C	Tranche D	Tranche E
Stock price (S)	$17,500	$17,500	$17,500	$17,500	$17,500
Exercise price (K)	$0	$2,500	$5,500	$11,500	$23,000
Time to expiration (T)	4.0	4.0	4.0	4.0	4.0
Volatility (σ)	35.0%	35.0%	35.0%	35.0%	35.0%
Risk-free rate (r)	1.500%	1.500%	1.500%	1.500%	1.500%
Value of call options	**$17,500**	**$15,148**	**$12,426**	**$8,033**	**$3,514**
Tranche Values	**$2,352**	**$2,722**	**$4,393**	**$4,519**	**$3,514**

Calculated by subtraction

The BSOPM can be used to determine the value of the right to receive proceeds above a given breakpoint

Calculating Equity Class Values

Exhibit 11

Calculation of Equity Class Values

		Tranche A	Tranche B	Tranche C	Tranche D	Tranche E	Total
Tranche Values	A	$2,352	$2,722	$4,393	$4,519	$3,514	$17,500
Marginal Allocations							
Class A Preferred	B	40.0%	0.0%	25.0%	21.7%	19.6%	
Class B Preferred		60.0%	0.0%	0.0%	13.0%	11.8%	
Common Shares		0.0%	100.0%	75.0%	65.2%	58.8%	
Warrants		0.0%	0.0%	0.0%	0.0%	9.8%	
Marginal Values							
Class A Preferred	A x B	941	0	1,098	982	689	3,710
Class B Preferred		1,411	0	0	589	413	2,414
Common Shares		0	2,722	3,295	2,947	2,067	11,031
Warrants		0	0	0	0	344	344
Total		$2,352	$2,722	$4,393	$4,519	$3,514	$17,500

Calculated by addition

The value of a given equity class is the "sumproduct" of the tranche values and the corresponding marginal allocation percentages

Calculating Per Share Values

Exhibit 12

Calculation of Per Share Values

	Total Value	Fully-Diluted Shares	Value per Share
Class A Preferred	$3,710	500	$7.42
Class B Preferred	$2,414	300	$8.05
Common Shares	$11,031	1,500	$7.35
Warrants	$344	250	$1.38

On a per share basis, the results conform to expectations regarding the relative value of the various classes. The higher liquidation preference of the Class B preferred shares causes those shares to be most valuable. The common shares, which do not have any liquidation preference, are worth less than either class of preferred shares. Finally, the strike price on the warrants reduces the value of those instruments relative to common shares.

The value per share is simply the quotient of the total value of the equity class and the number of shares outstanding

Developing Inputs

The OPM inputs can be developed, and tested for reasonableness, in the same manner as in applications of the Black-Scholes model.

- **Stock Price**. The stock price in the OPM is the total equity value of the subject business. The total equity value is derived through application of the traditional valuation methods under the asset-based, income and market approaches. As will be discussed in a subsequent section of this post, a known value for a particular component of the capital structure can be used to find the implied total equity value (the "back-solve" method).
- **Exercise Price.** The exercise prices in the OPM correspond to the equity value breakpoints identified in the formal analysis of the capital structure.
- **Time to Expiration**. In applying the OPM, one must assume a single point estimate for when liquidity will be achieved, either through dissolution, strategic sale, or IPO. While the actual time to expiration cannot be known with certainty, reasonable estimates can generally be made by reference to the subject company's life cycle stage, funding needs, and strategic outlook.
- **Volatility.** As with time to expiration, volatility cannot be directly observed. The most common starting point for volatility analysis is an examination of historical return volatility for a group of peer public companies. If reliable data is available, implied volatility from publicly traded options on the shares of such companies may also be consulted. Analysts adjust the observed peer volatility measures to take into account life cycle stage, remaining milestones, and other qualitative factors pertaining to the subject company.
- **Risk-free Rate.** The risk-free rate corresponds to the assumed time to expiration.

Five (generally) auditable inputs

Sensitivity Analysis

Exhibit 13

Sensitivity to OPM Inputs

	Volatility = 35%			Time to Expiration = 4 yrs		
	Changes in Time to Expiration			Changes in Volatility		
	2 yrs	4 yrs	6 yrs	20%	35%	50%
Total Value						
Class A Preferred	$3,744	$3,710	$3,696	$3,764	$3,710	$3,698
Class B Preferred	2,345	2,414	2,458	2,304	2,414	2,526
Common Shares	11,221	11,031	10,878	11,290	11,031	10,729
Warrants	189	344	467	142	344	546
Total	$17,500	$17,500	$17,500	$17,500	$17,500	$17,500
Per Share Value						
Class A Preferred	$7.49	$7.42	$7.39	$7.53	$7.42	$7.40
Class B Preferred	$7.82	$8.05	$8.19	$7.68	$8.05	$8.42
Common Shares	$7.48	$7.35	$7.25	$7.53	$7.35	$7.15
Warrants	$0.76	$1.38	$1.87	$0.57	$1.38	$2.19
Diff b/t Class B & Common	*$0.34*	*$0.69*	*$0.94*	*$0.15*	*$0.69*	*$1.27*

Compared to enterprise valuation, sensitivity effects generally muted

Exhibit 15

Comparison of OPM and PWERM

	OPM	PWERM
Required Assumptions	In addition to the breakpoints and tranche allocations dictated by the capital structure terms, requires only five inputs.	Requires more assumptions than the OPM. Analyst must specify amount, timing and probability of future liquidity events as well as dilution from future financing rounds and class-specific discount rates.
Sensitivity to Assumptions	As shown in Exhibit 13, sensitivity for many classes is somewhat muted. Since the OPM is only an allocation method, the impact of changes in inputs on allocation is generally tame compared to that in typical valuation methods.	Since the PWERM is both a valuation and allocation method, sensitivity to changes in inputs is potentially greater than with OPM.
Flexibility / Adaptability	Small number of required assumptions limits the flexibility and adaptability of the model. Cannot accomodate some common features of preferred shares such as mandatory conversion at IPO, IPO price guarantees and the like. The assumed lognormal distribution of outcomes may not be representative for many development-stage entities.	Can be readily adapted to unique features, such as price protection or ratchets. Offers the flexability to consider a range of potential future outcomes that more closely represent the market participant perspective than a lognormal distribution. Allows the analyst to consider outcomes at different times, and to model dilution from future funding rounds (even down rounds).
Transparency	Host of intermediate calculations and lack of familiarity with breakpoint analysis on the part of many report users contribute to perception that method is a "black box".	Generally intuitive, allocation of proceeds for each discrete scenario is readily checked for conformity to governing documents.
Auditability	While not necessarily intuitive for non-specialists, small number of assumptions and translation of governing documents to formal structure of model is highly auditable.	While the required inputs correlate to assumptions that market participants actually make, convincing and documentable support for these estimates may prove elusive.

Backsolve Method

This procedure is reasonable and appropriate in many circumstances. In our experience, however, it is important to keep in mind how the limitations of the OPM (primarily the lognormal distribution of outcomes) can distort the results of the analysis. When reading "backwards" from the value of a single equity class to the value of all equity, the effect of such distortions can be magnified. In our experience, the potential magnitude of such distortion is greatest when the known value is for the most senior security in the capital structure. In many cases, the lognormal assumption causes total loss scenarios to be under-represented in the probability distribution of potential future outcomes relative to market participant expectations. When combined with the use of the risk-free rate in a risk neutral framework, the OPM may assign greater value to the liquidation preference than market participants do. This can cause the difference between the most senior preferred class and other components of the capital structure to be exaggerated, resulting in an understated total equity value.

Exhibit 16

Backsolve Method Using the OPM

	Total Value	Fully-Diluted Shares	Value per Share
Class A Preferred	$1,618	500	$3.24
Class B Preferred	$1,500	300	**$5.00**
Common Shares	$4,089	1,500	$2.73
Warrants	$35	250	$0.14
Total	$7,242		

In our view, these distortions can be further aggravated when the equity class used to calibrate the total equity value accounts for only a small portion of the subject company's capital structure. In our practice, we temper the effect of this issue by also giving weight to the total equity value which is the product of the known per share price and the fully-diluted share count.

When a given share price is known, the OPM can be used to develop an implied enterprise value (the first step in calibration)

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Questions?

About the Speaker

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Travis's practice focuses on providing public and private clients with fair value opinions and related assistance pertaining to goodwill and other intangible assets, stock-based compensation, and illiquid financial assets. Travis performs valuations used for tax compliance, ESOP compliance, and other purposes for clients in a wide range of industries.

Travis is also a frequent speaker on fair value accounting topics to audiences across the U.S. Travis is a member of The Appraisal Foundation's working group to address best practices for control premiums. He co-authored the book *Business Valuation: An Integrated Theory*, Second Edition, and is a regular contributor to Mercer Capital's *Financial Reporting Blog*.

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