

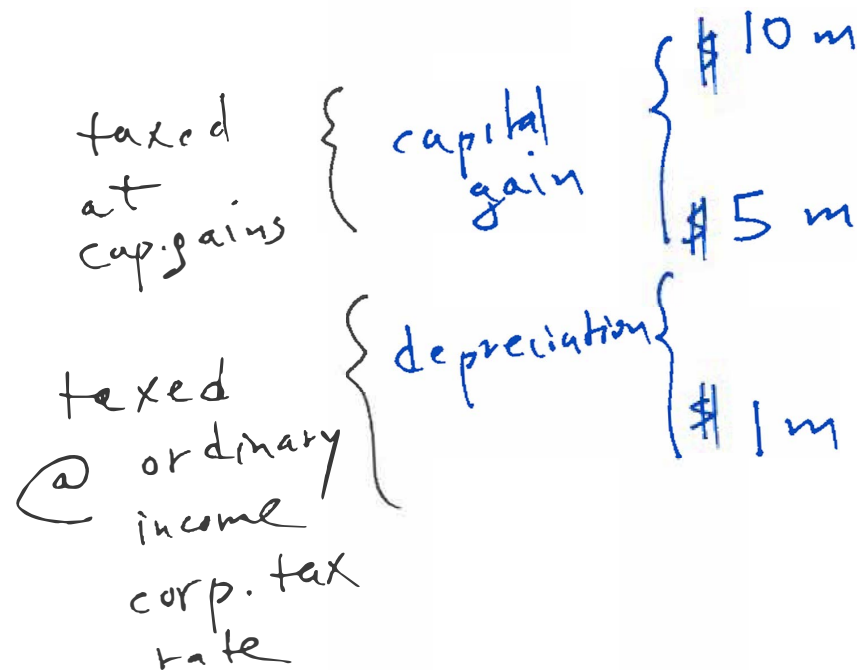
Class/Week #3: Valuation in M&A

Example of recapture of depreciation in asset purchase

Historical cost = $\boxed{\$5\text{m}}$

Depreciated acq. cost = $\boxed{\$1\text{m}}$

Sales price today = $\boxed{\$10\text{m}}$



Merger Valuation

Mergers & Acquisitions valuation

APV { Max
Price

$$= \sum_{i=1}^{\infty} \frac{CF_i}{(1+r)^i} + PV(\text{Synergy})$$

Independent
Firm Value

Min (Seller
Buyer)

(Buyer)
Max

value added

surplus

offer

$$V_{\text{Target}} = V_{\text{Target stand-alone}} + \underset{\parallel \sum_i \frac{CF_i}{(1+r_{\text{Fin}})^i}}{\text{Syn}_{\text{Fin}}} + \underset{\parallel \sum_i \frac{CF_i^*}{(1+r_{\text{rev. enh.}})^i}}{\text{Syn}_{\text{Rev. Enh.}}}$$

$$r_{\text{Fin}} \neq r_{\text{rev. enh.}}$$

Different synergies
are evaluated separate
(note the different
discount rates)

Valuing Cost Savings & Asset Reduction

Cost Synergies (Ex. 11.3, Ch. 11 Bruner)

Year	0	1	2	3	4	5
1 Pre-Tax Cost Savings, Constant US\$		\$ 50	\$ 100	\$ 100	\$ 100	\$ 100
2 Expected Inflation Rate		2%	2%	2%	2%	2%
3 Growth Rate FCF (nominal), perpetuity	2%					
4 Discount Rate	6%					
5 Ongoing Investment/Savings (year 3+)	5%					
6 Pre-Tax Cost Savings, Current US\$ COST SAVINGS		\$ 51	\$ 104	\$ 106	\$ 108	\$ 110
7 Tax Expense (@ .40)		(20)	(42)	(42)	(43)	(44)
8 After-Tax Cost Savings		31	62	64	65	66
9 Less: Investment to Realize Savings	\$ (1,000)			(5)	(5)	(6)
10 Plus: Disinvestment Associated with the Savings		20	20	10	-	-
11 Subtotal ASSET REDUCTION	(1,000)	51	82	68	60	61
12 Continuation Value						1,548
13 FCF	\$ (1,000)	\$ 51	\$ 82	\$ 68	\$ 60	\$ 1,609
14 NPV Cost Savings						
15 IRR Synergy Investment						

\$428

15%

Irregular CFs
have multiple
IRRs.

Irregular CF:
Increase from year #0 to
year #2;
Decrease #2 to year #4;
Increase in year #5

Can calculate with
MIRR function

= MIRR(CF, 0.06, 0.06) i.e. @ re-investment rate of 6%

Note: discount @ cost of debt

$$\left\{ \begin{aligned} PV_5 &= 1,548 = \text{Continuation Value}_5 \\ &= \frac{CF_5 * (1+g^*)}{r - g^*} = \frac{CF_6}{r - g^*} \end{aligned} \right.$$

Calculation of
the continuation value
for the cost savings synergies

real CF \longrightarrow real discount rates

//

$$\frac{\text{nom. CF}}{(1 + \pi)}$$

\searrow inflation

$$(\text{real } r + 1) = \frac{(1 + \text{nom. } r)}{(1 + \pi)}$$

nom. CF \longrightarrow nominal discount rates

Valuing Revenue Enhancements

Revenue Enhancements								
Year		0	1	2	3	4	5	
1 Revenue Enhancements, Constant Dollars			\$ 100	\$ 200	\$ 200	\$ 200	\$ 200	
2 Expected Inflation Rate			2%	2%	2%	2%	2%	
3 Growth Rate FCF (nominal), in perpetuity	3%							
4 Discount Rate	15%							
5 Ongoing Investment/Revenue (year 1+)	5%							
6 Operating Cost/Revenues	45%							
7 PV Revenue Enhancements			\$ 102	\$ 208	\$ 212	\$ 216	\$ 221	
8 Operating Costs Earmark			(46)	(94)	(96)	(97)	(99)	
9 Tax Expense (@ .40)			(22)	(46)	(47)	(48)	(49)	
10 After-Tax Cost Savings			34	69	70	71	73	
11 Less: Investment Necessary		\$ (400)	(5)	(10)	(11)	(11)	(11)	
12 Plus: Disinvestment for Revenue			10	5	-	-	-	
13 Subtotal		(400)	39	63	59	61	62	
14 Terminal Value							531	
15 Free Cash Flow		\$ (400)	\$ 39	\$ 63	\$ 59	\$ 61	\$ 593	
16 Net Present Value of Cost Savings		\$50						
17 IRR Synergy Investment								

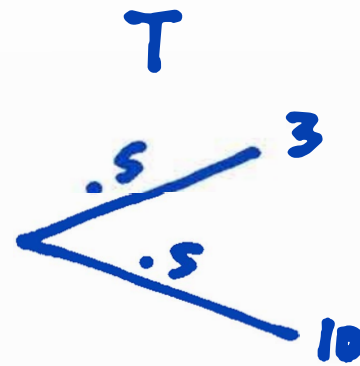
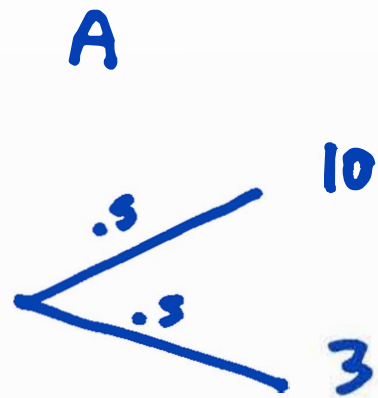
→ Note that revenue enhancements are riskier than cost synergies

MIRR(CF, 0.15, 0.15)

We use again Modified IRR (or MIRR)
Note the assumption of re-investment rate of 15%

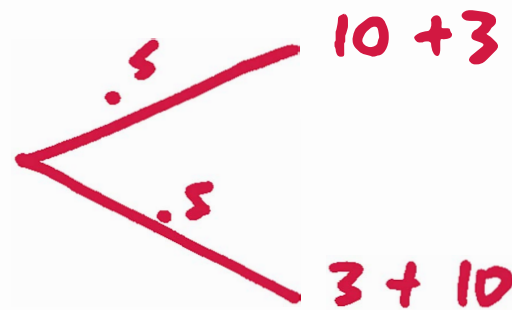
Note: discount @ cost of equity (i.e., riskier investment)

Example of Co-Insurance



(A) (T)
3m + 3m
borrowing
capacity

Merge



borrowing
capacity
13m

Merger Co-insurance Example (AD 25)

Ex. Based on Ch. 30, Damodaran,
p. 829 (Second Edition)

Two companies merge

	<u>Lube & Auto</u>	<u>Gianni Cosmetics</u>	<u>Combined</u>
Firm Value	\$100	\$150	\$250
Debt Face Value	\$80	\$50	\$130
Debt Maturity	10	10	10
St. Dev. Firm Value	40.0%	50.0%	0.154 ^{0.5}

Share of assets in survivor

0.4

0.6

Correlation b/n CFs

0.4

Option Price Values

Equity Value in Firm

\$75.9

\$134.5

\$207.6

Debt Value in Firm

\$24.1

\$15.5

\$42.4

Debt Yield = $\left(\frac{80}{24.1}\right)^{.10} - 1 = 12.75\%$

$\left(\frac{50}{15.5}\right)^{.10} - 1 = 10.52\%$

$\left(\frac{130}{42.4}\right)^{.10} - 1 = 10.52\%$

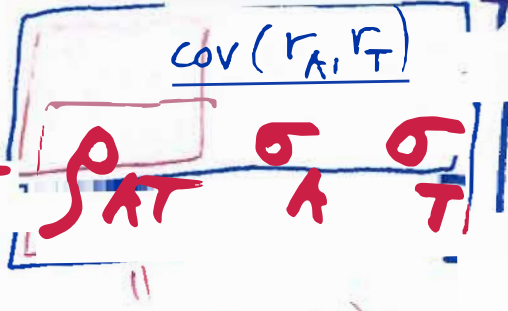
Black-Scholes Option Pricing

Option Pricing Calculator		
<i>S</i>	250	Current Asset Value
<i>X</i>	130	Exercise (Strike) Price
<i>T</i>	10.00	Time to Maturity (Years)
<i>r_f</i>	10.00%	Riskless Interest Rate (%)
<i>σ</i>	39.24%	Volatility (% p.a.)
<i>d₁</i>	1.9533	
<i>d₂</i>	0.7124	
<i>N(d₁)</i>	0.9746	
<i>N(d₂)</i>	0.7619	
<i>C_E</i>	207.215	European Call Value (\$)
<i>P_F</i>	5.039	European Put Value (\$)

N.B.: option-pricing C. Harvey

Calculating Variance of Combined firm (Co-Insurance Example)

Variance

$$\sigma_{\text{Newro}}^2 = \left[w_A^2 \sigma_A^2 + w_T^2 \sigma_T^2 + 2 \times w_A w_T \rho_{AT} \sigma_A \sigma_T \right]$$


We discussed the financial synergies $-1 \leq \frac{\text{cov}(r_A, r_T)}{\sigma_A \sigma_T} \leq 1$

$$\rho_{AT} = \frac{\text{cov}(r_A, r_T)}{\sigma_{r_A} \sigma_{r_T}}$$

Calculating r_D (YTM) for the co-insurance example

$$\begin{array}{l} \$42.78 \\ m \\ || \\ PV_0 \end{array} = \frac{\$130_m}{(1+r_D)^{10}} \quad \begin{array}{l} \nearrow \\ FV_{10} \end{array}$$

$$\Rightarrow \frac{\$130_m}{\$42.78_m} = (1+r_D)^{10}$$

Financial Synergy Calculation

Equity (levered) beta

asset beta (unlevered beta)

Newco

β_E

=

β_A

+ $\frac{D}{E}(1-T)$

$(\beta_A - \beta_D)$

(Hamada formula)

asset risk

financial risk

In reverse,

β_A

=

$\beta_E + \beta_D \frac{D}{E}(1-T)$

$1 + \frac{D}{E}(1-T)$

usually assumed \emptyset

Valuing Financial Synergies

$$\beta_A = \frac{\beta_E + (1 - T) \frac{D}{E} \beta_D}{1 + (1 - T) \frac{D}{E}}$$

	Buyer (Before)	Target (Before)	Buyer+Target (Before)	Newco	Value Impact
1 WACC before M&A	10.2%	11.2%	10.7%		
2 Newco WACC after M&A				10.1%	
3 Total Capital Buyer+Target, before M&A	\$ 6,000	\$ 6,000		\$ 12,000	
4 Dollar Cost of Capital	\$ 612	\$ 674	\$ 1,286	\$ 1,209	\$77
5 Implied PV Financial Synergies					\$760
Newco's Cost of Capital After M&A					
6 Cost of Equity =	12.0%	15.5%		12.6%	
7 Beta buyer, before M&A	1.00				
8 Beta target, before M&A		1.50			
9 Unlevered Beta $\beta_A = \beta_E / \left[1 + (1 - T) \frac{D}{E} \right]$	0.83	1.01		0.92	
Newco asset beta adj. because of					
10 covariance unanticipated by market				-0.10	
11 Market value weight buyer (%)	50%				
12 Market value weight target (%)		50%			
13 Beta Newco $\beta_E = \beta_A \left[1 + (1 - T) \frac{D}{E} \right]$				1.08	
14 Risk-Free Rate	0.05	0.05		0.05	
15 Equity market risk premium	0.07	0.07		0.07	
16 Cost of equity CAPM	12.0%	15.5%		12.6%	
17 Cost of Debt =	4.8%	6.0%		5.4%	
18 New rating Newco desired cap. structure	AA	BBB		A	
19 Debt maturity for desired cap. structure	7	7		7	
Current pre-tax debt yields, @ Newco					
20 rating & tenor	8.0%	10.0%		9.0%	
21 Marginal tax rate Newco	40.0%	40.0%		40.0%	
22 After-tax cost debt Newco	4.8%	6.0%		5.4%	
Weights in desired capital structure Newco					
23 Targeted weight debt (%)	25%	45%		35%	
24 Targeted weight equity (%)	75%	55%		65%	

$\rightarrow = \$77$
10.1%

assumed reduction in asset risk as a result of the acquisition

re-levered beta

assumed reduction of default risk

Unlevering of equity betas

$$\beta_A = \frac{\beta_E}{1 + (1-T)\frac{D}{E}}$$

$$\underbrace{r_A}_{\text{WACC}} = \boxed{(1-T)r_D} \frac{D}{D+E} + \boxed{r_E} \frac{E}{D+E}$$

after-tax
cost of debt

CAPM:

$$r_E = r_F + \beta_E * \text{MRP}$$

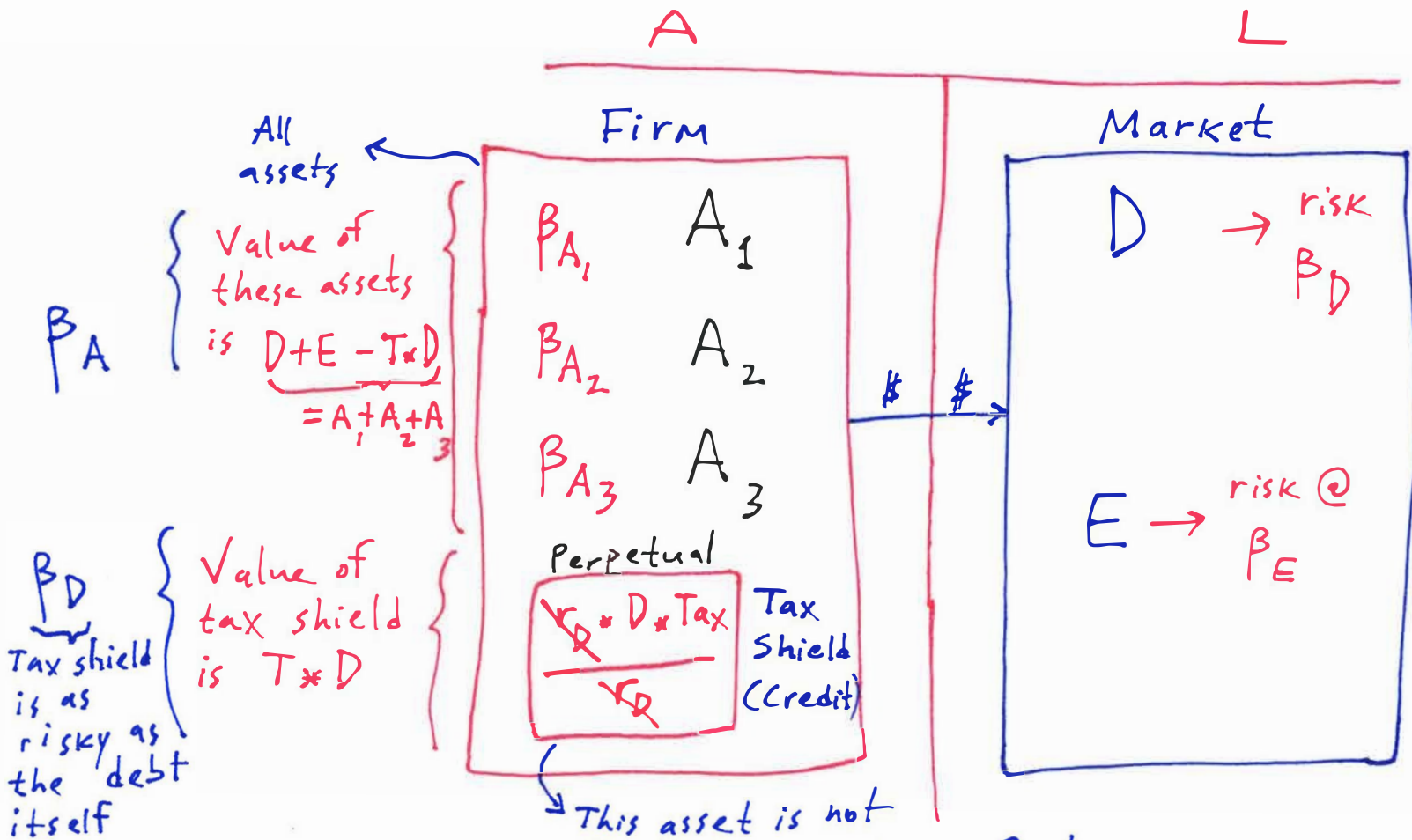
$$r_D = r_F + \beta_D * \text{MRP}$$

$$r_A = r_F + \beta_A * \text{MRP}$$

MRP

$r_M - r_F$
8.63%
0.98%

Optional: Levering & unlevering betas (Deriving the Hamada Formula)

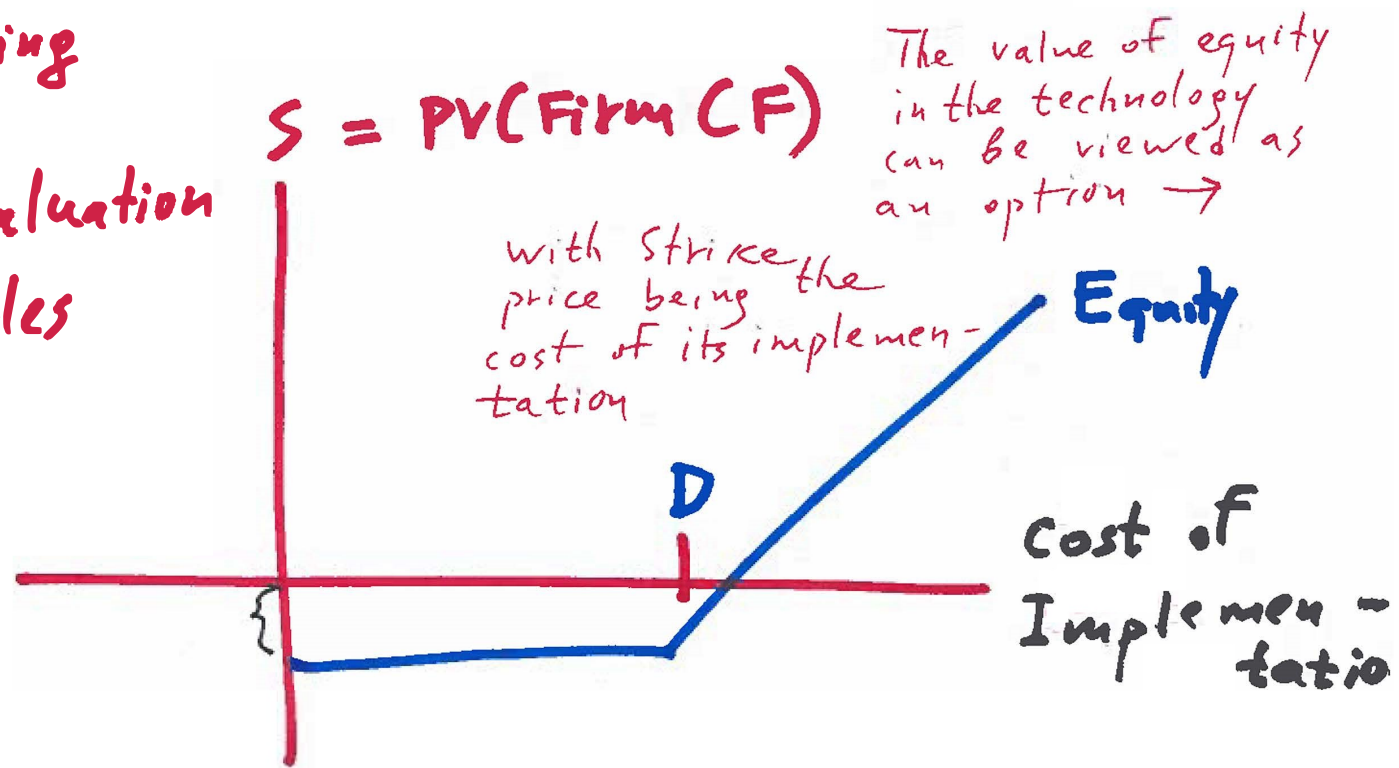


No loss of $###$ from firm to markets: \Rightarrow

$$\beta_A \times \frac{D + E - D \times T}{D + E} + \beta_D \times \frac{D \times T}{D + E} = \beta_D \frac{D}{D + E} + \beta_E \frac{E}{D + E} \Rightarrow \text{with some algebra:}$$

$$\beta_A = \frac{\beta_E + (1 - T) \frac{D}{E} \beta_D}{1 + (1 - T) \frac{D}{E}}; \text{ in reverse, } \beta_E = \beta_A + \frac{D}{E} (1 - T) (\beta_A - \beta_D)$$

Value of Enabling Technology
(Real Option Valuation via Black-Scholes calculator)



Asking Price
\$120m

\$100m (assets in place) + technology value

\downarrow
\$29.6m

Valuing Real Option Synergies: B-S Eq

$$C = [N(d_1) \times S] - [N(d_2) \times PV(X)]$$

$$d_1 = \frac{\log[S / PV(X)]}{\sigma \sqrt{t}} + \frac{\sigma \sqrt{t}}{2}$$

$$d_2 = d_1 - \sigma \sqrt{t}$$

Exhibit 11.6, Bruner: Valuation of a new technology

Value of technology

Call value (C)	\$29.6
Call delta (hedge ratio)	0.736
Using put-call parity	
Put value (P)	\$227.9
Delta	-0.264
S underlying asset price (US\$ million)	\$50.00
X exercise price (US\$ million)	\$500.00
r _F risk-free rate	7.0%
St. Dev. (volatility, σ)	80.0%
T years to expiration	10.0
<i>very risky cash flows</i>	
Cumulative Standard Normal Function	
d ₁ from Black-Scholes	0.631
N(d ₁)	0.736
d ₂ from Black Scholes	(1.898)
N(d ₂)	0.029

Constant yield, continuous dividend model

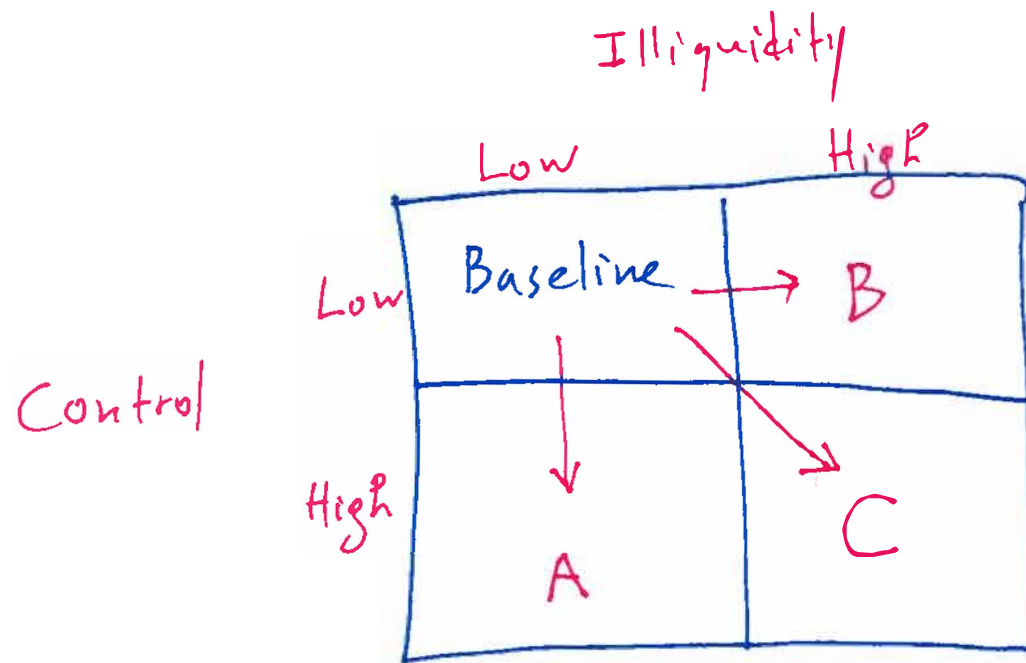
Call value (C)	\$28.1
Call delta (hedge ratio)	0.731
Using put-call parity	
Put value (P)	\$228.5
Delta	(0.269)
S underlying asset price (US\$ million)	\$50.0
X exercise price (US\$ million)	\$500.0
r _F risk-free rate	7.0%
St. Dev. (volatility, σ)	80.0%
T years to expiration	10.0
Dividend yield	0.43%
Cumulative Standard Normal Function	
d ₁ from Black-Scholes	0.614
N(d ₁)	0.731
d ₂ from Black Scholes	(1.915)
N(d ₂)	0.028

Price is lower if implemented technology immediate "throws off" 3 million \$

Why would a technology producing only \$50m but costing \$500m be worth \$29.6 million?? → chance of CF being higher!

Also value at the European call option
CF of technology if implemented

Liquidity & Control



Valuing Control & Liquidity: Ch. 15

Three acquisitions: DCF=\$100m SH. OUT= 100m P = 1\$ SECTION II

Multiplicative model for control and liquidity				
Assumptions				
% discount for illiquidity		30%		
% premium for control		40%		
Size of control block		51%		
Base Case VE: marketable & no control asymmetry	\$	100		
Shares outstanding (#)		100		
		Case A	Case B	Case C
Illiquidity?		no	yes	yes
Control Asymmetry?		yes	no	yes
1 Base Case V_E : liquid & no control asymmetry	\$	100.0	\$ 100.0	\$ 100.0
2 Illiquidity Adjustment		0%	-30%	-30%
3 Illiquidity-Adjusted VE	\$	100.0	\$ 70.0	\$ 70.0
4 %Premium for control		40%	0%	40%
5 Control Block Size		51%	0%	51%
6 Control Block Value	\$	71.4	\$ -	\$ 50.0
7 Minority Block Value	\$	28.6	\$ 70.0	\$ 20.0
8 Adjusted V_E : control asymmetry & illiquidity	\$	100.0	\$ 70.0	\$ 70.0
9 Control block price/share	\$	1.40	\$ -	\$ 0.98
10 Minority block price/share	\$	✓ 0.58	\$ ✓ 0.70	\$ ✓ 0.41

Baseline Scenario → no control issues, no illiquidity

Valuation of Private Companies: Cost of Capital

$$\beta_A^{\text{Priv}} = \text{Total Beta} = \frac{\beta_A^{\text{Public}}}{\rho(r_A, r_M)}$$

$$\frac{\sigma_{r_A}}{\sigma_{r_M}} = \frac{\left[\frac{\text{cov}(r_A, r_M)}{\sigma_{r_M}^2} \right]}{\frac{\text{cov}(r_A, r_M)}{\sigma_{r_A} \sigma_{r_M}}} \Leftarrow$$

A Note on Special Purpose Acquisition Companies (SPACs)

- SPAC is a “blank-check” company formed with the intention of acquiring or merging with another company.
- The SPAC needs to complete an acquisition within two years or the capital raised must be returned to investors, as such it mostly represents a vote of confidence in the sponsor or investor behind the SPAC and in their ability to find future deals that would generate a high ROI.
- In a typical SPAC structure, the sponsor raises initial capital by issuing units consisting of 1 share and $\frac{1}{2}$ or $\frac{1}{3}$ of a warrant.
- The shares are generally priced at \$10 and the warrants are typically struck 15% out of the money (\$11.50) with a 5-year term and an \$18 forced exercise.
- It comes with an embedded put option: Because the acquisition target is unknown at the time of the IPO, potential value creation is completely dependent on the ability of the sponsor to identify a target (typical private) company and negotiate the purchase. The SPAC purchase represents the de facto IPO for the acquired firm. However, in exchange for not knowing ahead of time the specific company that will be acquired, SPAC investors receive two benefits.
 - First, the right to evaluate the pending purchase and elect to hold or redeem the initial investment at cost (plus accrued interest) two days before the vote.
 - Second, warrants. The decisions are separate. A SPAC investor may choose to retain both the shares and warrants, or redeem the shares and hold the warrants, or sell both.
- The SPAC sponsor is typically compensated with a promote equal to 20% of pro forma equity and warrants. In a US SPAC, the sponsor’s promote is not contingent upon meeting any financial targets. However, the sponsors of some recent SPACs have put their equity promote into an earn-out that is only received if the company achieves certain performance objectives, further aligning the financial incentives of the SPAC sponsor and shareholders.
- European SPACs are structured slightly differently. First, since they lack a redemption feature, they are truly “blank check” firms. The European SPAC investor owns the shares regardless of whether the investor likes the acquisition or not. Second, the sponsor does not receive a 20% promote up front. Instead, the sponsor only earns a promote if the company achieves certain return targets.
- Once the IPO is complete, and the SPAC sponsor - now with millions in fresh funds in the bank - finds a suitable target, he or she negotiates a non-binding term sheet. Depending on the size of the transaction, the sponsor may wall cross potential new outside investors to

raise a PIPE (private investment in public equity). The transaction is then announced to the public and an 8-K is filed.

- The SPAC investor base is highly fluid and as Goldman writes, many SPACs experience nearly a full rotation in their shareholder base during the time between the announcement of the deal and closing of the acquisition (transition from merger arbitrage traders and hedge funds to longer-term fundamental investors).
- The sponsor will then file a proxy with the SEC, conduct a pre-merger roadshow, receive redemption notices (if any), and hold a shareholder vote. Redemption notices are due 2 days prior to the shareholder vote, and shareholders will typically determine whether or not to redeem based on where shares are trading at the time redemption notices are due. If the vote passes, the SPAC merges with the target company and will often undergo a ticker change to reflect the name of the target business.
- On the other hand, if the vote fails, the sponsor will resume searching for a suitable target. After 24 months from the capital raise the SPAC will be closed and the capital returned to investors if a merger has not been completed.
- Benefits of SPACs:
 - First, in the traditional IPO process, issuers are prohibited from including any forward-looking guidance in their Form S-1 registration.
 - As a result, prospective investors are required to evaluate the merits of an issue based on backward-looking results and their own expectations.
 - In contrast, the SPAC due diligence process allows a target company to present forecasts and enhances the ability of a SPAC to acquire early-stage companies or those with complicated business models. This can be useful in businesses like sports betting, cannabis, electric vehicles, or other nascent industries that lack meaningful comparisons in the traditional IPO market. Of course, it is a given that the target company will present the most optimistic projections to potential investors, which is why removing the investor diligence aspect of the process is usually a sign of complacent groupthink whereby the investor base is willing to believe anything the target company presents similar to how i) rating agencies assessed all pre-crisis debt as stellar even if it was generally garbage and ii) investors are willing to engage in groupthink when someone else does their "diligence" job for them.
 - Second, in a traditional IPO, the amount of new capital raised is limited, typically to 20%-25% of the value of a company. But in a SPAC transaction, no limit exists on potential proceeds. A SPAC may acquire a majority or minority interest in the target firm and the concurrent PIPE capital raise may be any size.

Make-up Quiz #3 (Week #3) for EMAD 5442

Question #1 (1 pts)

You are presented with a cost synergy of \$10 million, starting a year after the merger. The cost of debt is 7%, the cost of asset capital is 10% and the cost of equity capital is 15%. If the cost savings are perpetual and starting next year, what is the present value of the cost synergy?

$r_D = 7\%$
 $r_A = 10\%$
 $r_E = 15\%$

- A. \$142.86 million = \$10 million / 0.07
- B. \$100 million = \$10 million / 0.10
- C. \$93.75 million = \$10 million / [(7%+10%+15%)/3]
- D. \$66.67 million = \$10 million / 0.15

$$PV_0 = \frac{\$10m}{r_D} = \frac{\$10m}{7\%}$$

Question #2 (1 pts)

Please use the Excel file "Topic #3 (Real Option Synergies Valuation) (Ch11).xlsx" – posted on Canvas – to solve this question. A company possesses a growth opportunity (a patent) with the following parameters: (1) present value of the expected cash flows from the new technology is \$300 million; (2) in order to implement it the company must invest \$400 million; (3) the patent protection is for 10 years; and (4) the uncertainty about the returns from the project is 40%. If the risk-free rate is 2%, what is the value of this growth opportunity?

- A. \$300 million
- B. \$239.4 million
- C. \$134.9 million
- D. \$120 million

LRA:
 $FV = 80$
 $PV = -24.10$
 $PMT = \emptyset$
 $N = 10$
 $1/Y = 12.75\%$

Question #3 (1 pts)

Please use Excel file "Topic #3 (Co-Insurance Example).xlsx" – posted on Canvas – to solve this question. In the Gianni Cosmetics and Lube & Auto merger, what will be the yield associated with debt of combined firm if correlation of cash flows of Gianni & Lube is 1?

- A. 10.5%
- B. 11.75%
- C. 12.71%
- D. 14.3%

Combined:
 $FV = 130$
 $PV = -39.3$
 $PMT = \emptyset$
 $N = 10$
 $1/Y = 12.71\%$

(YTM)

Question #4 (0.5 pts)

Please use Excel file "Topic #3 (Liquidity and Control) (Ch15).xlsx" to solve this question.

In the class example of a public company going through a leveraged buyout to become private (i.e., Case C), what will be the price of the minority shares if the illiquidity discount is 10% and the control premium is 90%? Please assume that the control block size is 51%.

- A. 41 cents per share
- B. 15 cents per share
- C. 10 cents per share
- D. 6 cents per share

Question #5 (0.5 pts)

Cost synergies are riskier than revenue enhancement synergies.

- A. True
- B. False